IDENTIFICATION

Product Code: DEC-08-LBAA-D
Product Name: Binary Loader
Date Created: May 10, 1967
Maintainer: Software Services Group
1. **ABSTRACT**

The Binary Loader is a short routine for reading and storing information contained in binary-coded tapes, using the ASR 33 Perforated-Tape Reader or the Type 750 High-Speed Perforated Tape Reader.

The Binary Loader accepts tapes prepared by the use of PAL (Program Assembly Language) or MACRO-8. Diagnostic messages may be included on tapes produced when using either PAL or MACRO. The Binary Loader will ignore all diagnostic messages.

2. **PRELIMINARY REQUIREMENTS**

**Storage**

This program occupies 94 (decimal) core locations.

**Equipment**

The Binary Loader may be used with a system consisting of the PDP-8 and associated Teletype ASR 33 only. On the other hand, the same program operates with systems including the 750 High-Speed Tape Reader and/or the Memory Extension Control Type 183. This loader is compatible with the 552 DECTape Library System and the TC01 DECTape Library System.

3. **LOADING OR CALLING PROCEDURE**

The Binary Loader is brought into memory by the RIM or Read-In-Mode Loader. This requires that the Binary Loader tape itself be in RIM format. See Read-In-Mode Loader Manual for a thorough discussion of the RIM Loader and RIM format.

**NOTE:** 183 Memory Extension users; refer to Special Requirements section.

Proceed as follows:

a. Place the Binary Loader tape in the ASR 33 reader.

b. Make sure that the ASR 33 is on-line.

c. Place the starting address of the RIM Loader (7756) in the SWITCH REGISTER.

d. Press the LOAD ADDRESS key.

e. Press the START key.

f. Move the READER CONTROL switch to the START position.

**Switch Setting**

**NOTE:** 183 Memory Extension users see "Special Requirements" section.
4. **USING THE PROGRAM OR ROUTINE**

   a. Place the tape to be loaded (which must be in binary format) in either the ASR 33 Tape Reader or the Type 750 High-Speed Reader. When using the ASR 33, make sure the reader is on-line. When using the 750, make sure the reader is on.

   b. Place the starting address of the Binary Loader (7777) in the SWITCH REGISTER.

   c. Press LOAD ADDRESS key.

      When using the 750, change the SWITCH REGISTER to 3777 (bit 0 = 0). Omit this step if using the ASR 33.

   d. Press console START key.

      When using the ASR 33, move the READER CONTROL switch to START.

**Errors**

When PAL is used to produce a binary tape, a checksum is automatically placed at the end of the binary tape. The checksum is the sum of all data on the tape including the origin word.

To be more specific, it is the sum of all data contained on tape that will enter the accumulator (AC) in bit positions 4 through 11 from, for example, the ASR 33 Reader buffer. Note that the sum is accumulated character by character and not word by word. Overflow (a carry out of the most-significant bit position of the AC) is ignored both when calculating a checksum (which is done by PAL) and when the Binary Loader accumulates a checksum while loading a tape.

If the checksum accumulated while using the Binary Loader does not agree with the last two characters on the tape (i.e., the checksum on the tape calculated and placed there by PAL), an error has occurred.

When the computer halts, the display lights will be static, the memory buffer (MB) will contain 7402, and the contents of the AC will be unequal to zero if a checksum error has occurred.

Restart the computer after the tape has been repositioned by pressing the CONTINUE key.

5. **DETAILS OF OPERATION AND STORAGE**

This program furnishes the basic means by which the contents of binary-coded tapes are loaded into core.

The heart of the program is a short subroutine (tagged BEGG) which operates in outline as follows:

The incoming character is tested to see if it is a "rubout" (all eight tape channels punched).

If this is the case, all subsequent information coming from the reader is ignored until another rubout is detected.
This is the mechanism by which PAL diagnostic messages are detected. They are preceded and followed by a single rubout character. Within a diagnostic message, in contrast to the rules concerning the balance of the binary tape, any character is valid except, of course, a single rubout character itself which would prematurely conclude the diagnostic message. Note that two consecutive rubouts within a diagnostic message would, in effect, be ignored.

Next the character is tested to see if it is leader or field settings.

