IDENTIFICATION
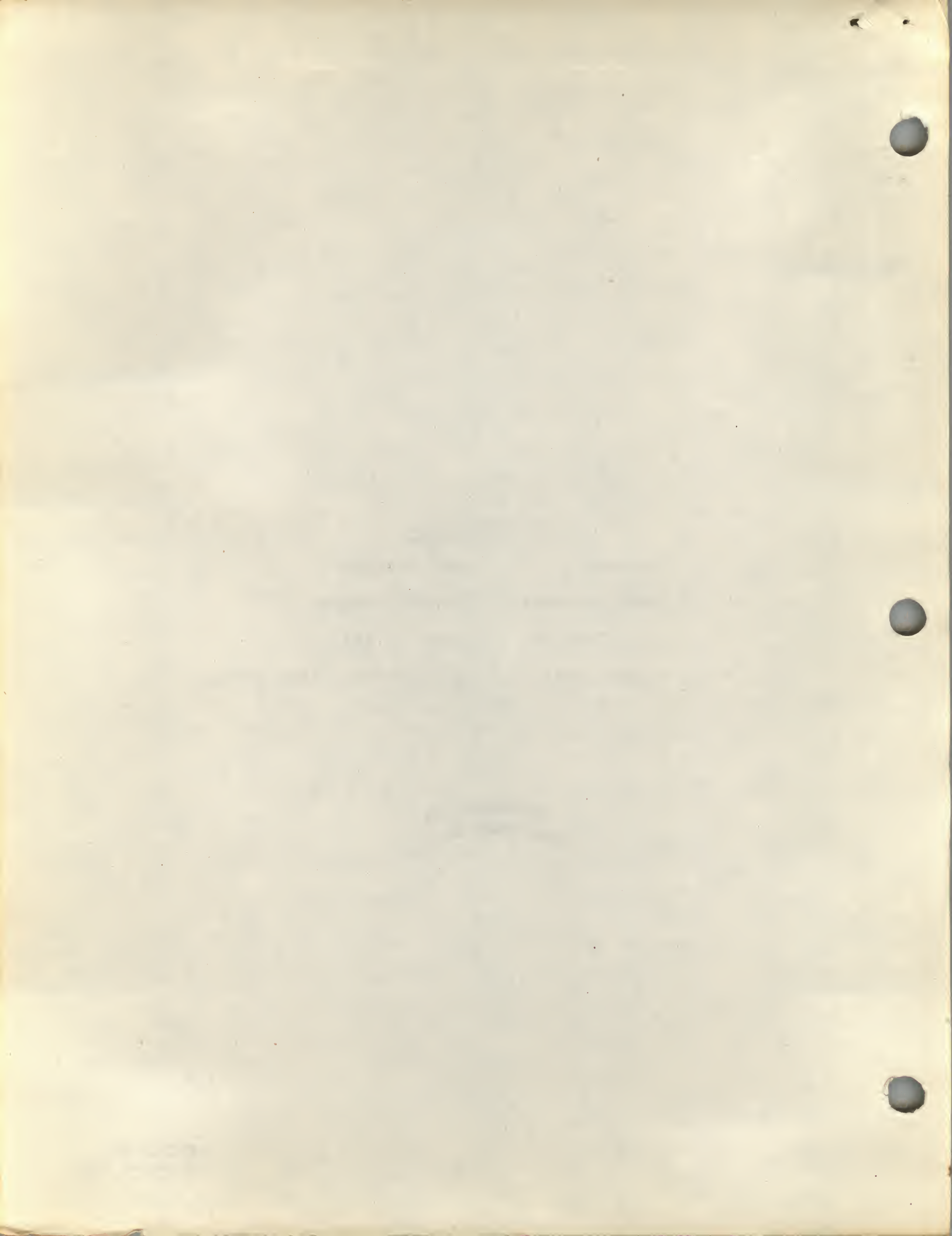
Product Code: DEC-08-LBAB-D

Product Name: Binary Loader

Date Created: June 4, 1971

Maintainer: Software Services Group

BINARY LOADER

1.1 ABSTRACT

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

The Binary Loader accepts tapes prepared with the PAL III, PAL-D, PAL8, or MACRO-8 assemblers. Diagnostic messages may be included on tapes produced when using either PAL or MACRO. The Binary Loader ignores all diagnostic messages.

1.2 REQUIREMENTS

This program occupies 94_{10} (136_8) core locations.

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

1.3 LOADING PROCEDURES

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 Introduction to Programming and Chapter 1 for discussions of the RIM Loader and RIM format.

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

Proceed as follows:

a. Load the RIM Loader for the type of reader which is to load the Binary Loader.

b. Place the Binary Loader tape in the reader.

c. Make sure that the reader is on-line.

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

e. Press the LOAD ADDRESS key.

f. Press the START key.

g. If the 33-ASR is the chosen reader, move the READER CONTROL switch to the START position.

1.3.1 Switch Setting

NOTE: Memory Extension users see "Special Requirements" section.

