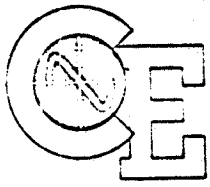

Diagnostic Engineering Publication

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INTRODUCTION TO DIAGNOSTICS

4/15/64

OBSOLETES ALL PRIOR

DIAGNOSTIC INTRODUCTORY MATERIAL

CONTENTS

I. DEFINITION OF DIAGNOSTIC PROGRAMS

A. DIAGNOSTIC PROGRAMS are groups of instructions which, when executed, will exercise the system's circuitry and detect any malfunction. Since it would take an extremely large program to exercise all of the circuitry, the DIAGNOSTIC PROGRAMS are divided into small separate groups each of which will exercise only a particular portion of the entire system the entire DIAGNOSTIC PROGRAM complex will then exercise the entire system. The smaller groups are referred to as "DIAGNOSTICS" and these programs can exist either in card deck form or on magnetic tape. Descriptive write-ups of each individual diagnostic are sent along with the programs at the time of installation.

B. Each Diagnostic has an identification in the form of a 5 digit code - for example: C020B

1. The first character is a letter which usually denotes the unit being tested.
   a. C for CPU, D for Disk File, T for Tape, S for System Tests, etc.
   b. Example:
      CU01B - CPU Reliability Test
      DA03C - 1301 Reliability Test
      T022B - Tape IRG Test
      ST01B - 1410/7010 System Test
   c. Refer to Volume index for Entire List

2. The second character will further define the unit being tested
   Example:
      CS43A - 1410 Memory (Core Storage) Reliability Test
      ST01B - 1410/7010 System Test
      DA03C - 1301 Reliability Test

3. The third and fourth characters are numerics and indicate the sub-unit within a Unit, defined by the first two characters.
   Example:
      ST01B
      DA03C
   The "01" in ST01B indicates this is one of a series of System tests, etc.

4. The last or 5th character (called suffix) denotes the program's revision level.
   a. When a program is first released it has the letter "A" as a suffix. If this same diagnostic has changes made to it, the suffix letter will change from A to B - the third change will have a suffix letter "C", etc.
   b. Any revised diagnostic completely obsoletes its predecessor. The older program should be immediately deleted from all files, as it will no longer be maintained.
   c. Diagnostic cards have their titles punched into columns 73-77. Columns 78-80 are used for the card number sequence within that diagnostic deck.

5. Refer to Index for the complete listing of Programs.

II DIAGNOSTIC PROGRAMS IN CARD DECK FORM

A. A complete test in card form consists of a load routine, data cards, and execute cards.

1. A seven card loader entitled L1.

2. A diagnostic core clear execute card.

3. Diagnostic data cards numbered in sequence starting with card #ØØ1.

4. The last card, an execute card, causes a Branch Out of the load routine to the first instruction of the acutal diagnostic program. (Address 02000)

B. CARD DIAGNOSTICS ARE LOADED INTO CPU STORAGE

By the seven card load routine, L1. Several diagnostics can be run sucessively by placing them into the reader hopper sequentially. As soon as one program is completed the next deck will be read in automatically. (It is never necessary to remove the load or core clear cards from program decks.)

C. The load routine L1 is capable of reading in cards:

1. From "E" Channel

II C. (continued)

2. From "F" Channel

3. From "E" Channel using the load button feature.

("E" Channel loading will subsequently be discussed in detail)

III STANDARD PROGRAM CARD FORMAT CONSISTS OF FOUR MAJOR FIELDS:

A. CARD LAYOUT:

1st Field
- Column 1 - Word separator character (ϒ)
- Column 2-6 - Initial Address of Data to be stored. (Left Most)

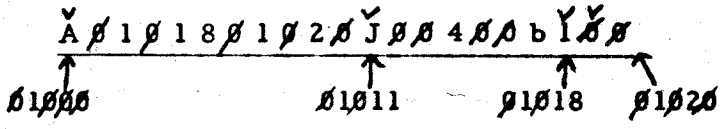
2nd Field
- Column 7 - (ϒ)
- Column 8-12 - Number of storage positions required.

3rd Field - Columns 13-72 - Instructions/data

4th Field
- Columns 73-77 Test Title
- Columns 78-80 Card Number

B. EXAMPLE-STORAGE CONTENTS AS A RESULT OF LOADING THE FOLLOWING CARD

1st Fld.	2nd Fld.	3rd Field	4th Field
1 2-6	7 8-12	12 ----------72	73-77 78-80
ϒ Ø1ØØØ	ϒ ØØØ21	ϒAØ1Ø18Ø1Ø2ØϒJØØ4ØØbϒIØØbb	Title Card #
Initial Addr.	Num of Pos.	Instructions/Data	



III STANDARD PROGRAM CARD FORMAT CONSISTS OF FOUR MAJOR FIELDS: (continued)

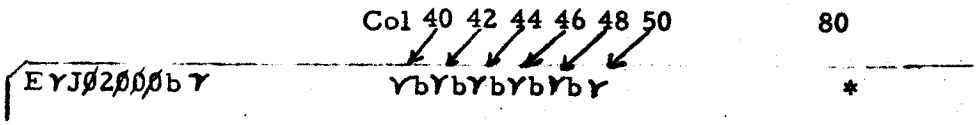
C. Note that all program cards are usually first loaded into memory before the execution of the program starts.

IV EXECUTE CARD

A. The function of the "EXECUTE" card is to interrupt the loading routine and perform the instructions that are punched in that same card. These instructions will then permit the program to branch out of the loading routine for any desired operation - perhaps to clear storage or to request some manual intervention by the operator (inquiry request) and then branch back into the loading routine, or branch to start the program already loaded. The last card of every diagnostic program is always an "DIAGNOSTIC EXECUTE" card, however, there may be more than one "E" card in one diagnostic deck.

B. The L1 loading routine has the facility to execute instructions punched into a card which has just been read IF column one of that card contains the character "E" and is immediately followed by an instruction. After detecting the "E" in column 1, CPU will then address the instruction starting with column 2. The last instruction in this execute card must necessarily be a branch to an existing instruction in memory.

