INTERNATIONAL BUSINESS MACHINES CORPORATION
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7040/44 DIAGNOSTIC PROGRAM
REFERENCE

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1.00.01.0   <u>INTRODUCTION</u>

.01.1   PURPOSE

This volume is for the purpose of explaining the contents
and philosophy of the 7040/44 Diagnostic Programming
Package as well as the "Load and Go" operation. It is
to be used as a quick reference of the standards and pro-
cedures used by the 7040/44 Diagnostic Program Pack-
age. An index to all volumes and programs, and summary
sheets of all programs are contained in this volume.

1.00.01.0   INTRODUCTION

.01.2   OVERALL DESCRIPTION

The Diagnostic Programming package is designed to
aid the C.E. in maintaining any 7040/44 machine con-
figuration. Because of the many optional features a-
vailable the number of machine configurations possible
becomes large. To avoid the prohibitive costs of cus-
tomizing the diagnostic package for each possible con-
figuration a modular approach was used. Ground rules
were established for writing diagnostic programs us-
ing the features available on a minimum system. The
diagnostic package for a particular system could then
be assembled by selecting "off-the-shelf" the applicable
diagnostics. In this case the "shelf" consists of a Mas-
ter Tape containing all released diagnostic programs.
This Master Tape will be made available to all installa-
tions and may be used as the work tape or, which may be
more desirable, make a work tape from the Master Tape
containing just those programs needed for the system on
which it will be used.

The first program found on the work tape or Master
Tape will be 4DC3, the Diagnostic Control Program(DCP),
which is important to the operation of the modular pro-
gramming system and provides the following functions:

    a   attempts to standardize procedures,
    b   automatic sequencing of programs,
    c   permit selection of any one or com-
         binations of programs,
    d   input - output functions; that is, load
         diagnostics from any tape on any chan-
         nel and provide WRS instruction for
         outputing messages on available print
         device,
    e   common subroutines.

1.00.01.0   INTRODUCTION

    .01.2   OVERALL DESCRIPTION -continued-

A key to DCP operations are the configuration con-
trol words of which there are two types, configura-
tion available and configuration required words. The
configuration available words, at present there are
two, are located in the DCP area of storage and in-
dicate the equipment or features available for testing.
These words will most likely vary from installation to
installation and therefore the DCP on the Master Tape
sent may not contain them. Upon loading, DCP will
halt to allow entering the proper configuration data.
On subsequent updates or when making a work tape from
the Master these words may be entered at that time and
thus avoid future need of manual entry for this purpose.
The configuration available words are used by DCP in
determining what programs shall be run. The configura-
tion required words are supplied by the individual diag-
nostics and informs DCP of the requirements for runn-
ing that diagnostic.

For card loading the operation is a little different.
When loading from column binary cards 4DC1 is used,
while 4DC2 is used to load BCD cards (using all 64 char-
acters). These two programs are much the same as 4DC3
except for tape selection, automatic sequencing and selec-
tion of programs which do not apply. The card loading
DCP version is placed first followed by decks of the indiv-
idual diagnostics desired. No configuration available words
are supplied with the decks shipped therefore, they will
have to be punched into the proper card or cards of the DCP
deck or entered manually upon loading DCP. Patch cards
with this data may be inserted in the DCP deck as well.

1.00.01.0   INTRODUCTION

.01.2   OVERALL DESCRIPTION -continued-

The 7040/44 Diagnostic Programming package pro-
duced is based on a 'Load and Go' concept, that is,
automatic sequencing and selection of programs with
no manual intervention required except for initial set-
up. This, in what follows, is also referred to as se-
quential mode of operation. The diagnostic programs
have been placed on tape in a logical order (building
block approach) where succeeding diagnostics depend
mainly on what has been tested to that point for fur-
ther diagnosis. Those programs that require no man-
ual intervention have been placed in the sequential a-
rea of tape. Those which do require manual interven-
tion or may be run infrequently are placed in the search
area and can be called in under Search Mode of opera-
tion only. The Master Tape sent is arranged in this
manner but means are provided via update facilities to
rearrange the work tape as desired. In sequential mode
of operation the entire CPU plus features, memory,
tapes, overlap channels (partial) are checked this in-
cludes running of the systems check program. Thus,
except for devices a rapid and fairly through systems
checkout can be performed with minimum setup.

The operation of DCP assumes a sizeable portion of the
system is working. Machine malfunctions may occur which
prevent DCP operation. To overcome this, Hard Core
programs were developed which could be used to establish
the reliability of the basic system, if necessary, before
attempting to run under control of DCP. The Hard Core
programs perform a step by step check followed by force
loads of the basic CPU programs. The two Hard Core pro-
grams provided are 4HC1 which is loaded from BCD cards
and 4HC2 which can be made to load from any tape on any
channel.

