File No. S360-20
Order No. GC28-6692-2

OS

IBM Systems Reference Library

IBM System/360 Operating System:

Operator's Procedures

This book is for the operator of an IBM System/360 Operating system and is to be used with the Operator's Reference, GC28-6691. This book contains procedures for running the three major system types: Primary Control Program (PCP); Multiprogramming with a Fixed number of tasks (MFT); and Multiprogramming with a Variable number of Tasks (MVT). It also contains operator procedures that apply to all three systems. Operator control panel procedures on tear out sheets are provided for the Operator's console.

Preface

To run the operating system, you must have the required books listed below, as well as this procedures book. In addition, you are encouraged to read the recommended books.

Required Books

IBM System/360 Operating System:

Operator's Reference, GC28-6691

Messages and Codes, GC28-6631

If you have a display tube console you will need:

Operator's Guide for Display Consoles, GC27-6949

Recommended Books

IBM System/360 Operating System:

Utilities, GC28-6586

Job Control Language Reference, GC28-6704

Third Edition (May, 1972)

This is a reprint of GC28-6692-1 incorporating changes released in the following Technical Newsletters:

GN28-2474 (dated June 1, 1971)
GN28-2508 (dated January 15, 1972)

This edition applies to release 21 of IBM System/360 Operating System and to all subsequent releases until otherwise indicated in new editions or Technical Newsletters. Changes are continually made to the information herein; before using this publication in connection with the operation of IBM systems, consult the latest IBM System/360 and System/370 Bibliography, Order No. GA22-6822, and the current SRL Newsletter, Order No. GN20-0360, for the editions that are applicable and current.

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Summary of Amendments for GC28-6692-1 OS Release 21

PCP Removal

Support for the Primary Control Program (PCP) has been removed from this publication. All pages that relate to PCP are to be removed.

Summary of Amendments for GC28-6692-1 OS Release 20.1

3211 Printer Support

Character sets for the 3211 printer have been added to the procedure, "How to Reply to UCS Messages."

The procedure, "How to Reply to FCB Messages" has been added to the "Operator Techniques" chapter. The procedure tells how to respond to the 3211 Forms Control Buffer (FCB) messages.

Introduction to Operator's Procedures

Before using the procedures in this book, you must become familiar with those sections of the Operator's Reference, GC28-6691 that pertain to your system (MFT or MVT). Once you are familiar with the reference material in those sections, you are ready to use the Operator's Procedures.

How to Use the Operator's Procedures

Notice each section is like a separate book. This allows you to remove a section without affecting the rest of the book. The first two sections are on the OS systems (MFT and MVT). Delete from the book the sections that do not pertain to the system(s) you will be using. In the "Operator Techniques" section, there are console procedures (for display tube consoles see Operator's Guide for Display Consoles, GC27-6949), procedures that apply to both systems, and control panel procedures. Remove from the book the control panel procedures for the 360 you will be running on, and place it on the console for quick reference. Also, the hexadecimal to decimal conversion table will be helpful.

Example: I am running MVT on a Model 65. I would remove the OS MFT section and all procedures that pertain to 360 models other than the one I am using. This would leave me with just those procedures that I need to run MVT on a Model 65. Then I would take the Model 65 procedures and the hexadecimal to decimal conversion table and place them on the console for easy reference.

The procedures in this book are for the standard IBM System/360 Operating Systems. Any difference between the book and the system you are running on may be due to options specified at system generation time, uncatalogued system data sets, or modifications to your particular system. These differences may cause messages and requests for replies that are not included in the procedures. To make the procedures book more complete, write up the missing procedures and insert them in the procedures book where needed.

Format Conventions

The following is an explanation of the format conventions used in the procedures.

Names that are capitalized and in bold type and numbers that are in bold type represent a key, switch, dial, or light on the 360 computer.

Examples: **LOAD** **WAIT** **5**

Messages from OS to you are indicated by a box.

Example:

```
IEE101A READY
```

Commands to OS from you are indicated by a box with an arrow pointing in.

Example:

```
r 00,'parameters'
```

Enter all underlined characters, including spaces and commas, exactly as shown. Substitute letters or numbers, NO blank spaces, for the parameters that are not underlined.

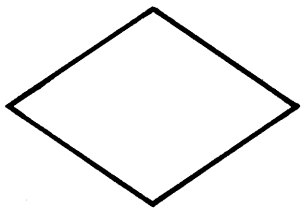
Flow Charts

The flow charts tie together a sequence of procedures. The numbered sections on the flow charts correlate to the numbers on the procedures.

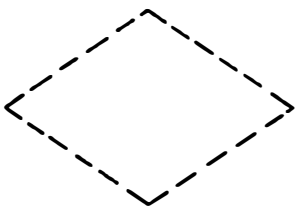
The symbols used in the flow charts are:

Action done by you.

Action done by the system.



A decision made by you.



A decision made by the system.

Operator Commands

The operator commands used in the procedures do not always use all of the available parameters. The parameters used are those that are most commonly used. In the explanations and examples, the operator command abbreviations are used (see Operator's Reference).

Positional parameters: Positional parameters, such as unitaddr, volumserial, and parmvalue in the START command, must be entered exactly in the order in which they appear. If you leave one out, put a comma in its place. You do not need to use a replacing comma if:

- The parameter to be left out is the last one in a series.
- All positional parameters following the absent one are also to be left out.
- All optional positional parameters, such as volumserial and parmvalue, are to be left out.

Examples:

```
s rdr,284,FILESEQ=2
```

```
s rdr,284,,JOBA
```

Keyword Parameters: Keyword parameters, such as DSN and FILESEQ, can appear in any order. To leave one out, simply omit it; do not replace a missing keyword parameter with a comma.

Explanation of the Term (signal EOB)

Signal EOB – signal end of block. While you are entering a command on your console, the system is not aware that the entry is being made. When the entry is complete, enter it into the system by signalling EOB.

To signal EOB; press simultaneously the **ALTN** and **5** keys on the console.

If you make an error while entering a command, press simultaneously the **ALTN** and **0** (zero) keys. The system will ignore what you have entered on that line and give you a new line. If your console can be backspaced, simple errors can be corrected by backspacing and reentering from the point the error was made.

IBM

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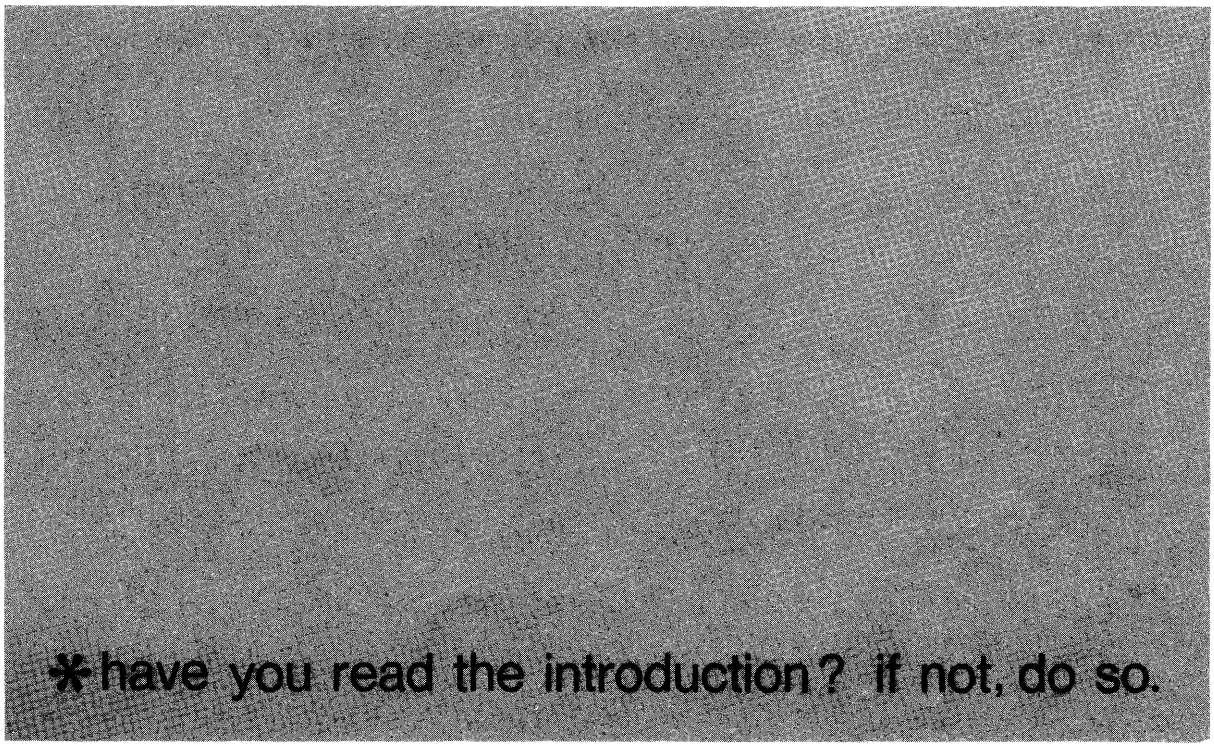

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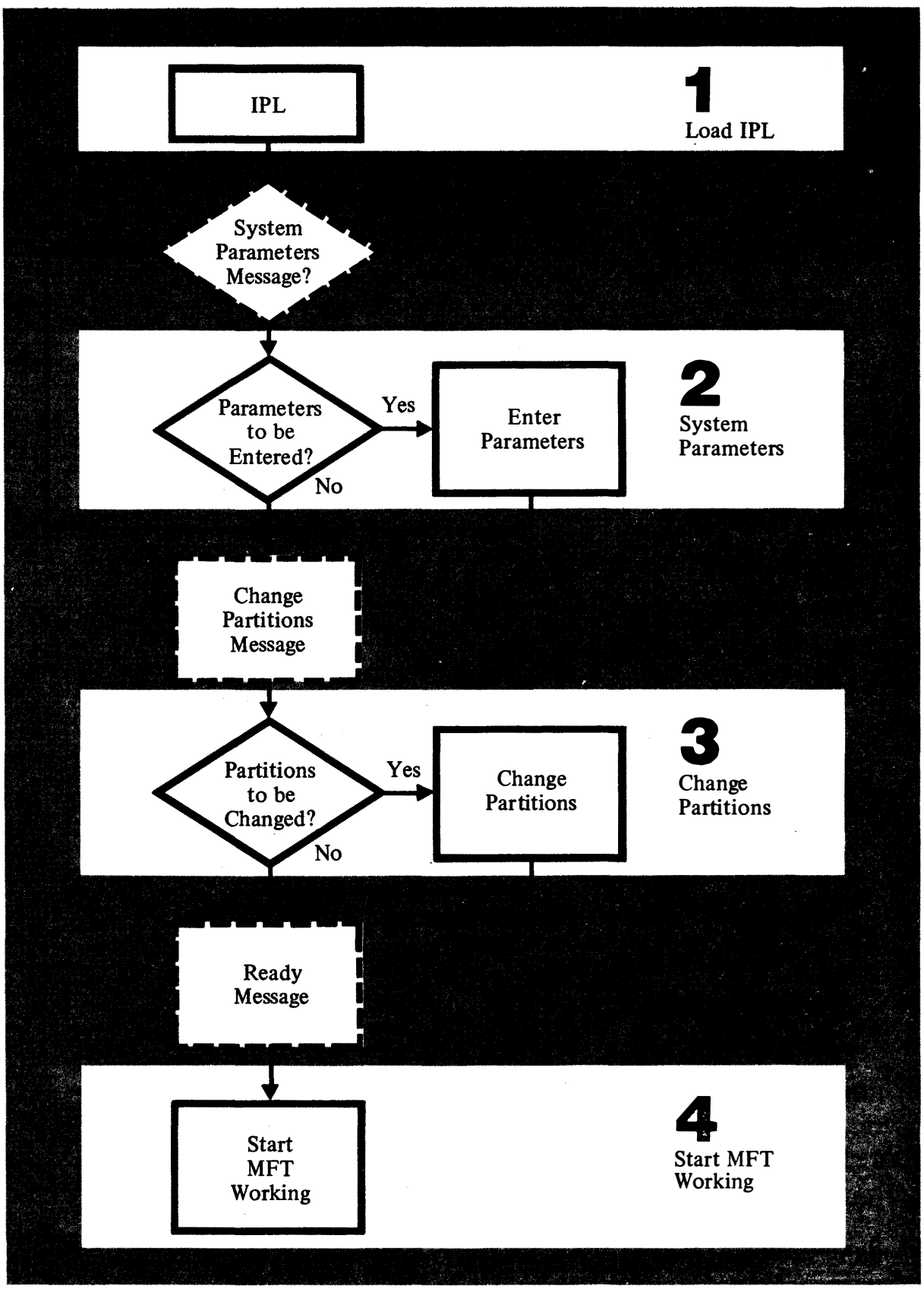
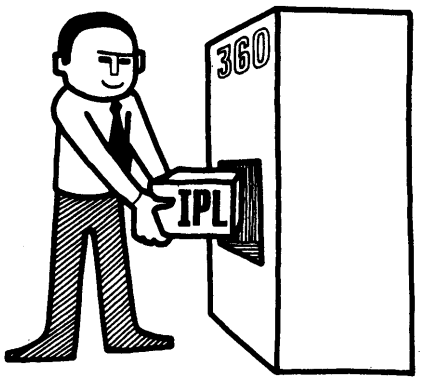
How to Get MFT In and Running



How to Load IPL



1

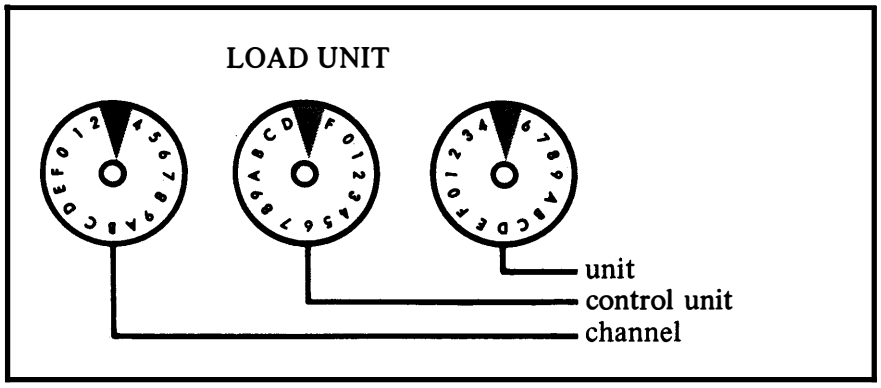
To get MFT running you must first load the IPL[1] program.

To load IPL:

Locate the direct access storage device on which the system residence volume (volume to be IPL'ed) resides.

Set the **LOAD UNIT** dials on the control panel to the unit address of the SYSRES volume.

The unit address is made up of the unit, control unit, and channel numbers.



Hit the **LOAD** key on the control panel, this turns off the **MANUAL** light, turns on the **LOAD** light, and reads in the IPL program.

When the **LOAD** light goes off, IPL is in and running.

MFT

[1] IPL – Initial Program Load

If the **WAIT** light goes on and there is no message on the console, display the PSW[1] and write down the wait state code. The wait state code is the low order 3 bytes of the PSW. (Displaying the PSW for your Model 360 is explained in Chapter 4.)

If the wait state code is 000, check the SYSRES unit to make sure it is ready, and check the address set into the **LOAD UNIT** dials.

Try to load IPL again.

When the IPL is finished, the **WAIT** light will go on and you will receive a message.

One of two messages should appear:

```
IEA101A SPECIFY SYSTEM PARAMETERS
```

The system is asking you if you have any system parameters to be entered.

or:

```
id IEE801D CHANGE PARTITIONS - REPLY YES/NO (,LIST)
```

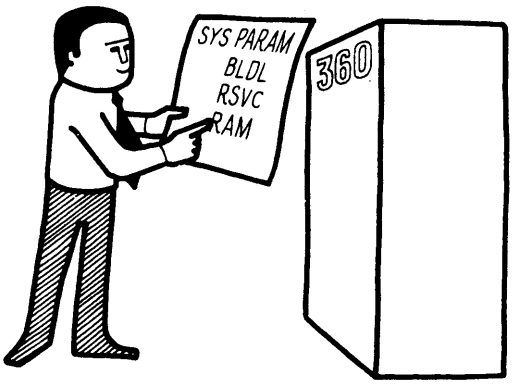
The system is asking you if you have any partitions to be changed and/or want a list of the partitions.

---

[1] PSW – Program Status Word

Note: If you have Automatic Volume Recognition (AVR), check the section on Volume Mounting in the Operator's Reference, GC28-6691.

How to Specify System Parameters



2

After the IPL, if MFT sends you this message:

```
IEA101A SPECIFY SYSTEM PARAMETERS
```

The system is asking you if you have any requests to list, cancel, or alter the system parameters. Requests usually come from your system programmer.

If you have no requests; signal EOB.

The system will return the message:

```
id IEE801D CHANGE PARTITIONS - REPLY YES/NO (,LIST)
```

The system is asking you if you have any partitions to be changed and/or want a list of the partitions.

If there are requests, they are carried out by issuing the REPLY command. To reply enter:

```
r id,'parameters'
```

signal EOB

r – the REPLY command.

id – identification number of the message requesting the reply, in this case, the SPECIFY SYSTEM PARAMETERS message. The reply id for the SPECIFY SYSTEM PARAMETERS message is always 00.

,'parameters' – the entire field is enclosed in apostrophes, and may be entered in upper or lower case letters. Each parameter is separated by a comma.

Parameters are entered by using parameter codes and option keywords. Parameter codes are used to request an action and option keywords represent system options and their values.

Parameter Codes:

U – no changes are made.
L – list BLDL, RAM, and/or RSVC.
H – list storage hierarchies.

Option Keywords:

KEYWD=nn – keyword format.

KEYWD= – A name like BLDL= or RAM=.

nn – A keyword number like 01.

To cancel an option replace nn with , .

To list without changing an option replace nn with 00,L .

To change an option just give a new nn.

To make an entry of more than 80 characters, make the last parameter in the line ,CONT .

After signaling EOB the system will return the message:

```
id IEE801D CHANGE PARTITIONS - REPLY YES/NO (,LIST)
```

The system is asking you if you have any partitions to be changed and/or want a list of the partitions.

Examples:

To list BLDL, RAM, and RSVC enter:

```
r 00,'U,L'
```

signal EOB

To list the storage hierarchies, enter:

```
r 00,'U,H'
```

signal EOB

To cancel BLDL, enter:

```
r 00,'BLDL=,'
```

signal EOB

To list RAM with no change, enter:

```
r 00,'RAM=00,L'
```

signal EOB

To cancel RAM, alter and list BLDL, and list RSVC with no changes, enter:

```
r 00,'RAM=,BLDL=nn,L,RSVC=00,L'
```

signal EOB

Making an entry longer than 80 characters.

To change and list RAM, BLDL, and RSVC enter:

```
r 00,'RAM=nn,L,BLDL=nn,L,CONT'
```

signal EOB

The system will return the message:

```
IEA116A CONTINUE SYSTEM PARAMETERS
```

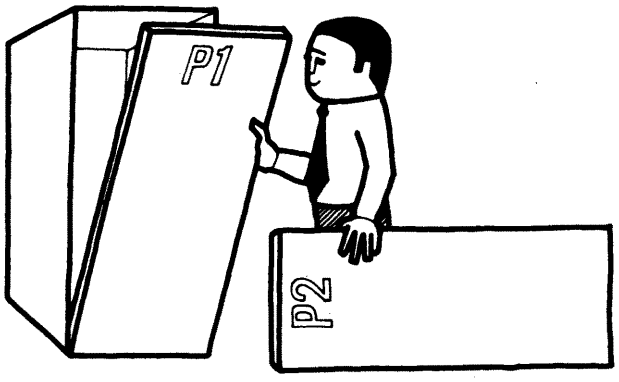
Continue to enter the requests.

```
r 00,'RSVC=nn,L'
```

signal EOB

IBM

How to Change Partitions



3

After the IPL program is loaded, and you have replied to the System Parameters message, MFT will send you the message:

```
id IEE801D CHANGE PARTITIONS - REPLY YES/NO (,LIST)
```

The system is asking you if you have any requests from your system programmer to change the partitions in the system. You may also list the partition definitions, job classes to be serviced, and, if used, time-slicing specifications. To answer the CHANGE PARTITIONS message use the REPLY command.