C. Example of a Branch Execute Card:

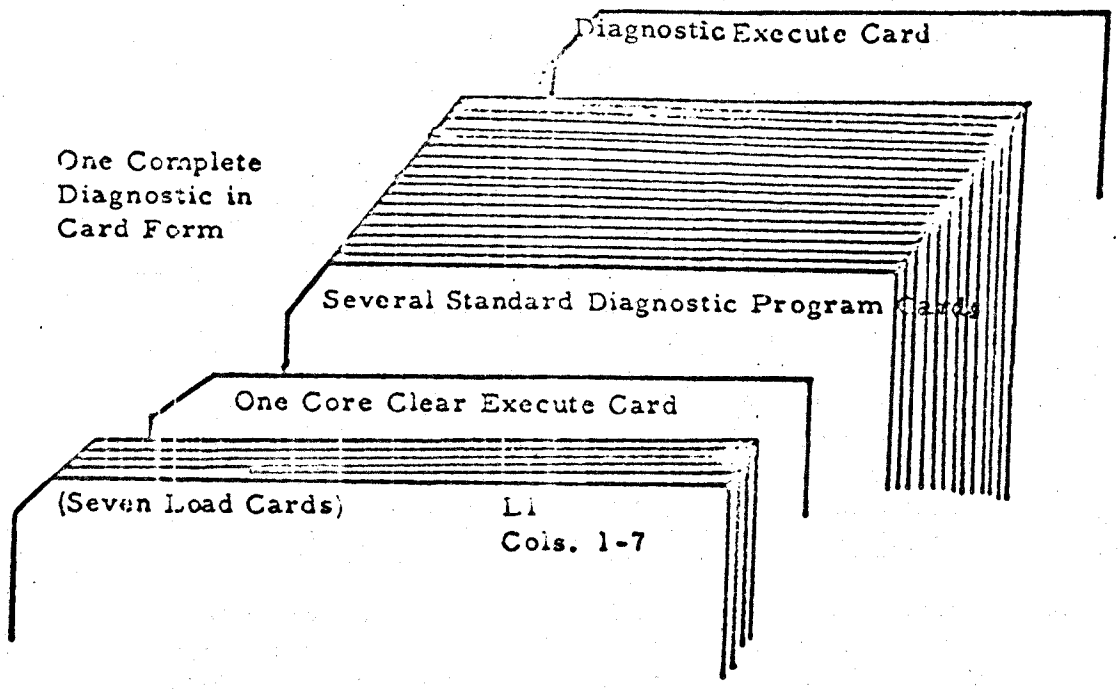


E J Ø2ØØØb

Assume ØØ6Ø1

(The relationship between the E cards and the load routine is borne out in the section dealing with L1)

V. SEQUENCE OF CARDS WITHIN A DIAGNOSTIC



VI THE SEVEN CARD LOADER, L1

SPECIFIC FUNCTIONS

1. Load itself in from Channel 1 as a result of manually entering in position ØØØØØ; "RL%1100011$." -- or by use of the load button feature.

2. Load the diagnostic card data into storage.

3. Enable the immediate execution of the instructions punched into an EXECUTE CARD.

4. Enable the program to ignore cards which are not either data cards or Execute Cards, and continue to read the next card. This allows the diagnostics to be separated by a blank card or a comment card, or another set of L1 load cards. (Comment card can not have an X in column 1).

5. Automatically adjusts its I/O instructions if the card reader is on Channel II. This would require the manually entered instruction in position ØØØØØ to be "XL␣1100011$.".

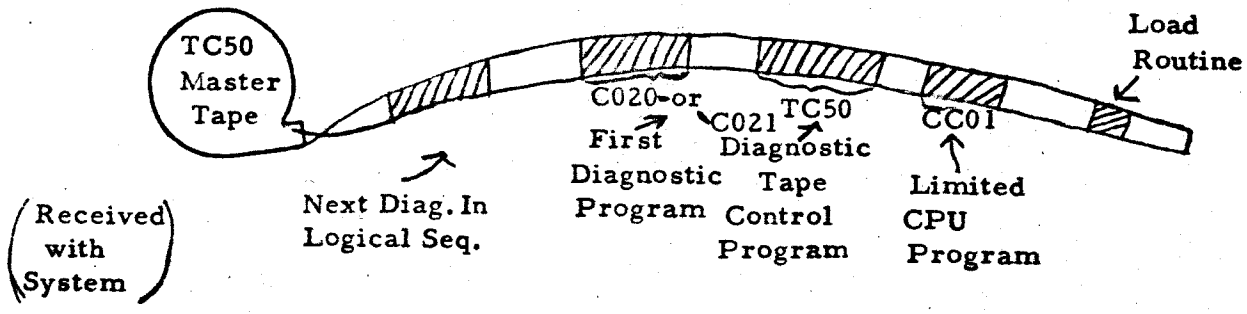
6. In the event of a card jam, the operator can reload the reader with the jammed (or error) card as the first card and restart from that point.

--------REFER TO APPENDIX IV FOR ACTUAL PROGRAM------

VII DIAGNOSTIC PROGRAMS WRITTEN ON MAGNETIC TAPE

A. Diagnostic Program Card data are read into storage and packed (blocked) starting at location 01000 and then written on tape as one record from 01000 to the end of the program (Actual area required by program). These records are called "DUMP" records; hence this type of tape is commonly referred to as a "DUMP TAPE". A Diagnostic Dump Tape is shipped with each system at the time of installation. Instructions for operating this tape are described in a later section of this Introduction. Also, these Operating Procedures and Updating Procedures will be found in the TC50 program writeup.

B. The Diagnostic Dump tape contains <u>all</u> Diagnostic Programs plus a load routine, a limited CPU Program and TC50 (Diagnostic Tape Control Program). TC50 is a Supervisory Program.



THE MASTER TAPE SHIPPED TO YOU DOES NOT CONTAIN ANY SYSTEM OR CHANNEL CONFIGURATION INFORMATION.

THIS TAPE WAS CREATED AT 556 B.P.I.

VIII CORE CLEAR CARD

A. Function: The core clear card precedes each diagnostic test. It is used to clear memory from the Highest address (required by the program), down through address 01000. It will also clear a word mark at 999, set a word mark at 998 and clear a word mark at 997.

B. Card Format

Ev,01000v□v,v□v/09999vG00616BvV00611010001vJ00400bv

The character in column 17 defines core storage size.

EACH PROGRAM WILL HAVE A CORE CLEAR CARD THAT CLEARS THE AMOUNT OF CORE REQUIRED BY THAT PROGRAM.

A core clear card for a 10K system will have columns 78-79-80 Blank.

A core clear card for 20K system will have columns 78 Blank, 79 Blank, and an * in column 80.

A core clear card for 40K system will have columns 78 Blank, 79 an *, and 80 a Blank.

IX TAPE LOAD ROUTINE (Load TC50 Dump Tape)

A. FUNCTION

1. To initialize (adjust instructions) TC50 for the channel that the dump tape is to be used on.

2. To read in CC01 from the tape, operate it, and then read in TC50.

B. Whenever a TC50 Diagnostic Tape is created, duplicated, or updated, the first record of the new tape will be a short load routine.

SEE APPENDIX I OF TC50 WRITE-UP FOR DETAILED LISTING OF TC50 LOAD ROUTINE

X FUNCTION OF TC50

A. The TC50 Program is a combination of a Tape Search Program and a Tape Update Program.

The prime objectives of TC50 are:

1. Assist in "Bringing Up" a new 1410/7010 System to the point where Diagnostics can be run.

2. Provide an initial master tape that may be used to run some Diagnostics without requiring the updating of tape (System and Channel Control Information)

3. Provide rapid access to Diagnostic Programs.

4. Provide the versatility of "Machine Configuration Control Cards" without requiring that they be punched for every program on tape.

5. Provide a Fast, Simple means of updating 1410/7010 Diagnostic Tapes.

6. Provide for multiple outputs (Extra Tapes) when updating the Diagnostic Tape.

7. Automatically provide, at the OPTION of the operator, an "EDITED" working tape that contains only those programs needed for that particular system, while updating the system's master tape that contains all 1410/7010 Diagnostic Programs.

8. Provide a means for Card/Tape systems to obtain card decks directly from their Diagnostic Tape. (Accomplish by Diagnostic Utility Program UP51).

9. Provide a "Quick" Reliability check of a 1410/7010 Machine System

B. Operating Procedure for using the Diagnostic Dump Tape
(See TC50 Write-Up for details)

1. Make the file protected dump tape ready on Tape Drive # 0, any channel. (The tape supplied to you was created at 556 BPI.)