These tests are listed in the order in which they are performed. If none of the actions indicated have occurred upon exit from the BEGG subroutine, the character is part of the origin address, contains part of a data word, or is a part of the checksum, and the appropriate course is followed by the main routine.

6. SPECIAL REQUIREMENTS OR FORMATS

6.1 Format

6.1.1 External Format – Tapes to be read by this program must be in binary-coded format. Leader of about 1 foot of leader-trailer codes (any code with channel 8 punched; preferably code 200).

Two characters representing the address (origin) into which the first command on the next portion of the tape will be placed. Successive commands are placed in memory at addresses:

origin + 1, origin + 2, .............origin + n.

The initial character of the origin has no punch in channel 8, while channel 7 is punched. The second character designating the origin has no punches in either channel 8 or 7.

A concluding 2-character group representing the checksum with no punches present in channels 8 or 7.

Trailer similar to leader.

Reference to Program Listing, will indicate that after the BEGG subroutine tests to see if the character just read was leader/trailer, a test is made to determine whether the character is a "field setting." This is a reference to the fact that PAL produces tapes on which characters of the form 11 XXX 000 indicate the memory field into which the following data is to be loaded. If for example XXX were 101, all data following the field designator should be loaded into memory field five.
6.1.2 Example of Binary Loader Format

<table>
<thead>
<tr>
<th>Tape Channel</th>
<th>Channels 8 and 7</th>
<th>Program Proper</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>87 654 S 321</td>
<td>Indicate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 000 . 000</td>
<td>Leader</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>01 000 . 010</td>
<td>Origin</td>
<td>No</td>
<td>In octal the origin 0200. Loading will start at 0200.</td>
</tr>
<tr>
<td>00 000 . 000</td>
<td></td>
<td></td>
<td>The command 7200 or CLA.</td>
</tr>
<tr>
<td>00 111 . 010</td>
<td>Contents of 200</td>
<td>Yes</td>
<td>The command 3276 or DCA Z 076.</td>
</tr>
<tr>
<td>00 000 . 000</td>
<td></td>
<td></td>
<td>The command 7402 or HLT.</td>
</tr>
<tr>
<td>00 111 . 110</td>
<td>Contents of 201</td>
<td>Yes</td>
<td>The program determines that these two characters are the checksum since trailer follows.</td>
</tr>
<tr>
<td>00 111 . 100</td>
<td>Contents of 202</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>00 000 . 010</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>00 000 . 100</td>
<td>Checksum</td>
<td>No</td>
<td></td>
</tr>
<tr>
<td>00 010 . 010</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10 000 . 000</td>
<td>Trailer</td>
<td>No</td>
<td></td>
</tr>
</tbody>
</table>

The octal checksum in this example is 0422. Note that this is the following sum:

| 102 | Origin |
| 000 |
| 072 | First word |
| 000 |
| 032 | Second word |
| 076 |
| 074 | Third word |
| 002 |
| 422 |

6.2 Memory Extension Usage

6.2.1 Loading - It is recommended that the Binary Loader exist in field 0. This will insure a permanent program lining around location 7754 and 7755 which are used for TC01 DECtape. The loader will of course exist in any field, though caution must be taken not to use location 7754 and 7755 in field 0. This applies only to DECtape users. Also, when the proper field is chosen it should be noted that the RIM Loader must already be in that field.
Binary Loader Loading Procedure For Extended Memory Users

a. Place the Binary Loader tape in the reader.

b. Place the proper FIELD in the INSTRUCTION FIELD REGISTER when putting the starting address of the RIM Loader (7756) in the SWITCH REGISTER.

c. Press the LOAD ADDRESS key.

d. Press the START key.

e. Start the reader. (ASR 33 - press READER CONTROL to start, 750 High-Speed Reader - should already be ready to start).

Operation and Usage For Extended Memory Users

a. Place the tape to be loaded (tape must be in binary format) in the reader.

   When using the ASR 33, make sure reader is on-line. When using the 750, make sure reader is on and tape is positioned with leader/trailer over read head.

b. In the DATA FIELD REGISTER place the field in which the program is to be loaded.

   In the INSTRUCTION FIELD REGISTER place the field that the binary loader is in.