1.00.02.0   PROGRAMMING PACKAGE

The Diagnostic Programming package is designed to
give the C.E. complete support for any machine. The
"Hard Core" programs test a basic machine that may
have basic errors. The diagnostics, under control of
the Diagnostic Control Program (DCP), test certain a-
reas of the machine individually. The Systems Test
program tests the entire machine simultaneously. A
group of utility programs are available to make the C.E.
(as much as possible) independent of other installations
and equipment.

The Diagnostic Programming package will be shipped in
the following form:

    Column Binary Card Decks:

        4DC1, 4DC3, 4UT1, 4UT3

    BCD Card Decks:

        4DC2, 4DC3, 4UT1, 4UT2, 4UT3,
        4HC1, 4HC2, Test Decks (4RP2,
        4RP6), 4C52, 4C53

    Master Tape:

        All programs not listed above will
        be sent only on the master tape.
        Card decks of these programs may
        be punched from the master tape
        using 4UT3. Because of this these
        program decks will not be sent.
        4DC3 will be the first program on
        tape. This tape will be generated by
        4UT1 and can be used to check out
        the system. Two "load-points" with
        two complete files will be written on
        the tape. Recommended procedure
        for the use of this master tape is dis-
        cussed in section 1.00.03.5

1.00.02.0   PROGRAMMING PACKAGE   -continued-

.02.1   HARD CORE PROGRAMS

The Hard Core programs are the most basic programs
for the 7040/44. They check out basic data flow and con-
trol circuitry. The basic tests of the Hard Core programs
have visual checks to determine if the circuitry is work-
ing correctly. Each area of the machine is tested before
it is used. When it is found to be correct, it may be used
to test other areas of the machine.

The Hard Core programs are self-loading and self-con-
trolled. They test individual areas of the machine. Upon
completion of the Hard Core programs, most of the in-
structions used in the DCP will have been checked.

.02.2   DIAGNOSTIC CONTROL PROGRAM (DCP)

The purpose of the DCP is to standardize the operating
procedures and relieve programmers of many functions re-
quired by all diagnostic programs. Therefore, the DCP is
little more than a collection of independent subroutines. A
description of these follows.

.02.2.1   Loader

The DCP will load the diagnostic into memory. Due to the
variability of the system, 3 DCPs have been required. These
DCPs differ only in the loader portion.

a)   4DC1 - This DCP is designed to read
column binary cards. It reads the out-
put of a FAP absolute assembly (i.e.
(1) starting address & word count in the
1st word of the card, (2) checksum in the
2nd word of the card. This is not com-
patible with the FAP output. The address
portion of the TRA instruction is the loc-
ation to which 4DC1 will transfer when load-
ing is complete.

1.00.02.0   PROGRAMMING PACKAGE

   .02.2   DIAGNOSTIC CONTROL PROGRAM (DCP)   -continued-

b)   4DC2 - This DCP is designed to read
a BCD card deck. These BCD cards
must have a starting address & word
count in the 1st word. No checksum
is allowed on this card. The transfer
card has 0 in the 1st word (i.e. 0 pun-
ches in columns 1-6) & a TRA instruc-
tion in the 2nd word (columns 7-12).

c)   4DC3 - This DCP is designed to read
a tape generated by 4UT1. 4DC3 will
determine whether a program can op-
erate (by use of the configuration a-
vailable words) on a given system. If
the program can not operate, it will
not be read into memory. 4UT1 will
put information regarding the configura-
tion required for each program on the
tape. 4DC3 uses this information to op-
erate or bypass a program.

All DCPs reserve locations 100- 775 for their own use.
All programs using the DCP must not disturb these loca-
tions. Except where stated differently, all the following
information refers to all DCPs.

   .02.2.2   Output Device Select

Location 316 (474_8) within the DCP contains a select instruc-
tion for printing. This is to be used by all diagnostics. When
the diagnostic wants to print a message, it should .

```
          XEC               316
          RCHA              IORD
```

1.00.02.0   PROGRAMMING PACKAGE

.02.2   DIAGNOSTIC CONTROL PROGRAM (DCP) -continued-

.02.2.3   Subroutine to Change Output Device

Within the DCP, a routine exists to allow the operator
to change the output device. The operator has the option
of selecting:

1)   1403 Printer
2)   1401 on-line
3)   Typewriter
4)   Tape on Channel A
5)   Bypass printing

To bypass printing, the DCP sets up an IOT instruction
in location 474_8. This makes it imperative that the diag-
nostic follows his XEC 316 (select output instruction) im-
mediately with an RCHA. Sample:

TSL   308   CHANGE OUTPUT
XEC   316   EXECUTE WRS INSTRUCTION
RCHA   IORD

.02.2.4   Subroutine to Set-up Trap Area

This routine is designed to relieve the diagnostic of the
problem of taking care of traps the diagnostic is not test-
ing. The DCP sets up the entire trap area with TSL to a
DCP routine. In the trap routine, the DCP will halt, with
the trap store data displayed in the accumulator, and the
trap location in the MQ.