If you have no requests to change partitions, enter:

```
r id,'NO'
```

signal EOB

or

```
r id,'NO,LIST'
```

signal EOB

r – the REPLY command.

id – identification number of the message requesting the reply, in this case, the CHANGE PARTITIONS message. The two digit number that precedes IEE801D in the CHANGE PARTITIONS message is the id to be used here.

,'NO – no partitions are to be changed.

,LIST' – list the partition definitions, job classes to be serviced, and if used, time-slicing specifications.

If you specified 'LIST' the system will next list the partition definitions, job classes to be serviced, and, if used, time-slicing specifications.

If there are no error messages MFT will send you the message:

```
IEE101A READY
```

If there are requests to change partitions, enter:

```
r id,'YES,LIST'
```
signal EOB

r – the REPLY command.

id – identification number of the message requesting the reply. in this case, the CHANGE PARTITIONS message. The two digit number that precedes IEE801D in the CHANGE PARTITIONS message is the id to be used here.

,'YES – yes, partitions are to be changed.

,LIST' – list the partition definitions, job classes to be serviced, and, if used, time-slicing specifications.

The system will return the message:

```
IEE866I DEFINE COMMAND BEING PROCESSED
```

The system will then list the partition definitions, job classes to be serviced, and, if used, time-slicing specifications. At the end of the list, the system will send you the message:

```
id IEE803A CONTINUE DEFINITION
```

At this time, use the REPLY command to enter the partition definitions.

```
r id,'definitions'
```

signal EOB

,'definitions' – the entire field is enclosed in apostrophes, and is entered in upper case or lower case letters. Each definition is separated by a comma. At the end of a line of definitions if END or CANCEL are not the last definitions, signal EOB and continue to enter your definitions. The line to be entered within the apostrophes will be given to you by your system programmer.

After the partition definitions have been entered, the system will send you the following messages:

```
IEE805I DEFINITION COMPLETED
IEE101A READY
```

How to Start MFT Working

4

When MFT is ready to start working, it sends you the message:

```
IEE101A READY
```

4a

If your system has automatic START commands, the system will enter the START commands on your console after the READY message. Your then enter the SET command with the AUTO= parameter. The AUTO= parameter of the SET command tells the system which of the START commands entered by the system you will accept, and which ones you will reject. If you do not have automatic START commands, enter the SET command after the READY message; do not use the AUTO= parameter. The SET command gives the system the date, time of day, and addresses of the system data sets.

4b

If you used the Q= parameter in the SET command, the system will send you a message asking if you want to change or accept the job queue parameters now in the system. If you are requested by your system programmer to change the job queue parameters, use the REPLY command.

4c

Using the START command, start the system input readers (SYSIN) for input, the system output writers (SYSOUT) for output, and the initiators to select jobs for execution and allocate input/output devices for the selected jobs. For START commands that were entered automatically, and rejected in the AUTO= parameter of the SET command, enter the new START commands.

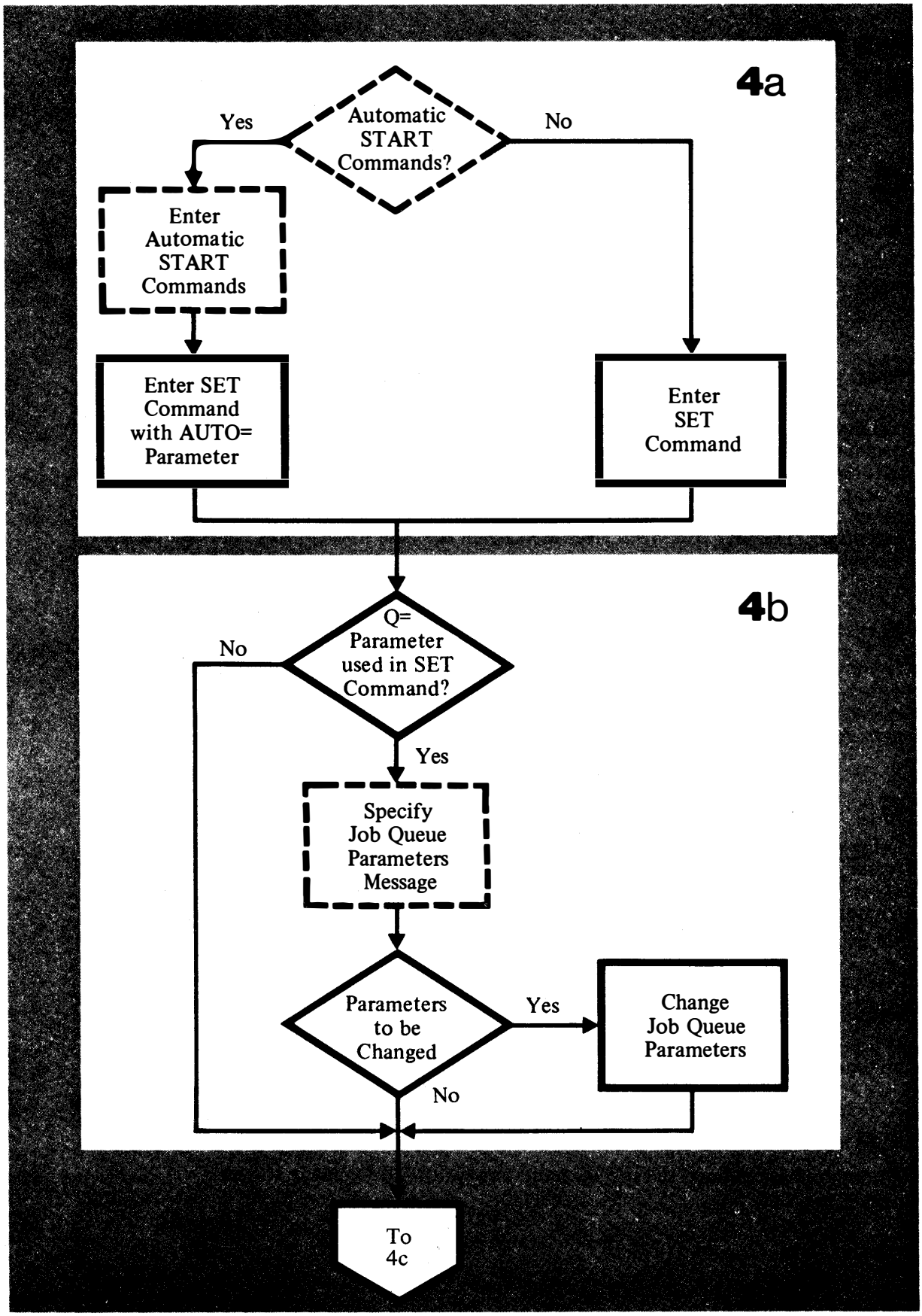
4d

If you want some devices taken offline, use the VARY command. The VARY command will tell MFT that a device is or is not to be used.

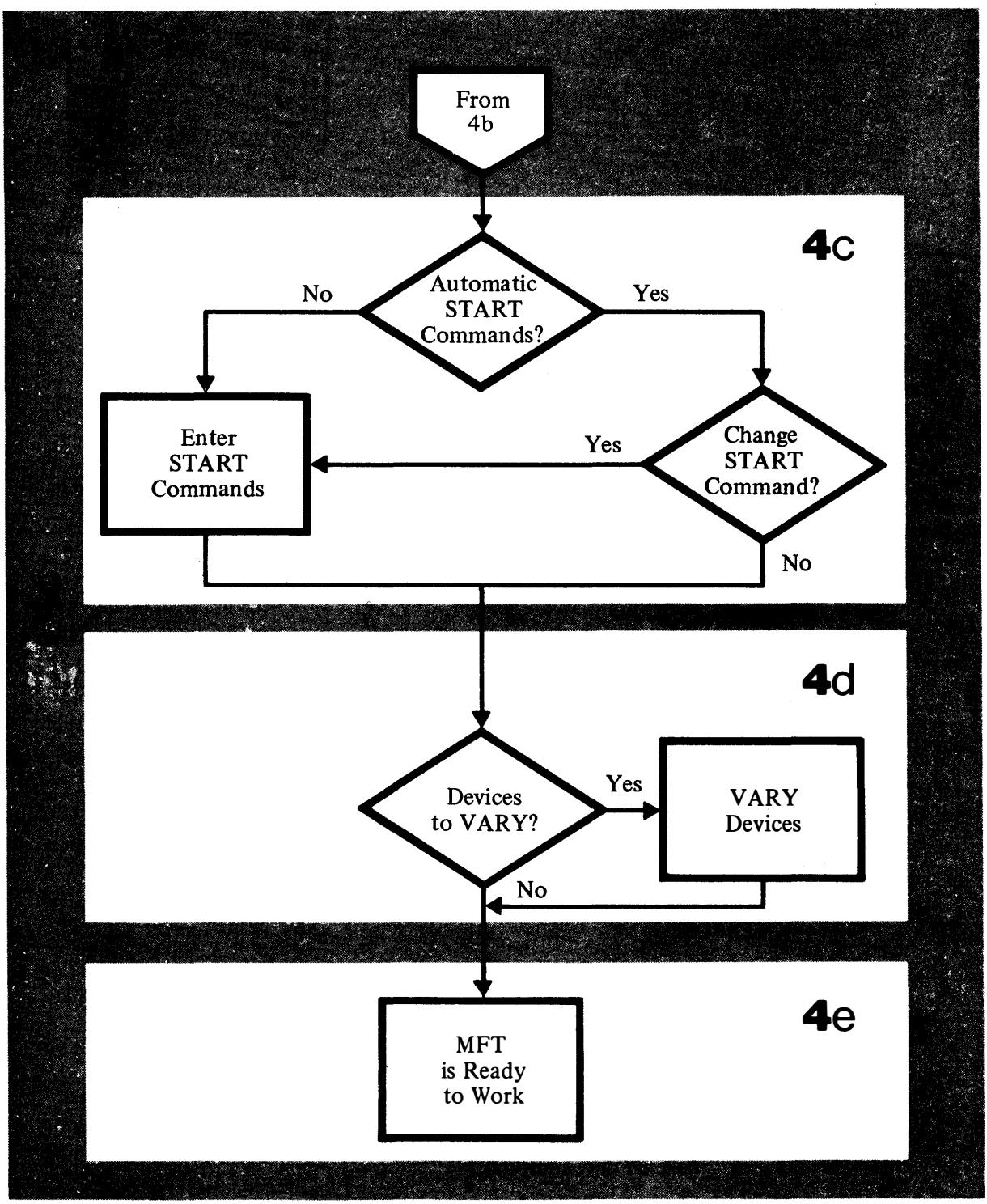
4e

When you have entered the system setup you want, MFT is ready to work.

How to Start MFT Working



How to Start MFT Working



IBM

Enter SET Command

4a

After the READY message, or the automatic START commands, enter the SET command.

The SET command procedure will use the SET command parameters that you must enter through the console, and one parameter that may be entered optionally. The optionally entered parameter can be previously specified by your system programmer or entered through the console by you.

To use the SET command enter:

```
t date=yy.ddd,clock=hh.mm.ss,Q=(unitaddr,F),AUTO=aaa
```

signal EOB

t_ – SET command.

date=yy . ddd – the date, must be included.

- ddd — day of year (001-366)
- yy — year (00-99)

Example:

January 2, 1969 looks like this:

date=69. 002

,clock=hh . mm . ss – time of day, optional.

- ss — seconds (00-59)
- mm — minutes (00-59)
- hh — hours (00-23)

Example:

The time 3:25 and 14 seconds in the afternoon looks like this:

```
,clock=15. 25. 14
```

,Q= (unitaddr, F) – unit address and format code for the SYS1.SYSJOBQE[1] data set. This parameter is used after the first IPL, after turning the power on.

,Q= – Keyword for the SYS1.SYSJOBQE data set.

(unitaddr – unit address of the SYS1.SYSJOBQE data set, usually specified at system generation time, if not, you must specify it.

,F) – the data set is to be formated.

Example:

The parameter for the first IPL may look like this:

```
,Q=(,F)
```

,AUTO=aaa – automatic START command acceptance parameter. This parameter is used when the system has entered automatic START commands on your console. You tell the system which of the automatic START commands you will accept and which ones you will not accept.

,AUTO= – keyword for the acceptance parameter.

aaa – the acceptance or rejection of the automatic START commands listed after the READY message. If you accept all of the automatic START commands, do not use the AUTO= parameter. If you reject all the START commands, enter none in place of aaa.

If you accept some of the commands and reject others, enter a y (yes) for those you accept and an n (no) for those that you reject. Enter a Y or an N for each of the START commands entered on your console by the system.

MFT

---

[1] SYS1.SYSJOBQE – job queue data set.

Example:

Three automatic START commands have been entered on your console by the system, you accept the first two and reject the third, enter:

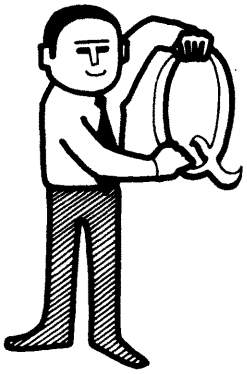
```
,AUTO=yyn
```

A SET command with all the examples used in this procedure.

```
t date=69.002,clock=15.25.14,Q=(,F),AUTO=yyn
```

signal EOB

How to Specify Job Queue Parameters



4b

If you used the Q= parameter in the SET command, MFT will send you the message:

```
id IEF423A SPECIFY JOB QUEUE PARAMETERS
```

The system is asking you if you have any requests from your system programmer to alter the job queue parameters.

If there are no requests, enter:

```
r id,'U'
```

signal EOB

r – the REPLY command.

id – identification number of the message requesting the reply, in this case the SPECIFY JOB QUEUE PARAMETERS message. Use the id that precedes the message number IEF423A.

,'U' – no changes are made.

If there are requests, enter:

```
r id,'parameters'
```

signal EOB

r – the REPLY command.

id – identification number of the message requesting the reply, in this case the SPECIFY JOB QUEUE PARAMETERS message. Use the id that precedes the message number IEF423A.

,'parameters' – the entire field is enclosed in apostrophes; it contains four parameters. The four parameters are positional and are separated by a comma. Your system programmer will give you the line to be entered between the apostrophes.

The parameters are positional; only those parameters being changed need to be given.

Examples:

To change all four parameters, enter:

```
r id,'12,60,5,12'
```

signal EOB

To change the first parameter only, enter:

```
r id,'12'
```

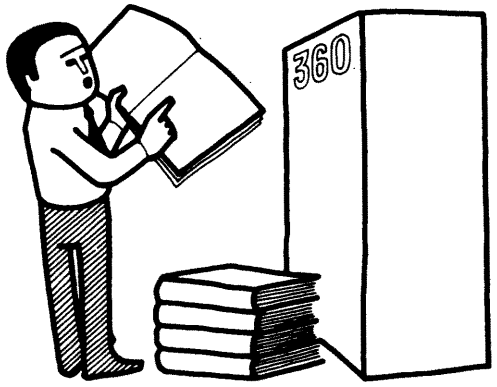
signal EOB

To change the third parameter only, enter:

```
r id,',,5'
```

signal EOB

How to Start the SYSIN Readers



4c

When you start the SYSIN readers, you are telling MFT what devices the system input will come in from. You can start one, two, or three readers.

To start a SYSIN reader, enter:

```
s rdr.Pn,devicn,volserial,parmvalue,keyword=option
```

s rdr – the START RDR command.

.Pn – partition number that the reader is to be started in.

,devicn – the name of the device the system input volume is mounted on. The device name can be either a unit address (like 293) or a device type (like 2400).

,volserial – serial number of the system input tape or direct access volume.

,parmvalue – the name of a job in the input stream; the reader is to start reading in data at this job. The jobs that precede it are skipped.

,keyword=option – keywords used in Job Control Language DD[1] statements. If the input device is a disk, you must use the keyword DSNAME=name. (See Job Control Language Reference, GC28-6704.)

[1] DD – Data Definition statement.

Examples:

Start a reader in partition 2 with input from tape volume number 123456.

```
s rdr.P2,,123456
```

Start a reader in partition 1 with input from direct access unit 292, and use the data set named IN.

```
s rdr.P1,292,DSN=IN
```

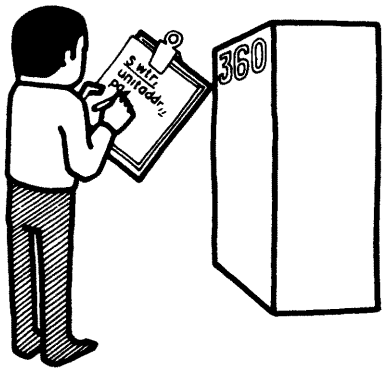
Start a reader in partition 0 with input coming from card reader 00c.

```
s rdr.P0,00c
```

Start a reader in partition 0, with input coming from tape unit 282, volume 111111. Start input at a job named N.

```
s rdr.P0,282,111111,N
```

How to Start the SYSOUT Writers



4C

When you start the SYSOUT writers, you are telling MFT what devices the system is to write on and the classes of output the devices are to put out. You can start up to 36 SYSOUT writers.

To start a SYSOUT writer, enter:

```
s wtr.Pn,devicn,volserial,parmvalue,keyword=option
```

s wtr – the START WTR command.

.Pn – partition number that the writer is to be started in.

,devicn – the output device associated with the output writer. This can be either a unit address (like 293) or a device type (like 2400).

,volserial – serial number of an output tape.

,parmvalue – job classes or output classes to be processed.

,keyword=option – keywords used in Job Control Language DD[1] statements. (See Job Control Language Reference, GC28-6704.)

[1] DD – Data Definitions statements.

Examples:

Start a writer in partition 3 for classes A, B, and C, with output going to device 00e.

```
s wtr.P3,00e,,ABC
```

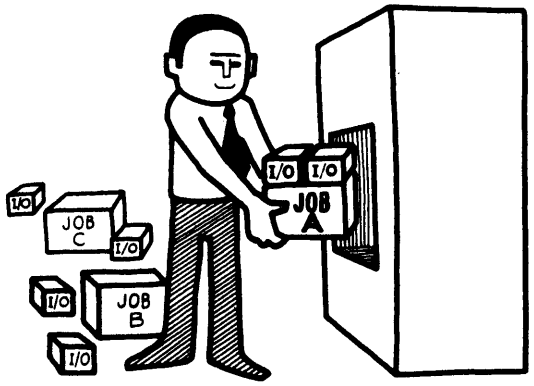
Start a writer in partition 2 for class A, with output going to device 292.

```
s wtr.P2,292,,A
```

Start a writer in partition 4 for class C, with output going to tape unit 282 on volume 555555.

```
s wtr.P4,282,555555,C
```

How to Start the Initiators



4C

When you start an initiator, you are starting a program in a partition. This program will select the jobs to be run in that partition, and allocate I/O devices for the selected jobs.

To start an initiator, enter:

```
s init.Pn,,,parmvalue
```

s init – the START INIT command.

.Pn – partition number that the initiator is to be started in.

,,,parmvalue – job classes to be processed in the partition.

