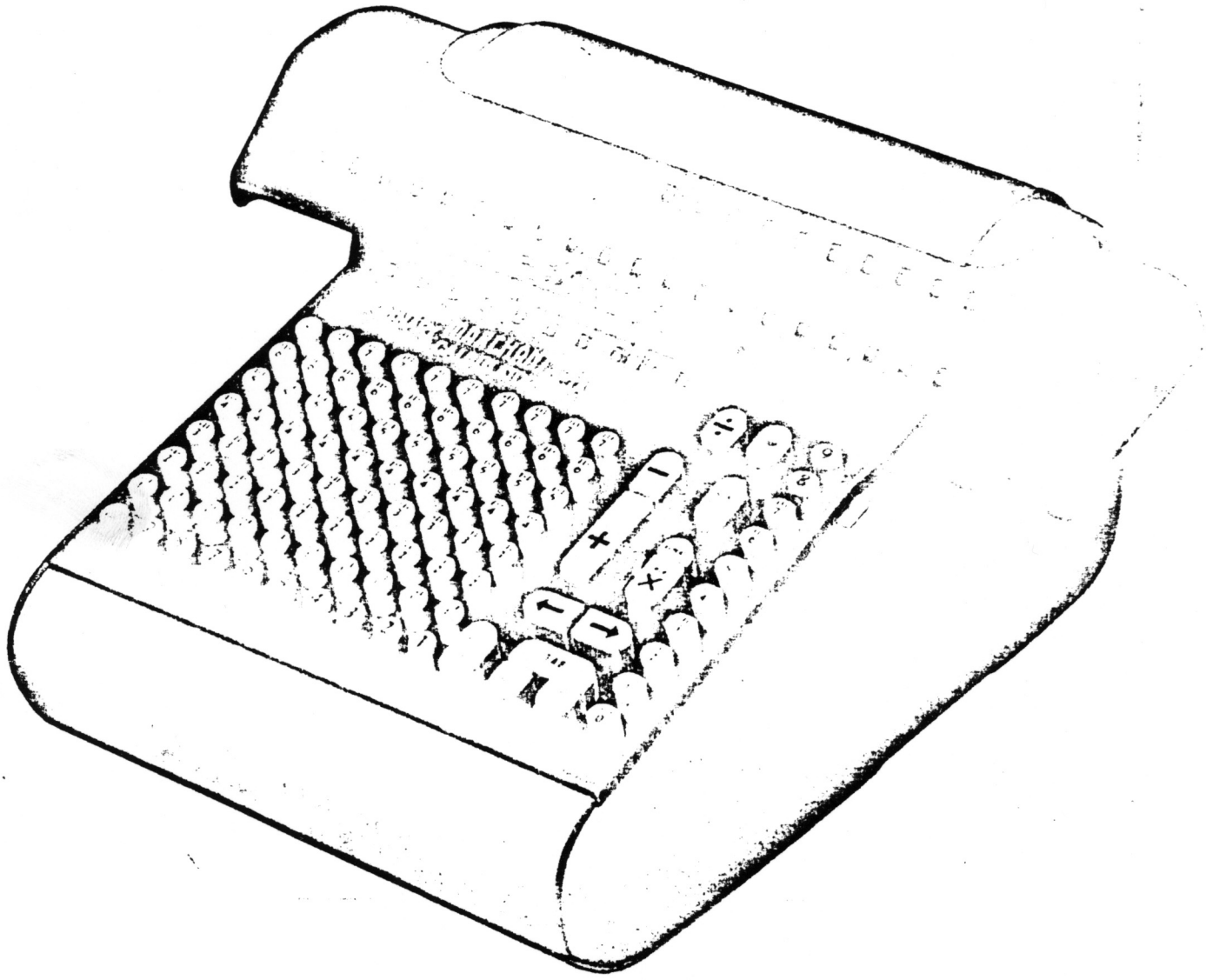
BINARY **MARCHANT** OCTAL

CALCULATOR



A new Automatic Calculator designed for the needs of the engineer, mathematician, and operator performing binary calculations.