The diagnostic may TSL 306(462_8) to have the DCP set up
the trap area. The DCP will store the contents of the TRA
instruction in the transfer card in location O. All other
"trap to" locations will be set up to enter the DCP.

1.00.02.0   PROGRAMMING PACKAGE

.02.2   DIAGNOSTIC CONTROL PROGRAM (DCP) -continued-

.02.2.5   Input Device Select Instruction

The RDS instruction for program input is stored in location $315(473_8)$. Applicable programs will check this location to insure they do not reposition the master tape.

.02.2.6   Terminating a Program

Upon completion of each pass of the program, the program should TSL $310(466_8)$. At this time, the DCP will check SWT 6 to determine if the operator wants to loop the program. If SWT 6 is set, DCP will return to the address in location 310. The diagnostic should print "PASS COMPLETE" and loop the program. (Note: The PASS COMPLETE print will be programmed such that it occurs no more often than once every 15 secs. If a program runs 1000 passes per minute when looping, it should print 250 PASSES COMPLETE every 15 secs.) If SWT 6 is off, the DCP will call the next program.

.02.2.7   Configuration Available Words

Locations 472 and 471 of the DCP contain the Configuration Available Words. (These locations are defined in section 1.00.04.0 of this write-up). They are for the use of the operator and the program DCP and the diagnostics will check the Configuration Available Words to determine what equipment is available for testing by the diagnostic. The operator may manually alter the Configuration Available words if desired.

1.00.02.0   PROGRAMMING PACKAGE -continued-

.02.3   DIAGNOSTIC PROGRAMS

The unit diagnostics check a specific area of the mach-
ine. All other areas are assumed to be operating cor-
rectly. As an example, the console typewriter diag-
nostic assumes that all CPU (except Channel A) func-
tions are operating correctly. The entire CPU is used
to test the console typewriter.

In general, the diagnostics will not concern itself with
traps that are generated by areas of the machine not be-
ing tested. These are considered error traps and are
handled by the DCP trap routine.

When all the unit diagnostics have been operated without
errors, the operator may assume that all areas of the
machine work correctly when used individually.

.02.4   SYSTEMS TEST

The systems test program attempts to test the entire
system simultaneously. In this respect, it simulates an
operational program. I/O unit tests are run simultaneously
with CPU unit tests. All data is checked for errors. Mach-
ine malfunctions due to interaction between operating areas
will be detected by this program.

The systems test program operates under the control of
the DCP. Sense switch use and operating procedure is con-
sistent with the diagnostics.

.02.5   UTILITY PROGRAMS

The utility package of the programming package is designed
to give the C.E. flexibility and as much as possible, in-
dependence from any other installation. It is felt that if
the C.E. is given a master maintenance tape and certain
card decks, he will be able to perform all functions requirred.
A brief description of the utilities follows:

1.00.02.0   PROGRAMMING PACKAGE

.02.5   UTILITY PROGRAMS -continued-

.02.5.1   4UT1 is the program that puts all the card decks on the maintenance tape. A program is read into memory, then memory is written on the tape.

4UT1 has the ability to update a tape, duplicate a tape, or print a listing of the programs on the tape. To update a tape, control cards and card decks of programs being revised or inserted on the tape are required.

4UT1 will always be shipped in card form. It cannot be loaded from other than a card reader.

A program dump tape will always be shipped with the machine. This tape is the primary method of running the diagnostics. This tape can be duplicated (by 4UT1) to provide a back-up maintenance tape; it can be punched (see 4UT3 below) to provide a card deck back-up; it can be updated (by 4UT1) to change or add any future releases or re-releases of the diagnostics.

.02.5.2   4UT2 - 1414 Simulator

4UT2 is a 1401 program designed to simulate an on-line 1414. 4UT2 will run only on-line. It will perform all functions required by the diagnostic programming package (i.e. read cards for the 7040/44, punch cards for the 7040/44, print for the 7040/44). 4UT2 will supply all the needs of a system that has no card reader, card punch or printer other than that attached to the on-line 1401.

1.00.02.0   PROGRAMMING PACKAGE

.02.5   UTILITY PROGRAMS -continued-

.02.5.3   4UT3 Diagnostic Tape To Card Punch Program

4UT3 is the program that punches the maintenance
tape. Every program on the tape can be punched by
4UT3. The program deck can then be used as a back-
up or can be used to run the programs from cards.
Only 4DC3 cannot run from cards. All card decks are
designed to run under control of 4DC1 or 4DC2 depend-
ing on whether they are binary or BCD respectively.

In some cases, the card deck punched by 4UT3 will
not agree with the release decks or the comments in
the program write-up. This should not cause concern
because the punched decks will be complete in every way
and will load properly. The card count may be off and
extraneous data may appear in the card where there
should be zeros. During normal program housekeeping
operations these locations will be cleared. On subse-
quent re-releases these differences will be corrected.