Examples:

To start an initiator in partition 3 for classes a, b, and c, enter:

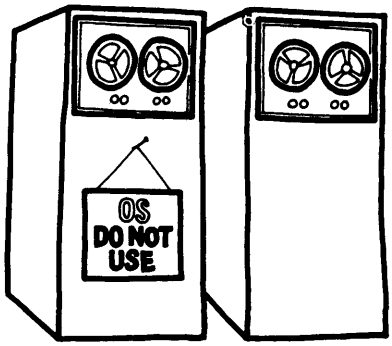
```
s init.P3,,,ABC
```

To start an initiator in partition 2 for class D, enter:

```
s init.P2,,,D
```

IBM

How to VARY a Device Online or Offline



4d

When you VARY a device you are telling MFT that a device is, or is not, available for use.

To VARY a device online, enter:

```
v unitaddr,online
```

or offline, enter:

```
v unitaddr,offline
```

v – VARY command.

unitaddr – address of the unit to be put online or offline.

,online – the device is to be made available to the system.

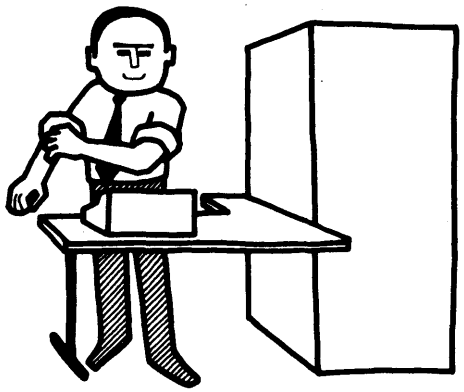
,offline – the device is to be made unavailable to the system.

Example:

To VARY tape unit 283 offline, enter:

```
v 283,offline
```

MFT is Ready to Work



4e

When you have entered the SET command, and if necessary, the START and VARY commands, you are ready to start work.

Example of how to start MFT working.

Problem: Start a system with automatic START commands, change the START RDR to a new unit address. Format the queue and do not change the job queue parameters. VARY one device offline.

After the READY message the system will enter the automatic START commands.

```
IEE103I S WTR.Pn,unitaddr *
IEE103I S RDR.Pn,unitaddr *
IEE103I S INIT.ALL *
```

Now enter the SET command.

```
t date=yy.ddd,clock=hh.mm.ss,Q=(,F),AUTO=yny
```

signal EOB

In response to the use of the F in the Q parameter, MFT will send you the message:

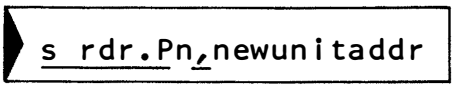
```
id IEF423A SPECIFY JOB QUEUE PARAMETERS
```

For this example, the job queue parameters are not to be changed so you would enter:

```
r id,'U'
```

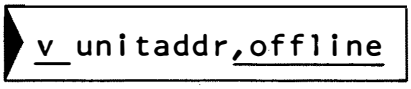
signal EOB

In the AUTO= parameter of the SET command, we rejected the second START command. The second START command is a S RDR command and the unit address is to be changed to a new address. Enter a new START command.



signal EOB

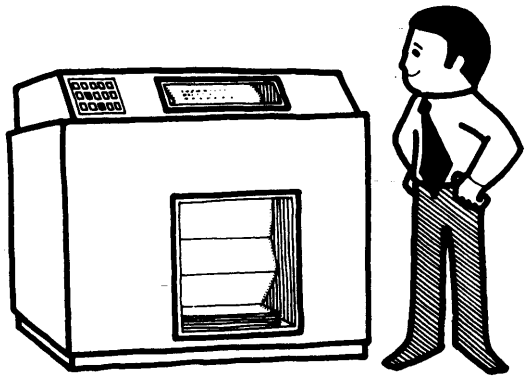
To VARY one device offline enter:



signal EOB

If there are no further messages from MFT you are ready to start work.

How to Print a SYSOUT Tape



To print the SYSOUT tape execute the program called IEBGENER.

Punch the following cards and run them as a job:

```
//xxx          JOB     xxx
//xxx          EXEC    PGM=IEBGENER
//SYSPRINT     DD      SYSOUT=A
//SYSUT1       DD      DSN=SYSOUT, UNIT=2400,
//                     DISP=(OLD,DELETE),
//                     VOL=SER=(VOL1,...,VOLn)
//SYSUT2       DD      UNIT=1403,
//                     DCB=(LRECL=133,
//                     BLKSIZE=133,RECFM=FM)
//SYSIN        DD      DUMMY
/*
```

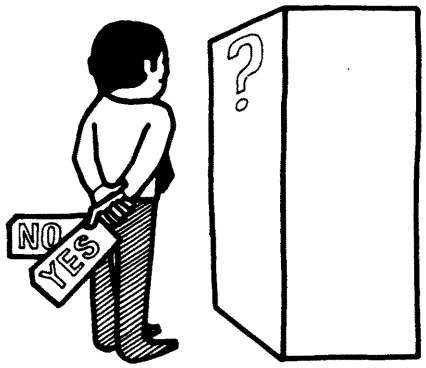
The variables are:

xxx – defined by your installation.

(VOL1, . . .VOLn) – the volume serial numbers produced by the SYSOUT writer that wrote the tape.

IBM

How to Restart a Job



Automatic Restart

When the system is requesting your authorization for an automatic restart, you will receive the message:

```
IEF225D SHOULD job RESTART
```

Use the REPLY command, and answer the message with one of the following:

```
r id,'YES'
```
signal EOB

This authorizes an immediate restart.

```
r id,'HOLD'
```
signal EOB

The restart is canceled.

```
r id,'HOLD'
```
signal EOB

The restart is suspended until you enter either the RELEASE jobname or CANCEL jobname command.

Deferred Restart

The job to be restarted is submitted by the programmer as a normal run. When the system completes the restart procedure on the job, you will get the message:

```
IHJ0081 job RESTARTED
```

and the job will continue. No action on your part is necessary.

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IBM

OS/MVT

MVT

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FLOW CHARTS

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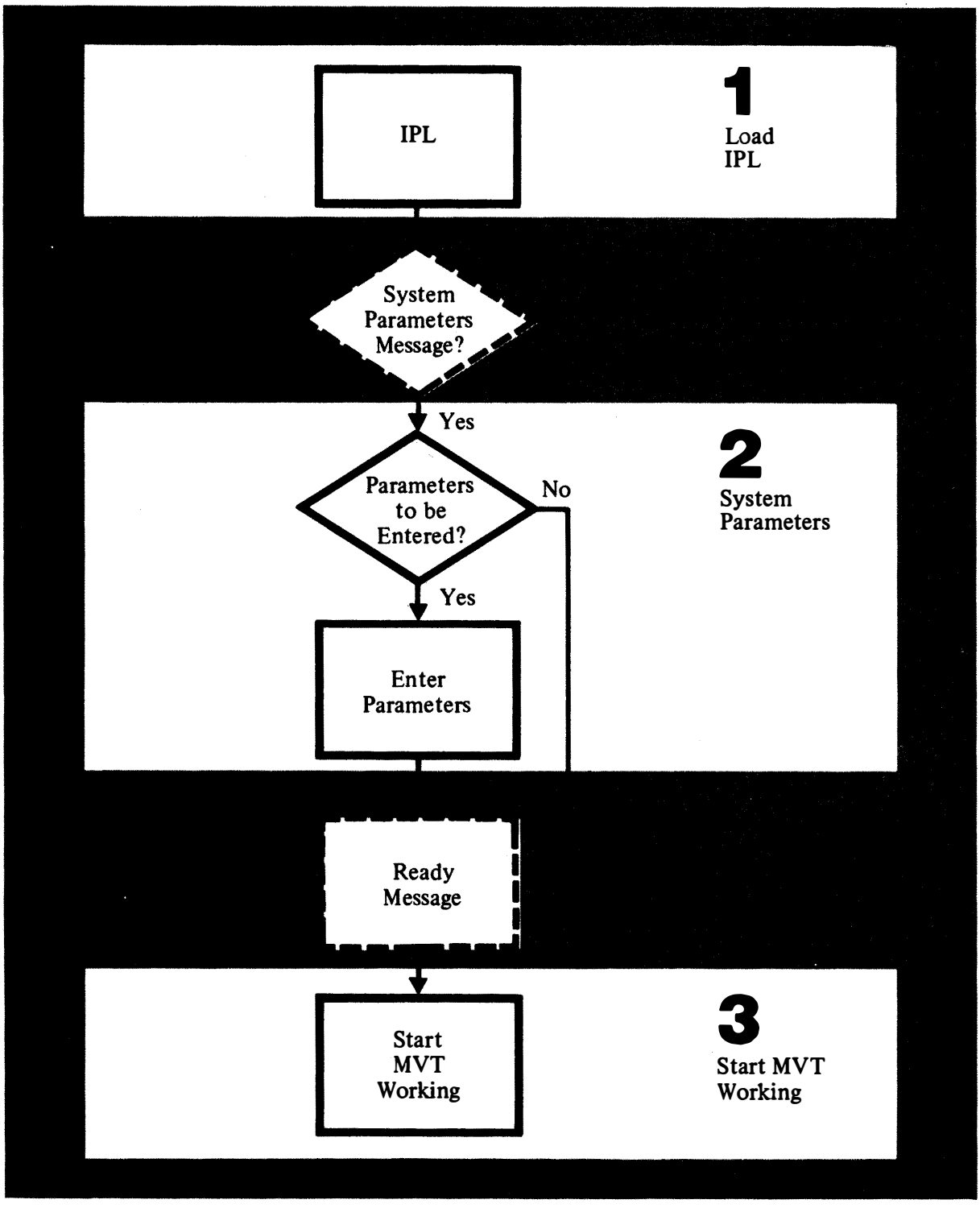
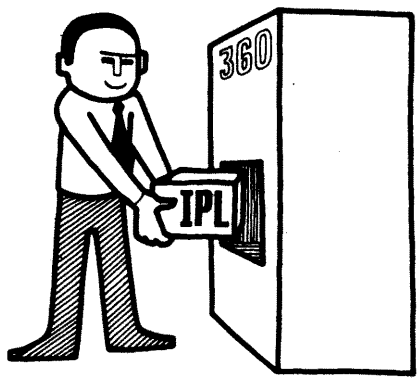
How to Get MVT In and Running



How to Load IPL



1

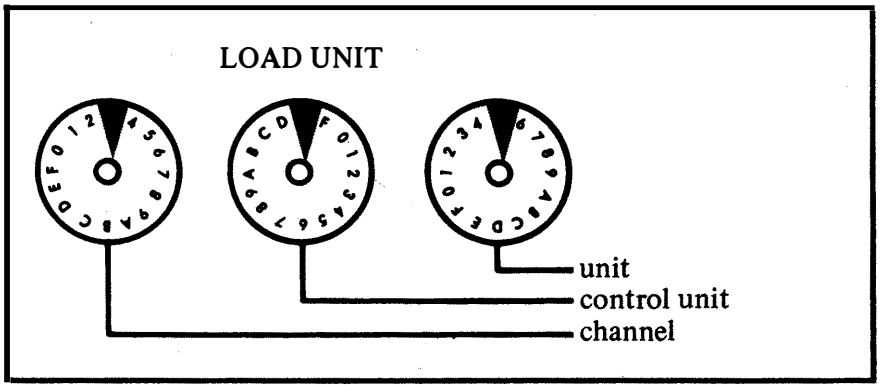
To get MVT running you must first load the IPL[1] program.

To load IPL:

Locate the direct access storage device on which the system residence volume (volume to be IPL'ed) resides.

Set the **LOAD UNIT** dials on the control panel to the unit address of the SYSRES volume.

The unit address is made up of the unit, control unit, and channel numbers.



Hit the **LOAD** key on the control panel, this turns off the **MANUAL** light, turns on the **LOAD** light, and reads in the IPL program.

When the **LOAD** light goes off, IPL is in and running.

[1] IPL – Initial Program Load

If the **WAIT** light goes on and there is no message on the console, display the PSW[1] and write down the wait state code. The wait state code is the low order 3 bytes of the PSW. (Displaying the PSW for your Model 360 is explained in Operator Techniques.)

If the wait state code is 000, check the SYSRES unit to make sure it is ready, and check the address set into the **LOAD UNIT** dials.

Try to load IPL again.

When the IPL is finished, the **WAIT** light will go on and you will receive a message..

One of two messages should appear:

```
IEA101A SPECIFY SYSTEM PARAMETERS
```

The system is asking you if you have any system parameters to be entered.

Or:

```
IEE101A READY
```

MVT is now ready to be started.

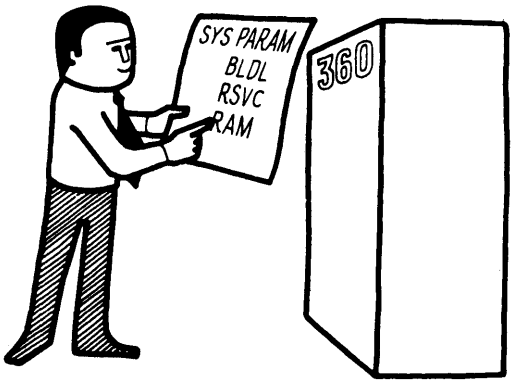
---

[1] PSW – Program Status Word

Note: If you have an Automatic Volume Recognition (AVR), check the section on Volume Mounting in the Operator's Reference, GC28-6691.

IBM

How to Specify System Parameters



2

After the IPL, if MVT sends you this message:

```
IEA101A SPECIFY SYSTEM PARAMETERS
```

The system is asking you is you have any requests to list, cancel, or alter the system parameters. Requests usually come from your system programmer.

If you have no requests; signal EOB.

The system will return the message:

```
IEE101A READY
```

MVT is now ready to be started.

If there are requests, they are carried out by issuing the REPLY command. To reply enter:

```
r id,'parameters'
```

signal EOB

r – the REPLY command

id – identification number of the message requesting the reply, in this case, the SPECIFY SYSTEM PARAMETERS message. The reply id for the SPECIFY SYSTEM PARAMETERS message is always 00.

,'parameters' – the entire field is enclosed in apostrophes, and may be entered in upper or lower case letters. Each parameter is separated by a comma.

MVT

Parameters are entered by using parameter codes and option keywords. Parameter codes are used to request an action and option keywords represent system options and their values.

Parameter Codes:

U – no changes are made.
L – list BLDL, RAM, and/or RSVC.
H – list storage hierarchies.

Option Keywords:

KEYWD=nn – keyword format.

KEYWD= – A name like BLDL= or RAM=.

nn – A keyword number like 01.

To cancel an option replace nn with ,.

To list without changing an option replace nn with 00,L.

To change an option just give a new nn.

To make an entry of more than 80 characters, make the last parameter in the line ,CONT.

After signaling EOB the system will return the message:

```
IEE101A READY
```

MVT is now ready to be started.

Examples:

To list BLDL, RAM, and RSVC enter:

```
r 00,'U,L'
```

signal EOB

To list the storage hierarchies, enter:

```
r 00,'U,H'
```

signal EOB

To cancel BLDL, enter:

```
r 00,'BLDL=,'
```

signal EOB

To list RAM with no change, enter:

```
r 00,'RAM=00,L'
```

signal EOB

To cancel RAM, alter and list BLDL, and list RSVC with no changes, enter:

```
r 00,'RAM=,BLDL=nn,L,RSVC=00,L'
```

signal EOB

Making an entry longer than 80 characters.

To change and list RAM, BLDL, and RSVC enter:

```
r 00,'RAM=nn,L,BLDL=nn,L,CONT'
```

signal EOB

The system will return the message:

```
IEA116A CONTINUE SYSTEM PARAMETERS
```

Continue to enter the requests.

```
r 00,'RSVC=nn,L'
```

signal EOB

How to Start MVT Working

3

When MVT is ready to start working, it sends you the message:

```
IEE101A READY
```

3a

If your system has automatic START commands, the system will enter the START commands on your console after the READY message. You then enter the SET command with the AUTO= parameter. The AUTO= parameter of the SET command tells the system which of the START commands entered by the system you will accept, and which ones you will reject. If you do not have automatic START commands, enter the SET command after the READY message; do not use the AUTO= parameter. The SET command gives the system the date, time of day, and addresses of the system data sets.

3b

If you used the Q= parameter in the SET command, the system will send you a message asking if you want to change or accept the job queue parameters now in the system. If you are requested by your system programmer to change the job queue parameters, use the REPLY command.

3c

Using the START command, start the system input readers (SYSIN) for input, the system output writers (SYSOUT) for output, and the initiators to select jobs for execution and allocate input/output devices for the selected jobs. For START commands that were entered automatically, and rejected in the AUTO= parameter of the SET command, enter the new START commands.

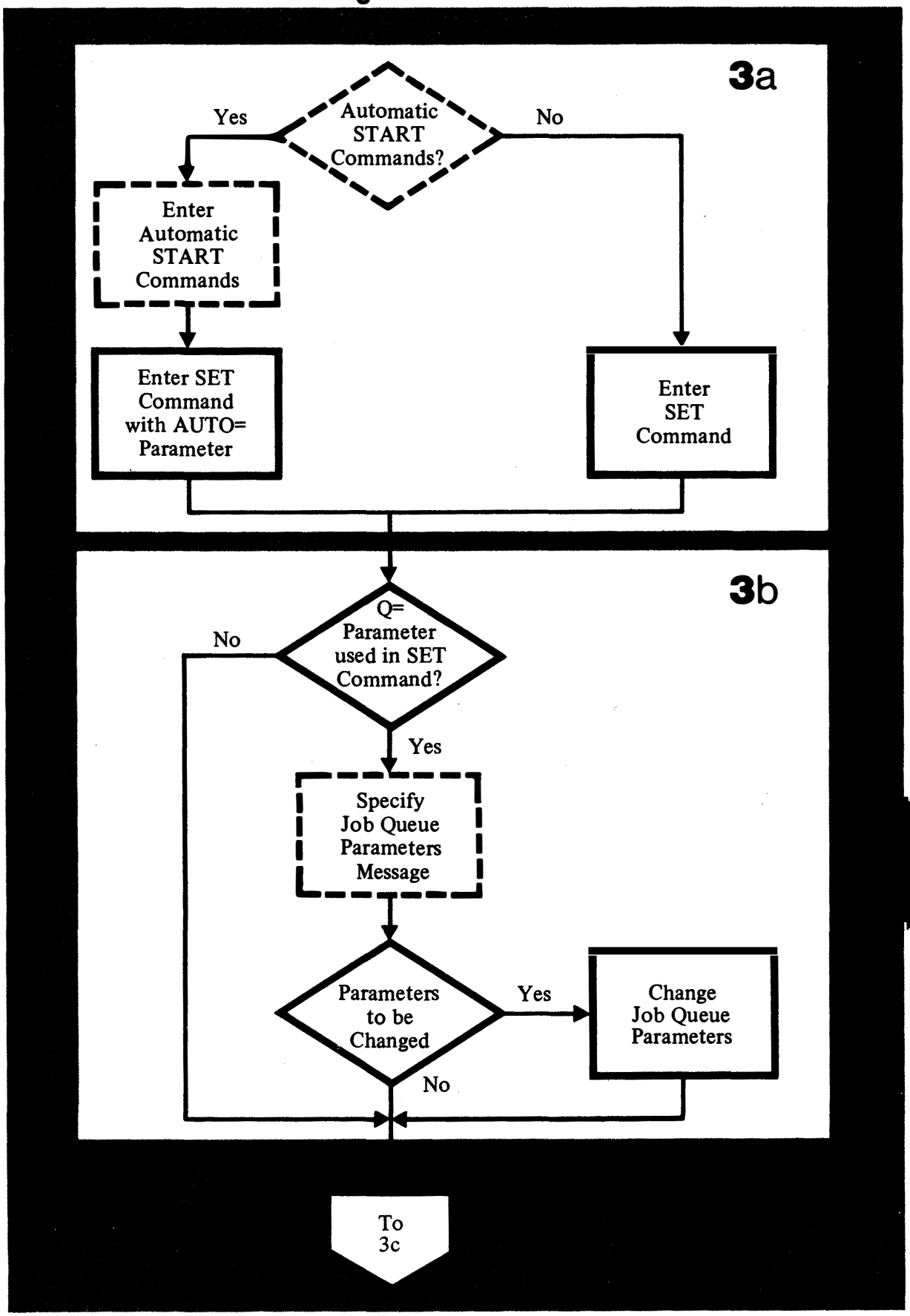
4d

If you want some devices taken offline, use the VARY command. The VARY command will tell MVT that a device is or is not to be used.