2. Clear Storage and/or

   a. Use Load Button if 7010 and Tape 0 is on Channel 1
   b. If 1410 or Tape 0 is not on Channel 1, ENTER at 00000:

   RL%B000011$. - Channel 1
   XL□B000011$. - Channel 2
   3L?B000011$. - Channel 3
   IL!B000011$. - Channel 4

3. Computer Reset and Start.

4. The load routine then causes CC01 (Limited CPU test) to be loaded and run. After the typeout CC01 complete, a message will be typed -- "OPTION". (if no data is entered (Request/Release) all programs will be run.

5. Depress Inquiry Request Key and enter one of the following for the desired type of operation:

   a. TO RUN DIAGNOSTIC PROGRAMS

      (1) *Enter the program identity, i.e. "CU01". The disignated program will be run.

   or (2) *Left portion of a program identity. All programs having the designated portion of the identity, that are adjacent on the tape, will be run. i.e., if "C" were entered, all programs with a "C" identity would be run; if "CU" were entered, all programs with "CU" identity would be run; if "CU0" were entered, all programs with a "CU0" identity would be run; etc.

   *NOTE: Normally when a program identity or a portion of a program identity is entered, the diagnostic tape is rewound before the search of the tape is started. If a word mark is entered with the first character of the identity, this rewind will be inhibited.

or (3) Nothing (Request/Release)
All programs on this tape will be run in sequence starting at the point the tape is located when this entry is made.

or (4) $
Entering a dollar sign will select the reliability mode. (includes a portion of a CPU reliability program, the addressing tests of applicable memory programs, and a complete system test program.)

C. Creating, modifying or duplicating a TC50 Diagnostic Tape

REFER TO TC50 WRITE-UP FOR DETAILS

XI PROGRAM ALTER ROUTINE

Most Diagnostics will use this routine.
This routine may not always be called the "Program Alter Routine" in all programs, but will usually operate in a similar fashion.

A. Function

To enable the operator to change a character or characters by use of the console Inquiry Request key, after the diagnostic test starts its operation.

B. Operation

J(I)Q instructions are strategically located throughout the program. After pressing the inquiry request key, a J(I)Q instruction is eventually encountered and branches to the "Program Alter Routine" instructions where the following sequence occurs:

1. An "I" types
2. Enter the FIVE(5) digit address of the character to be changed.
3. Depress the release key.
4. Again depress the Inquiry Request key.
5. Type in the desired character or characters.
6. Depress the Release key.

XI. TADS - TEST ALTERATION DIGITS

A STANDARD TADS

MOST DIAGNOSTIC PROGRAMS WILL USE ALL FOUR STANDARD TADS

1. TADS are an integral part of almost all diagnostic programs, and are automatically read in with each program. They are located in memory positions 01000 thru 01003. They are Preset in the OFF (Not 1) condition. To set a TAD to the ON condition (character 1), the Program Alter Routine will normally be used.

2. Functions

TAD	MEM. ADDR	OFF (Not 1)	ON (1)
TAD 0	01000	Typeout	Bypass Typeouts
TAD 1	01001	Do not repeat routine	Repeat the routine
TAD 2	01002	Bypass error halts	Halt on error
TAD 3	01003	One program pass	Repeat the program

B SPECIAL TADS

MOST DIAGNOSTIC PROGRAMS WILL USE SOME SPECIAL TADS. SPECIAL TADS ARE USED BY INDIVIDUAL PROGRAM AS REQUIRED. THEY ALSO WILL AUTOMATICALLY BE READ IN WITH EACH PROGRAM. THEY WILL BE LOCATED IN MEMORY STARTING AT POSITION 01004.
SOME PROGRAMS MAY HAVE SEVERAL SPECIAL TADS.
CONSULT INDIVIDUAL PROGRAM WRITE-UPS FOR DETAILS.

XII. MESSAGES

Messages to the operator are usually printed on the console printer. The 1403 Printer, if available, may be used if lengthy messages are required.

Messages will normally be typed by a "Type Routine." This "Type Routine" will not have a fixed memory address common to all programs. Normal entry to this routine is a BR TYP1. Following the branch will be the message. Upon completion of the message the type routine will return to the instruction immediately following the message.

Example:

```
START     B      TYP1
          DCW    @THIS IS A MESSAGE@,G
RETURN    H
```

The type routine will typeout "THIS IS A MESSAGE," and return to location labeled RETURN.

There may be variations to the type routine but the above is the basic function of all the type routines.

XIV SYSTEM AND CHANNEL CONTROL CARDS

A Function

They are punched by the C.E. with information peculiar to a given system. The information contained describes the system's core size, optional features installed, and the I/O units attached to each channel, etc. This information is used subsequently by the program and renders it to a more automatic operation - LOAD AND GO.

B Card only Systems

At Card only systems the card or cards specified by the Program Write-Ups must be removed from the individual card decks and the system and channel information punched as specified in Appendix I of this Introduction, and then reinserted in each card deck.

C Tape Systems

For Tape Systems these cards are to be punched as indicated in Appendix I of this Introduction. These cards then will be handled automatically by TC50 Update. TC50 will use the information on these cards to determine what programs are to be placed on your "EDITED" working tape.

XV USING DIAGNOSTICS

A. They should be the final test given to the system prior to assigning the system to the customer.

1. Final check after initial installation.

2. Final check after PM
(Refer to PM schedule for proper use during PM)

3. Final check after installing an engineering or sales change.

B. Trouble Shooting the System Using Diagnostics: (Assume proper power-up sequence, basic console operations, etc.)

1. The prime objective when a machine failure occurs is to fix and reassign the system to the customer as soon as possible. The approaches to the most efficient repair are varied and the following is an attempt to make the CE knowledgeable as to what facilities diagnostic programs offer.

2. Several kinds of errors may occur:

   a. Load routine fails.
   b. A master error occurs - "Red Light" error.
   c. An error message types - control error.

3. When an error occurs, analyze the stop print-out format very closely. (If print-out switch is on inhibit, flip to print and depress start print switch,) Analyze the console indicators very closely. Analyze the error message. Then READ THE DIAGNOSTIC WRITE-UP. (Particular attention to DESCRIPTION, OPERATING PROCEDURE, HINTS AND COMMENTS.)

   a. Determine the sub-routine that failed. (Other diagnostics can be run to realize something common with each diagnostic that failed in an effort to localize the operation.)
   b. The diagnostic write-up contains a description, operating procedures, comments, etc. for that test. The program listing is both in actual and symbolic. All Diagnostic Programs Start In Address 02000, with the exception of some memory programs.
   c. If a master error, the console check control switch can be flipped to reset/restart. Then in position 00001, enter a branch instruction directly to the first instruction of the failing sub-routine. (Some tests may automatically insert the branch instruction in 00001.) The trouble shooting loop is now from the branch instruction in 00001 to the sub-routine; master error within the routine (with reset/restart generates an automatic computer reset) back to address 00001.
   d. If no master error, set proper TADS by the Program Alter routine (if available in program) to assist in Diagnosing the machine malfunction.

C. Each diagnostic test has particular pecularities and the importance of Reading the Write-Ups is stressed.

XVI UPDATING THE DIAGNOSTIC PACKAGE

As required, updates to the Diagnostic Program Package will be in one of the following methods:

A. TAPE SYSTEMS

TAPE SYSTEMS will receive a Disposable Reel of Tape of approximately 400 feet in length. This will contain change (Patch) cards or whole programs as necessary in card image form. This Reel of Tape will be used in a normal TC50 Update run.

