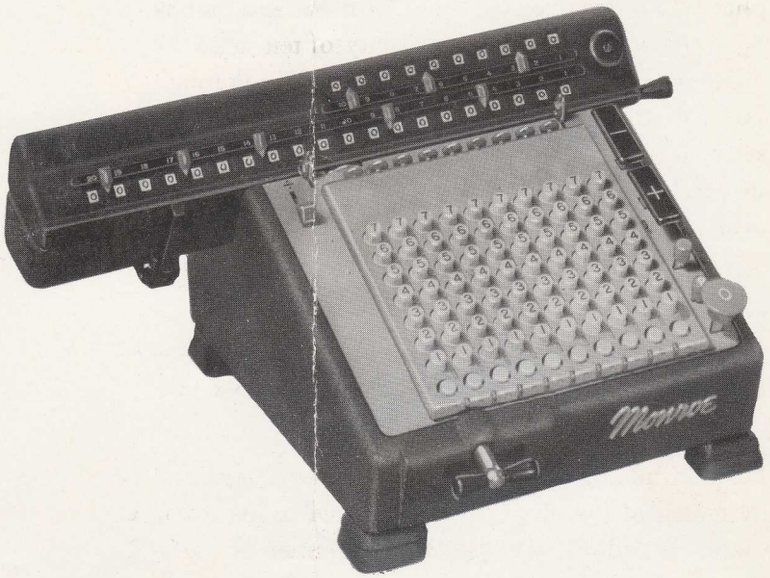
MONROE

Octal

CALCULATOR

The Machine and What It Does

MONROE OCTAL CALCULATOR



The Machine

The Monroe Octal Calculator has been especially designed for mathematicians and engineers who work with electronic binary computers and in testing and checking the various operations of these large scale devices must frequently solve both simple and complex problems in the binary and octal systems. It is used for translating from the decimal to the binary or octal system, for the actual calculations in either of these systems, and for translating back to the decimal system.

The Octal machine is very much like the standard Model LA 5-200 Monroe Adding-Calculator except it is constructed with an eights carryover mechanism instead of the conventional tens or decimal carryover. It has a ten column keyboard, each column representing one octal or three binary digits, thus providing a total capacity of ten octal or thirty binary digits. The upper dials in which plus operations are registered in black and minus operations in red, have a capacity of ten octal or thirty binary digits. The lower dials with a through carry to the end, register up to twenty octal or sixty binary digits. All quantities are represented in octal notations which can be quickly changed over by sight-translation to the binary system.

The four fundamental arithmetical operations are performed on the Octal machine in the same easy, direct, and simple way as on any Monroe model. Amounts are always visible and can be instantly checked by the operator for accuracy.

For addition, amounts are set on the keyboard and by means of the plus bar accumulated in the lower dials. In subtraction the larger number is registered in the lower dials, then the smaller amount is set on the keyboard and deducted by merely touching the minus bar. Over-subtraction results in a complement of the true difference, indicated by a series of 7's preceding the significant digits.

Multiplication is performed by setting one factor on the keyboard and registering the other factor in the upper dials by depressing the plus bar and shifting the carriage from digit to digit.

For division the dividend is entered in the lower dials and the upper dials cleared; then the divisor is set on the keyboard and the carriage shifted to align the two amounts; when the divide control lever is pushed the machine carries out the division rapidly and automatically, the quotient appearing in red figures in the upper dials.

Translating quantities from the decimal system to the octal system is straightforward and simple.

The operator multiplies the left-hand decimal digit by 12, the octal equivalent of 10, adds to that result the next decimal digit; then multiplies this amount by 12, the octal equivalent of 10, and adds the next decimal digit. This procedure is continued until the last decimal digit has been added.

The method of translating from the octal to the decimal system is just as simple. The octal amount is registered in the right-hand part of the lower dials and when divided by 12, the octal equivalent of 10, the first right-hand decimal digit is read in the right lower dials. The operator then sets a 1 on the keyboard and after clearing the lower dials changes the upper dials back to zeros by means of the plus bar. Next the keyboard set-up is changed to 12 and division performed. The same steps are repeated until the result of division is zero, the decimal equivalent of the octal being produced in the lower dials, digit by digit, at the end of each division.

In both types of translation the octal equivalents 10 and 11 are utilized for the decimal digits 8 and 9 respectively.

A few examples of basic operations with brief explanations of how they are performed have been included in this folder in order to give the technician an idea of the possibilities of the Monroe Octal Calculator. Other problems, such as the extraction of roots, are handled with the ease and simplicity characteristic of all Monroe Adding-Calculators. Inquiries about the application of the Octal Model to any kind of mathematical work are invited and can be addressed to any Branch Office of the Monroe Calculating Machine Company, Inc., or to the General Offices in Orange, N. J.