1.00.02.0   PROGRAMMING PACKAGE

.02.6   CARD DECK

Due to the differences possible in reading capability
the diagnostic programs exist in two card deck forms,
BCD and Column Binary. (Note: The DCP exists in
three forms and is explained in section 1.00.02.2).
The write-ups for the diagnostics refer to card decks
released by the programming group. As noted above in
some cases card decks punched by 4UT3 will differ from
this descriptions in the released write-ups.

.02.6.1   Column Binary Card Decks

The format of a column binary card is as follows:

Columns 1-3	Word count is in upper half of column 2 and a starting address is in columns 2 and 3. The word count specifies the number of words to be relocated in memory starting at the address specified. Column 1 must also have a 7 and 9 punch to indicate column binary.
Columns 4-6	May contain a checksum but is not used. Card decks punched by 4UT3 will contain blanks in these columns.
Columns 5-72	These columns allow for 22 words of either instructions or other data and comprise a part of the program. They correspond to the write-up listing.
Columns 73-77	Contain the program identity and release level (letter suffix) in Hollerith coding.
Columns 78-80	Decimal sequence number of the card in the card deck.

The program write-up will state that the card deck contains
XXX cards, numbered from 000 to XXX. If the program was
punched by 4UT3, this may not be correct.

1.00.02.0   PROGRAMMING PACKAGE

.02.6   CARD DECK

.02.6.1   Column Binary Card Decks -continued-

The last card of the column binary program deck is a
transfer of control card. It will contain the following:

Columns 1-3	Column 1 will contain only a 7-9 punch. Column 2 and 3 will be blank.
Columns 4-6	A TRA instruction to the address specified at which point the diagnostic program gets control.
Columns 7-9	The 1st configuration required word (blank if a basic program).
Columns 10-12	The 2nd configuration required word(will be blank if a basic program).
Columns 13-72	Blank
Columns 73-80	Program identity and card sequence number.

Column binary card decks should be used on all systems
that have a card reader with the column binary feature.

.02.6.2   BCD Card Decks

The BCD cards use all 64 character card codes and the format
is as follows:

Columns 1-3	A word count in column 3 specifying the number of words to be relocated in memory.
Columns 4-6	The starting address at which relocation occurs for words of that card.
Columns 7-72	These columns allow for 11 words of instructions or other data and comprise a part of the program. These will correspond to the program listing.

1.00.02.0   PROGRAMMING PACKAGE

  .02.6   CARD DECK

  .02.6.2   BCD Card Decks

        Columns 73-77   Contain the program identity and release
                                 level (letter suffix) in Hollerith coding.

        Columns 78-80   Decimal sequence number of the card in
                                 the card deck.

The program write-up will state that the card deck contains
XXX cards, numbered 000 to XXX.

The last card of the deck is the transfer of control card. It
contains the following:

        Columns 1-6   Zero punches

        Columns 7-12   A TRA instruction to the address specified
                                 at which point the diagnostic gets control.

        Columns 13-18   The 1st configuration required word. Will
                                 have zero punches if a basic program.

        Columns 19-24   The 2nd configuration required word. Will
                                 have zero punches if a basic program.

        Columns 25-72   Blank

        Columns 73-80   Program identity and card sequence number.

BCD card decks should be used only on those systems that do
not have a card reader with the column binary feature. Since
only eleven instructions can be punched in each card, the BCD
card decks will be about twice the size of the column binary
card decks.

1. 00. 03. 0   LOAD AND GO SYSTEM

.03. 1   PURPOSE

The basic aims of a Load and Go system are to ac-
complish:

1)   A fast check of the basic system to insure
correct operation of the system.

2)   An easy means of converting from (1) above
to a complete and detailed check of the entire
system.

3)   If possible, to minimize the expense of shipp-
ing programs to the system installation.

In order to accomplish these aims, certain require-
ments are placed on each phase of the programming
package. The diagnostic, the DCP, the tape genera-
tor and the operator all have a part in the successful
attainment of these goals.

.03. 2   DIAGNOSTIC AND THE LOAD AND GO

All diagnostics in the 7040/44 package must do two
things to allow a Load and Go operation.

1)   The diagnostic must return to the DCP at a
specified location upon completion of the pro-
gram. This allows the DCP to read the next
program into memory.

2)   The diagnostic must give the DCP two words
indicate what equipment is required to be a-
vailable for this diagnostic to test. (These
words are called the "Configuration Required"
words and are explained in section 1. 00. 04. 0
below.) The diagnostic indicates (through the
comfiguration required words) what equipment
is tested by the diagnostic. As will be ex-
plained later, the DCP uses these words to de-
termine if the equipment required by the diag-
nostic is available to be tested.

1.00.03.0   LOAD AND GO SYSTEM -continued-

,03.3   THE TAPE GENERATOR AND LOAD AND GO

The tape generated by 4UT1 is written in a format designed to facilitate the load and go operation. The very first record must contain 4DC3, the tape DCP. Each succeeding program on the tape has two records: An identity record and a program record. The identity record supplies DCP with the necessary data for identifying, sequencing, and selection of programs, and also provides 4UT1 with information for purposes of updating.