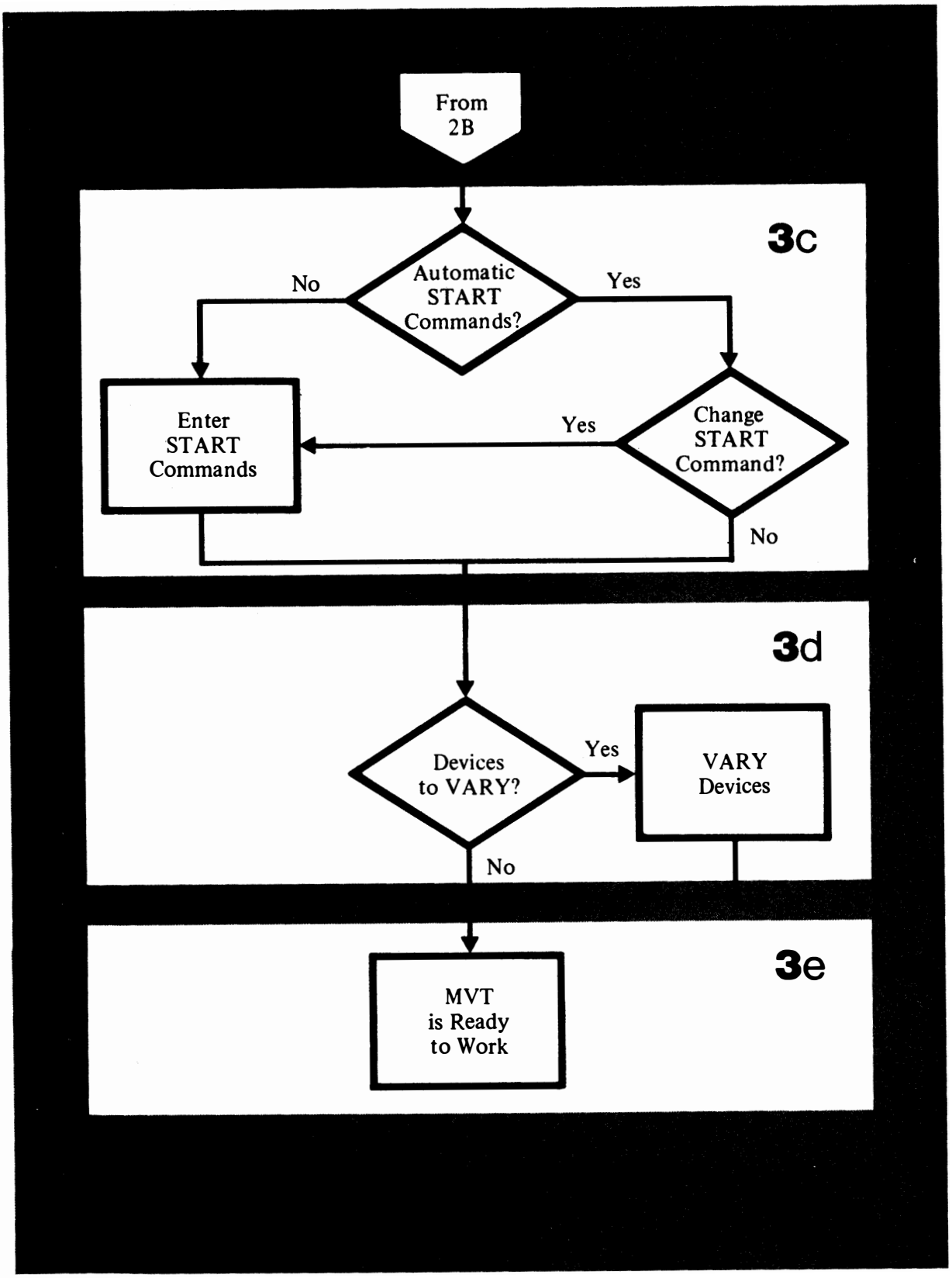
4e

When you have entered the system setup you want, MVT is ready to work.

How to Start MVT Working



How to Start MVT Working



Enter SET Command

3a

After the READY message, or the automatic START commands, enter the SET command.

The SET command procedure will use the SET command parameters that you must enter through the console, and one parameter that may be entered optionally. The optionally entered parameter can be previously specified by your system programmer or entered through the console by you.

To use the SET command enter:

```
t date=yy.ddd,clock=hh.mm.ss,Q=(unitaddr,F),AUTO=aaa
```

signal EOB

t_ – SET command.

date=yy . ddd – the date, must be included.

- ddd — day of year (001-366)
- yy — year (00-99)

Example:

January 2, 1969 looks like this:

date=69.002

,clock=hh . mm . ss – time of day, optional.

- ss — seconds (00-59)
- mm — minutes (00-59)
- hh — hours (00-23)

Example:

The time 3:25 and 14 seconds in the afternoon looks like this:

,clock=15. 25. 14

,Q= (unitaddr, F) – unit address and format code for the SYS1.SYSJOBQE[1] data set. This parameter is used after the first IPL, after turning the power on.

,Q= Keyword for the SYS1.SYSJOBQe data set.

(unitaddr – unit address of the SYS1.SYSJOBQE data set, usually specified at system generation time, if not, you must specify it.

,F) – the data set is to be formated

Example:

The parameter for the first IPL may look like this:

, Q=(, F)

,AUTO =aaa – automatic START command acceptance parameter. This parameter is used when the system has entered automatic START commands on your console. You tell the system which of the automatic START commands you will accept and which ones you will not accept.

,AUTO= – keyword for the acceptance parameter.

aaa – the acceptance or rejection of the automatic START commands listed after the READY message. If you accept all of the automatic START commands, do not use the AUTO= parameter. If you reject all the START commands, enter none in place of aaa.

If you accept some of the commands and reject other, enter y (yes) for those you accept and an n (no) for those that you reject. Enter a Y or an N for each of the START commands entered on your console by the system.

[1] SYS1.SYSJOBQE – job queue data set.

Example:

Three automatic START commands have been entered on your console by the system, you accept the first two and reject the third, enter:

```
,AUTO=yyn
```

A set command with all the examples used in this procedure.

```
t date=69.002,clock=15.25.14,Q=(,F),AUTO=yyn
```

signal EO

IBM

How to Specify Job Queue Parameters

3b

If you used the Q= parameter in the SET command, MVT will send you the message:

```
id IEF423A SPECIFY JOB QUEUE PARAMETERS
```

The system is asking you if you have any requests from your system programmer to alter the job queue parameters.

If there are no requests, enter:

```
r id,'U'
```

signal EOB

r – the REPLY command.

id – identification number of the message requesting the reply, in this case the SPECIFY JOB QUEUE PARAMETERS message. Use the id that precedes the message number IEF423A.

,'U' – no changes are made.

If there are requests, enter:

```
r id,'parameters'
```

signal EOB

r – the REPLY command.

id – identification number of the message requesting the reply, in this case the SPECIFY JOB QUEUE PARAMETERS message. Use the id that precedes the message number IEF423A.

,'parameters' – the entire field is enclosed in apostrophes; it contains four parameters. The four parameters are positional and are separated by a comma. Your system programmer will give you the line to be entered between the apostrophes.

The parameters are positional; only those parameters being changed need to be given.

Examples:

To change all four parameters, enter:

```
r id,'12,60,5,12'
```

signal EOB

To change the first parameter only, enter:

```
r id,'12'
```

signal EOB

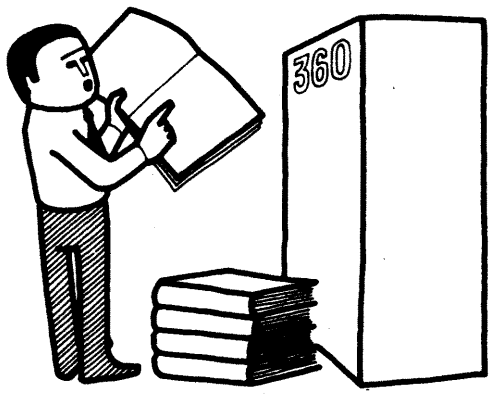
To change the third parameter only, enter:

```
r id,',,5'
```

signal EOB

IBM

How to Start the SYSIN Readers



3C

When you start the SYSIN readers, you are telling MVT what devices the system input will come in from. You can start any number of SYSIN readers.

To start a SYSIN reader, enter:

```
s rdr.ident,devicn,volserial,parmvalue,keyword=option
```

s rdr – the START RDR command.

.ident – a name that identifies a specific SYSIN reader to the system. The name is up to eight characters long, the first of which is alphabetical. If you do not specify an ident, the system will assign either the unit address of the device specified in the START command or, when no device is specified, the system procedure name specified in the START command. In this case the procedure is rdr.

,devicn – the name of the device the system input volume is mounted on. The device name can be either a unit address (like 293) or a device type (like 2400).

,volserial – serial number of the system input tape or direct access volume.

,parmvalue – the name of a job in the input stream; the reader is to start reading in data at this job. The jobs that precede it are skipped.

,keyword=option – keywords used in Job Control Language DD[1] statements. If the input device is a disk, you must use the keyword DSNAME=name. (See Job Control Language Reference, GC28-6704.)

---

[1] DD – Data Definition statement.

Examples:

Start a reader with the ident FIRST and input from tape volume number 123456.

```
s rdr.FIRST,,123456
```

Start a reader with the ident A1, the input from direct access unit 292, and use the data set named IN.

```
s rdr.A1,292,DSN=IN
```

Start a reader with the ident A and input coming from card reader 00c

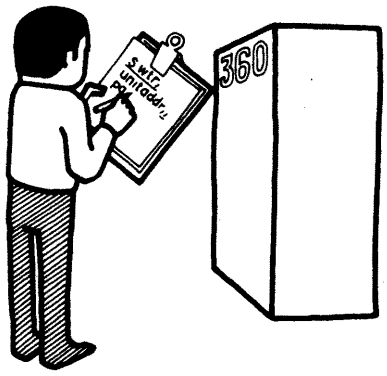
```
s rdr.A,00c
```

Start a reader with input coming from tape unit 282, volume 111111. Start input at a job named N.

```
s rdr,282,111111,N
```

IBM

How to Start the SYSOUT Writers



3C

When you start the SYSOUT writers, you are telling MVT what devices the system is to write on and the classes of output the devices are to put out. You can start any number of SYSOUT writers.

To start a SYSOUT writer, enter:

```
s wtr.ident,devicn,volserial,parmvalue,keyword=option
```

s wtr – the START WTR command.

.ident – a name that identifies a specific SYSOUT writer to the system. The name is up to eight characters long, the first of which is alphabetical. If you do not specify an ident, the system will assign either the unit address of the device specified in the START command or, when no device is specified, the system procedure name specified in the START command. In this case the procedure name is wtr.

,devicn – the output device associated with the output writer. This can be either a unit address (like 293) or a device type (like 2400).

,volserial – serial number of an output tape.

,parmvalue – job classes or output classes to be processed.

,keyword=option – keywords used in Job Control Language DD[1] statements. (See Job Control Language Reference, GC28-6704.)

[1] DD – Data Definition statements.

Examples:

Start a writer with ident W1, for classes A,B, and C, with output going to device 00e.

```
s wtr.W1,00e,,ABC
```

Start a writer for class A, with output going to device 292.

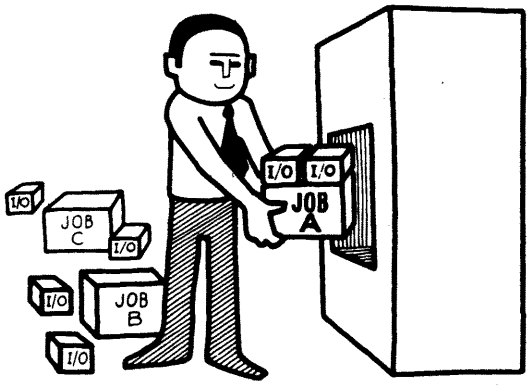
```
s wtr,292,,A
```

Start a writer with ident OUT1, for class C, with output going to tape unit 282 on volume 555555.

```
s wtr.OUT1,282,555555,C
```

IBM

How to Start the Initiators



3C

When you start an initiator, you are starting a program that selects the jobs to be run, and allocates I/O devices for the selected jobs.

To start an initiator, enter:

```
s init.ident,,,parmvalue
```

s init – the START INIT command.

.ident – a name that identifies a specific initiator to the system. The name is up to eight characters long, the first of which is alphabetical. If you do not specify an ident, the system will assign the system procedure name specified in the START command. In this case the procedure name is init.

,,,parmvalue – job classes to be processed in the partition.

Examples:

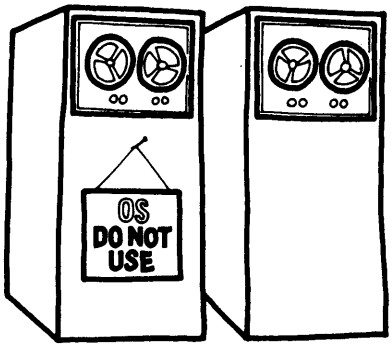
To start an initiator for classes a, b, and c, enter:

```
s init,,,ABC
```

To start an initiator with ident GT1 for class D, enter:

```
s init.GT1,,,D
```

How to VARY a Device Online or Offline



3d

When you VARY a device you are telling MVT that a device is, or is not, available for use.

To VARY a device online, enter:

```
v unitaddr,online
```

or offline, enter:

```
v unitaddr,offline
```

v – VARY command.

unitaddr – address of the unit to be put online or offline.

,online – the device is to be made available to the system.

,offline – the device is to be made unavailable to the system.

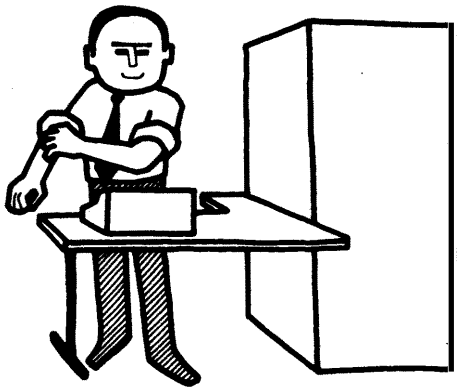
Example:

To VARY tape unit 283 offline, enter:

```
v 283,offline
```

IBM

MVT is Ready to Work



3e

When you have entered the SET command, and if necessary, the START and VARY commands, you are ready to start work.

Example of how to start MVT working.

Problem: Start a system with automatic START commands, change the START RDR to a new unit address. Format the queue and do not change the job queue parameters. VARY one device offline.

After the READY message the system will enter the automatic START commands.

```
IEE103I S WTR,unitaddr *
IEE103I S RDR,unitaddr *
IEE103I S INIT.ALL *
```

Now enter the SET command.

```
t date=yy.ddd,clock=hh.mm.ss,Q=(,F),AUTO=yny
```

signal EOB

In response to the use of the F in the Q parameter, MVT will send you the message:

```
id IEF423A SPECIFY JOB QUEUE PARAMETERS
```

For this example, the job queue parameters are not to be changed so you would enter:

```
r id,'U'
```

signal EOB

In the AUTO=parameter of the SET command, we rejected the second START command. The second START command is a S RDR command and the unit address is to be changed to a new address. Enter a new START command.

```
s rdr,newunitaddr
```

signal EOB

To VARY one device offline enter:

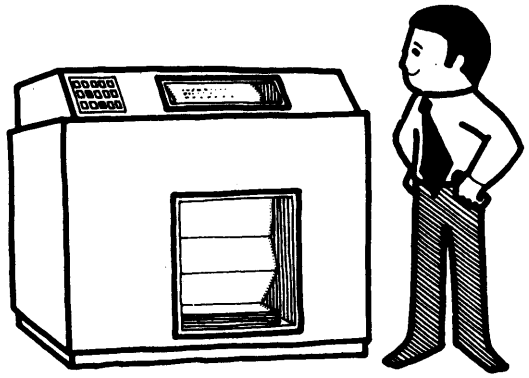
```
v unitaddr,offline
```

signal EOB

If there are no further messages from MVT you are ready to start work.

IBM

How to Print a SYSOUT Tape



To print the SYSOUT tape execute the program called IEBGENER.

Punch the following cards and run them as a job:

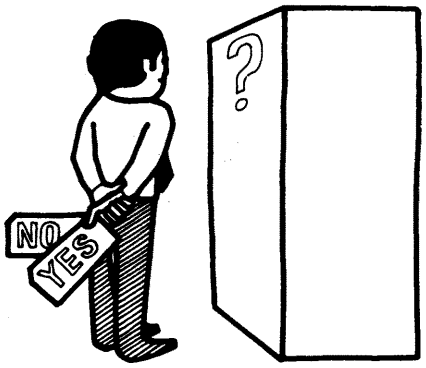
```
//xxx          JOB     xxx
//xxx          EXEC    PGM=IEBGENER
//SYSPRINT     DD      SYSOUT=A
//SYSUT1       DD      DSN=SYSOUT, UNIT=2400,
//                     DISP=(OLD, DELETE),
//                     VOL=SER=(VOL1,...,VOLn)
//SYSUT2       DD      UNIT=1403,
//                     DCB=(LRECL=133,
//                     BLKSIZE=133, RECFM=FM)
//SYSIN        DD      DUMMY
/*
```

The variables are:

xxx – defined by your installation.

(VOL1, . . . VOLn) – the volume serial numbers produced by the SYSOUT writer that wrote the tape.

How to Restart a Job



Automatic Restart

When the system is requesting your authorization for an automatic restart, you will receive the message:

```
IEF225D SHOULD job RESTART
```

Use the REPLY command, and answer the message with one of the following:

```
r id,'YES'
```
signal EOB

This authorizes an immediate restart.

```
r id,'NO'
```
signal EOB

The restart is canceled.

```
r id,'HOLD'
```
signal EOB

The restart is suspended until you enter either the RELEASE jobname or CANCEL jobname command.

Deferred Restart

The job to be restarted is submitted by the programmer as a normal run. When the system completes the restart procedure on the job, you will get the message:

```
IHJ0081 job RESTARTED
```

and the job will continue. No action on your part is necessary.