   Place starting address of the Binary Loader (7777) in the SWITCH REGISTER.

c. Press LOAD ADDRESS key.

   When using the 750, change the SWITCH REGISTER to 3777 (bit 0 = 0). Omit this step if using the ASR 33.

d. Press console START key.

6.2.2 Errors - See Program Usage Section (Errors)

6.2.3 Starting of Program - After program has been successfully loaded, place starting address of program in SWITCH REGISTER. Place the field where program exists in the FIELD INSTRUCTION REGISTER.

Press LOAD ADDRESS key.

Press console START key.

7. REFERENCED MANUALS

<table>
<thead>
<tr>
<th>Old Number</th>
<th>New Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>RIM Loader</td>
<td>Digital-8-1-U</td>
</tr>
<tr>
<td>PAL III</td>
<td>Digital-8-3-S</td>
</tr>
<tr>
<td>MACRO-8</td>
<td>Digital-8-8-S</td>
</tr>
</tbody>
</table>
8. **FLOW CHARTS**

Loading Binary (BIN) Loader

DEC Library Tape No: Digital-8-2-U

```
CHECK THE RIM LOADER IN MEMORY, IF NECESSARY

PUT SWITCH ON ASR-33 READER TO FREE **
BE SURE ASR-33 SWITCH IS ON LINE

PUT THE BINARY LOADER TAPE INTO READER WITH LEADER CODE OVER THE READER HEAD; NOT BLANK TAPE

PUSH ASR-33 SWITCH TO START

ASR-33 SWITCH IS ON LOCAL SWITCH TO LINE

PUT STARTING ADDRESS 7756, INTO THE SR
PRESS LOAD ADD KEY

PRESS START KEY

PUT DOWN, PRESS CONT.

DOES TAPE START AND CONTINUE MOVING IN READER ?

YES

DOES TELEPRINTER START PRINTING ?

NO

AFTER PROGRAM READS IN, WAIT UNTIL ONLY BIT "0" IS ON IN ACCUMULATOR (i.e., TRAILER CODE OVER READER HEAD)

PRESS STOP KEY ON CONSOLE, MOVE ASR-33 READER SWITCH TO FREE PROGRAM IS LOADED

** THIS ALLOWS THE TAPE TO FIT SMOOTHLY OVER THE READER HEAD AND THE SPROCKET WHEEL TO RUN FREELY.

EXTENDED MEMORY USERS

1. CHECK FOR RIM LOADER IN PROPER FIELD
2. PUT FIELD IN INSTRUCTION FIELD REGISTER

ASR-33 ON LINE ?

TURN ONTO LINE

NO

YES
```
Using Binary Loader

1. Put SA of Bin Loader 7777 into Switch Register

- Press Load Add Key

- If High Speed Photo Electric Reader:
  - Put Down Bit 0 in Switch Register
  - Put Program Tape into Reader With:
    - Feed-Hole Neater Face of Reader
    - Leader Code Over Photo-Diodes
  - Turn Reader On

- Extended Memory Users
  - Put Proper Field Where Binary Loader is Located in Instruction Field Register.
  - Put Proper Field Where Program is Desired in Data Field Register.

2. Leave Up Bit 0 in Switch Register

- If Low Speed ASR-33:
  - Put Program Tape into Reader With:
    - Leader Code Over the Readerhead
    - ASR-33 Reader Switch on Free
  - Turn ASR-33 to Line Push ASR-33 Reader To Start

3. Press Start on Console Wait Until Tape Stops After Reading In

- Is Accumulator 0000?
  - No: Program Loaded Incorrectly
  - Yes: Program is Loaded Correctly
9. LISTING