1.4 USING THE PROGRAM

a. Place the tape to be loaded (which must be in binary format) in either the 33-ASR Tape Reader or the High-Speed Reader, with leader-trailer under the read head. When using the 33-ASR, make sure the reader is on-line. When using the High-Speed reader, 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 High-Speed Reader, change the SWITCH REGISTER to 3777 (bit 0 = 0). Omit this step if using the 33-ASR.

d. Press console START key.

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

1.5 ERRORS

When any of the PDP-8 assemblers is used to produce a binary tape, a checksum is automatically punched 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 33-ASR Reader buffer. The sum is accumulated charac-ter by character and not word by word. Overflow (a carry out of the most-significant bit position of the AC) is ignored both when calculat-ing a checksum (which is done by the assembler used) 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 the assembler), 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.

2

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

1.6 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, <u>all subsequent information</u> coming from the reader is ignored until another rubout is detected.

This is the mechanism by which assembler 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 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 setting.

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.

1.7 SPECIAL REQUIREMENTS OR FORMATS

1.7.1 External Format

Tapes to be read by this program must be in binary-coded format and have about 1 foot of leader-trailer code (any code with channel 8 punched; preferably code 200).

The first two characters represent 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 has no punches present in channels 8 or 7.

Trailer tape is similar to leader.

Reference to Program Listing indicates 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 the assemblers produce 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. Unlike origins and other data, field settings are not included in the checksum.

1.7.2 Example of Binary Loader Format

Tape Channel 87 654 S 321	Channels 8 and 7 Indicate	Program Proper	Notes
10 000 . 000	Leader	No	
01 000 . 010 00 000 . 000	Origin	No	In octal the origin 0200. Loading will start at 0200.
00 111 . 010 00 000 . 000	Contents of 200	Yes	The command 7200 or CLA.
00 011 . 010 00 111 . 110	Contents of 201	Yes	The command 3276 or DCA Z 076.

Example of Binary Loader Format (Cont.)

Tape Channel 87 654 S 321	Channels 8 and 7 Indicate	Program Proper	Notes
00 111 . 100 00 000 . 010	Contents of 202	Yes	The command 7402 or HLT.
00 000 . 100 00 010 . 010	Checksum	No	The program determines that these two characters are the checksum since trailer follows.
10 000 . 000	Trailer	No	

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	

1.7.3 Memory Extension Usage

It is recommended that the Binary Loader exist in field 0. This ensures a permanent program lining around location 7754 and 7755 which are used for TC01 DECtape. The loader can 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. 33-ASR: press READER CONTROL to start. 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 33-ASR, make
    sure reader is on-line. When using the High-Speed Reader,
    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.

c. Press LOAD ADDRESS key.
    When using the High-Speed Reader, change the SWITCH
    REGISTER TO 3777 (bit 0 = 0). Omit this step if using
    the 33-ASR.

d. Press console START key.

Starting 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 START key.

1.8 PROGRAM LISTING

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                        /COPYRIGHT 1971  DIGITAL EQUIPMENT CORPORATION
                        /MAYNARD, MASSACHUSETTS
                        /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
7626    0000    BEGG,                   0
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 I 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
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7

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7673    5265                              JMP LOR+3
7674    0300        MASK,                 300

                    /TRAILER CODE SEEN
7675    4343        BEND,                 JMS ASSEMB
7676    7041                              CIA
7677    1215                              TAD CHKSUM
7700    7402        M376,                 HLT
7701    6032        BEGIN,                KCC
7702    6014                              RFC
7703    6214                              RDF
7704    1257                              TAD CHANGE
7705    3213                              DCA MEMTEM        /SAVE FIELD INSTRUCTION
7706    7604                              CLA OSR
7707    7700                              SMA CLA
7710    1353                              TAD HIRI
7711    1352                              TAD LORI
7712    3261                              DCA READ+1
7713    4226                              JMS BEGG
7714    5313                              JMP .-1           /IGNORE LEADER

7715    3215        GO,                   DCA CHKSUM
7716    1213                              TAD MEMTEM
7717    3336                              DCA MEMFLD
7720    1214                              TAD CHAR
7721    3376                              DCA WORD1
7722    4260                              JMS READ
7723    3355                              DCA WORD2
7724    4226                              JMS BEGG          /LOOK AHEAD
7725    5275                              JMP BEND          /TRAILER, END
7726    4343                              JMS ASSEMB
7727    7420                              SNL
7730    5336                              JMP MEMFLD

7731    3216                              DCA ORIGIN
7732    1376        CHEX,                 TAD WORD1
7733    1355                              TAD WORD2
7734    1215                              TAD CHKSUM
7735    5315                              JMP GO

7736    0000        MEMFLD,               0
7737    3616                              DCA I ORIGIN
7740    2216                              ISZ ORIGIN
7741    7600        M200,                 7600
7742    5332                              JMP CHEX

7743    0000        ASSEMB,               0
7744    1376                              TAD WORD1
7745    7106                              CLL RTL
7746    7006                              RTL
7747    7006                              RTL
7750    1355                              TAD WORD2
7751    5743                              JMP I ASSEMB
7752    5262        LORI,                 JMP LOR
```

8

```
7753    0006    HIRI,           HIR-LOR
7754    0000
                WORD1=7776
7755    0000    WORD2,          0

                *7777

7777    5301                    JMP BEGIN
```