.03.3.1   Identity (ID) Record

There are six words contained in the ID record in the following order:

1)   Program Search number

The programs on the tape are assigned sequential numbers by 4UT1. These are used by 4DC3 when the operator wants to search for a program.

2)   Program Title

A BCI title of the program is the 2nd word of the ID record. It is used by 4UT1 when printing the list of programs on the tape. It is obtained from the 2nd word of the 1st card of the deck.

3)   Starting Address and Word Count

4UT1 obtains this information from the first card of the program deck. It is used by 4DC3 when reading a program into memory.

4)   A transfer instruction to start the program.

This instruction is taken from the transfer card, the last card, of the card deck.

1. 00. 03. 0   LOAD AND GO SYSTEM

. 03. 3. 1   Identity (ID) Record -continued-

5)   First Configuration Required Word

This information designates the equipment to be
tested by the program and corresponds with the
1st configuration available word.

6)   Second Configuration Record Word

This information designates the equipment to be
tested by the program and corresponds with the 2nd
configuration available word.

. 03. 3. 2   Program Record

The program record is a memory dump of the entire body
of the program. This record contains all the information
that was contained in the card deck.

Whenever the program record is read into memory, it is
read into its operating area. Once in memory, it is ex-
actly the same as it would be if read from cards.

. 03. 4   4DC3 AND THE LOAD AND GO

4DC3 is the foundation of Load and Go operation. It al-
lows the operator, with a minimum amount of manual in-
tervention, to run allprograms that pertain to a given system.

4DC3 operates the programs on the tape in two modes: Se-
quential and Search. The Search mode allows the operator
to run any program desired. In this mode, however, the
operator must manually select the next program to be op-
erated.

In the Sequential mode of operation, 4DC3 runs those pro-
grams that will test the system with no manual intervention.
In the Sequential mode, 4DC3 uses the information in the ID
record in the following manner:

1.00.03.0   LOAD AND GO SYSTEM

.03.4   4DC3 AND THE LOAD AND GO -continued-

.03.4.1   Configuration Required Words

To determine whether a program can run on a specific
configuration 4DC3 takes the contents of the 2nd Con-
figuration Required word and does an ANA to the 2nd
Configuration Available word. If the result is zero,
4DC3 takes the contents of the 1st Configuration Re-
quired and does an ANA to the 1st Configuration A-
vailable word. If the result of either ANA is not zero,
4DC3 will allow that program to operate. If both re-
sults are zero, 4DC3 will bypass the program and check
the next program in sequence. If both configuration re-
quired words supplied by the individual program are zero
then this is a basic program and will always be run.

.03.4.2   Starting Address And Word Count

4DC3 will use the Starting Address and Word Count for
the IORD to read the program into memory.

.03.4.3   Transfer Card Instruction

The TRA instruction of the transfer card will be stored in
location 0. (This may be used to effect a restart of the
program). To begin operating the program 4DC3 will
transfer to the address specified in the instruction.

1.00.03.0   LOAD AND GO SYSTEM   -continued-

.03.5   THE OPERATOR'S PART IN THE LOAD AND GO

.03.5.1   Initially, each installation will receive one master tape.
This tape will contain 2 load-points. Each of these files
will contain all released programs. A new tape should be
generated immediately by editing this tape and deleting all
those programs on the tape not applicable to the system.
The master tape should then be saved and used again only
as a back-up.

.03.5.2   When generating a work tape from the master, 4DC3 should
be updated. At this time, the Configuration Available words
should be changed in the 4DC3 deck to exactly reflect the
system. (The tape and deck will not reflect the system when
they are shipped).

.03.5.3   The tape should be punched (by 4UT3) and the cards used as
a back-up if all tapes fail.

.03.5.4   The Customer Engineer should create the new tape in an
order that will allow the fastest and most complete check
of the system. Those programs that require no manual in-
tervention and little run time should be placed in the Se-
quential area (i.e. that which is used for Load and Go).
All other programs should be placed in the search only a-
rea.

.03.5.5   During an actual Load and Go run, the operator may change
the configuration available words. This will allow the DCP
to bypass testing units the operator already knows are failing
or off-line.

1.00.03.0   LOAD AND GO SYSTEM -continued-

.03.6   LOAD AND GO OPERATION

The Load and Go system is designed to operate in the following manner.

.03.6.1   When generating a tape, all those programs that run with no manual intervention should be placed in the Sequential area.

.03.6.2   When a quick, basic (but complete) check of the system is desired, mount the program tape on a drive and "LOAD."

.03.6.3   4DC3 will come to an initial halt. At this time the operator should manually make all changes desired to 4DC3. (The operator should insure that the configuration available words reflect exactly the present system.)