SEE WRITE-UP OF TC50 FOR DETAILS ON UPDATING.

B. CARD ONLY SYSTEMS

CARD ONLY SYSTEMS will receive their updates in the form of change (Patch Cards) or a whole, new program deck. If a new program deck is received the system and channel configuration cards must be created for this deck.

REFER TO TC50 WRITE-UP FOR DETAILS

Appendix I

Preparation of Configuration Control Card images

One complete set of configuration control card images consists of one "system control card image"; and one "channel control card image "for each channel your machine has. i.e.; If you have a one channel system, you need a system control card and a channel one control card. If you have a three channel system, you need a system control card and a channel one control card, and a channel two control card, and a channel three control card. etc.

All tape systems must initially prepare only one set of configuration cards.

Card only systems must prepare a set of configuration cards for each program deck.

Once these cards are prepared for a tape system you will never have to do it again unless:

(1) Your system machine configuration changes.
or (2) You damage your master tape and must replace it.
or (3) You replace your TC50 program on your master tape.

For TAPE SYSTEMS make up the system and the number of channel control cards required by your particular system as follows:

Card columns	Characters to Punch	Represent
1-4	SYS 1	SYSTEM CONTROL CARD
	CHN 1	CHANNEL ONE CONTROL CARD
	CHN 2	CHANNEL TWO CONTROL CARD
	CHN 3	CHANNEL THREE CONTROL CARD
	CHN 4	CHANNEL FOUR CONTROL CARD
5-12	Will be blank	
13-69	Punch the configuration information as indicated in APPENDIX IA, IB.	
70-80	May be blank or may contain comments if ~~desired~~	

For CARD ONLY systems punch the number of control cards required by your particluar system (system and channels 1 thru 4 as required) as follows:

SYSTEM CONTROL CARD

Card Column	Characters to Punch	
1	WORD SEPARATOR	
2-6	01256	-STARTING ADDRESS
7	WORD SEPARATOR	
8-12	00033	-LENGTH OF FIELD
13-45	SYSTEM CONFIGURATION AS INDICATED IN APPENDIX IA	
46-80	MAY BE BLANKS	

CHANNEL CONTROL CARDS

CHANNEL CONTROL CARDS are similar except for the starting address in columns 2-6.

Card Column		Characters to Punch	
1		WORD SEPARATOR	
2-6		01289	Starting Address- CHANNEL ONE
	or	01346	Starting Address- CHANNEL TWO
	or	01403	Starting Address -CHANNEL THREE
	or	01460	Starting Address- CHANNEL FOUR
7		WORD SEPARATOR	
8-12		00057	LENGTH OF FIELD
13-69		CHANNEL CONFIGURATION AS INDICATED IN APPENDIX IB	
70-80		MAY BE BLANKS	

APPENDIX I A. SYSTEM CONFIGURATION

The System Configuration of your particular system should be punched in CARD COLUMNS 13-45. PUNCH ONLY YOUR EXACT CONFIGURATION IF YOUR SYSTEM DOES NOT HAVE A FEATURE - LEAVE THE CORRESPONDING CARD COLUMN BLANK.

Punch your system configuration data from the information below:

	Card Column	Character or Bit Breakdown of Character to Punch	Representation
	13	O (Letter)	Mach. is 1410
		I	Mach. is 1410 ACC.
		X	Mach. is 7010
	14	0 (Zero)	10K Memory
		1	20K Memory
		3	40K Memory
		5	60K Memory
		7	80K Memory
		9	100K Memory
	15	1 Bit	Shared File System
	16	1 (100 Char. Buffer)	Chan. 1 Printer
		2 (132 Char. Buffer)	
	17	1 (100 Char. Buffer)	Chan. 2 Printer
		2 (132 Char. Buffer)	
	18	1 Bit	European Edit
		2 Bit	50 Cycle Power
*	19	A	Navy Stk. Pt.
		B	NYSE
	20	1	Overlap Feature Available
	21	1	Priority Alert Available
	22	1	Priority Extension Feature
	23	Blank	Spare (for future use)
	24	Blank	Spare (for future use)
	25	1	Mach. has Channel 1
	26	1	Mach. has Channel 2
	27	1	Mach. has Channel 3
	28	1	Mach. has Channel 4
	29	Blank	Spare (for future use)
	30	Blank	Spare (for future use)
	31	1	1401 Compatibility feature
	32	1 Bit	Timer Interrupt Feature
		2 Bit	Relocate and Protect Feature
		4 Bit	Floating Point Arith. Feature

*Designates an addition has been made to the card since last published.

33	1	Program Addressable Clock
34	Blank	Spare (for future use)
35	Blank	Spare (for future use)
36	Blank	Spare (for future use)
37	Blank	Spare (for future use)
38	Blank	Spare (for future use)
39	Blank	Spare (for future use)
40	Blank	Spare (for future use)
41	1 Bit	Audible Alarm
42	1, 2, 4, 8, A, B-Bits	Reserved for SPL-ENG
43	1, 2, 4, or 8 Bits	Reserved for SPL-ENG
44	1 Bit	Second 100K Memory
45	≠(Record Mark)	To define field
46-80	Blanks	NOT USED

APPENDIX 1 B. CHANNEL CONFIGURATION

The CHANNEL CONFIGURATION of your particular system should be punched in card columns 13-69.
PUNCH ONLY THE EXACT CONFIGURATION FOR EACH CHANNEL. CARD COLUMNS REFERRING TO A SPECIFIC UNIT SHOULD BE LEFT BLANK IN THE UNIT OR FEATURE IS NOT AVAILABLE.

	Card Column	Character or Bit Breakdown of character to punch	Representation
	13	1	Paper Tape Reader
	14	1	Console Printer
	15	1	Tapes - 729/7330
	16	A,B,C,D,E,F,G	7770 audio response unit 32, 48, 64 words 80, 96, 112, 128 words
*	17	1 Bit	1015 Display Unit
*	18	1 Bit	1026 Trans Ctl Unit
*	19	1 Bit	1627 Data Plotter
	20	Blank	Spare (For Future Use)
	21	Blank	Spare (For Future Use)
	22	Blank	Spare (For Future Use)
	23	Blank	Spare (For Future Use)
	24	1	51 Column Card Reader
	25	R	1402 Card Reader
		S	1442 Serial Card Reader
		C	7223 Console Card Reader
	26	B	Reader-Column Binary Feat
	27	P	1402 Punch
	28	B	Punch-Column Binary Feat
	29	P	1403 Printer
	30	A	1403 - Alpha Chain
		N	1403 Numeric Chain
	31	1	1403 - 100 Char. Buffer
		2	1403 - 132 Char. Buffer
	32	F	1301 File
	33	1-0 (1 thru 10)	Number of File Modules
	34	1-0 (1 thru 10)	Number of Accesses
	35	R	1311 Impac
	36	1-5 (1 thru 5)	No. of Modules -
	37	1	Impac - Seek Overlap Feat
	38	1	Impac - Scan Feat
	39	1	Impac - Track Record Feat

* Designates that an addition has been made to the card since last published.