/BINARY AND DECTAPE LOADERS FOR
/555 CONTROL

*7612
7612 0000 SWITCH, 0
7613 0000 MEMTEM, 0
7614 0000 CHAR, 0
7615 0000 CHKSUM, 0
7616 0000 ORIGIN, 0

*7626
/EXTRACT ERRORS, FIELD, L/T
BEGG,

7626 0000
7627 3212 DCA SWITCH /SET SWITCH
7630 4260 JMS READ /GET A CHARACTER
7631 1300 TAD M376 /TEST FOR 377
7632 7750 SPA SNA CLA
7633 5237 JMP .+4 /NO
7634 2212 ISZ SWITCH /YES: COMPLEMENT SWITCH
7635 7040 CMA
7636 5227 JMP BEGG+1
7637 1212 TAD SWITCH /NOT 377
7640 7640 SZA CLA /IS SWITCH SET?
7641 5230 JMP BEGG+2 /YES; IGNORE
7642 1214 TAD CHAR /NO; TEST FOR CODE
7643 0274 AND MASK /TYPES
7644 1341 TAD M200
7645 7510 SPA
7646 2226 ISZ BEGG /DATA OR ORIGIN
7647 7750 SPA SNA CLA
7650 5626 JMP BEGG /DATA, ORIGIN, or L/T
7651 1214 TAD CHAR /FIELD SETTING
7652 0256 AND FMASK
7653 1257 TAD CHANGE
7654 3213 DCA MEMTEM
7655 5230 JMP BEGG+2 /CONTINUE INPUT
7656 0070 FMASK, 70
7657 6201 CHANGE, CDF
7660 0000 READ, 0
7661 0000 0
7662 6031 LOR, KSF /WAIT FOR FLAG
7663 5262 JMP .-1
7664 6036 KRB
7665 3214 DCA CHAR
7666 1214 TAD CHAR
7667 5660 JMP I READ
7670 6011 HIR, RSF
7671 5270 JMP .-1
7672 6016 RRB RFC
<table>
<thead>
<tr>
<th>Line</th>
<th>Address</th>
<th>Opcode</th>
<th>Label</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>7673</td>
<td>5265</td>
<td>JMP</td>
<td>LOR+3</td>
<td></td>
</tr>
<tr>
<td>7674</td>
<td>0300</td>
<td>LDI</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7675</td>
<td>4343</td>
<td>BEND</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7676</td>
<td>7041</td>
<td>JMS</td>
<td>ASSEMB</td>
<td></td>
</tr>
<tr>
<td>7677</td>
<td>1215</td>
<td>CIA</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7700</td>
<td>7402</td>
<td>TAD</td>
<td>CHKSUM</td>
<td></td>
</tr>
<tr>
<td>7701</td>
<td>6032</td>
<td>HLT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7702</td>
<td>6014</td>
<td>KCC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7703</td>
<td>6214</td>
<td>RFC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7704</td>
<td>1257</td>
<td>TAD</td>
<td>CHANGE</td>
<td></td>
</tr>
<tr>
<td>7705</td>
<td>3213</td>
<td>DCA</td>
<td>MEMTEM</td>
<td></td>
</tr>
<tr>
<td>7706</td>
<td>7604</td>
<td>SAVE</td>
<td>FIELD</td>
<td>INSTRUCTION</td>
</tr>
<tr>
<td>7707</td>
<td>7700</td>
<td>CLA</td>
<td>OSR</td>
<td></td>
</tr>
<tr>
<td>7710</td>
<td>1335</td>
<td>SMA</td>
<td>CLA</td>
<td></td>
</tr>
<tr>
<td>7711</td>
<td>1352</td>
<td>TAD</td>
<td>HIRI</td>
<td></td>
</tr>
<tr>
<td>7712</td>
<td>3261</td>
<td>TAD</td>
<td>LORI</td>
<td></td>
</tr>
<tr>
<td>7713</td>
<td>4226</td>
<td>DCA</td>
<td>READ+1</td>
<td></td>
</tr>
<tr>
<td>7714</td>
<td>5313</td>
<td>JMS</td>
<td>BEGG</td>
<td></td>
</tr>
<tr>
<td>7715</td>
<td>3215</td>
<td>JMP</td>
<td>.-1</td>
<td></td>
</tr>
<tr>
<td>7716</td>
<td>1213</td>
<td>DCA</td>
<td>CHKSUM</td>
<td></td>
</tr>
<tr>
<td>7717</td>
<td>3336</td>
<td>TAD</td>
<td>MEMTEM</td>
<td></td>
</tr>
<tr>
<td>7720</td>
<td>1214</td>
<td>DCA</td>
<td>MEMFLD</td>
<td></td>
</tr>
<tr>
<td>7721</td>
<td>3376</td>
<td>TAD</td>
<td>CHAR</td>
<td></td>