.03.6.4   On "START," 4DC3 will read into memory and allow to operate all those programs in the Sequential area that the configuration will allow. If any program cannot run on the system, the tape will be spaced by it and the next program will be checked.
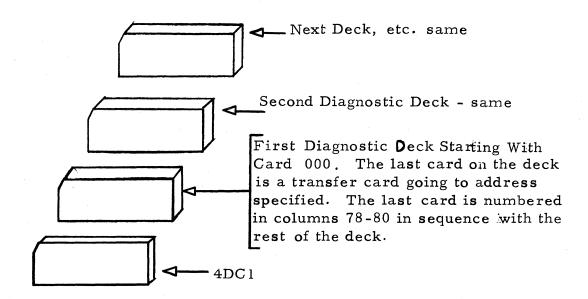
In this manner, one master tape may be generated and it will run (in a Load and Go operation) all those programs applicable to the system. After running any program, the operator has the opportunity to change the mode of operation and to Search for any specific program that will run on the system.

1.00.04.0   OPERATING STANDARDS

.04.1   LOADING PROCEDURES

The Loading Procedures for the 7040/44 diagnostic
programming package varies with the DCP used.

.04.1.1   LOADING FROM CARDS USING 4DC1 (COLUMN BINARY)

Step 1   Place 4DC1 and column binary diagnostic pro-
gram decks in the reader in the following order.

Next Deck, etc. same

Second Diagnostic Deck - same

First Diagnostic Deck Starting With
Card 000. The last card on the deck
is a transfer card going to address
specified. The last card is numbered
in columns 78-80 in sequence with the
rest of the deck.

4DC1

Step 2   Depress reader "START" and "END OF FILE"

Step 3   At 7040/44 console set the keys to the correct
Binary select instruction. (+076203001230 or
+076205001230 if loading via 1401).

Step 4   Turn Sense Switch 6 ON if only one diagnostic
deck is to be run. Turn all other sense switches
OFF.

1.00.04.0   <u>OPERATING STANDARDS</u>

   .04.1.1   LOADING FROM CARDS USING 4DC1 (COLUMN BINARY)

               -continued-

               Step 5   If an interval timer option is on the system, it
                          may be turned on before loading. All diagnostics
                          can run with the interval timer on.

               Step 6   Place machine in "AUTOMATIC," "CLEAR,"
                          "RESET" and "LOAD"

               Step 7   4DC1 will be loaded into memory and Halt 000
                          will occur. Make any changes desired. Press
                          "START"

1.00.04.0   OPERATING STANDARDS   -continued-

.04.1.2   LOADING FROM CARDS USING 4DC2 (BCD)

Step 1   Place 4DC2 and BCD diagnostic program decks
          in the card reader in the following order.

→ Next Deck, etc. - same

→ Second Diagnostic Deck - same

→ First Diagnostic Deck Starting With
  Card 000 to Transfer Card (last).

→ 4DC2

Step 2   Depress reader "START" and "END OF FILE"

Step 3   At the 7040/44 console, set the keys to the correct
          BCD select instruction. (+076203001210, +076201001210 ,
          or +076205001210 if loading via 1401).

Step 4   Turn sense switch 6 ON if only one diagnostic deck
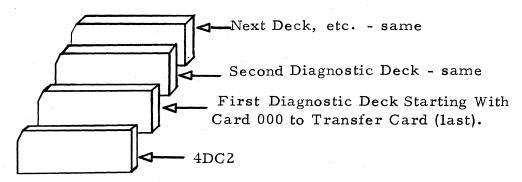   is to be run. Turn all other sense switches OFF.

Step 5   If an interval time is available on the system, it
          may be turned on before loading. All diagnostics
          can run with the interval timer on.

Step 6   Place the machine in "AUTOMATIC," "CLEAR,"
          "RESET," and "LOAD."

Step 7   4DC2 will be loaded into memory and Halt 000
          will occur. Make any changes desired. Press
          "START."

1.00.04.0   OPERATING STANDARDS   -continued-

.04.1.3   LOADING FROM TAPE USING 4DC3

Step 1   Mount the program dump tape on the Normal Operating Channel. (If this channel is not a-vailable, see step 5 below(.

Step 2   "LOAD-REWIND" and "READY" the tape drive.

Step 3   Set the word bank keys to the proper select in-struction.

Step 4   Turn all sense switches OFF.

Step 5   If not operating from the Normal Operating Channel, set sense switch 5 ON and set pre-fix key -0 in the word bank,

Step 6   Place the machine in "AUTOMATIC," "CLEAR," and "LOAD."

Step 7   4DC3 will be read into memory and Halt 000 will occur. Manually make any changes desired.

Step 8   If it is desired to search for a program, put a +1 in the prefix and the search number of the pro-gram in the decrement, of the word bank keys. If no search is desired, clear sense switch 5. "START."

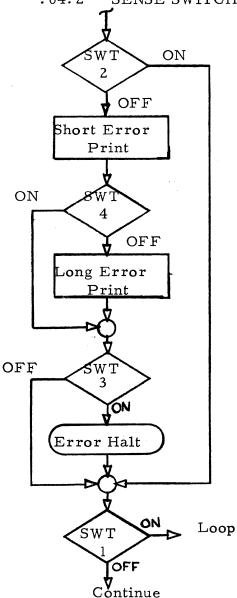Step 9   If a search was requested, the search halt will occur. Clear sense switch 5. "START."