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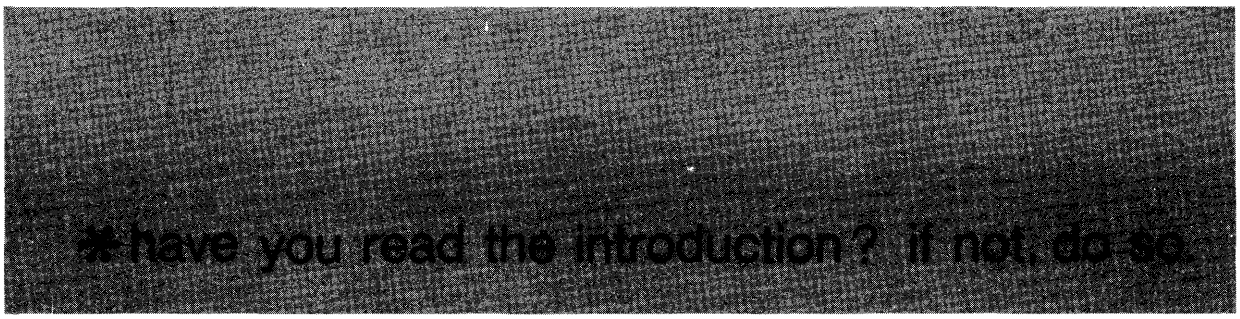

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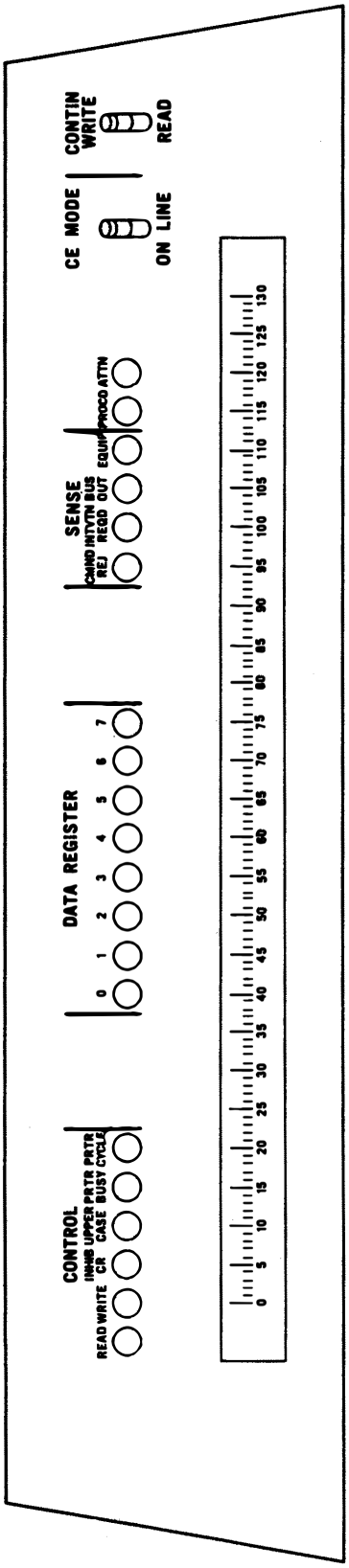
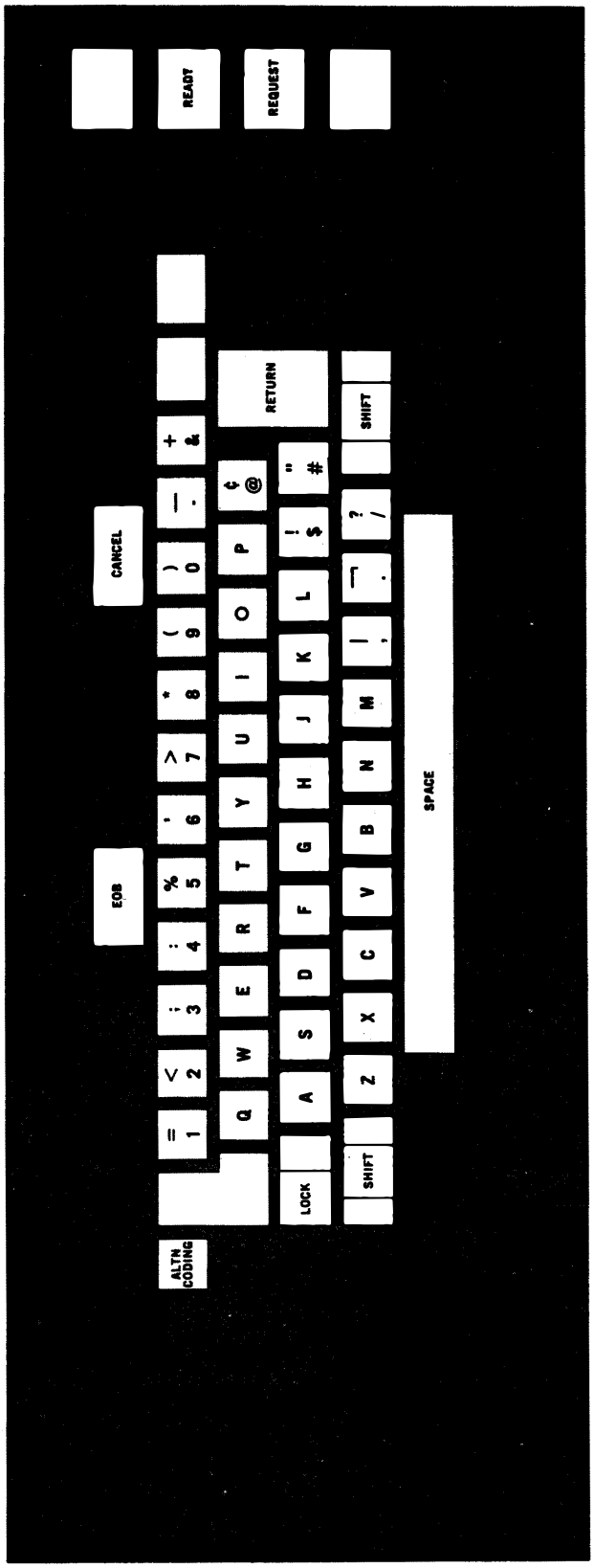
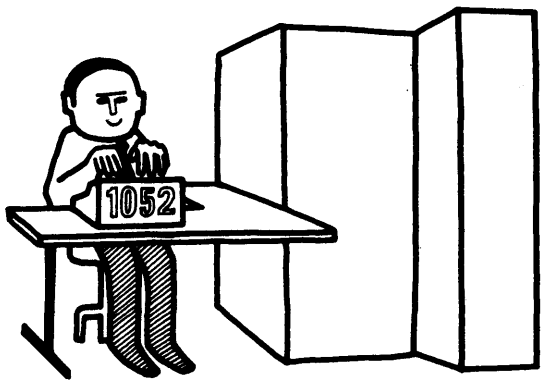
IBM 1052 Model 8 Keyboard and Switch Panel





How to Use a 1052 Console



The IBM Console can be used with any system and with any model CPU. The maximum line length is 126 characters for both input commands and output messages. Figure 7 illustrates the keyboard of the Model 8.

To enter a command through the 1052 Console:

Check to see if the **PROCEED** light is on.

If the **PROCEED** light is not on:

Hit the **REQUEST** button on the 1052.
Wait for the **PROCEED** light to go on.

The **PROCEED** light is on:

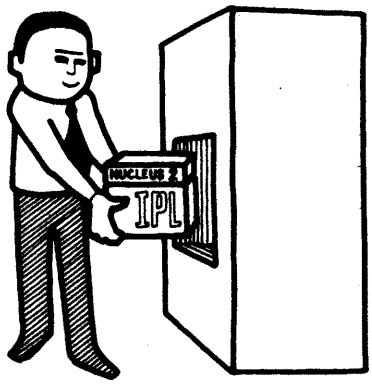
Type the command(s)
Signal EOB by pressing simultaneously the **ALTN** and **5** keys on the console.

If you happen to hit the **REQUEST** button when the **PROCEED** light is on, recover by signalling **EOB** twice after entering the command(s).

If you make an error while entering a command, press simultaneously the **ALTN** and **0** (zero) keys. The system will ignore what you have entered on that line and give you a new line. If your 1052 can be backspaced, simple errors can be corrected by backspacing and retyping from the point the error was made.

IBM

How to Load IPL With a Secondary Nucleus

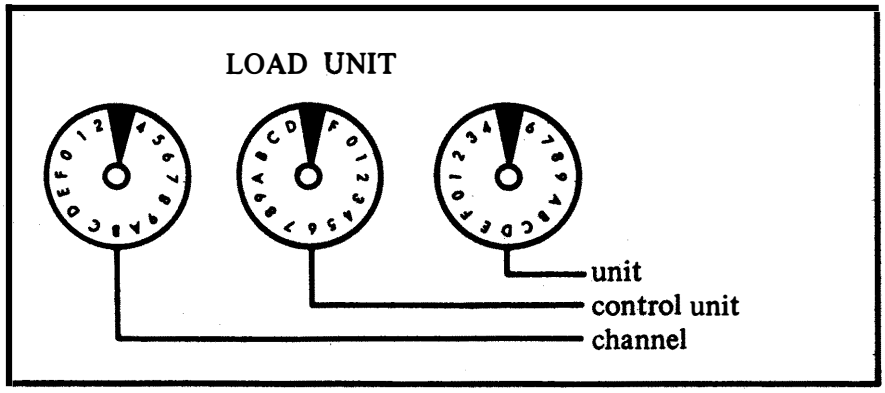


If you are requested by your system programmer to load IPL with a secondary nucleus, use this procedure in place of the first half of the regular IPL[1] procedure.

Locate the direct access storage device on which the systems residence volume (volume to be IPL'ed) resides.

Set the LOAD UNIT dials on the control panel to the unit address of the SYSRES volume.

The unit address is made up of the unit, control unit, and channel numbers.



Set the **ADDRESS COMPARE** to stop.

Set the **ADDRESS SWITCHES** [2] to hex 80.

---

[1] IPL – Initial Program Load

[2] The **ADDRESS SWITCHES** and the **INSTRUCTION COUNTER SWITCHES** are the same switches. The name depends on which model of the 360 you are running.

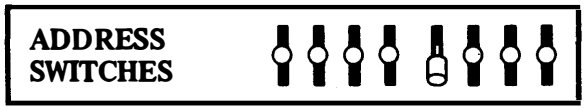
Hit the **LOAD** key on the control panel, this turns off the **MANUAL** light, turns on the **LOAD** light, and starts to read in the IPL program.

The system will stop almost immediately at location 80.

Set in the **DATA SWITCHES** a hexadecimal number (F1 to F9). Get the number to be used from your system programmer.

Example: F1

Set in the **ADDRESS SWITCHES** the hexadecimal number 08.



Hit the **STORE** key.

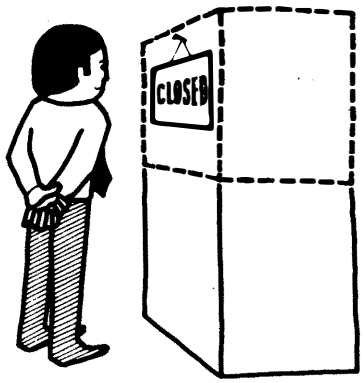
Set **ADDRESS COMPARE** to **PROCESS**.

Hit the **START** key.

The IPL program will continue to load, and you continue with your regular IPL procedure.

IBM

How to Limit the Size of Main Storage



When you limit the size of main storage, you are telling the system that it can only use part of the actual main storage.

Before loading the system, you can enter a hexadecimal number representing the highest main storage address in the system. This causes the main storage locations higher than the limit to be inaccessible to the system.

The hex numbers that represent main storage sizes are:

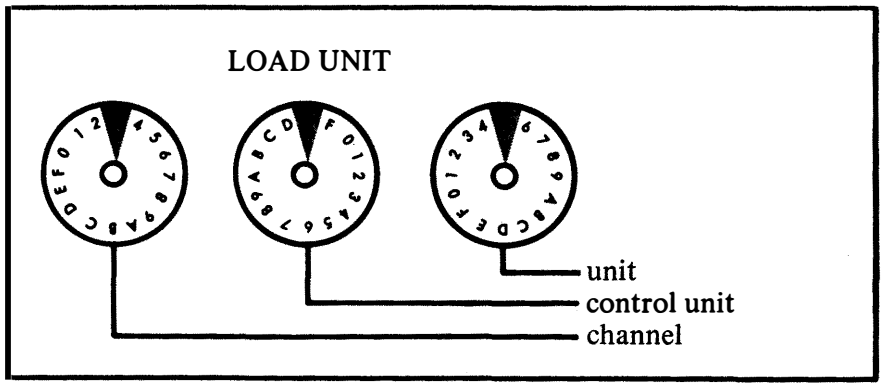
Hex Number	C6	C7	A7	C8	A8	C9	D0	D1
Storage Size	64K	128K	192K	256K	384K	512K	768K	1024K

To limit the size of main storage:

Locate the direct access storage device on which the systems residence volume (volume to be IPL'ed) resides.

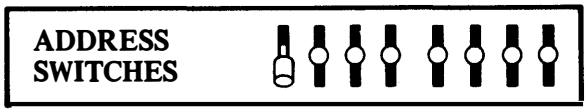
Set the LOAD UNIT dials on the control panel to the unit address of the SYSRES volume.

The unit address is made up of the unit, control unit, and channel numbers.



Set the **ADDRESS COMPARE** to STOP.

Set the **ADDRESS SWITCHES**[1] to hex 80.



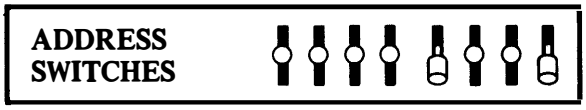
Hit the **LOAD** key on the control panel.

When the system stops at location 80.

Set in the **DATA SWITCHES** a hex number (A7, A8, C6-C9, D0 or D1).
The hex number corresponds to the storage size that you want.

Example: C6

Set in the **ADDRESS SWITCHES** a 9.



Hit the **STORE** key.

Set **ADDRESS COMPARE** to PROCESS.

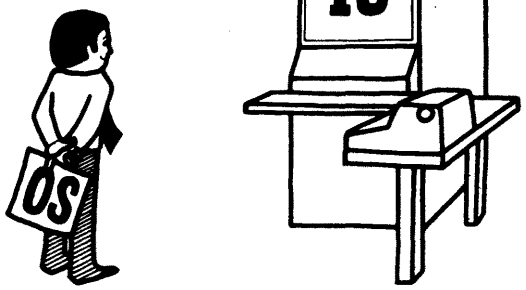
Hit the **START** key.

OT

[1] The **ADDRESS SWITCHES** and the **INSTRUCTION COUNTER SWITCHES** are the same switches. The name depends on which model of the 360 you are running.

IBM

How to Use Independent Utility Programs



Independent utility programs do not run under OS, they run by themselves.

They include:

DASDI (IBCDASDI),
a program that initializes and assigns alternate tracks to a direct access volume.

DUMP/RESTORE (IBCDMPRS),
a program that dumps and restores the contents of a direct access volume.

RECOVER/REPLACE (IBCRCVRP),
a program that recovers usable data from a bad track, assigns an alternate track, and merges replacement data with the recovered data onto the alternate track.

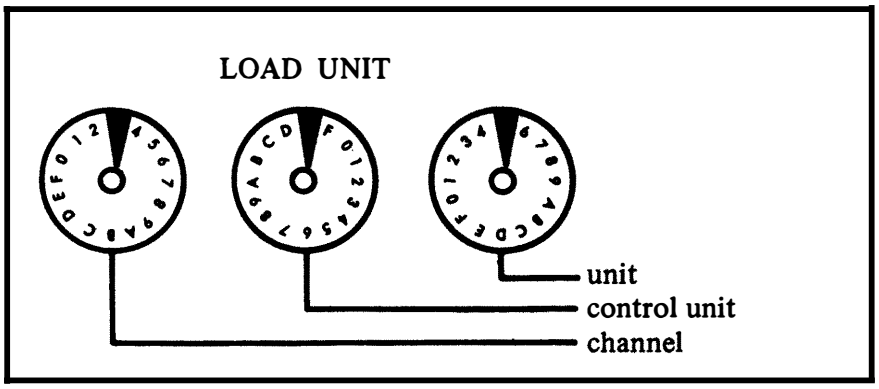
Independent utilities are loaded as card decks or from a tape. The programs and the control statements needed to use them are described in IBM System/360 Operating System: Utilities, GC28-6586.

To run an independent utility program:

Mount a tape that contains the utility program or, punch the utility program into a deck and place the deck in the card reader.

Set the **LOAD UNIT** dials on the control panel to the address of the input device.

The unit address is made up of the unit, control unit, and channel number.



Hit the **LOAD** key on the control panel, this turns off the **MANUAL** light, turns on the **LOAD** light, and reads in the utility program.

When the utility program is loaded, the system goes into a wait state. The **INSTRUCTION ADDRESS**[1] lights will contain FFFF.

Hit the **REQUEST** key on your console;
the system will send you the message:

```
IBC105A DEFINE INPUT DEVICE
```

The system is asking you which device the utility control statements[2] will be read in from.

OT

---

[1] The **INSTRUCTION ADDRESS** lights and the **INSTRUCTION COUNTER** lights are the same lights depending on which model of the 360 you are running.
[2] The utility control statements are used to describe to the utility program what it is to do. (See Utilities, GC28-6586).

To reply, enter:

```
Input=dddd,acu
```

signal EOB

input= – the reply keyword.

dddd – the device type.

,a – the channel address.

c – control unit

u – unit

When the job is done, the system enters on your console or printer:

```
END OF JOB
```

and then goes into a wait state.

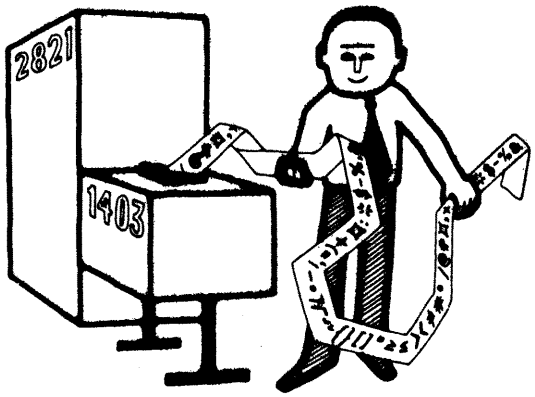
Note: If running the utility program RECOVER/REPLACE and the output is to be on tape, the end of the job code will be in the INSTRUCTION ADDRESS lights.

DDDD – a normal end of job.

EEEE – an abnormal end of job. Try the job again.

IBM

How to Reply to UCS Messages



The Universal Character Set (UCS) feature provides for printing any set of up to 240 graphics by the 1403 printer or 256 graphics by the 3211 printer.

The 2821 and the 3811 control units have read/write storage units (buffers) of 240 and 512 bytes respectively for each printer attached. Each position in the 2821 buffer corresponds to a character on the printer's chain or train. The 3811 buffer contains a train image in all but the last 80 positions of a buffer, which are used to screen data checks.

A one-to-four byte code (character set-code) identifies the character set image in the system library that is to be loaded by the operating system into the UCS buffer. It also tells you which chain cartridge to physically mount on the printer.

The identification codes that correspond to IBM standard character sets are:

Code 1403	Code 3211	Character Set
AN	A11	alphameric
HN	H11	alphameric
	G11	ASCII
PCAN		alphameric[1]
PCHN		alphameric[1]
PN	P11	alphameric (PL/I)
QNC		alphameric (PL/I–commercial)[1]
QN		alphameric (PL/I–scientific)
RN		FORTRAN–COBOL–commercial
SN		text printing[1]
TN	T11	text printing
XN		high-speed alphameric
YN		high-speed alphameric[1]

User-designated character set images are stored in the system library and assigned a character set-code defined by the user.

---

[1] preferred character set.

To reply to a UCS message, enter:

```
r id,'code,FOLD,VERIFY'
```

r – the REPLY command.

id – identification number of the UCS message requesting the reply.

,'code – a one to four byte character set-code that identifies the character set image to be used.

,FOLD – causes certain EBCDIC characters to be printed with the graphics corresponding to other EBCDIC characters. This parameter should not be specified unless the programmer requests it or it is known that the character set specified requires folding. The letter F can be used in place of the word Fold.

