A PLASMA WAVE FOURIER TRANSFORM PROCESSOR EMPLOYING 1802 MICROCOMPUTERS FOR SPACECRAFT INSTRUMENTATION
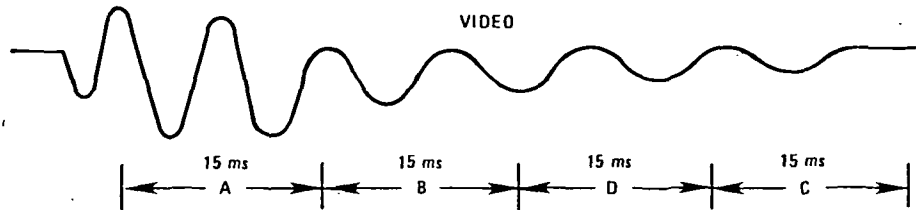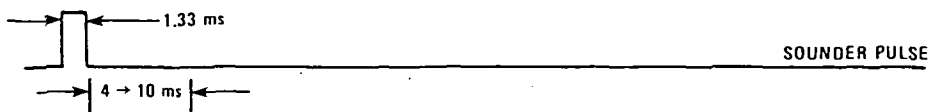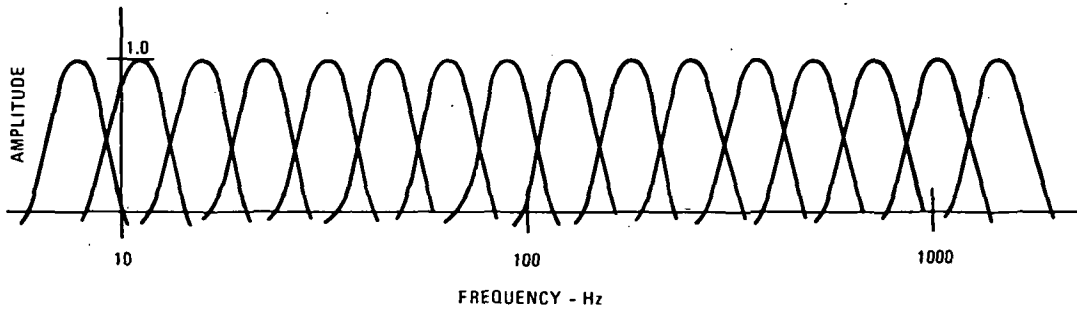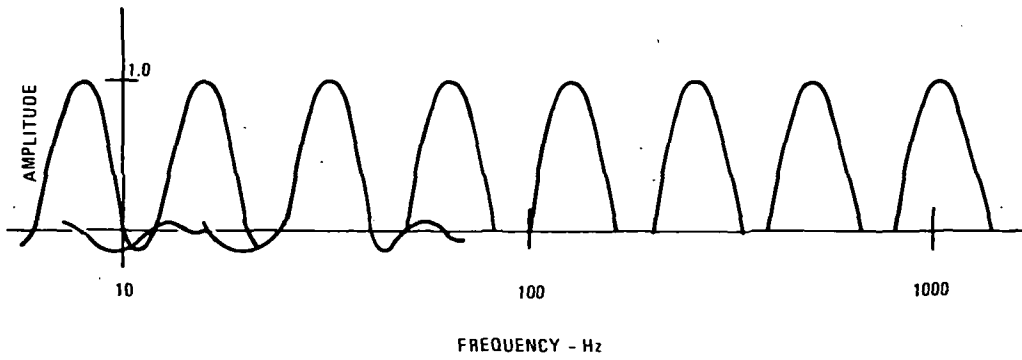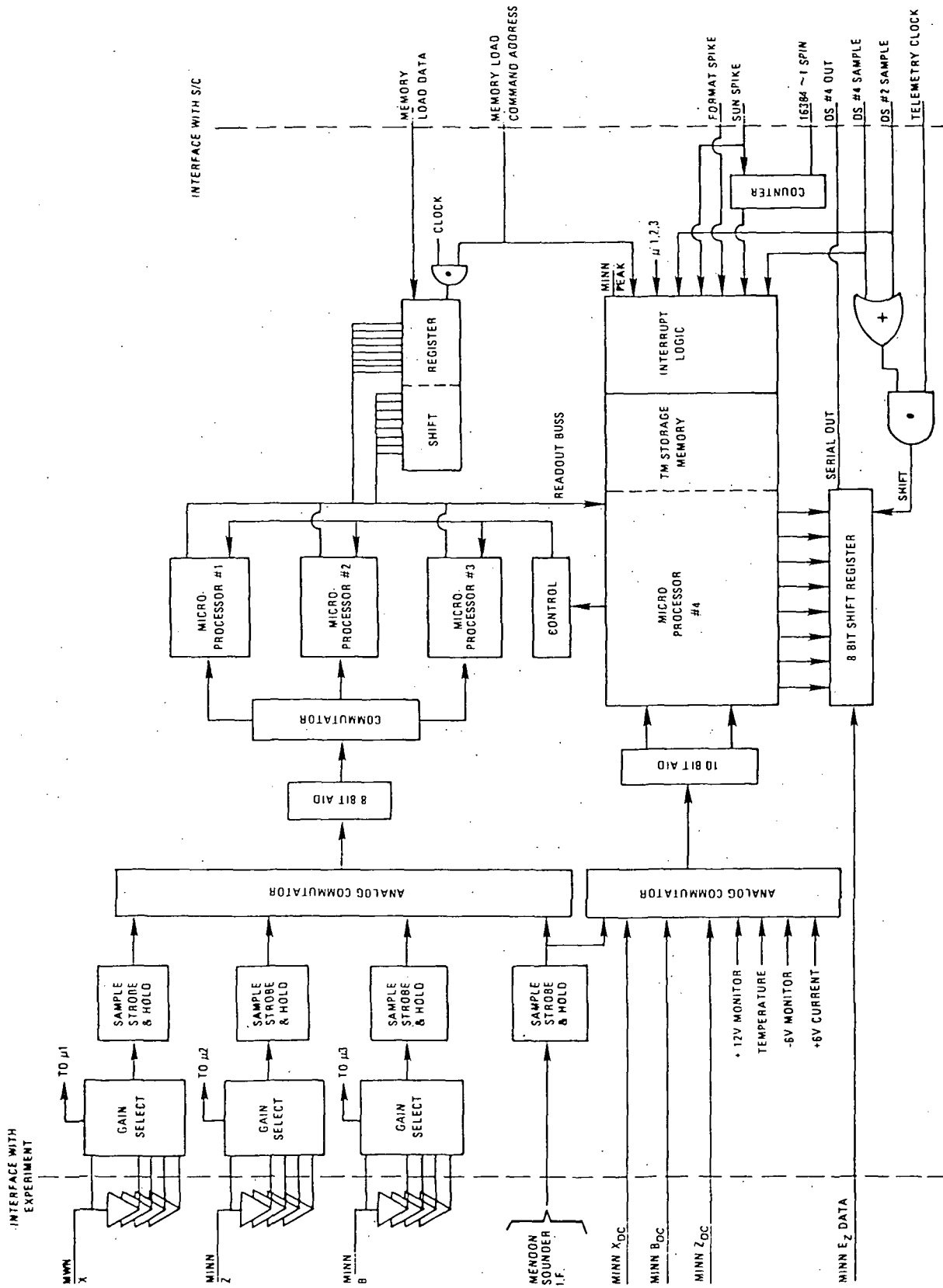
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The requirements of low power, small space, low weight, and high data compression limit the capabilities of interplanetary plasma wave processing. The processing of plasma wave signals in spinning spacecraft in the range from D.C. to 500 Hz are described. Another signal source from the intermediate frequency of a sounder transponder is processed by the same hardware, but with linear Fourier transform software.

Three antenna inputs are filtered to prevent aliasing above 500 Hz. A 92 db range of data is multiplexed to an analog-to-digital converter, and then to three RCA 1802 microcomputers. Groups of this data are collected under DMA control by each microcomputer. A logarithmically-spaced Fourier transform is computed. Each computer requires 2 kilowords of read-only-memory and a half kiloword of random access memory.