1.00.04.0   OPERATING STANDARDS -continued-

   .04.2   SENSE SWITCH DEFINITIONS

SWT 1	ON	Loop in Routine
SWT 1	OFF	Proceed
SWT 2	ON	Bypass error indications
SWT 2	OFF	Print or halt on error
SWT 3	ON	Halt on error
SWT 3	OFF	Print or halt on error
SWT 4 O	ON	Bypass long error prints. Bypass normal prints.
SWT 4	OFF	Extended print on error. Allow normal prints.
SWT 5	ON	Gate service-aid halt
SWT 5	OFF	Proceed
SWT 6	ON	Loop this program
SWT 6	OFF	Do not loop this program

The following flow chart best illustrates the manner in which sense switches 1, 2, 3, and 4 may be used.

1.00.04.0   OPERATING STANDARDS

.04.2   SENSE SWITCH DEFINITIONS -continued-

NOTE:

1. With sense switch 2 ON all error indications are bypassed.

2. Sense switch 4 on will by-pass only intended prints.

3. With sense switch 3 OFF no error halts will occur.

4. Sense switch 1 loops a small routine.

Normal procedure is expected to be all sense switches off. This will allow short and long prints with no halts.

Flowchart:
- SWT 2 → ON / OFF
- OFF → Short Error Print
- SWT 4 → ON / OFF
- OFF → Long Error Print
- SWT 3 → OFF / ON
- ON → Error Halt
- SWT 1 → ON → Loop
- OFF → Continue

Sense switch 4 could also be used to bypass any operator messages.
Sense switch 5 ON indicates:
  a)   A normal halt is allowed.
  b)   Printed operator instructions, followed by a halt is allowed.
  c)   Allow the word bank keys to be used for looping, unit selection, test selection, etc.

1.00.04.0   OPERATING STANDARDS -continued-

.04.3   CONFIGURATION AVAILABLE WORDS

The configuration available words allow maximum flex-
ibility for the 7040/44 diagnostic programming package.
These words contain information that describes, to the
diagnostic, the equipment available on the system being
tested. Through these configuration words, for example,
the tape diagnostic can determine what channels have
tapes that must be tested.

A bit set in the configuration available word indicates that
the corresponding device is available to be tested. Examples:

.04.3.1 Bit 10 of the 1st Configuration Available word (location 472)
indicates a 1622 Card Reader-Punch is available on the system.

.04.3.2 Bits 12 and 16 of the 2nd Configuration Available word (loca-
tion 471) indicate a 7740 Programmed Transmission Con-
trol Unit is available on Channel C.

The Configuration Available words should be contained with-
in 4DC3 and placed or stored in locations mentioned above.
The deck or Master tape sent which contain 4DC3 do not have
the configuration available words. These must be inserted by
the operator in the field either manually each time 4DC3 is
loaded, or punch these two words in the proper card of the
deck and update the Master tape to avoid manual entry.

1.00.04.0   OPERATING STANDARDS

.04.3   CONFIGURATION AVAILABLE WORDS -continued-

The Configuration Available words are defined as follows:

First Configuration Word - Location 472

Bit	Definition	
S	1402 RDR Punch	Interface 3
1	1402 COL Binary	Interface 3
2	1403 Printer	Interface 3
3	1402 RDR Punch	Interface 1
4	1402 COL Binary	Interface 1
5	1403 Printer	Interface 1
6	1402 RDR Punch	Interface 2
7	1402 COL Binary	Interface 2
8	1403 Printer	Interface 2
9	1401	Channel A
10	1622	Reader Punch
11	1014	Console Inquiry
12	More Than One Direct Data Interface Per Channel	
13	Cylinder Mode On Files	
14	1301 File	Channel A
15	1301 File	Channel E
16	1301 File	Channel D
17	1301 File	Channel C
18	1301 File	Channel B
19	Direct Data	Channel E
20	Direct Data	Channel D
21	Direct Data	Channel C
22	Direct Data	Channel B
23	Tapes	Channel E
24	Tapes	Channel D
25	Tapes	Channel C
26	Tapes	Channel B
27	Tapes	Channel A
28	Double Precision Float Pt.	
29	Single Precision Float Pt.	
30	Interval Timer, 16.6 msec.	
31	Storage Protect	
32	Extended Performance	