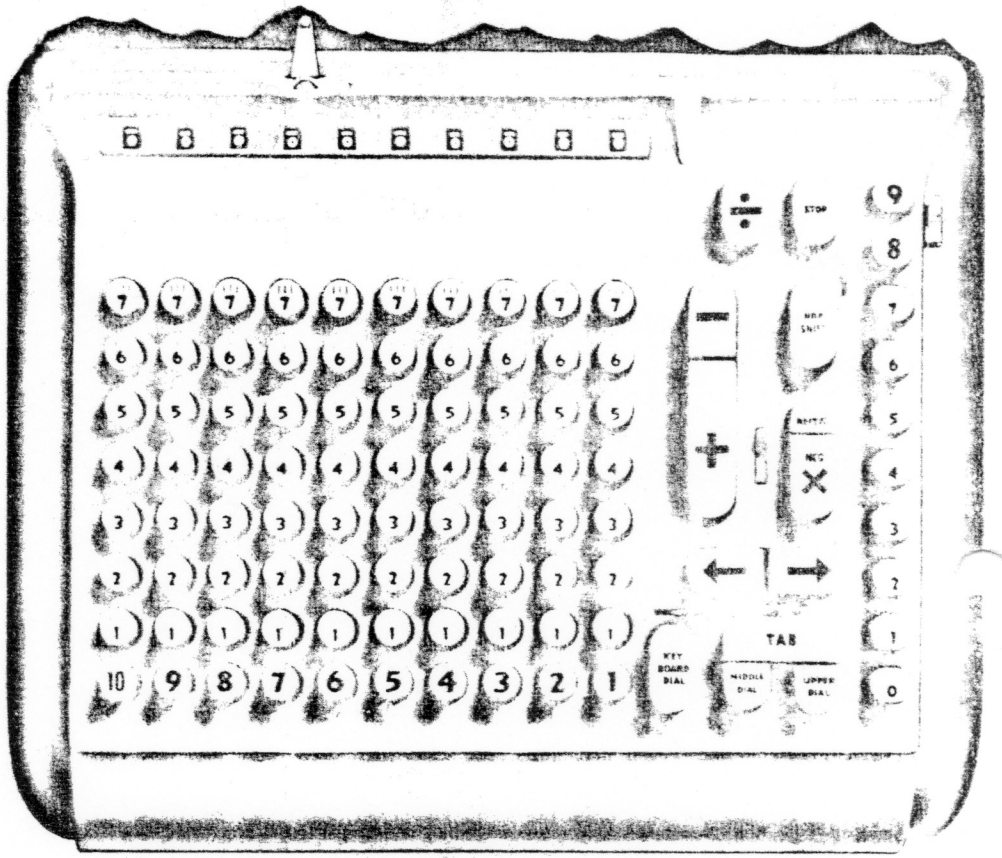
Addition – subtraction – multiplication – division – conversion – with the same *silent speed* performance of the world renowned Marchant Figuremaster.

Fully Automatic

ADDITION
SUBTRACTION
MULTIPLICATION
DIVISION
and CONVERSION

●

For companion usage with binary electronic digital computer.



In the efficient operation of an electronic digital computer installation utilizing the binary number system the importance of a small automatic binary desk calculator has become increasingly evident.

A substantial amount of binary computation is frequently required in the derivation of special programming sequences for an electronic computer. Although the elementary addition and multiplication tables for the binary system are very simple indeed, nevertheless, when one attempts to add or subtract, multiply or divide, binary quantities having as many as thirty to sixty binary places, the task of arithmetic combination becomes a formidable one. Experience has shown, for example, that one can expect to spend approximately twenty minutes in multiplying by hand two 30-digit binary quantities; even then, the possibility that an error may have taken place in the course of computation is always present.

The engineers who are responsible for testing the electronic digital computer are continually faced with the task of performing binary calculations. It is not always sufficient merely to ascertain whether or not an arithmetic operation was performed properly. Frequently, it is important to discover, in case of error, in what particular column or columns the sum, product, or quotient is incorrect.

Furthermore, when the computer is completed and installed in the field, routine programming and maintenance problems require that an enormous amount of binary computation be performed by the mathematicians and engineers; the time spent by these professional personnel could become prohibitive.

It was this need for reducing the time involved in performing binary calculations which led to the development of the Binary-Octal Marchant Calculator.