	40	F	1405 File
	41	1,2, or 3	No. of Arms, Module - 0
	42	1,2, or 3	No. of Arms, Module - 1
	43	1,2, or 3	No. of Arms, Module - 2
	44	1,2, or 3	No. of Arms, Module - 3
	45	1,2, or 3	No. of Arms, Module - 4
	46	1	7750 on this Channel
	47	1	7740 on this Channel
	48	1	1440/1460 on this Channel
	49	1	Chan. has Channel Extender
	50	L	Low Speed Hyper Tape - 7341
	51	1	1050 Adapter - 1
		2	1050 Adapter - 2
		3	1050 Both Adapters
	52	1 Bit	1412 Magnetic Ink Char RDR
		2 Bit	1419 Magnetic Ink Char RDR
	53	1 Bit	1009 Data Transmission Unit
		2 Bit	1009 Second Sync. - RPQ
	54	1 Bit	1014 Remote Inquiry
		2 Bit	1014 Second Sync - RPQ
	55	1 Bit	Telegraph
		2 Bit	Telegraph Second Sync - RPQ
	56	F	1302 Files
	57	Blank	Reserved
	58	Blank	Reserved
	59	Blank	Reserved
	60	1 Bit	1404 Without RD/CMP
		2 Bit	1404 With RD/CMP
*	61	1 Bit	1050 Auto Answer Adapter 0
		2 Bit	1050 Polling Adapter 0
*	62	1 Bit	1050 Auto Answer Adapter 1
		2 Bit	1050 Polling Adapter 1
*	63	1 Bit	Need Drum
		2 Bit	1012 Paper Tape Punch
		4 Bit	Punch Feed Read RPQ
	64	Blank	Spare (For Future Use)
	65	Blank	Spare (For Future Use)
	66	Blank	Spare (For Future Use)
	67	Blank	Spare (For Future Use)
	68	Blank	Spare (For Future Use)
	69	Record Mark	To Define Field

* Designates an addition has been made to the card, since last published.

APPENDIX II

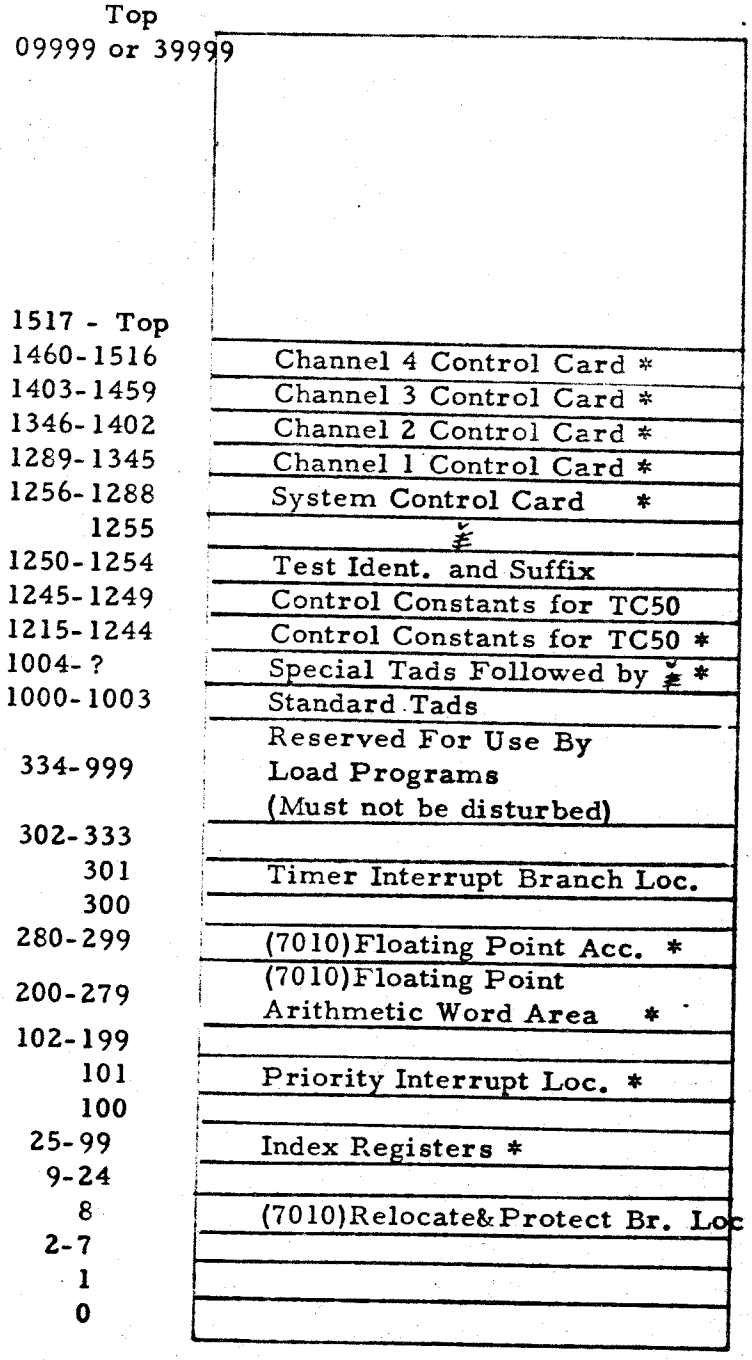
The following is a sample typeout from the console printer, using the System Diagnostic Dump tape running a Tape Reliability Programs, followed by 2 CPU Program

```
D 00000
D bbbbbbbbbbbbb
bbbbbbb
A RL%B000011$.

R CC01A
R CC01 COMPLETE
R OPTION?
I T020
R T020A
R TU 18
R *U@U8M      8   02379          - "ERROR MESSAGES FROM T020"
R *M@B809400W 4   05361          - "ERROR MESSAGES FROM T020"
R PASS
R EOJ
R OPTION?
I CU
R CU01B
R ?
R!!
R A
R S
R @
R %
R E
R Z
R C
R /                              NORMAL MESSAGES FROM CU01
R ,
R Л
R W
R V
R D
R B
R T
R J
R R
R Y
R 1000 PASSES, 1000 OK
R CU06B
R END OF JOB 6 PASSES
R OPTION?
```

APPENDIX III

THE FOLLOWING IS A MEMORY ALLOCATION CHART FOR 1410/7010



1. *If a Program does not test or use this feature, it may be used as needed by the program.

2. Diagnostic Read In at location 1000 and Start operating at location 2000 (with the exception of some memory programs). Any address between 1000-09999 (39999 for 7010) may be included in the program.

APPENDIX IV

UNIVERSAL LOADER

1.00 00.0 Test Description

00.1 Modifications
This load program obsoletes all diagnostic card load programs and card load procedures now being used on the 1410/7010.

00.2 Description

L1 permits a common card loading procedure for 1410/7010 with or without a load button.

All card decks may now have a load program added to them and never removed. The card load program ignores the loader on card decks that may follow the initial diagnostic program loaded into memory. In addition, cards may be loaded from any channel that has a 1402 Reader/Punch.

00.3 Equipment

A. Standard 1410 or 7010 with any memory size.
B. 1402, or 1442 Reader on any channel.

00.4 Card Deck

L1A consists of seven cards, numbered 1 thru 7. There is an identification on each card in columns 77 thru 79 with the card number in column 80.

00.5 EC Level
Not applicable.

1.00 01.0 Loading Procedures
Not applicable.

1.00 02.0 Operating Procedure
The operating procedure for the card load program is actually the loading procedure for all other diagnostic programs.

