

June 26, 1959

MEMORANDUM TO: 1401 FILE

SUBJECT: Change in Operation Codes For:
Add, Subtract, Reset Add, Reset subtract,
and Change in Memory Addressing

Consider an instruction such as:

$\&$ 456 789

where the Op code is located at address 654.

If it should be desired to modify the 'A' address of this instruction by the addition of a quantity, say '012', the simplest, most direct way would be to add the quantity to the instruction, treating ' $\&$ 456' as a B-field.

As a result of the addition, the blank numeric part of the ' $\&$ ' Op code will be changed to an 8-2, resulting in an invalid Op code. The same would be true, of course, if the Op code were '-'.

Since this kind of address modification will be fairly common, new Op codes are being assigned as follows:

A - ADD	(A - B - 8 - 1)
S - SUBTRACT	(B - 2)
\dagger - RESET ADD	(A - B - 8 - 2) C
\ominus - RESET SUBTRACT	(B - 8 - 2)

thus permitting address modification to be performed simply.

Note that whenever this method is used, it is the programmer's responsibility to constrain address modification to within the thousand - character blocks 000-999, 1000-1999, 2000-2999 and 3000-3999.

The reason for this should be obvious: if one attempts to modify a B-address to an address in the next-higher thousand character block, a "carry" will result, modifying the A-address, and if one attempts to modify an A-address to an address in the next-higher thousand - character block, a "carry" will occur, modifying the Op code.

Also, it should be apparent that one cannot simply modify an address downward.

Instead, in order to accomplish either of the above kinds of address modification, either of two schemes may be used:

- 1.) Precede the "modification" step by a "WORD MARK SET" instruction, placing a word mark in the high-order position of the address to be modified, perform the modification (either adding a true figure or adding a "4-thousands complement") and follow with a "WORD MARK CLEAR" instruction.
- 2.) Add the address to be modified to the three-character constant, then move the result back to the instruction.

As an adjunct to the foregoing change, it is necessary to respicify the present addresses "200" - "299" (2000-2999) and "300" - "399" (3000-3999)

as "⁴000" - "⁴099"

and "000" - "000"

The double key-strokes necessary for punching 0 and 5 are unavoidable.

It should be recalled that the printer will print "2" for "0" and "-" for "5".

Recipients of "Product Specifications - 1401 Data Processing System" will be furnished with "replace" pages in order that the specifications be kept up-to-date.



F. O. Underwood
Development Engineer
Dept. 250

POU/nh

- CC: G. E. Boers
A. A. Bissell
R. F. Ellsworth
P. Farbanish
J. A. Harvilchuck ←
J. J. Ingram
Miss A. Murray
R. W. Phillips
P. M. Quigley
W. S. Schaffer