DESCRIPTION OF THE CALCULATOR

The Binary-Octal Marchant Calculator has been designed so as to operate in the octal scale of notation. This octal notation is simply related to the binary notation, as indicated by the following table:

Octal	0	1	2	3	4	5	6	7
Binary	000	001	010	011	100	101	110	111

To each of the eight possible permutations of three successive binary digits is assigned one of the eight octal symbols 0, 1, . . . 7. Any binary number can be converted to its octal equivalent by the following process: the binary digits are marked off in groups of three, both to the right and to the left of the binary point. For each group of three binary digits the corresponding octal digit, as indicated by the table, is

entered. The resulting number is the octal equivalent of the original binary number. Thus, using the above rule, the binary number

101.111 011 010 110

will read

5.7326

when transcribed to the octal scale of notation.

The Calculator is a ten-bank octal machine, each bank corresponding to one octal digit. The total keyboard capacity, therefore, is thirty binary digits. Each key on the keyboard contains in its lower section the appropriate octal digit; the upper section of the key contains the three binary digits which correspond to the octal digit in the lower section. This same arrangement of octal and binary notation extends to all the dials of the Calculator, including the keyboard dial, the middle dial, and the upper dial.

To facilitate binary to decimal conversion, a stop lock lever has been provided which enables the operation of division automatically to be stopped at the conclusion of the first quotient cycle, which the corresponding remainder recorded on the middle dial.

In addition to the regular octal and binary symbols, the upper dials also contain the decimal digits 8 and 9, which permits the direct reading of decimal equivalents from the upper dial register. Furthermore, the retention of the 8 and 9 multiplier keys in this machine enables rapid conversion from decimal to binary notation.

The four fundamental arithmetic processes are performed in the same way as the corresponding processes on a standard Marchant Decimal Calculator. A single addition or subtraction operation will yield the sum or difference of two 30-digit binary quantities. The Calculator will also give the product of two 30-digit binary numbers to sixty binary places. In division, a dividend containing up to sixty binary columns may be divided by a divisor of thirty binary digits and a thirty binary digit quotient is obtained, together with the 30-digit remainder.

Where it is desired to compute with more than thirty binary places, the standard routines for double precision operations may be used. Where a division operation involving a divisor of greater than thirty binary digits is to be performed, the reciprocal of the divisor may be obtained to approximately sixty binary places by a single iteration, and the result may then be multiplied by the dividend, utilizing the standard techniques for double precision multiplication. Thus, it will be found that the Binary-Octal Marchant Calculator may be used to excellent advantage in the programming for, and the maintenance of, binary computers having capacities as great as sixty binary digits. Of course, calculations extending beyond sixty binary places may also be performed, using multiple precision operations.

Many special machine methods which are familiar to operators of decimal calculators may also be applied to the Binary-Octal Marchant Calculator. For example, the well-known method for obtaining a first approximation to the square root of a number by mean of subtracting successive odd integers, may be used with the Binary-Octal Marchant Calculator to obtain the square root of an octal or binary number. The successive odd integers to be subtracted in this case are: 1, 3, 5, 7, 11, 13, etc., omitting the integer 9 which is, of course, nonexistent in the octal scale of notation.

The Binary-Octal Marchant Calculator is also capable of converting integral and fractional decimal numbers into the binary scale of notation; conversion of binary integral and fractional numbers may, likewise, be converted to the decimal scale of notation by the Calculator. In certain programming work, this rapid conversion property of the Calculator should prove very advantageous.

In many instances, the programming of very complex problems to be run on large automatic binary computers requires that the programmer make certain critical trial runs manually. It is expected that the use of the Binary-Octal Marchant Calculator for this purpose will result in the saving of hours upon hours of valuable programming time. This fact is especially important when it is realized that the enormous speed and problem capacity of large-scale electronic computers place a great burden upon the men who are responsible for the preparation of problems for the computer. Furthermore, the saving of valuable operating time of the high-speed computer, by making the Binary-Octal Marchant Calculator available to the maintenance staff, is another point which cannot be treated lightly.

Just as decimal desk calculators are a requisite in any installation which utilizes a decimal high-speed computer, so the Binary-Octal Marchant Calculator may be expected to assume a similarly important role in installations incorporating high-speed computers operating in the binary scale of notation.