,VERIFY' – causes a character set image to be displayed on the printer. This allows you to verify that the chain mounted on the printer corresponds to the character set-code requested. The letter V can be used in place of the word VERIFY. If the VERIFY parameter is used and the FOLD parameter is not used enter a comma in place of it.

Examples of replies to UCS messages.

Reply with a character set of AN.

```
r id,'AN'
```
signal EOB

Reply with a character set of H11 and use the FOLD option.

```
r id,'H11,F'
```
signal EOB

Reply with a character set of SN and use the VERIFY option.

```
r id,'SN,,V'
```
signal EOB

CHARACTER SET CODE	SOURCE CHARACTERS			
	TOTAL	ALPHA	NUMERIC	SPECIAL CHARACTERS
1403				
AN	48	A–Z	0–9	/ ¢ # ¤ . + * $ – % , &
A11	48	A–Z	0–9	/ ¢ # . + * $ – % , &
HN	48	A–Z	0–9	/ ' =) . + * $ – (, &
PCAN	48	A–Z	0–9	/ ¢ # ¤ . + * $ – % , &
PCHN	48	A–Z	0–9	/ ' =) . + * $ – (, &
PN, QNC, and QN	60	A–Z	0–9	/ ' =) . + * $ – (, & " — : | > ? # % ¢ < ; ¬
RN	52	A–Z	0–9	/ ' =) . + * $ – (, & ¤ # % ¢
SN	84	A–Z a–z	0–9	/ ') . + * $ – (, & " — : | ¤ ? ! % ¢ £ ;
TN	120	A–Z a–z	0–9	/ ' =) . + * $ – (, & " — : | ¤ ? ! % ¢ £ ; ¬ – • ┐ ┌ ┘ └ { } [ ] ▪ ≥ ≤ > < ≠ # °) (+ – 0 9 8 7 6 5 4 3 2 1 ± +
XN	40	A–Z	0–9	. * $,
YN	42	A–Z	0–9	# . * $ – ,
3211				
A11	48	A–Z	0–9	/ ¢ # ¤ . + * $ – % , &
H11	48	A–Z	0–9	/ ' =) . + * $ – (, &
G11	63	A–Z	0–9	/ ' =) . + * $ – (, & " — : | > ? # % ¢ < ; ¬
P11	60	A–Z	0–9	/ ' =) . + * $ – (, & " — : | > ? # % ¢ < ; ¬
T11	120	A–Z a–z	0–9	/ ') . + * $ – (, & " — : | ¤ ? ! % ¢ £ ; ¬ – • ┐ ┌ ┘ └ { } [ ] ▪ ≥ ≤ > < ≠ # °) (+ – 0 9 8 7 6 5 4 3 2 1 ± +

IBM

Sample Print-outs for IBM Standard Chains

AN IMAGE

12	34	56	78	90	#@	/S	TU	VW	XY	Z&	,%	JK	LM	NO	PQ	R-	$*	AB	CD	EF	GH	I+	.⌑
12	34	56	78	90	#@	/S	TU	VW	XY	Z&	,%	JK	LM	NO	PQ	R-	$*	AB	CD	EF	GH	I+	.⌑
12	34	56	78	90	#@	/S	TU	VW	XY	Z&	,%	JK	LM	NO	PQ	R-	$*	AB	CD	EF	GH	I+	.⌑
12	34	56	78	90	#@	/S	TU	VW	XY	Z&	,%	JK	LM	NO	PQ	R-	$*	AB	CD	EF	GH	I+	.⌑
12	34	56	78	90	#@	/S	TU	VW	XY	Z&	,%	JK	LM	NO	PQ	R-	$*	AB	CD	EF	GH	I+	.⌑

HN IMAGE

12	34	56	78	90	='	/S	TU	VW	XY	Z&	,(	JK	LM	NO	PQ	R-	$*	AB	CD	EF	GH	I+	.)
12	34	56	78	90	='	/S	TU	VW	XY	Z&	,(	JK	LM	NO	PQ	R-	$*	AB	CD	EF	GH	I+	.)
12	34	56	78	90	='	/S	TU	VW	XY	Z&	,(	JK	LM	NO	PQ	R-	$*	AB	CD	EF	GH	I+	.)
12	34	56	78	90	='	/S	TU	VW	XY	Z&	,(	JK	LM	NO	PQ	R-	$*	AB	CD	EF	GH	I+	.)
12	34	56	78	90	='	/S	TU	VW	XY	Z&	,(	JK	LM	NO	PQ	R-	$*	AB	CD	EF	GH	I+	.)

PCAN IMAGE

12	34	56	78	90	,-	PQ	R#	$@	/S	TU	VW	XY	Z⌑	.*	12	34	56	78	90	,-	JK	LM	NO	AB	CD	EF	GH	I+	.*
12	34	56	78	90	,-	PQ	R&	$%	/S	TU	VW	XY	Z⌑	.*	12	34	56	78	90	,-	JK	LM	NO	AB	CD	EF	GH	I+	.*
12	34	56	78	90	,-	PQ	R#	$@	/S	TU	VW	XY	Z⌑	.*	12	34	56	78	90	,-	JK	LM	NO	AB	CD	EF	GH	I+	.*
12	34	56	78	90	,-	PQ	R&	$%	/S	TU	VW	XY	Z⌑	.*	12	34	56	78	90	,-	JK	LM	NO	AB	CD	EF	GH	I+	.*

PCHN IMAGE

12	34	56	78	90	,-	PQ	R=	$'	/S	TU	VW	XY	Z)	.*	12	34	56	78	90	,-	JK	LM	NO	AB	CD	EF	GH	I+	.*
12	34	56	78	90	,-	PQ	R&	$(	/S	TU	VW	XY	Z)	.*	12	34	56	78	90	,-	JK	LM	NO	AB	CD	EF	GH	I+	.*
12	34	56	78	90	,-	PQ	R=	$'	/S	TU	VW	XY	Z)	.*	12	34	56	78	90	,-	JK	LM	NO	AB	CD	EF	GH	I+	.*
12	34	56	78	90	,-	PQ	R&	$(	/S	TU	VW	XY	Z)	.*	12	34	56	78	90	,-	JK	LM	NO	AB	CD	EF	GH	I+	.*

PN IMAGE

12	34	56	78	90	XY	/S	TU	VW	|:	_"	,=	JK	LM	NO	PQ	R-	Z(	AB	CD	EF	GH	I+	.)	%$	*#	&@	<;	¬'	?>
12	34	56	78	90	XY	/S	TU	VW	|:	_"	,=	JK	LM	NO	PQ	R-	Z(	AB	CD	EF	GH	I+	.)	%$	*#	&@	<;	¬'	?>
12	34	56	78	90	XY	/S	TU	VW	|:	_"	,=	JK	LM	NO	PQ	R-	Z(	AB	CD	EF	GH	I+	.)	%$	*#	&@	<;	¬'	?>
12	34	56	78	90	XY	/S	TU	VW	|:	_"	,=	JK	LM	NO	PQ	R-	Z(	AB	CD	EF	GH	I+	.)	%$	*#	&@	<;	¬'	?>

QNC IMAGE

123	456	789	0#@	/ST	UVW	XYZ	&.%	JKL	MNO	PQR	-$*	ABC	DEF	GHI	",=
123	456	789	0#@	/ST	UVW	XYZ	&.%	JKL	MNO	PQR	-$*	ABC	DEF	GHI	|:_
123	456	789	0#@	/ST	UVW	XYZ	&.%	JKL	MNO	PQR	-$*	ABC	DEF	GHI	<;¬
123	456	789	0#@	/ST	UVW	XYZ	&.%	JKL	MNO	PQR	-$*	ABC	DEF	GHI	'?>
123	456	789	0#@	/ST	UVW	XYZ	&.%	JKL	MNO	PQR	-$*	ABC	DEF	GHI	)+(

Sample Print-outs for IBM Standard Chains

QN IMAGE

```
|12|34|56|78|90|XY|/S|TU|VW|_"|$*|,=|JK|LM|NO|PQ|R-|Z(|AB|CD|EF|GH|I+|.)|
|12|34|56|78|90|XY|/S|TU|VW|<;|#*|,=|JK|LM|NO|PQ|R-|Z(|AB|CD|EF|GH|I+|.)|
|12|34|56|78|90|XY|/S|TU|VW|?>|@*|,=|JK|LM|NO|PQ|R-|Z(|AB|CD|EF|GH|I+|.)|
|12|34|56|78|90|XY|/S|TU|VW|¬'|&*|,=|JK|LM|NO|PQ|R-|Z(|AB|CD|EF|GH|I+|.)|
|12|34|56|78|90|XY|/S|TU|VW||:|%*|,=|JK|LM|NO|PQ|R-|Z(|AB|CD|EF|GH|I+|.)|
```

RN IMAGE

```
|12|34|56|78|90|XY|/S|TU|VW|'@|$*|,=|JK|LM|NO|PQ|R-|Z(|AB|CD|EF|GH|I+|.)|
|12|34|56|78|90|XY|/S|TU|VW|%@|$*|,=|JK|LM|NO|PQ|R-|Z(|AB|CD|EF|GH|I+|.)|
|12|34|56|78|90|XY|/S|TU|VW|#@|$*|,=|JK|LM|NO|PQ|R-|Z(|AB|CD|EF|GH|I+|.)|
|12|34|56|78|90|XY|/S|TU|VW|⌑@|$*|,=|JK|LM|NO|PQ|R-|Z(|AB|CD|EF|GH|I+|.)|
|12|34|56|78|90|XY|/S|TU|VW|&@|$*|,=|JK|LM|NO|PQ|R-|Z(|AB|CD|EF|GH|I+|.)|
```

SN IMAGE

```
|12|34|56|78|90|&.|/S|TU|VW|XY|Z,|$*|JK|LM|NO|PQ|R-|":|AB|CD|EF|GH|I+|ab|cd|ef|gh|ij|kl|mn|op|qr|st|uv|wx|yz|@'|()|—||
|12|34|56|78|90|&.|/S|TU|VW|XY|Z,|$*|JK|LM|NO|PQ|R-|":|AB|CD|EF|GH|I+|ab|cd|ef|gh|ij|kl|mn|op|qr|st|uv|wx|yz|@'|()|—||
|12|34|56|78|90|&.|/S|TU|VW|XY|Z,|$*|JK|LM|NO|PQ|R-|":|AB|CD|EF|GH|I+|ab|cd|ef|gh|ij|kl|mn|op|qr|st|uv|wx|yz|@'|()|—||?!|;¢|%⌑|
```

TN IMAGE

```
|12|34|56|78|90|=.|/S|TU|VW|XY|Z,|#&|JK|LM|NO|PQ|R-|":|AB|CD|EF|GH|I+|ab|cd|ef|gh|ij|kl|mn|
|op|qr|st|uv|wx|yz|@'|?;|±!|$*|%⌑|12|34|56|78|90|-+|()|°¬|()|≠+|><|≤≥|¢=|[]|}||└┘|┌┐|°_|—||
|12|34|56|78|90|=.|/S|TU|VW|XY|Z,|#&|JK|LM|NO|PQ|R-|":|AB|CD|EF|GH|I+|ab|cd|ef|gh|ij|kl|mn|
|op|qr|st|uv|wx|yz|@'|?;|±!|$*|%⌑|12|34|56|78|90|-+|()|°¬|()|≠+|><|≤≥|¢=|[]|}{|└┘|┌┐|°_|—||
```

XN IMAGE

```
|12|34|56|78|90|,.|AB|CD|EF|GH|IZ|JK|LM|NO|PQ|R*|$S|TU|VW|XY|
|12|34|56|78|90|,.|AB|CD|EF|GH|IZ|JK|LM|NO|PQ|R*|$S|TU|VW|XY|
|12|34|56|78|90|,.|AB|CD|EF|GH|IZ|JK|LM|NO|PQ|R*|$S|TU|VW|XY|
|12|34|56|78|90|,.|AB|CD|EF|GH|IZ|JK|LM|NO|PQ|R*|$S|TU|VW|XY|
|12|34|56|78|90|,.|AB|CD|EF|GH|IZ|JK|LM|NO|PQ|R*|$S|TU|VW|XY|
|12|34|56|78|90|,.|AB|CD|EF|GH|IZ|JK|LM|NO|PQ|R*|$S|TU|VW|XY|
```

YN IMAGE

```
|123|456|789|OST|ABC|DEF|GHI|JKL|MNO|PQR|UVW|XYZ|*,.|
|123|456|789|OST|ABC|DEF|GHI|JKL|MNO|PQR|UVW|XYZ|*,.|#-$|
|123|456|789|OST|ABC|DEF|GHI|JKL|MNO|PQR|UVW|XYZ|*,.|
|123|456|789|OST|ABC|DEF|GHI|JKL|MNO|PQR|UVW|XYZ|*,.|
|123|456|789|OST|ABC|DEF|GHI|JKL|MNO|PQR|UVW|XYZ|*,.|#-$|
|123|456|789|OST|ABC|DEF|GHI|JKL|MNO|PQR|UVW|XYZ|*,.|
```

IBM

OT

IBM

Sample Print-outs for IBM Standard Chains

A11 IMAGE

1<	.+	1H	GF	ED	CB	A*	$-	RQ	PO	NM	LK	J%	,&	ZY	XW	VU	TS	/@	#0	98	76	54	32
1<	.+	1H	GF	ED	CB	A*	$-	RQ	PO	NM	LK	J%	,&	ZY	XW	VU	TS	/@	#0	98	76	54	32
1<	.+	1H	GF	ED	CB	A*	$-	RQ	PO	NM	LK	J%	,&	ZY	XW	VU	TS	/@	#0	98	76	54	32
1<	.+	1H	GF	ED	CB	A*	$-	RQ	PO	NM	LK	J%	,&	ZY	XW	VU	TS	/@	#0	98	76	54	32
1<	.+	1H	GF	ED	CB	A*	$-	RQ	PO	NM	LK	J%	,&	ZY	XW	VU	TS	/@	#0	98	76	54	32
1<	.+	1H	GF	ED	CB	A*	$-	RQ	PO	NM	LK	J%	,&	ZY	XW	VU	TS	/@	#0	98	76	54	32

H11 IMAGE

1H	GF	E)	.+	ID	CB	A*	$-	RQ	PO	NM	LK	J(	,&	ZY	XW	V8	76	5'	=0	9U	TS	/4	32
1H	GF	F)	.+	ID	CB	A*	$-	RQ	PO	NM	LK	J(	,&	ZY	XW	V8	76	5'	=0	9U	TS	/4	32
1H	GF	E)	.+	ID	CB	A*	$-	RQ	PO	NM	LK	J(	,&	ZY	XW	V8	76	5'	=0	9U	TS	/4	32
1H	GF	E)	.+	ID	CB	A*	$-	RQ	PO	NM	LK	J(	,&	ZY	XW	V8	76	5'	=0	9U	TS	/4	32
1H	GF	E)	.+	ID	CB	A*	$-	RQ	PO	NM	LK	J(	,&	ZY	XW	V8	76	5'	=0	9U	TS	/4	32
1H	GF	E)	.+	ID	CB	A*	$-	RQ	PO	NM	LK	J(	,&	ZY	XW	V8	76	5'	=0	9U	TS	/4	32
1H	GF	E)	.+	ID	CB	A*	$-	RQ	PO	NM	LK	J(	,&	ZY	XW	V8	76	5'	=0	9U	TS	/4	32
1H	GF	E)	.+	ID	CB	A*	$-	RQ	PO	NM	LK	J(	,&	ZY	XW	V8	76	5'	=0	9U	TS	/4	32
1H	GF	E)	.+	ID	CB	A*	$-	RQ	PO	NM	LK	J(	,&	ZY	XW	V8	76	5'	=0	9U	TS	/4	32

G11 IMAGE

1'	BD	JL	-5	K*	C(	NO	?)	SA	@=	E¬	#R	>V	92	\Y	T[	G6	8]	XF	"H	.|	UO	7/	P3	WM	IQ	,4
1'	BD	JL	-5	K*	C(	NO	$)	SA	&=	E:	#R	ZV	92	;Y	T+	G6	8<	XF	%H	._	UO	7/	P3	WM	IQ	,4
1'	BD	JL	-5	K*	C(	NO	?)	SA	@=	E¬	#R	>V	92	\Y	T[	G6	8]	XF	"H	.|	UO	7/	P3	WM	IQ	,4
1'	BD	JL	-5	K*	C(	NO	$)	SA	@=	E:	#R	ZV	92	;Y	T+	G6	8<	XF	%H	._	UO	7/	P3	WM	IQ	,4
1'	BD	JL	-5	K*	C(	NO	$)	SA	@=	E¬	#R	>V	92	\Y	T[	G6	8]	XF	"H	.|	UO	7/	P3	WM	IQ	,4
1'	BD	JL	-5	K*	C(	NO	$)	SA	@=	E:	#R	ZV	92	;Y	T+	G6	8<	XF	%H	._	UO	7/	P3	WM	IQ	,4
1'	BD	JL	-5	K*	C(	NO	$)	SA	@=	E¬	#R	>V	92	\Y	T[	G6	8]	XF	"H	.|	UO	7/	P3	WM	IQ	,4
1'	BD	JL	-5	K*	C(	NO	$)	SA	@=	E:	#R	ZV	92	;Y	T+	G6	8<	XF	%H	._	UO	7/	P3	WM	IQ	,4

P11 IMAGE

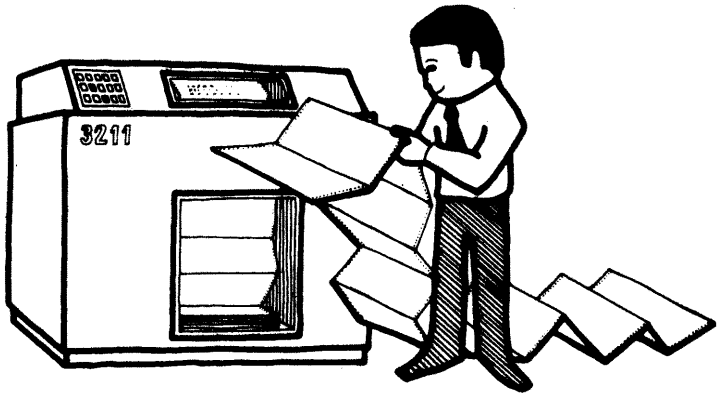
1'	BD	JL	-5	K*	C(	NA	@=	EO	?)	S¬	#R	>V	92	"6	8<	XY	T|	GF	%H	._	UO	7/	P3	WM	IQ	,4
1'	BD	JL	-5	K*	C(	NO	$=	E:	#)	SA	&R	ZV	9+	G6	82	;Y	T<	XF	%H	._	UO	7/	P3	WM	IQ	,4
1'	BD	JL	-5	K*	C(	NA	@=	EO	?)	S¬	#R	>V	92	"6	8<	XY	T|	GF	%H	._	UO	7/	P3	WM	IQ	,4
1'	BD	JL	-5	K*	C(	NO	$=	E:	#)	SA	&R	ZV	9+	G6	82	;Y	T<	XF	%H	._	UO	7/	P3	WM	IQ	,4
1'	BD	JL	-5	K*	C(	NA	@=	EO	?)	S¬	#R	>V	92	G6	8<	XY	T|	GF	%H	._	UO	7/	P3	WM	IQ	,4
1'	BD	JL	-5	K*	C(	NO	$=	E:	#)	SA	&R	ZV	9+	G6	82	;Y	T<	GF	%H	._	UO	7/	P3	WM	IQ	,4
1'	BD	JL	-5	K*	C(	NA	@=	EO	?)	S¬	#R	>V	92	G6	8<	XY	T|	GF	%H	._	UO	7/	P3	WM	IQ	,4
1'	BD	JL	-5	K*	C(	NO	$=	E:	#)	SA	&R	ZV	92	G6	82	;Y	T<	GF	%H	._	UO	7/	P3	WM	IQ	,4

T11 IMAGE

1Q	Xg	Re	bJ	G3	Hy	fI	Tp	m1	-u	Uh	r9	c1	,4	Bd	MS	P_	F7	.=	NL	ts	On	8E	oi	CA	o>	<6	Oε	!+	D*	?⌑	¯5	67	9_	≠⌑	°2
1±	08	Re	≥5	"3	3¬	4I	T≤	@(	-+	12	r9	;{	}4	[]	%S	jz	?7	.&	¬r	t┘	└:	8E	g,	oA	Zx	#6	Ov	$k	D*	w+	)5	(K	W-	/y	V2
1Q	Xg	Re	bJ	G3	Hy	fI	Tp	M1	-u	Uh	R9	c1	,4	Bd	MS	P_	F7	.=	NL	ts	On	8E	oi	CA	o>	<6	Oε	!+	D*	?⌑	¯5	67	9_	≠⌑	°2
1±	08	Re	≥5	"3	3¬	4I	T≤	@(	-+	12	r9	;{	}4	[]	%S	jz	?7	.&	¬r	t┘	└:	8E	g,	oA	Zx	#6	Ov	$k	D*	w+	)5	(K	W-	/y	V2
LQ	Xg	Re	bJ	G3	Hy	fI	Tp	M1	-u	Uh	R9	c1	,4	Bd	MS	P_	F7	.=	NL	ts	On	8E	oi	CA	o>	<6	Oε	!+	D*	?⌑	¯5	67	9_	≠⌑	°2
1±	08	Re	≥5	"3	3¬	4I	T≤	@(	-+	12	r9	;{	}4	[]	%S	jz	?7	.&	¬r	t┘	└:	8E	g,	oA	Zx	#6	Ov	$k	D*	w+	)5	(K	W-	/y	V2

IBM

How to Reply to FCB Messages



The 3211 printer uses a forms control buffer (FCB) located in the 3811 control unit to regulate the movement of forms. A forms control image defines the form length and the positions of channels. The forms control images are IBM supplied or user defined and reside in the system library. An FCB image is loaded automatically by a programmer or as the result of you replying to message:

```
IEC129D XXX,SPECIFY FCB PARAMETERS
```

XXX is the address of the printer that you are requested to specify a forms control image for. To reply to the FCB message, enter:

```
r id,'imageid,ALIGN,VERIFY'
```

r – the REPLY command.

id – the identification number of message IEC129D.