1.00.04.0   OPERATING STANDARDS

.04.3   CONFIGURATION AVAILABLE WORDS -continued-

Bit   Definition

33   Memory Size. 1-1 32K, 1-0
34   16K 0-1 8K, 0-0   4K.

35   Memory Speed 1-2.5, 0-8. MS

1.00.04.0   OPERATING STANDARDS

.04.3   CONFIGURATION AVAILABLE WORDS -continued-

Second Configuration Word - Location 471

Bit

S	1011 Paper Tape Channel A
1	Spare
2	Spare
3	Spare
4	Spare
5	1009 Data Trans. Channel A
6	1009 Data Trans. Channel B
7	1009 Data Trans. Channel C
8	1009 Data Trans. Channel D
9	1009 Data Trans. Channel E
10	Used With Conf. Required Word For The 7750/7740/1440 Program
11	7750/7740/1440------Channel B
12	7750/7740/1440------Channel C
13	7750/7740/1440------Channel D
14	7750/7740/1440------Channel E
15	7750 Is The Trans. Cont. Unit
16	7740 Is The Trans. Cont. Unit
17	1440 Is The Trans. Cont. Unit
18	Reserved For System Check Diagnostic
19	Used In Conf. Req. By 4DC3 To Denote Non-7040/44 PGM
20	Teletype-------------Channel A
21	Telephone Inq.-------Channel A
22	Shared File
23	Spare
24	Spare
25	Spare
26	Spare
27	Spare
28	Spare
29	Spare
30	Interval Timer, 1msec
31	Drum Storage -Channel A

1.00.04.0   OPERATING STANDARDS

.04.3   CONFIGURATION AVAILABLE WORDS -continued-

Second Configuration Word - Location 471

-continued-

Bit

32	Drum Storage--------	Channel B
33	Drum Storage--------	Channel C
34	Drum Storage--------	Channel D
35	Drum Storage--------	Channel E

1.00.04.0   OPERATING STANDARDS -continued-

.04.4   CONFIGURATION REQUIRED WORDS

Within the DCP system, there are two configuration required
words.   They are punched in the 3rd and 4th words of the transfer
card of each diagnostic card deck.   4UT1 will place these con-
figuration words in the ID record written on the tape.   4DC3 will
use these words in determining whether or not a program can
run on the system. (See sec. 1.00.03.4)

In each of these words, a bit should be set if the corresponding
bit in the configuration available word must be set for the pro-
gram to run.

Program

4RP6	bit 10 of word 1	1622 must be avail-able to be tested.
4RP2	5, 3, or 6 of word 1	Any 1402 must be a-vailable to be tested.
4M51	None	No bits set will in-dicate a basic program.
4T51	bits 23-27 of word 1	Will test any tape.
4SY1, 4SY2	18 of word 2	Indicates a systems test program.

1.00.04.0   OPERATING STANDARDS

   .04.4   CONFIGURATION REQUIRED WORDS -continued-

The following are the ground rules and are followed when generating the configuration required words.

1)   No program will specify extended performance unless it is designed to test the extended performance feature. (This system is designed for an 8K, extended performance minimum machine.)

2)   No program will specify any memory size or speed except that program that tests the memory . (Exceptions to this are listed under 3 and 4.)

3)   Any program that requires a minimum exceeding the 8K, extended performance minimum, may indicate this by setting bit 18 of word 2. (Reserved for 4SY1). When this bit is set, 4DC3 will insure that all options specified in the configuration required words are available before a program will be allowed to run.

4)   If a specific memory size is required and bit 18 of word 2 is not set, 4DC3 will check only the memory size. If the configuration available word designates a memory size exactly the same as the configuration required word demands, the program will be allowed to operate. If they differ, the program will not be allowed to operate.

In punching the configuration required words, the 1st configuration required word will be punched in the 3rd word of the card (i.e. the configuration required word that corresponds to location 472). The 2nd configuration required word will be punched in the 4th word of the card.

NOTE: If the configuration required words are both zero then 4DC3 considers the program to be basic and will allow it to run regardless of the configuration available.

1.00.04.0   OPERATING STANDARDS -continued-

.04.5   ABORT PROCEDURE

The following procedure may be used when the operator
wants to terminate a program prematurely.

Step 1   "RESET"
Step 2   Clear sense switch 6
Step 3   "START"

The diagnostic will check sense switch 6. With sense switch
6 off, the diagnostic will return to the DCP and the next pro-
gram will be read.

.04.6   RESTART PROCEDURE

The following procedure may be used when the operator wants
to restart a program.

Step 1   "RESET"
Step 2   Set sense switch 6 to ON.
Step 3   "START"

The diagnostic will check sense switch 6. With sense switch
6 on, the diagnostic will restart. Location 00000 should have
the program restart address.

.04.7   PROGRAM DUMP TAPE PRINTOUT

Whenever 4UT1 is used to generate or update a diagnostic tape,
a listing of the programs and associated search numbers is
also produced. The programs are listed in the order in which
they appear on tape. If desired that listing may be placed in
this volume at this point for reference and safekeeping.

1.00.05.0   <u>SUMMARY PAGES OF PROGRAMS</u>

Each program released has a summary page as the last
page of the writeup. These may be removed from the
writeups and placed in this volume following this page.
These are intended to serve as a ready reference to all
programs and should provide enough information to op-
erate the program in normal mode. To more fully under-
stand the programs their writeup should be studied.