ELLIOTT
903

Volume 2: PROGRAMMING INFORMATION

Part 2: PROGRAM DESCRIPTIONS

Section 10: QLN (B. 1)

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Chapter 1: DESCRIPTION

1. 1 INTRODUCTION

1. 1. 1 Purpose.

To calculate

$1/16 \log_e x$

where x is the fraction in the accumulator.

1. 1. 2 Form of Distribution.

The programme is distributed as a machine code tape for input by T2 or SIR.

1. 1. 3 Method of Use.

The routine is assembled as a block of the user's program and used as a sub-routine. It may be run at any program level and in any store module.

1. 1. 4 Accuracy.

The maximum error is 2^{-16}. ($\simeq .000015$)

1. 2 FUNCTIONS

1. 2. 1 Number Type.

The 903 is a fractional machine and all numbers in the accumulator, on entry and exit, must be treated as pure fractions by the programmer.

1. 2. 2 Entry and Exit.

On entry the accumulator contains the number whose logarithm is to be calculated. Entry is made by

(for assembly by SIR.)	(for translation by T2.)
11 QLN	11 0;N
8 QLN + 1	8 1;N

where N is the number of block.

On exit

$\frac{1}{16} \log_e x$ is held in QLN + 52 (52;N) and in the accumulator.

1.2.3 Identifiers.

On the library tape, a mnemonic label and identifier list are separated from the coding by several inches of blank tape : the mnemonics must not be loaded into the tape reader if the tape is to be translated by T2.

QLN must be declared as a global identifier in all blocks of the user's program which refer to it.

1.3 ERROR INDICATION

If the accumulator's contents on entry are not positive the 8 least significant bits of the number are output continuously.

1.4 METHOD USED

x is the fraction whose logarithm is to be found.

(a) The program shifts x until the accumulator holds y, where:

$$y = 2^h$$

$$\text{and } \tfrac{1}{4} \leq y < \tfrac{1}{2}$$

(b) A transformation is made:

$$Z = \frac{[y - \frac{1}{4}\sqrt{2}]}{[y\,(3 - 2\sqrt{2}) + \frac{1}{4}(3\sqrt{2} - 4)]}$$

so that for $\frac{1}{4} \leq y < \frac{1}{2}$

$$-1 \leq Z < +1$$

(c) The result is now given by:

$$\frac{1}{16}\log_e x = -\frac{3}{32}\log_e 2 + \sum_{n=0}^{2} b_{2n+1} Z^{2n+1} - \frac{b}{16}\log_e 2$$

where: (1) x , Z, h are defined above;

(2) b_{2n+1} are Chebyshev coefficients.

1.5 STORE USED

58 locations and the appropriate B-register.

1.6 TIME TAKEN

Between 1.3 and 2.8 milliseconds (dependent on the number of shifts required to scale x).