

Digital Computer Laboratory
Massachusetts Institute of Technology
Cambridge, Massachusetts

SUBJECT: BASIC CONVERSION PROGRAM

To: S&EC Group, Group 61

From: H. Briscoe

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Abstract: The basic conversion programs have been rewritten so that the CS conversion program described in E-516-2 will convert tapes prepared for conversion by the basic conversion routines if they use decimal addresses, although the converse is not necessarily true. These basic conversion routines will convert programs that use only WWI orders, single register fixed-point numbers, absolute addresses, relative addresses, preset parameters, temporary storage, and the special word DITTO TO. There are three modes of basic conversion available; direct-read-in which can fill all of storage, 556 punch-out using direct punch, and 556 punch-out using delayed punch. This memorandum supersedes E-479. The direct basic program described in E-479 will be available for old tapes, but no tapes will be prepared for it in the future.

The Basic Conversion Programs

Three programs are available to perform basic conversions without the aid of magnetic tape storage. These are the direct basic, which reads directly into the electrostatic store by way of magnetic drum group 0, and two 556 basic programs, one of which produces a 556 tape on the direct punch and the other of which produces a 556 tape on the delayed punch. All programs handle the following vocabulary. They are not adaptable to the use of floating addresses. They are intended for use to increase speed in special simple cases and for use in magnetic tape failure emergencies.

Heading

The tape begins with the tape number written out, e.g., TAPE 4567m2, followed by any desired information, such as the programmer's name, that can be put on one typewritten line. All programs print the heading as written, preceded and followed by 1 carriage return. In all programs, the printing of the heading can be suppressed by resetting FF2 to a positive value by TP3 during the early part of the conversion. The 556 basic programs punch the number readably on tape and provide suitable feedout before and after. When octal addresses are to be used, the heading is written

TAPE 4567m2 J.Jones

OCTAL

Otherwise, decimal addresses are assumed.

Addresses

At the start and at any point thereafter, an address followed by a vertical

Bar (40 |) sets the current address which indicates the location in which the next word is to be stored. In the absence of any indication, words are stored consecutively starting in register 40 octal.

Relative Addresses

Instructions within a subroutine or within any block of instructions may be written with addresses relative to the start of the block. Such relative addresses are obtained by including an "r" in the address section of a word. This causes the content of a special register known as the relative address indicator (r.a.i.) to be added to the word during conversion. The r.a.i. may be set to the value of the current address i.e. the address into which the next word will be put, by the symbol "Or," or "O,". If an integer n precedes the letter r or the comma, the r.a.i. will be set to a value equal to the current address minus the integer n; e.g. if the current address is 90 the symbols 5, or 5r, will set the r.a.i. to 85. The current address may be set to a desired relative value at any point in a program by punching that value followed by the letter r and a vertical bar; e.g., 35r| will cause the next word to be stored in 35r regardless of consecutivity. All relative addresses are treated decimally, even if the other addresses in the program are octal.

Instructions

An instruction is written as a pair of function letters followed by an address. The following pairs of letters will be assigned values ranging from 00000 to 11111 consecutively: si, rs, bi, rd, bo, rc, -, sb, ts, td, ta, ck, ab, ex, cp, sp, ca, cs, ad, su, cm, sa, ao, dm, mr, mh, dv, sl, sr, sf, cl, md. The operations numbered 11011, 11100, and 11110 are written as three letter operations the third letter indicating the presence or absence of a one in digit 6.

e.g. slr = 1101100
 slh = 1101101
 srr = 1110000
 srh = 1110001
 clc = 1111000
 clh = 1111001

Numbers

Decimal fractions are written as +. or -. followed by exactly 4 decimal digits.

Decimal integers, less than $32,768 (2^{15})$, with an implicit factor of 2^{-15} , are written as + or - followed by as many digits as necessary, and no decimal point.

Octal numbers are written as 0. or 1. followed by exactly 5 octal digits, the "1." being the start of a negative number, the remaining digits being sevens complement digits of the desired number. Octal numbers must be less than 1 in magnitude.

Preset Parameters

The only class of preset parameters available in the basic conversion programs are personal parameters (PP). A preset parameter consists of a lower case p and any lower case letter except l or o followed by a decimal integer greater than 0. A value may be assigned to a preset parameter by a word consisting of the parameter followed by an equals sign and the value to be assigned terminated by a tab or

carriage return. Each parameter must be assigned before it may be used. Parameters are added or subtracted into words by writing + or - followed by the preset parameter. A word cannot consist of a parameter alone.

e.g. pa 5 = si 3
105 | ca 5 + pa 5

will set preset parameter pa 5 to si 3 and will assign the word (ca 5 + si 3) = ca 8 to register 105.

Temporary Storage

The value of the temporary storage parameter, t, is assigned by writing the character "t=" followed by the address of the 0'th temporary register in the number system used by the rest of the addresses in the program. Wherever a "t" appears within a word the assigned address is added to the word. For example, in a decimal program where the symbols t = 15 are followed anywhere by the word ca 5 t, this word is assigned the value ca 20.

Duplicated Words

A block of consecutive registers may be assigned the same word if, after the first word of the block is assigned, the special word, DITTO TO, is written, followed by the address of the first register after the desired block. This address should be followed by a vertical bar.

e.g. 70 | ca 27
ad 5
si 3
DITTO TO
100 | ad 8

will put si 3 in a block from 72 to 99 consecutively. Ditto may be used only once in each block of words.

End of the Program

The end of the program is indicated by the words "START AT" followed by the address of the register which contains the first instruction to be obeyed in the program proper. In the case of the direct basic program, the computer will perform a conditional stop before control is transferred to the indicated location.

Terminal Characters

The heading, instructions, and numbers, must each be terminated by at least one carriage return or tab.

Fence

A fence (series of 25 or more vertical bars) must occur after at most 500 words, with address assignments counting as 4 words for the 556 punch-out programs. In practice, most tapes prepared clerically will have a fence after every five lines of printing for use in the Comprehensive Conversion System described in E-516-2. A fence may, of course, occur anywhere between words.

Illegal Characters

To aid in the detection of mistakes, the basic conversion program will stop whenever a foreign or illegal character occurs on tape. This includes all binary combinations not contained in the flexowriter code except 000000 (with 7th hole), which is disregarded.

Disregarded Characters

For the convenience of the typist, nullify (111111), space, back space, color shift, and the character 000000 with 7th hole are completely ignored at all times by basic conversion programs. Carriage return and tab are ignored between words (i.e., two carriage returns or a tab followed immediately by a carriage return are all right), but may not appear within a word. Other ignored characters include j,k,g,q,w,y,z, and lower case.

Synonyms

For convenience, the characters "o" and "0", "l" and "1", tab and carriage return, and "#," and "#r," are treated intentionally as synonyms. Other accidental synonyms do exist.

Signed: H. W. Briscoe

H. Briscoe

Approved : J. D. Porter

J.D.Porter

HB:JDP:mmm