What the Machine Does

Relationship of Systems

DECIMAL	OCTAL	BINARY
0	0	000
1	1	001
2	2	010
3	3	011
4	4	100
5	5	101
6	6	110
7	7	111
8	10	001 000
9	11	001 001
10	12	001 010

Thus it can be seen that each octal digit is represented by a group of three binary digits, the value being expressed by the position and combinations of the 1 character within the group. For example, octal 1 = 001, octal 2 = 010, octal 3 = 011 (sum of 1 and 2), octal 4 = 100; all higher values are combinations of these.

In this way the octal quantity 7231 is translated into the binary system as follows:

7	2	3	1
↓	↓	↓	↓
111	010	011	001

Anyone operating the Monroe soon becomes familiar with this simple relationship and can quickly recognize the equivalents of the binary system.

Addition

BINARY	OCTAL
101 001 010	512
+ 011 110 111	367
001 001 000 001	1101

Step 1 With machine clear, set 512 on the right of the keyboard and depress plus bar once.

Step 2 Set 367 on the right of the keyboard and depress plus bar once.

Result in lower dials 1101 Octal
or 001 001 000 001 Binary

Subtraction

BINARY	OCTAL
001 001 000 001	1101
−000 011 110 111	367
101 001 010	512

Step 1 With machine clear, set 1101 on right of the keyboard and depress plus bar once.

Step 2 Set 367 on right of keyboard and depress minus bar once.

Result in lower dials 512 Octal
or 101 001 010 Binary

Multiplication

BINARY	OCTAL
101 001 010	512
×011 110 111	×367
010 011 111 001 100 110	237146

Step 1 Clear machine and depress repeat key. With carriage in the 1st position set 367 on the right of the keyboard and hold plus bar down until a 2 appears in the first upper dial.

Step 2 Shift carriage one place to the right and depress plus bar once.

Step 3 Shift carriage one more place to the right and hold plus bar down until a 5 appears in the third upper dial. Both factors 367 on the keyboard and 512 in the upper dials can be checked.

Result in lower dials 237146 Octal
or 010 011 111 001 100 110 Binary

Division

BINARY	OCTAL
010 011 111 001 100 110	237146
011 110 111	367

Step 1 With the machine clear and repeat key down, shift the carriage to the extreme right-hand or 10th position. Set 237146 on extreme left of the keyboard and depress plus bar once.

Step 2 Clear 1 from upper dials by depressing keyboard clear key and minus bar simultaneously. Set 367 on extreme left of the keyboard. Move automatic divide lever to forward position.

Result in upper dials 512 Octal
or 101 001 010 Binary

Radix Markers

The use of radix markers on the Monroe Octal Calculator is according to the simple rule: The number of radix places in the upper dials plus the number on the keyboard is equal to the number of radix places in the lower dials.

In multiplication a radix marker is set in the upper dials for the number of places required by the multiplier, a radix is set on the keyboard for the number of places required by the multiplicand, then the sum of these two is set for the radix in the lower dials.

In division the radix is set in the proper position in the lower dials after the dividend has been registered there. The divisor is then set on the keyboard and the proper radix indicated. The radix for the upper dials is set according to the difference between the number of places in the lower dials and the number of places on the keyboard.

Translation

From decimal to octal or binary system
for amount greater than 1

DECIMAL	OCTAL
196	304

Step 1 Set 1, the first digit of the decimal quantity, on the right of the keyboard and multiply by 12, the octal equivalent of 10.

Step 2 Shift carriage to 1st position and clear upper dials and keyboard only. Set 11, octal equivalent of 9, on the keyboard. Depress plus bar once.

Step 3 Copy 23 from the lower dials directly to the keyboard and depress minus bar once. Multiply by 12.

Step 4 Return carriage to 1st position and clear upper dials and keyboard only. Set 6 on the keyboard. Depress plus bar once.

Result in lower dials, 304 Octal equivalent for 196

From octal or binary to decimal system
for amount greater than 1

OCTAL	DECIMAL
304	196

Step 1 With machine clear and carriage in 1st position, set 304 on the right of the keyboard and depress plus bar once to register in lower dials. Clear keyboard and upper dials only. Set 12, octal

equivalent of 10, on right of keyboard. Shift carriage so that the left-hand digit in the lower dials is in direct alignment with the left-hand digit of the keyboard figure. Divide. The 6 in the lower dials is the first right-hand digit of the decimal quantity.

Step 2 Clear lower dials and keyboard. Set 1 on the keyboard. With the plus bar clear the upper dials to zeros. Set 12 on the keyboard and divide. The 11 in the lower dials represents 9, the second digit of the decimal quantity.

Step 3 Repeat the operations of Step 2. The 1 in the lower dials is the third digit of the decimal quantity. As the upper dials now read all zeros the translation is therefore complete and 196 is the decimal equivalent.

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