,'imageid – the identifier of the image to be loaded.
The image identifier can be IBM supplied (STD1 and STD2) or user supplied.

,ALIGN – the system will send you a message asking you to align the forms on the printer. The letter A can be used in place of the word align.

,VERIFY' – the FCB image requested is printed for verification. You will also receive a message requesting you to check the forms alignment on the printer. The letter V can be used in place of the word verify.

Examples of replies to the FCB message.

Reply with an imageid of STD1.

```
r id,'STD1'
```

Reply with a user specified of IMG1 and request a verification of the image on the printer.

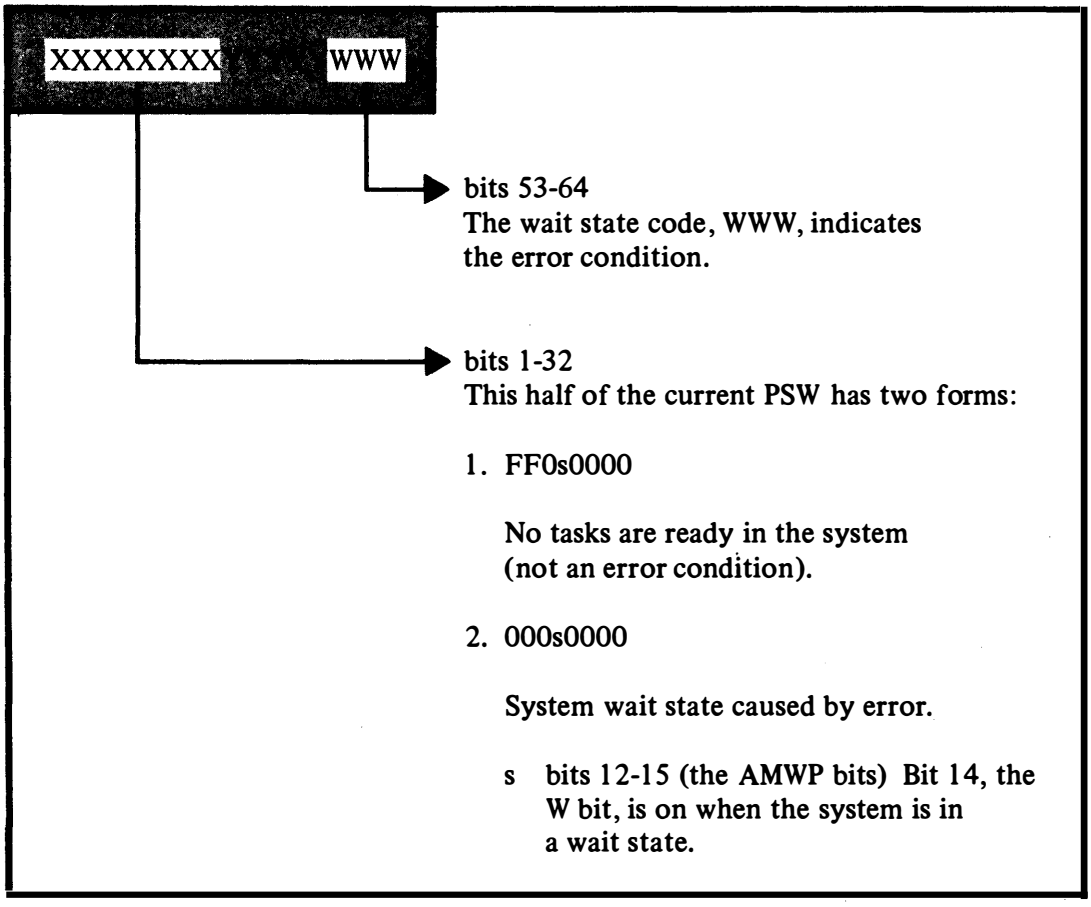
```
r id,'IMG1,V'
```

The Current PSW

When the machine goes into a WAIT state (the WAIT light on the control panel goes on), display the wait state code in the low-order 12 bits of the current PSW. (See Displaying the Current PSW in the Operator Techniques section for your Model 360).

The wait state codes, their explanations, and your responses are given in the publication Messages & Codes, GC28-6631.

Format of the Current PSW (64 bits)



Permanent Main Storage Assignments

Hex Address	Length	Content
0	8 bytes	Initial program loading PSW
8	8 bytes	Initial program loading CCW1
10	8 bytes	Initial program loading CCW2
18	8 bytes	External old PSW
20	8 bytes	Supervisor call old PSW
28	8 bytes	Program old PSW
30	8 bytes	Machine check old PSW
38	8 bytes	Input/output old PSW
40	8 bytes	Channel status word
48	4 bytes	Channel address word
4C	4 bytes	Unused
50	4 bytes	Timer
54	4 bytes	Unused
58	8 bytes	External new PSW
60	8 bytes	Supervisor call new PSW
68	8 bytes	Program new PSW
70	8 bytes	Machine check new PSW
78	8 bytes	Input/output new PSW
80	up to 256 bytes	Diagnostic scan-out area

Channel Address Word

The CAW specifies the storage protection key and the address of the first channel command word associated with the START I/O instruction. The CAW is found at hex location 48.

Program Status Word

The PSW contains information required for program execution. By storing the PSW, the control program can preserve the status of the CPU for later inspection. By loading a new PSW or part of a PSW, the status of the CPU can be changed.

The format of old and new PSWs is the same as that of the current PSW, shown under the heading "Displaying the Current PSW."

The interruption code (bits 16-31) in the old PSWs indicates the source of the most recent interruption.

External Old PSW – Hex location 18

Code	Interruption Source
0001	External Signal 7
0002	External Signal 6
0004	External Signal 5
0008	External Signal 4
0010	External Signal 3
0020	External Signal 2
0040	Interupt Key
0080	Timer

External interruptions from more than one source can occur at one time. An interruption code of 008A means, for example, that an interruption was requested by the timer and external sources 4 and 6.

Supervisor Call Old PSW – Hex location 20

Code	Interruption Source
00xx	SVC instruction in a program

In the interruption code, xx is the 1 field of the SVC instruction that was given.

Program Old PSW – Hex location 28

Code	Interruption Source
0001	Op code incorrect
0002	Privileged operation
0003	Execute error
0004	Protection
0005	Addressing
0006	Specification
0007	Data
0008	Fixed point overflow
0009	Fixed point divide
000A	Decimal overflow
000B	Decimal divide
000C	Exponent overflow
000D	Exponent underflow
000E	Significance
000F	Floating point divide

Machine Check Old PSW – Hex location 30

Code	Interruption Source
0000	CPU or channel error

Input/Output Old PSW – Hex location 38

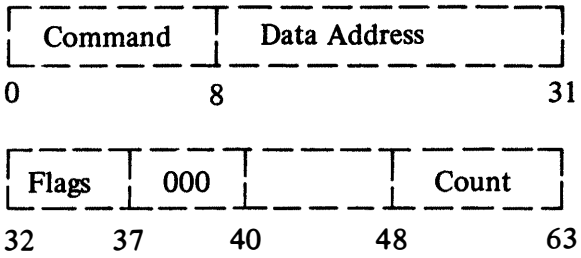
Code	Interruption Source
00xx	Multiplex channel
01xx	Selector channel 1
02xx	Selector channel 2
03xx	Selector channel 3
04xx	Selector channel 4
05xx	Selector channel 5
06xx	Selector channel 6

In the interruption code, xx is the control unit and device address.

Permanent Main Storage Assignments (Cont'd)

Channel Command Word

The CCW specifies the command, the storage area to be used for I/O operations, and the action to be followed when the operation is completed. CCWs can be anywhere in main storage, and can exist singly or in a group called a channel program.



Bits 0-7 give the command code (m identifies a modifier bit, while x indicates that the bit position is ignored):

mmmm0100	Sense command
xxxx1000	Transfer in channel command
mmmm1100	Read backward command
mmmmmm01	Write command
mmmmmm10	Read command
mmmmmm11	Control command

Bits 8-31 give the location of a byte in main storage.

Bit 32 causes the command code and data address in the CCW to be used.

Bit 34 causes a possible incorrect length indication to be suppressed.

Bit 35 suppresses the transfer of data into main storage.

Bit 36 causes a program-controlled interruption (PCI).

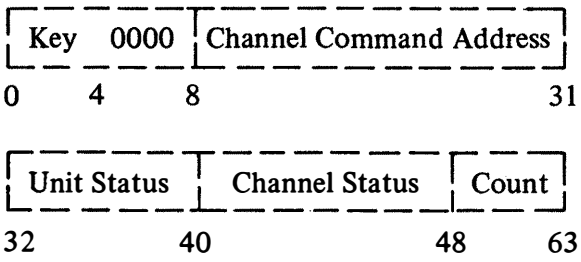
Bits 37-39 contain zeros.

Bits 40-47 are ignored.

Bits 48-63 specify the number of bytes in the operation.

Channel Status Word

The CSW provides information about the termination of an input/output operation. The CSW is found at hex location 40. It can be made up or changed by input/output interruptions as well as by START I/O, TEST I/O, and HALT I/O instructions.



Bits 0-3 contain the protection key used in the last operation.

Bits 4-7 contain zeros.

Bits 8-31 contain the address plus 8 of the last CCW used.

Bits 32-39 contain the unit status byte:

- Bit 32 – attention
- Bit 33 – status modifier
- Bit 34 – control unit end
- Bit 35 – busy
- Bit 36 – channel end
- Bit 37 – device end
- Bit 38 – unit check
- Bit 39 – unit exception

Bits 40-47 contain the channel status byte:

- Bit 40 – program-controlled interruption
- Bit 41 – incorrect length
- Bit 42 – program check
- Bit 43 – protection check
- Bit 44 – channel data check
- Bit 45 – channel control check
- Bit 46 – interface control check
- Bit 47 – chaining check

Bits 48-63 contain the residual count of the last CCW used.

Model 30 Techniques

Displaying the Current PSW

Storage displaying, including displaying the current PSW, is done one byte at a time on the Model 30.

- Hit STOP.
- Turn the DISPLAY STORE SELECTION switch E to 'AS' with red flag up.
- Turn switch A to LS or numeric 7.
- Turn MAIN STORAGE switches: B to zero, C and D to the desired location. PSW fields will be found at the locations below.

System Mask	B8
Protect Key	B9 (high order 4 bits)
AMWP	B9 (low order 4 bits)
Interruption Code	External old PSW (bits 16-31)
Instruction Length	AC (bits 4 and 5)
Condition Code	BB (high order 4 bits)
Program Mask	BB (low order 4 bits)
Instruction Address	A9 & AA (or I & J register)

Note: Condition code is displayed as four bits (8, 4, 2, 1), one bit at a time.

- Hit DISPLAY to display the data in the main storage data register and the address in the low order eight bits of the main storage address register.

Displaying a General Purpose Register (GPR)

- Hit STOP (put machine in manual mode).
- Turn switch A to LS.
- Turn switch B to zero.
- Turn switch C to desired GPR.
- Turn switch D to desired byte of GPR--that is, to 0, 1, 2, or 3. The data is displayed in the main storage data register.

Displaying Main Storage

- Hit STOP.
- Turn the DISPLAY STORE SELECTION switch E to MS with red flag up.
- Turn MAIN STORAGE ADDRESS switches A, B, C, and D to address to be displayed.
- Hit DISPLAY. The data will be in the main storage data register, while the address will be in the main storage address register.

Clearing Main Storage

- Hit STOP.
- Set INSTRUCTION ADDRESS keys to 0BF9.
- Set RCS CONTROL to ROS SCAN.
- Set CHECK CONTROL to DISABLE.
- Hit SYSTEM RESET.
- Hit ROAR RESET.
- Hit START.
- To stop the clearing process, set RATE switch to SINGLE CYCLE.
- Hit SYSTEM RESET.

Altering Main Storage

- Hit STOP.
- Set up address as you would in displaying main storage (machine must be in manual mode).
- Put new data in DATA switches H and J (use hexadecimal representation of data).
- Hit STORE; the new data is displayed in the main storage data register.

Altering The Current PSW

- Proceed as in displaying current PSW.
- Put new data in DATA switches H and J.
- Hit STORE and new data will be entered.

Altering Registers

- Follow same procedure as in displaying a register.
- Put new data in DATA switches H and J.
- Hit STORE.

Stopping on Address Compare

- Hit STOP.
- Put the address you wish to stop on in address switches A, B, C, and D.
- Turn ADDRESS COMPARE switch to SAR.
- DELAYED STOP.
- The CPU STATUS MATCH indicator will come on when the address is reached.

Displaying a Floating Point Register (FPR).

Floating point registers are an optional feature. If your machine has this feature, you can display an individual FPR following the same procedure used in displaying a GPR, with the following differences.

- Hit STOP.
- Turn switch C to desired FPR.
- Turn switch D to desired byte of FPR:

FPR byte	Switch D setting
0	8
1	9
2	A
3	B
4	C
5	D
6	E
7	F

- The data is displayed in the main storage data register.

Model 40 Techniques

Displaying the Current PSW

Storage displaying, including displaying the current PSW, is done two bytes at a time on the Model 40.

- Hit STOP.
- Set the STORAGE SELECT switch to PSW.
- Set the STORAGE ADDRESS bit switches as follows, depending on which halfword you want to see:

  All bits off for the first halfword of the PSW.
  Bit 7 on for the second.
  Bit 6 on for the third.
  Bits 6 and 7 on for the last.
- Hit DISPLAY. The halfword will be displayed in the storage data lights.

Altering the Current PSW

- Proceed as in displaying the current PSW.
- Put new data in the STORAGE DATA bit switches.
- Hit STORE and the new data will be entered.

Displaying Main Storage

- Hit STOP.
- Set the STORAGE SELECT switch to MS.
- Set the STORAGE ADDRESS bit switches to the address to be displayed.
- Hit DISPLAY. The data will be displayed in the STORAGE DATA lights.

Clearing Main Storage

- Hit STOP.
- Disable the interval timer.
- Hit SYSTEM RESET.
- Set the RATE switch to SINGLE CYCLE.
- Enter 1000 (hexadecimal) in STORAGE DATA keys.
- Flip up the STORE STATS switch.
- Set RATE switch to PROCESS.
- Set DIAGNOSTIC CONTROL switch to MS ADDRESS.
- Hit START. The microprogram light should come on when main storage is cleared. If any other red lights are on, main storage is not fully cleared; repeat procedure.
- Set DIAGNOSTIC CONTROL switch to OFF.
- Hit SYSTEM RESET.

Altering Main Storage

- Set up address as you would in displaying main storage.
- Put the new data in the STORAGE DATA bit switches.
- Hit STORE.

Displaying Registers

- Hit STOP.
- Set STORAGE SELECT switch to GP (to display a general purpose register) or to FP (to display a floating point register).
- Enter into the REGISTER SELECT bit switches the number in binary of the desired register, and into the HALFWORD SELECT bit switches the desired halfword (see Displaying the Current PSW).
- Hit DISPLAY. The halfword will be displayed in the STORAGE DATA lights.

Altering Registers

- Follow same procedure as in displaying a register.
- Put data in STORAGE DATA bit switches.
- Hit STORE.

Stopping on Address Compare

- Hit STOP.
- Put the address you wish to stop on in the storage address keys.
- Turn ADDRESS COMPARE switch to MS STOP.

Model 50 Techniques

Displaying the Current PSW.

Storage displaying, including displaying the current PSW, is done 4 bytes (one word) at a time on the Model 50.

- Hit STOP (put machine in manual mode).
- Set the ADDRESS bit switches to 170.
- Set the STORAGE SELECT switch to LOCAL.
- Hit DISPLAY.
- Rotate roller 3 (CPU 1) to position 1, showing the L register which contains the first half of the PSW.
- Rotate roller 4 to position 3 and examine bits 6-13, labeled PSW, to find the first byte of the second word of the PSW.
- The last three bytes of the PSW are in the instruction address register.

Altering the Current PSW

- Hit STOP (put machine in manual mode).
- Set the ADDRESS keys to 170.
- Set the STORAGE SELECT switch to LOCAL.
- Put new data in the DATA keys.
- Hit STORE and the new data will be entered.

Displaying Main Storage

- Hit STOP (put machine in manual mode).
- Set the ADDRESS keys to the address to be displayed.
- Set the STORAGE SELECT switch to MAIN.
- Hit DISPLAY. The data will be in the storage data register.

Clearing Main Storage

- Hit STOP.
- Hit SYSTEM RESET.
- Set INSTRUCTION ADDRESS REGISTER to zero.
- Set RATE switch to SINGLE CYCLE.
- Put 0200 in the DATA keys.
- Flip ROS REPEAT INSN down.
- Hit START.
- Set RATE switch to PROCESS.
- Flip up all DATA keys.
- Flip up ROS REPEAT INSN.
- Hit START.
- Hit SYSTEM RESET.
- Hit STORE.

Altering Main Storage

- Hit STOP.(put machine in manual mode).
- Set address to be stored into, in the ADDRESS keys.
- Set the STORAGE SELECT switch to MAIN.
- Put data to be stored in the DATA keys.
- Hit STORE.

Note: Any location not ending in 0, 4, 8, or C, must be stored at its proper byte location in the selected word.