02.1 To load any diagnostic test using L1A (no load button):

A. Display memory location 00000
B. Alter to

```
v v              v
RL%1100011$.   For card reader on Channel 1
v v
XL ⊏ Chan 2    For card reader on Channel 2
v v
3L ? Chan 3    For card reader on Channel 3
v v
1L ! Chan 4    For card reader on Channel 4
```

C. Set to Run, press computer reset and start.

To load any diagnostic test using L1A with a load button.

A. Computer Reset
B. Depress Load Button.

1.00 03.0 Operating Hints, Comments
Read and follow the operating procedures carefully.

1.00 04.0 Program Stops and Restarts

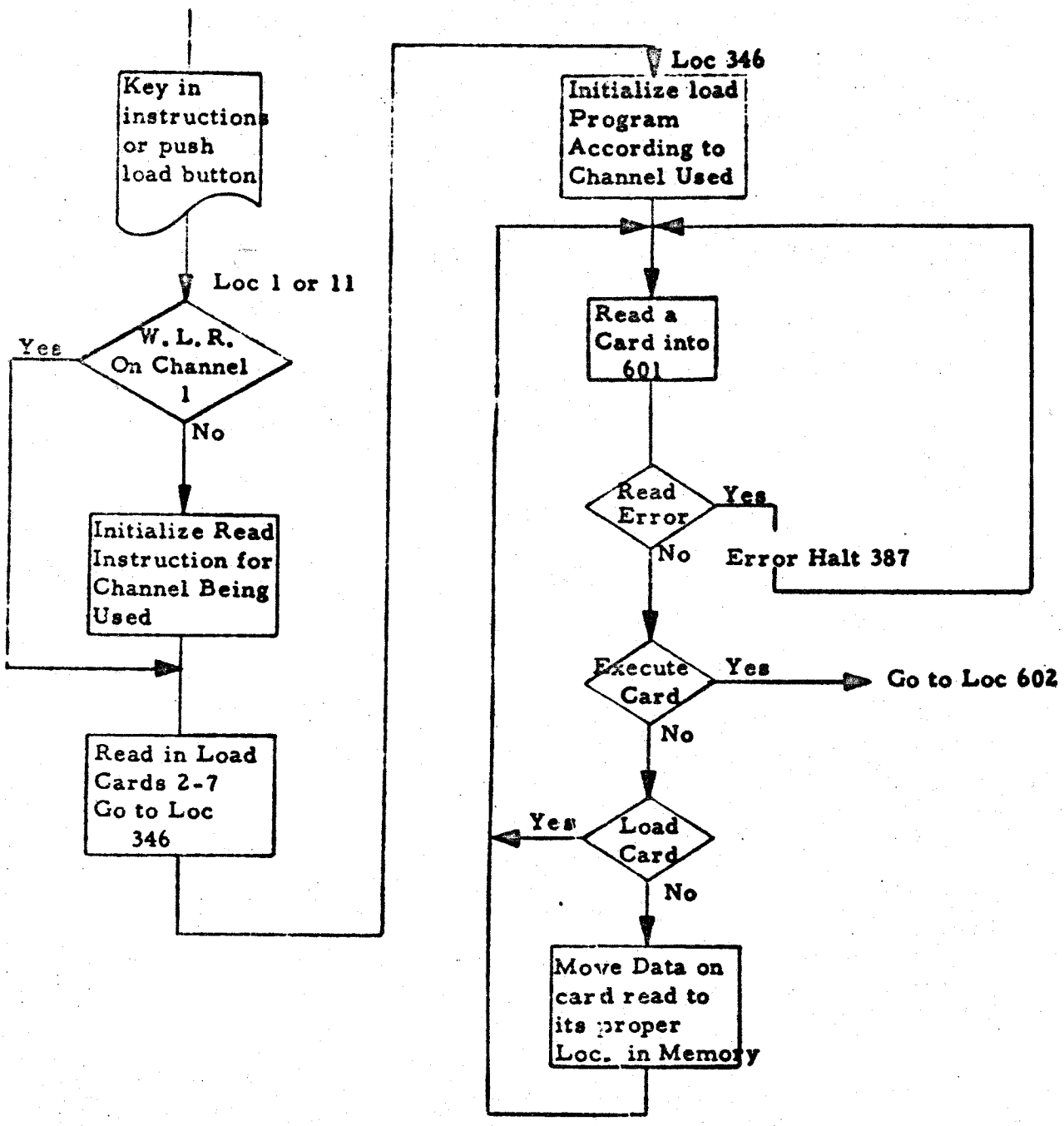
04.1 L1A Stops (Card Loader)
Memory Loc.
00587 This is an error stop indicating that a data check occurred while reading a card. The card in error will be in pocket 0, Reload the reader with the card in error as the first card and press start.

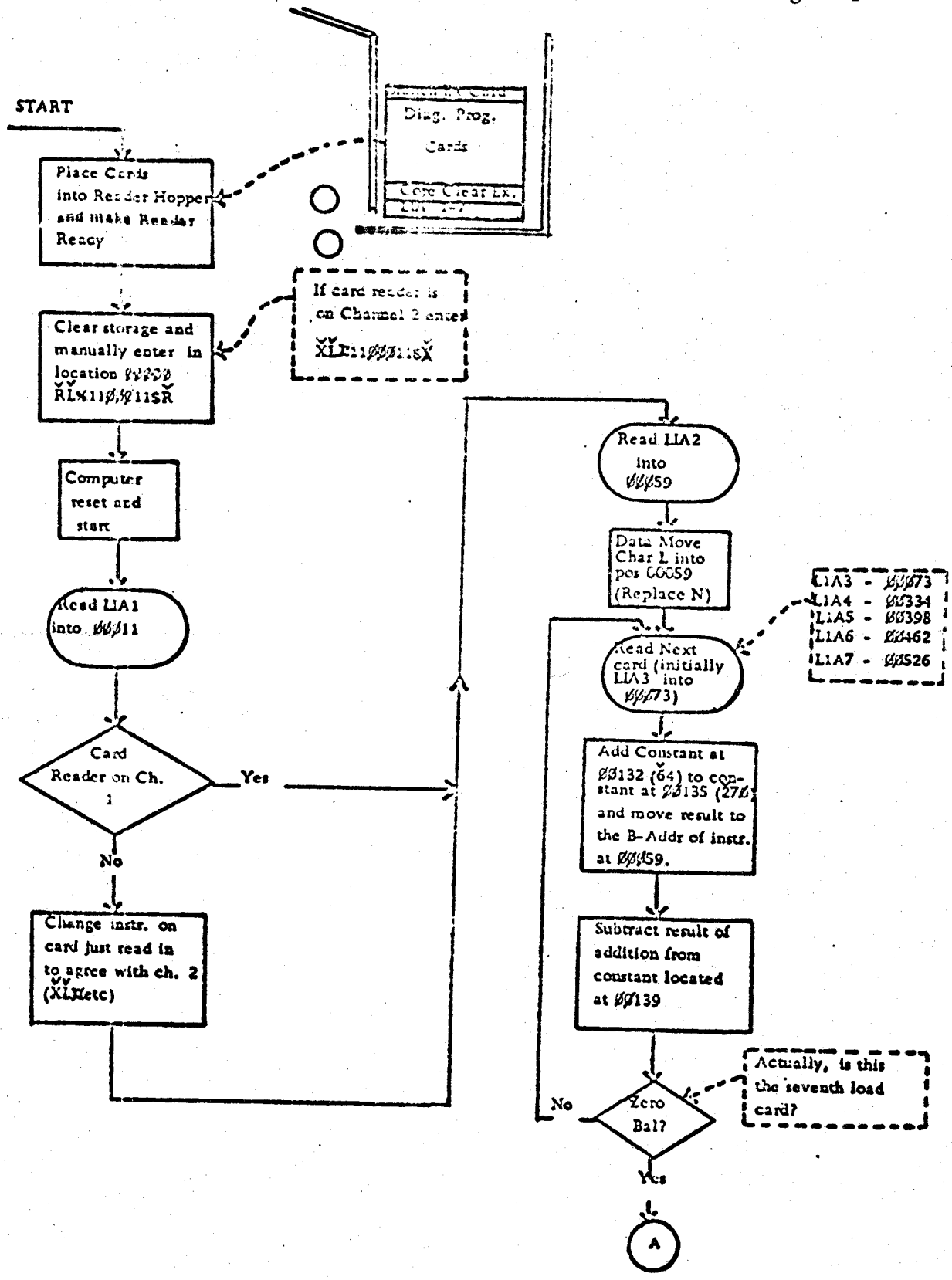
1.00 05.0 Typeouts
The only typeout is caused by the error stop as described in section 04. This typeout will appear as follows:

