HEXADAISY™

INSTRUCTIONS

SUBTRACTION OF HEXADECIMAL NUMBERS

Locate the minuend on the inner disc. Rotate the outer disc until the subtrahend is lined up with the minuend. Read the difference on the inner disc opposite the highlighted number -00- on the outer disc. Note the location of the Page Crossing line with respect to the numbers on the outer disc. If the number 00 on the inner disc is opposite a number on the outer disc that is smaller than the subtrahend (but larger than 00) it means that the subtraction results in a borrow.

If the numbers to be subtracted are more than two digits long, they must be divided into groups of two digits. The subtraction is performed on two digits at a time, starting with the rightmost group. If one of the subtractions results in a borrow, the difference in the next subtraction must be read opposite the number FF rather than -00-.

If a subtraction results in a negative difference, the result is obtained as the twos complement of the negative number.

EXAMPLE AD 4F - A9 50 = 03 FF
Note that the subtraction of the rightmost two digits results in a borrow.

TWO'S COMPLEMENT OF HEXADECIMAL NUMBERS

The two's complement of a number is obtained by subtracting the number from zero, as described in the previous paragraph.

DECIMAL TO HEXADECIMAL AND HEXADECIMAL TO DECIMAL CONVERSION

NUMBER RANGE 00 TO FF (DECIMAL 0 TO 255)

Conversion from decimal to hexadecimal and back within this number range can be performed using the inner disc of HEXADAISY which carries the numbers in both number systems, separated by a dot.

HEXADECIMAL TO DECIMAL CONVERSION NUMBER RANGE 01 00 TO FF FF (256 TO 65 535)

This conversion can be simplified by the use of any simple four-function electronic calculator.

First convert the high-order pair of digits to a decimal number as described above. Multiply the result by 256. Then convert the low-order pair and add its decimal equivalent to the product.

EXAMPLE F2 35 = 242x256 + 53 = 61 749

DECIMAL TO HEXADECIMAL CONVERSION NUMBER RANGE 01 00 TO FF FF (256 TO 65 535)

This conversion can be simplified by the use of any simple four-function electronic calculator.

Divide the number to be converted by 256. The integer part of the result is the decimal equivalent of the high-order two digits of the hexadecimal number and can be converted as decribed above. Then multiply the decimal fraction part of the quotient by 256. The product (if necessary after rounding it to an integer number) is the decimal equivalent of the low-order half of the hexadecimal number and can be converted as described above.

EXAMPLE 65 534 divided by 256 = 255.99218
integer part 255 converted to hexadecimal = FF
decimal fraction part .99218x256 = 253.99808 rounded to 254
254 converted to hexadecimal = FE
Result : FF FE

HEXADAISY consists of two circular plastic discs held together by a concentric rivet which allows rotating the discs with respect to each other.

The outer (larger) disc is divided into 256 segments, alternately black and white, which are marked with the hexadecimal numbers from 00 to FF (decimal 0 to 255). The numbers -00- and -FE- are highlighted by special marks. The dividing line between segments 7F (decimal 127) and 80 (decimal 128) is also specially marked.

The inner (smaller) disc is divided in the same way and also carries the hexadecimal numbers from 00 to FF. In addition the decimal equivalent is shown next to each hexadecimal number, separated from it by a dot. The dividing line between segments 00 and FF is marked as the Page Crossing.

Note that the segments form a "ladder pattern" when even numbers on the inner disc are lined up with even numbers on the outer disc. A "checkerboard pattern" is formed when even numbers are lined up with odd numbers. This special feature avoids ambiguities if the segments are not lined up exactly with each other.

CALCULATION OF OFFSET FOR RELATIVE ADDRESSING

Locate the highlighted number -FE- on the outer disc. Rotate the inner disc until this number is lined up with the low-order part of the memory address containing the opcode of the BRANCH instruction. Find the low-order part of the address to which the program shall branch on the inner disc. The offset for the branch is read opposite this number on the outer disc. For backward branches the offset appears directly in two's complement notation as required by the microprocessor and no further conversion is necessary.

Note the mark on the outer disc that indicates the range for forward and backward branching. If a branch extends beyond the Page Crossing line on the inner disc it indicates that origin and destination of the branch are located in adjacent memory pages.

EXAMPLE

```
24 56  LOOP  INX
.. ..
.. ..
24 AC        BNE  LOOP
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Line up -FE- on the outer disc with AC on the inner disc. Find 56 on the inner disc. Read the offset on the outer disc opposite 56 as A8. Note that the range for this branch extends to 25 2D for forward branching and to 24 2E for backward branching.

ADDITION OF HEXADECIMAL NUMBERS

Locate the highlighted number -00- on the outer disc. Rotate the inner disc until this number is lined up with the addend. Find the augend on the outer disc. The sum is read opposite it on the inner disc. Note the location of the Page Crossing line with respect to the numbers on the outer disc. If the number 00 on the inner disc is opposite the augend or any number smaller than the augend (but larger than 00) it means that the addition results in a carry.

If the numbers to be added are more than two digits long, they must be divided into groups of two digits. The addition is performed two digits at a time, starting with the rightmost group. If one of the additions results in a carry, the number FF rather than -00- must be used as a pointer when adding the next group.

EXAMPLE 17 EC + 35 6A = 4D 56

Note that the addition of the rightmost two digits results in a carry.

DETERMINATION OF LENGTH OF PROGRAMS OR SUBROUTINES

Subtract the address of the first instruction in the program from the address of the last instruction as described on the previous page under SUBTRACTION OF HEXADECIMAL NUMBERS. Note that if the difference is less than FF (255 decimal) it can be read directly in either hexadecimal or decimal notation.

GENERATION OF DELIMITERS FOR ASCII STRINGS

A convenient way to indicate the end of an ASCII string is the use of bit 7, which is not normally used in ASCII characters and is assumed to be 0. The end of the string is marked by an ASCII character which has this bit set to 1. This requires that (hex) 80 must be added to the hex equivalent of the last ASCII character of the string. Using hexadecimal addition this operation can be performed conveniently with HEXADAISY without converting to binary notation and back.

EXAMPLE String H E L P
Hex equivalent of ASCII characters of string : 48 45 4C 50
Hex 80 added to last character as delimiter : 48 45 4C D0

CONVERSION TABLES

For the convenience of the user HEXADAISY's inner disc carries tables for converting hexadecimal to binary numbers and for the powers of two for positive and negative exponents.

CARE OF HEXADAISY

HEXADAISY is manufactured from Vinyl plastic, the same material from which phonograph records are made. Like records,HEXADAISY should not be placed on top of hot radiators or electronic equipment to avoid deformation.
HEXADAISY can be cleaned with water and soap or mild detergents. DO NOT use abrasive cleaners.

HEXADAISY™

HEXADECIMAL CALCULATOR

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Rev.2