Displaying Local Storage

There are four 'sectors' in local storage:

00 - Channel Sector
01 - Working Sector
10 - Floating Point Registers (FPR)
11 - General Purpose Registers (GPR)

- Hit STOP (put machine in manual mode).
- Put sector number to be displayed in ADDRESS keys 22 and 23.
- Put word to be displayed in ADDRESS bit switches 24 - 27.
- Set STORAGE SELECT switch to LOCAL.
- Hit DISPLAY. The display will appear in the L register.

Altering Local Storage

- Hit STOP (put machine in manual mode).
- Put sector number in ADDRESS keys 22 and 23.
- Put words to be stored into ADDRESS bit switches 24-27.
- Set STORAGE SELECT to LOCAL.
- Put data in the DATA keys.
- Hit STORE.

Stopping on Address Compare

Do not perform the following steps while a program is executing.

- Hit STOP.
- Put address to be stopped on in the ADDRESS keys.
- Set IAR switch to STOP.
- The instruction pointed to by the ADDRESS bit switches will be executed and the next address in the program will be displayed in the instruction address register.
- If the instruction pointed to by the ADDRESS keys is a branch instruction and the branch is taken, the address of the branch instruction will be displayed in the instruction address register.

Model 65 Techniques

Displaying the Current PSW

Storage displaying, including displaying the current PSW, is done eight bytes (two separate words) at a time on the Model 65.

- Hit STOP.
- Look at roller 4 position 1 for the left half of the current PSW.
- Look at the D register (roller 1 position 2) for the instruction address.

Altering the Current PSW

- Hit STOP.
- Put new PSW doubleword in the DATA keys.
- Store the data at location zero.
- Hit PSW RESTART.

Displaying Main Storage

- Hit STOP.
- Set the STORAGE SELECT lever switch to the middle position -- main storage.
- Set the ADDRESS keys to the address to be displayed.
- Hit DISPLAY. The data will be in the ST register (roller 1 position 3 and roller 2 position 3) and the AB register (roller 3 position 3 and roller 4 position 3).

Clearing Main Storage

- Hit STOP.
- Flip DATA keys up.
- Flip down ADDRESS keys 0,21,22.
- Hit SYSTEM RESET.
- Hit ROS TRANSFER.
- Set STORAGE SELECT to LOCAL and then back to MAIN.
- Hit SYSTEM RESET.

Altering Main Storage

To alter a doubleword:

- Hit STOP.
- Put address to be altered in the ADDRESS keys.
- Set STORAGE SELECT to MAIN.
- Put data in the 64 DATA keys.
- Hit STORE.

To alter a byte do the same as above but:

- Hit STOP.
- Put into address keys 21-23 the byte number of the DATA keys to be stored.
- Set STORAGE SELECT to MAIN BYTE.
- Hit STORE.

Displaying a General Purpose Register (GPR)

- Hit STOP.
- Set STORAGE SELECT to LOCAL.
- Put GPR number in ADDRESS keys 20-23.
- Hit DISPLAY. The contents of the register will be displayed in the T register (roller 2 position 3).

Displaying a Floating Point Register (FPR)

- Hit STOP.
- Set STORAGE SELECT to LOCAL.
- Flip down bit position 19 in the ADDRESS keys.
- Put FPR number in ADDRESS keys 21-23.
- Hit DISPLAY; the word pointed to by the address keys is displayed in the T register (roller 2 position 3).

Altering Registers

Proceed as in displaying a register but:

- Put in the bottom bank of DATA keys the data you wish to store.
- Hit STORE.

Stopping on Address Compare

- Hit STOP.
- Put the address to stop on in the ADDRESS keys.
- Flip down the ADDRESS COMPARE STOP switch.
- Hit START.

Model 75 Techniques

Displaying the Current PSW

Storage displaying, including displaying the current PSW, is done eight bytes (one whole doubleword) at a time on the Model 75.

- Hit STOP.
- Look at the PSW register indicator lights for the current PSW.

Altering the Current PSW

- Hit STOP.
- Put new PSW doubleword in the DATA keys.
- Hit SET PSW. The whole PSW, including the instruction counter, will be set to that data.

Displaying Main Storage

- Hit STOP.
- Set the STORAGE SELECT switch to MAIN STOR.
- Set the ADDRESS keys to the address to be displayed.
- Hit DISPLAY. The data will be in the J register.

Clearing Main Storage

- Hit STOP.
- Hit SYSTEM RESET.
- Set GENERAL PURPOSE REGISTER 0 to zeros.
- Set PSW to zeros.
- Set the DATA keys to 90 in first byte, 01 in second.
- Flip down ENABLE STORAGE RIPPLE.
- Flip up all other switches.
- Hit LOAD A-B REGS.
- Hit START.
- Flip up ENABLE STORAGE RIPPLE.
- Hit SYSTEM RESET.

Altering Main Storage

- Hit STOP.
- Set ADDRESS keys to the location of the lowest byte of the doubleword to be altered.
- Set STORAGE SELECT to MAIN STOR.
- Hit DISPLAY. Contents of doubleword will be displayed in J register.
- Set new information in the appropriate DATA keys.
- Hit STORE.
- Repeat first four steps to check for accuracy.

Displaying a General Purpose Register (GPR)

- Hit STOP.
- Set STORAGE SELECT to GP REGS.
- Put the register number in the REGISTER SELECT keys.
- Hit DISPLAY. The left word of RBL REG will show the contents of the GPR. The right word will show the contents of the next higher numbered register.

Displaying a Floating Point Register (FPR)

- Hit STOP.
- Set STORAGE SELECT to FLP REGS.
- Put the register number in the REGISTER SELECT keys.
- Hit DISPLAY. The FPR will be displayed in RBL REG.

Altering Registers

To alter a GPR proceed as in displaying and:

- Put data into the left half of the DATA keys.
- Hit STORE.

To alter a FPR proceed as in displaying and:

- Put data into DATA keys. Put the characteristic in the 0 byte; when you display the FPR, the characteristic will be in its proper place.
- Hit STORE.

Stopping on Address Compare

- Hit STOP.
- Put address to be stopped on in the ADDRESS keys.
- Flip down the ADDRESS COMPARE STOP switch.
- Hit START.

Model 85 Techniques

Displaying the Current PSW

- Hit STOP if the manual light is not on.
- If CRT MODE SELECT is installed, set it to CE.
- The last three bytes of the PSW (the instruction address) will appear on the right side of the CRT after the IC indicator.
- The first five bytes may be seen in Image A 3 of the Indicator Viewer. The interruption code (the third and fourth bytes) will be interpreted on the bottom line of Image A3.
- Restore CRT MODE SELECT (if installed) to OP.
  Hit START.

Altering the Current PSW

- Hit STOP if the manual light is not on.
- If CRT MODE SELECT is installed, set it to CE.
- Set MANUAL ENTRY SELECT to MCDR.
- Enter the PSW data through the data keys; the cursor indicates what is actually entered at each byte location.
- Hit SET PSW.
- Restore CRT MODE SELECT (if installed) to OP.
- Hit START.

Displaying Main Storage

- Hit STOP if the manual light is not on.
- If CRT MODE SELECT is installed, set it to CE.
- Set STORAGE SELECT to MAIN.
- Set MANUAL ENTRY SELECT to
- MCAR (to enter the address).
- Press Cursor Advance ( ) until the cursor underscores the second byte (byte 1) in MCAR.
- Enter desired address (6 hex digits) through data keys.
- Hit DISPLAY. Eight bytes of storage are displayed at MCDR on the CRT display. (The same 8 bytes appear in the B-register. Any blinking byte indicates a parity check, which is corrected before the byte is transferred to MCDR.) To display the next doubleword of main storage, hit ADV ADDRESS and then hit DISPLAY.
- Restore CRT MODE SELECT (if installed) to OP.
- Hit START.

Altering Main Storage

- Hit STOP if the manual light is not on.
- If CRT MODE SELECT is installed, set it to CE.
- Set STORAGE SELECT to MAIN.
- Set MANUAL ENTRY SELECT to MCAR (to enter the address).
- Press Cursor Advance ( ) until the cursor underscores the second byte (byte 1) in MCAR.
- Enter desired address (6 hex digits) through data keys.
- Hit DISPLAY. Eight bytes of storage are displayed at MCDR on the CRT display. (The same eight bytes appear in the B-register. Any blinking byte indicates a parity check, which is corrected before the byte is transferred to MCDR.)
- Press Cursor Advance ( ) until the cursor underscores the first byte you wish to change.
- Enter data in MCDR through data keys. If you make an error, reposition the cursor to the byte you wish to correct and enter the correct data through the data keys.
- Press STORE to store at address specified in MCAR all data (eight bytes) in MCDR.
- Hit DISPLAY to verify the store operation.
- Restore CRT MODE SELECT (if installed) to OP.
- Hit START.

Model 85 Techniques (Cont'd)

Displaying a General Purpose Register

- Hit STOP if the manual light is not on.
- If CRT MODE SELECT is installed, set it to CE.
- Set STORAGE SELECT to GP.
- Set MANUAL ENTRY SELECT to MCAR (to select register).
- Press Cursor Advance ( ) until the cursor underscores the first byte (byte 0) in MCAR.
- Using the data keys, enter 2 hex digits (00 to 0F) to identify the register.
- Press DISPLAY to display the contents of the register on the CRT in the right half of MCDR. (The same four bytes appear in the right half of the B-register. Any blinking byte indicates a parity check, which is corrected before the byte is transferred to MCDR.)
- Restore CRT MODE SELECT (if installed) to OP.
- Hit START.

Altering a General Purpose Register

- Follow the procedure for displaying a general purpose register. The contents of the register you wish to change will be displayed in the right half of MCDR.
- Position the cursor to underscore the first byte to be altered in MCDR; enter the data through the data keys.
- Press STORE. The four bytes (right half of MCDR) are loaded into the selected register.
- Hit DISPLAY to verify load operation.
- Restore CRT MODE SELECT (if installed) to OP.
- Hit START.

Displaying a Floating Point Register

- Hit STOP if the manual light is not on.
- If CRT MODE SELECT is installed, set it to CE.
- Set STORAGE SELECT to FP.
- Set MANUAL ENTRY SELECT to MCAR (to select register).
- Press Cursor Advance ( ) until the cursor underscores the first byte in MCAR.
- Enter 2 hex digits (00, 02, 04 or 06) to identify the register.
- Press DISPLAY. The contents of the floating point register will be displayed on the CRT in the entire area of MCDR. (The same eight bytes appear in the B-register. Any blinking byte indicates a parity check, which is corrected before the byte is transferred to MCDR.)
- Restore CRT MODE SELECT (if installed) to OP.
- Hit START.

Altering a Floating Point Register

- Follow the procedure for displaying a floating point register. The contents of the register you wish to change will be displayed in the entire area of MCDR.
- Position the cursor under the first byte you wish to change in MCDR. Enter the data through the data keys.
- Hit STORE. Eight bytes of data (the full MCDR) are loaded into the floating point register selected.
- Hit DISPLAY to verify the load operation.
- Restore CRT MODE SELECT (if installed) to OP.
- Hit START.

Stopping on Instruction Address Compare

- Hit STOP if manual light is not on.
- Set ADDRESS COMPARE rotary switch to IC.
- Set Stop on Compare (MAIN STORE) toggle switch to STOP.
- If CRT MODE SELECT is installed, set it to CE.
- Set MANUAL ENTRY SELECT to MRAR. Locate MRAR in lower right hand corner of CRT display.
- Press Cursor Advance ( ) until the cursor underscores the second byte (byte 1) in MRAR.
- Use data keys to enter address (6 hex digits) at which the stop is desired. If an error occurs, reposition the cursor and enter the correct data.
- Hit START. After compare stop has occured, restore CRT MODE SELECT (if installed) to OP and MAIN STORE toggle switch to NOR.
- Hit START again to resume processing.

Clearing Main Storage

Main storage is cleared automatically each time you IPL if the IPL CLEAR STORAGE toggle switch is set to CLEAR.

Caution: If you do not want main storage cleared by the IPL procedure, be sure that IPL CLEAR STORAGE is set to NOT CLEAR. A good practice is to set this switch to NOT CLEAR immediately after you IPL the system. This will prevent you from clearing storage when you do not want to, as, for example, when you IPL a stand-alone dump program.

Model 91 Techniques

Displaying the Current PSW

- Hit STOP.
- Set CRT DISPLAY switch to CPE REGS.
- Hit SCAN.
- Look at the PSW register indicator lights for the current PSW.
- When ready to resume processing, set CRT DISPLAY switch to PROCESS.
- Hit START.
- Signal EOB (press ALT and numeric 5 keys) to recover 2250 console display.

Altering the Current PSW

- Hit STOP.
- Put new PSW doubleword in the DATA keys (labeled CBR).
- Hit SET PSW. The whole PSW, including the instruction counter, will set to that data.

Displaying Main Storage

- Set STORE/DISPLAY switch to STORAGE.
- Hit CLEAR CAR.
- Set ADDRESS keys to desired doubleword address.
- Hit DISPLAY. The data will be displayed in the CBR lights.

Altering a Register

- Hit STOP.
- Hit CLEAR CAR.
- Set STORE/DISPLAY switch to GEN REGS (to alter a general purpose register) or to FLP REGS (to alter a floating point register).
- Put register number in GEN or FLP keys.
- Hit DISPLAY. Current data will be displayed in the CBR lights.
- Put new data in DATA keys (labeled CBR).
- Reset only the keys you need to change.
- Hit STORE.
- Repeat first four steps to check accuracy.

Clearing Main Storage

- Hit SYSTEM RESET.
- Hit CLEAR CBR.
- Flip STORAGE TEST switch to STORE.
- Hit START STORAGE TEST.
- (Wait a few seconds)
- Flip STORAGE TEST switch to OFF.

Altering Main Storage

- Hit STOP.
- Hit CLEAR CAR.
- Set ADDRESS keys to desired doubleword address.
- Set STORE/DISPLAY switch to STORAGE.
- Hit DISPLAY. Current data will be displayed in the CBR lights.
- Put new data in DATA keys (labeled CBR). Reset only the keys you need to change.
- Hit STORE.
- Repeat first five steps to check accuracy.

Stopping on Instruction Address Compare

- Hit STOP.
- Set ADDRESS keys to desired address (flip key up.)
- Set ADDRESS COMPARE to SOFT STOP INSN.
- Hit START.

Inhibiting Overlap Processing

- Hit STOP.
- Set INHIBIT OVERLAP switch to INHIBIT.
- Hit START.

Model 91 Techniques (Cont'd)

Restoring Overlap Processing

- Hit STOP.
- Set INHIBIT OVERLAP to NORMAL.
- Hit START.

Displaying a Register (Using the 2250)

- Hit STOP.
- Set CRT DISPLAY switch to CPE REGS.
- Hit SCAN. All registers will be displayed on the 2250.
- When ready to resume processing, set CRT DISPLAY to PROCESS to prepare for restoring the console display.
- Hit START.
- Signal EOB (press ALT and numeric 5 keys) to recover 2250 console display.

Displaying Main Storage (Using the 2250)

- Hit STOP.
- Set CRT DISPLAY switch to STORAGE.
- Hit CLEAR CAR.
- Set ADDRESS keys to desired doubleword address.
- Hit SCAN. Sixteen doublewords, starting with the desired address, will be displayed on the 2250.
- When ready to resume processing, set CRT DISPLAY to PROCESS to prepare for restoring the console display.
- Hit START.
- Signal EOB (press ALT and numeric 5 keys) to recover 2250 console display.

Displaying a Register

- Hit STOP.
- Set STORE/DISPLAY switch to GEN REGS (to display a general purpose register) or to FLP REGS (to display a floating point register).
- Hit CLEAR CAR.
- Put register number in ADDRESS keys.
- Hit DISPLAY. The register will be displayed in the CBR lights.

Hexadecimal Math

To Convert Hexadecimal to Decimal

1. Locate the column of decimal numbers corresponding to the left-most digit or letter of the hexadecimal; select from this column and record on a scratch sheet the number that corresponds to the position of the hexadecimal digit or letter.
2. Repeat step 1 for the next (second from the left) position.
3. Repeat step 1 for the units (third from the left) position.
4. Add the numbers selected from the table to form the decimal number.

Sample	
Conversion of Hexadecimal	D34
1. D	3328
2. 3	48
3. 4	4
4. Decimal	3380

To Convert Decimal to Hexadecimal

1. (a) Select from the table the higher decimal number that is equal to or less than the number to be converted.
   (b) Record the hexadecimal of the column containing the selected number.
   (c) Subtract the selected decimal from the number to be converted.
2. Using the remainder from step 1(c) repeat all of step 1 to develop the second position of the hexadecimal (and a remainder).
3. Using the remainder from step 2 repeat all of step 1 to develop the units position of the hexadecimal.
4. Combine terms to form the hexadecimal number.

Sample	
Conversion of Decimal	3380
1. D	-3328
	52
2. 3	-48
	4
3. 4	-4
4. Hexadecimal	D34

To convert integer numbers greater than the capacity of the table, use the techniques below:

- **Hexadecimal to Decimal**

Successive cumulative multiplication from left to right, adding units position.

Example: $D34_{16} = 3380_{10}$

D = 13
x 16
208
3 = + 3
211
x 16
3376
4 = + 4
3380

- **Decimal to Hexadecimal**

Divide and collect the remainder in reverse order.

Example: $3380_{10} = X_{16}$

		remainder
16	3380	
16	211	4
16	13	3
		D

$3380_{10} = D34_{16}$

Hexadecimal and Decimal Integer Conversion Table

HALF WORD								HALF WORD							
BYTE				BYTE				BYTE				BYTE			
0123		4567		0123		4567		0123		4567		0123		4567	
HEX	Decimal	HEX	Decimal	HEX	Decimal	HEX	Decimal	HEX	Decimal	HEX	Decimal	HEX	Decimal	HEX	Decimal
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	268,435,456	1	16,777,216	1	1,048,576	1	65,536	1	4,096	1	256	1	16	1	1
2	536,870,912	2	33,554,432	2	2,097,152	2	131,072	2	8,192	2	512	2	32	2	2
3	805,306,368	3	50,331,648	3	3,145,728	3	196,608	3	12,288	3	768	3	48	3	3
4	1,073,741,824	4	67,108,864	4	4,194,304	4	262,144	4	16,384	4	1,024	4	64	4	4
5	1,342,177,280	5	83,886,080	5	5,242,880	5	327,680	5	20,480	5	1,280	5	80	5	5
6	1,610,612,736	6	100,663,296	6	6,291,456	6	393,216	6	24,576	6	1,536	6	96	6	6
7	1,879,048,192	7	117,440,512	7	7,340,032	7	458,752	7	28,672	7	1,792	7	112	7	7
8	2,147,483,648	8	134,217,728	8	8,388,608	8	524,288	8	32,768	8	2,048	8	128	8	8
9	2,415,919,104	9	150,994,994	9	9,437,184	9	589,824	9	36,864	9	2,304	9	144	9	9
A	2,684,354,560	A	167,772,160	A	10,485,760	A	655,360	A	40,960	A	2,560	A	160	A	10
B	2,952,790,016	B	184,549,376	B	11,534,336	B	720,896	B	45,056	B	2,816	B	176	B	11
C	3,221,225,472	C	201,326,592	C	12,582,912	C	786,432	C	49,152	C	3,072	C	192	C	12
D	3,489,660,928	D	218,103,808	D	13,631,488	D	851,968	D	53,248	D	3,328	D	208	D	13
E	3,758,096,384	E	234,881,024	E	14,680,064	E	917,504	E	57,344	E	3,584	E	224	E	14
F	4,026,531,840	F	251,658,240	F	15,728,640	F	983,040	F	61,440	F	3,840	F	240	F	15
8		7		6		5		4		3		2		1	

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