05.1 S 00587 00XXX 00400 .4

1.00 06.0 Flow Charts
On the following pages are flow charts of the load Program. These should be an aid in getting the Basic Concepts used in the Programs.

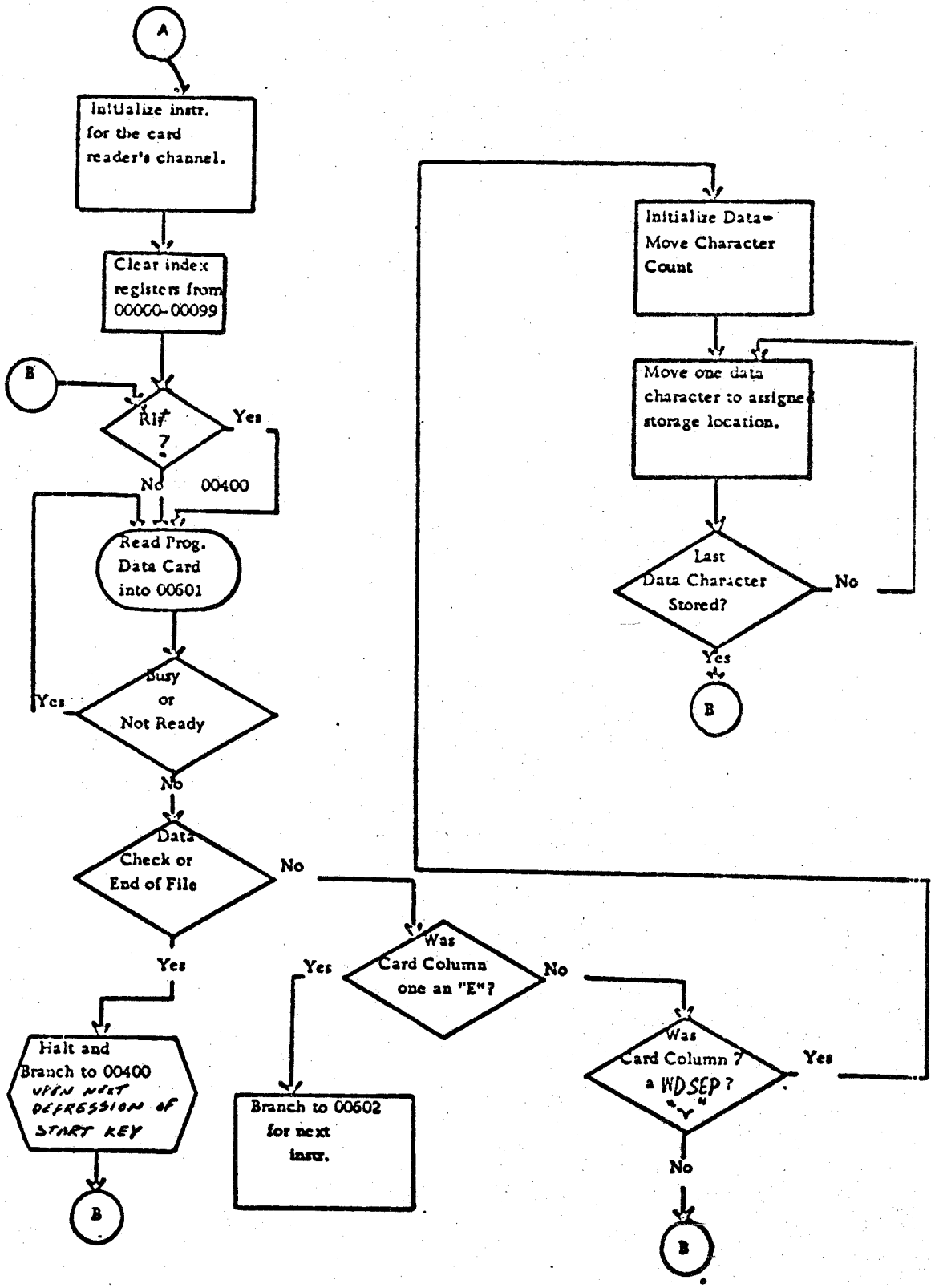
Flow Chart For L1A Card Load Version




START
Diag. Prog. Cards
Core Clear Ex.
Place Cards into Reader Hopper and make Reader Ready
If card reader is on Channel 2 enter
XLR11ØØ11SX
Clear storage and manually enter in location ØØØØ
RLX11Ø,Ø11SR
Computer reset and start
Read LIA1 into ØØ11
Card Reader on Ch. 1
Yes
No
Change instr. on card just read in to agree with ch. 2 (XLR etc)
Read LIA2 into ØØ59
Data Move Char L into pos 00059 (Replace N)
Read Next card (initially LIA3 into ØØ73)
LIA3 - ØØ073
LIA4 - ØØ334
LIA5 - ØØ398
LIA6 - ØØ462
LIA7 - ØØ526
Add Constant at ØØ132 (64) to constant at ØØ135 (27Ł) and move result to the B-Addr of instr. at ØØ59.
Subtract result of addition from constant located at ØØ139
Actually, is this the seventh load card?
Zero Bal?
No
Yes
A