</tr>
<tr>
<td>7722</td>
<td>4260</td>
<td>DCA</td>
<td>WORD1</td>
<td></td>
</tr>
<tr>
<td>7723</td>
<td>3355</td>
<td>JMS</td>
<td>READ</td>
<td></td>
</tr>
<tr>
<td>7724</td>
<td>4226</td>
<td>DCA</td>
<td>WORD2</td>
<td></td>
</tr>
<tr>
<td>7725</td>
<td>5275</td>
<td>JMS</td>
<td>BEGG</td>
<td></td>
</tr>
<tr>
<td>7726</td>
<td>4343</td>
<td>JMP</td>
<td>BEND</td>
<td></td>
</tr>
<tr>
<td>7727</td>
<td>7420</td>
<td>JMS</td>
<td>ASSEMB</td>
<td></td>
</tr>
<tr>
<td>7730</td>
<td>5336</td>
<td>JMP</td>
<td>MEMFLD</td>
<td></td>
</tr>
<tr>
<td>7731</td>
<td>3216</td>
<td>DCA</td>
<td>ORIGIN</td>
<td></td>
</tr>
<tr>
<td>7732</td>
<td>1376</td>
<td>TAD</td>
<td>WORD1</td>
<td></td>
</tr>
<tr>
<td>7733</td>
<td>1355</td>
<td>TAD</td>
<td>WORD2</td>
<td></td>
</tr>
<tr>
<td>7734</td>
<td>1215</td>
<td>TAD</td>
<td>CHKSUM</td>
<td></td>
</tr>
<tr>
<td>7735</td>
<td>5315</td>
<td>JMP</td>
<td>GO</td>
<td></td>
</tr>
<tr>
<td>7736</td>
<td>0000</td>
<td>MEMFLD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7737</td>
<td>3616</td>
<td>DCA</td>
<td>I ORIGIN</td>
<td></td>
</tr>
<tr>
<td>7740</td>
<td>2216</td>
<td>ISZ</td>
<td>ORIGIN</td>
<td></td>
</tr>
<tr>
<td>7741</td>
<td>7600</td>
<td>M200</td>
<td></td>
<td>7600</td>
</tr>
<tr>
<td>7742</td>
<td>5332</td>
<td>JMP</td>
<td>CHEX</td>
<td></td>
</tr>
<tr>
<td>7743</td>
<td>0000</td>
<td>ASSEMB</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7744</td>
<td>1376</td>
<td>TAD</td>
<td>WORD1</td>
<td></td>
</tr>
<tr>
<td>7745</td>
<td>7106</td>
<td>CLL</td>
<td>RTL</td>
<td></td>
</tr>
<tr>
<td>7746</td>
<td>7006</td>
<td>RTL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7747</td>
<td>7006</td>
<td>RTL</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7750</td>
<td>1355</td>
<td>TAD</td>
<td>WORD2</td>
<td></td>
</tr>
<tr>
<td>7751</td>
<td>5743</td>
<td>JMP</td>
<td>I ASSEMB</td>
<td></td>
</tr>
<tr>
<td>7752</td>
<td>5262</td>
<td>JMP</td>
<td>LOR</td>
<td></td>
</tr>
<tr>
<td>ADDRESS</td>
<td>DATA</td>
<td>DESCRIPTION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>---------</td>
<td>--------</td>
<td>-------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7753</td>
<td>0006</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7754</td>
<td>0000</td>
<td>HIRI,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>HIR-LOR</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7755</td>
<td>0000</td>
<td>WORD1=7776</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>WORD2,</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>*7777</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7777</td>
<td>5301</td>
<td>JMP BEGIN</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

ASSEMB 7743
BEGG 7626
BEGIN 7701
BEND 7675
CHANGE 7657
CHAR 7614
CHEX 7732
CHKSUM 7615
FMASK 7656
GO 7715
HIR 7670
HIRI 7753
LOR 7662
LORI 7752
MASK 7674
MEMFLD 7736
MEMTEM 7613
M200 7741
M376 7700
ORIGIN 7616
READ 7660
SWITCH 7612
WORD1 7776
WORD2 7755

NOTE: A vertical bar present in the listing before an instruction indicates a revision in the program.