XXX

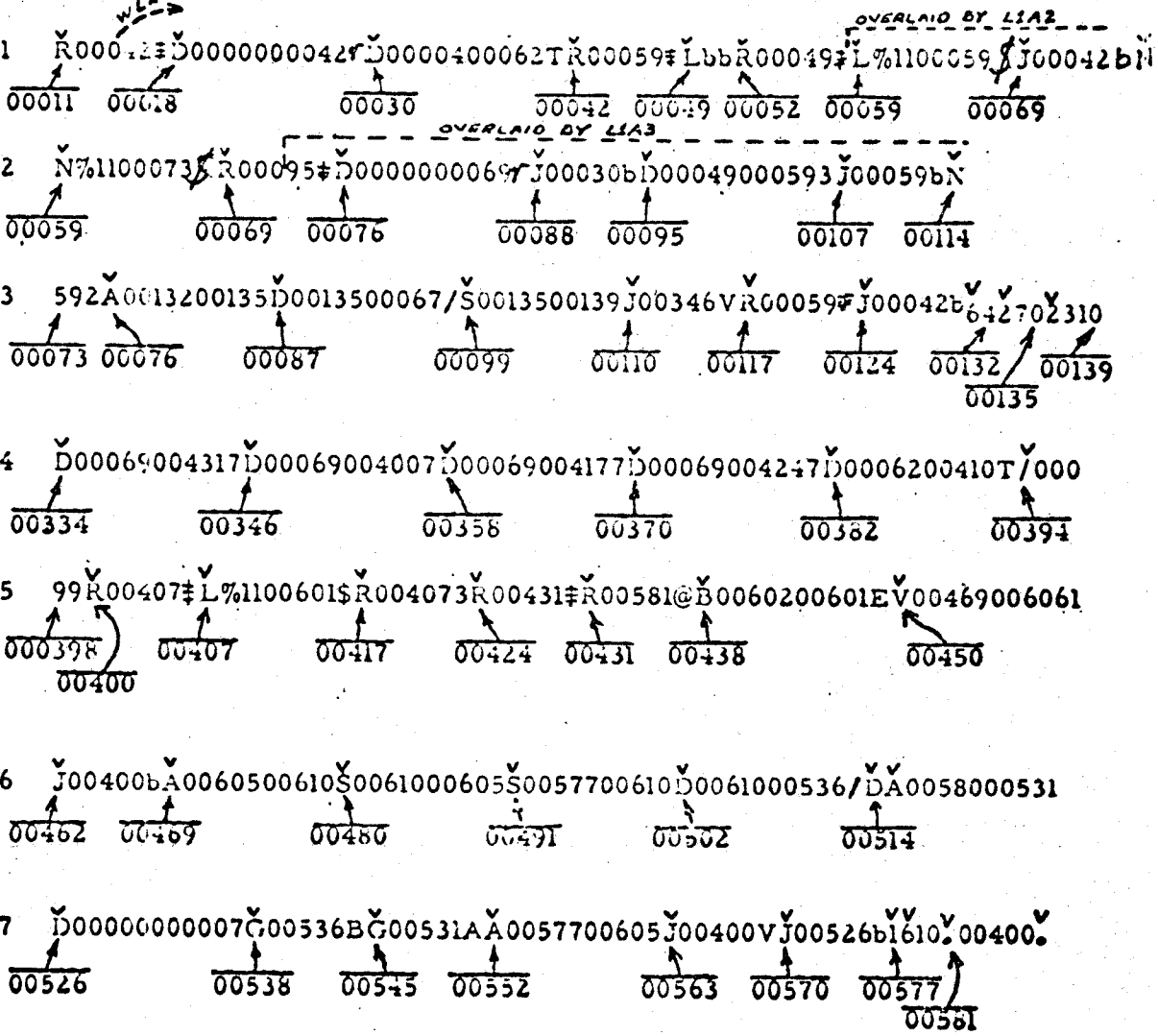
This page depicts loading of data and checking for only EXECUTE cards and program cards.



k2x

C. Information contained on Loader Cards and Storage assignments:
(Be mindful of instructions overlaid by cards L1A2 and L1A3)

Manually enter:
RL%1100011$R (if ch 2 reader, enter XL%1100011$X)
00000



Card Version L1A Listing

This portion is used to read in and initialize the main loader into locations 346 thru 587.

Memory With Load Button	Location Without Load Button	Instruction	Comment
	0	R (or)	These instructions are entered when operating on ch 1 or 2 of the 1410, or when operating on Chan 1 or 2 of the 7010 and not using the load button.
	1	L%1100011$	
	11	.	
1	11	R 00042 ǂ	Clear the I/O interlock if on channel 1, and branch because of the W. L. R.
8	18	D 00000 00042	Initialize branch on status indicator on instruction, if other than ch. 1
20	30	D 00004 00062 T	Initialize read card instruction, if other than ch 1.
32	42	R 00059 ǂ	Clear I/O interlock on ch. 2, and brach because of W. L. R. or busy.
39	49	Lbb	
42	52	R 000 49 ǂ	Clear I/O interlock on ch. 1, used with 2nd card read inst.
49	59	L% 11 00059 R	Read the 2nd card from ch. 1 or 2.
59	69	J 00042 b	If reader is busy this branch will be taken.
66	76	N	Defines length of branch inst.
59	59	N % 11 00073R	Read the cards 3, 4, 5, 6 and 7 on ch 1 or 2.

Memory With Load Button	Location Without Load Button	Instruction	Comment
69	69	R 00095 ǂ	Clear I/O interlock ch. 1 or 2 Branch because of W.L.R. or busy.
76	76	D 00000 00069 ⌐	Initialize branch on status indicator on instruction for ch. 2.
88	88	J 00030 b	If operating on ch. 2, this branch is taken so that the read card instruction may be initialized.
95	95	D 00049 00059 3	Move "L" op code to position 59.
107	107	J 00059 b	Return to read a card instruction.
114	114	N	Defines the length of the branch instruction.
69	69	R 00059 2	Branch busy to read a card inst.
76	76	A 00132 00135	Add card character count to starting address of card previously read.
87	87	D 00135 00067/	Move starting address of next card into read a card instruction.
99	99	S 00135 00139	Subtract address from total of all starting addresses.
110	110	J 00346 V	Branch if total of all starting addresses has gone to zero.
117	117	R 00059 ǂ	Clear the I/O interlock on ch. 1 and branch because of W.L.R.

Memory Location With Load Button	Location Without Load Button	Instruction	Comments
124	124	J 000-2 b	If operating on ch. 2, this branch is taken.
131	131	65	Card character count of cards 4, 5, 6, and 7
133	133	281	Starting address of card 4 minus 65.
136	136	2310	Total of the starting address for cards 4, 5, 6, and 7.

Card Version

This portion loads the actual programs.

Memory Location	Instruction	Comments
334	D 00069 004317	
346	D 00069 004007	Initialize branch on status
358	D 00069 004177	indicator on, and read card
370	D 00069 004247	instructions for the channel
382	D 00062 00410T	being used.
394	/ 00099	Clear index register area
400	R 00407 ≠	Clear I/O interlock for ch. 1 or 2.
407	L%11 00601$	Read a card into read area from ch. 1 or 2.
417	R 004073	Branch on channel busy
424	R 00431 ≠	Clear I/O interlock for ch. 1 or 2.
431	R 00581 @	Branch on channel data check to error routine.
438	B 00602 00501E	Branch if card read was an execute card.

Memory Location	Instruction	Comments
450	V 00469006061	Branch if card is a normal program card.
462	J 00400 b	Go read next card.
469	A 00605 00610	Add starting address of card read to the card character count.
480	S 00610 00605	Subtract address and count from address.
491	S 00577 00610	Subtract 1 from address and count.
502	D 00610 00536/	Move starting address + count -1.
514	D	Move starting address - starting address + count
515	A 00580 00531	Add 610 to "A" address of data move.
526	D 00000 00000 7	Move character read from card to its proper location in memory.
538	G 00536 B	Store B address in data move
545	G 00531 A	Store A address in data move.
552	A 00577 00605	Add 1 to starting address - starting address + count.
563	J 00400 V	Branch if all characters have been moved to their proper locations in memory.

Memory Location	Instruction	Comments
570	J 00526 b	Branch if there are more characters to be moved.
577	1	Constants
578	610	
581	.00400	Error halt when a data check occurred.
587	.	Defines length of halt and branch instruction.