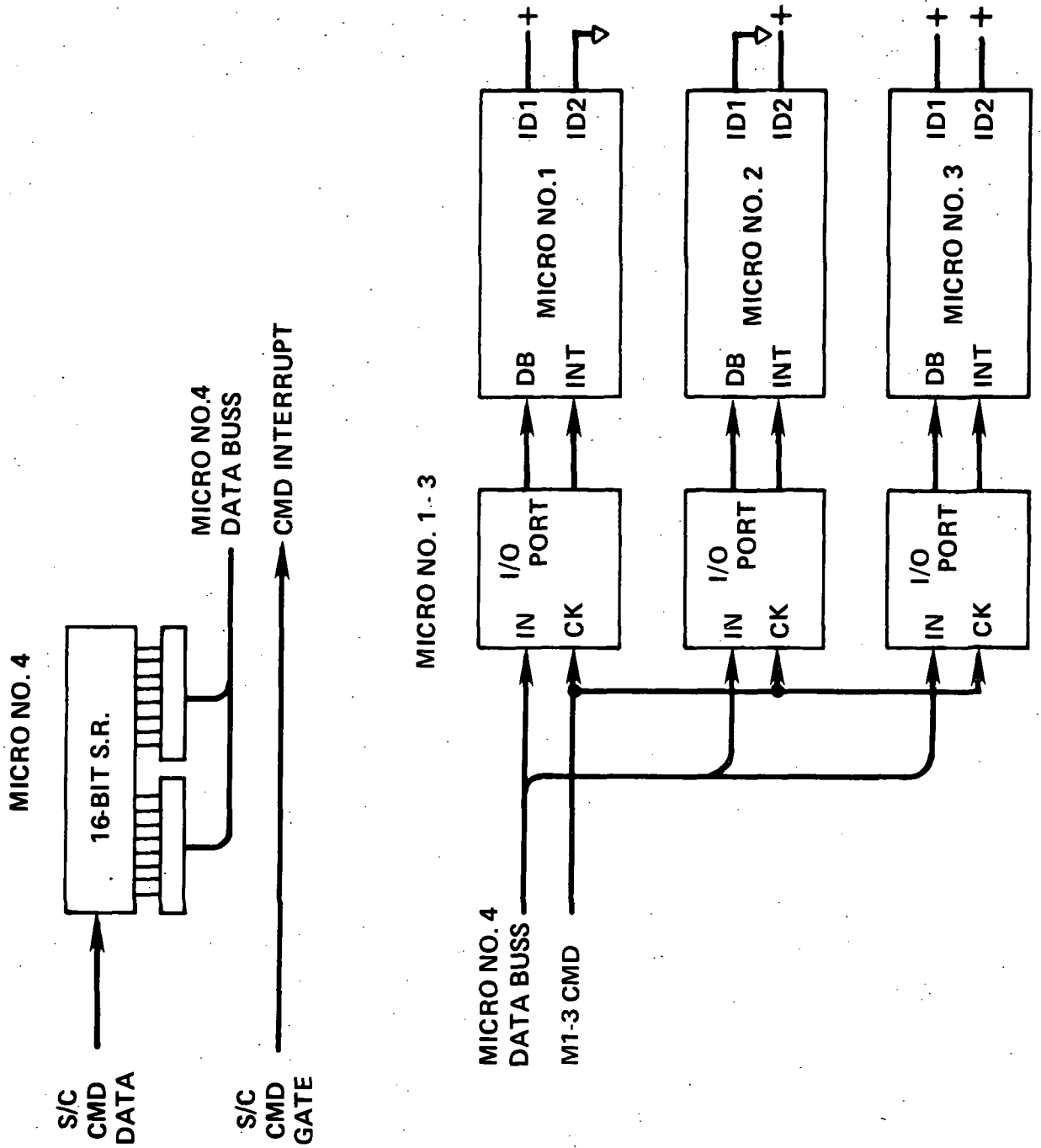
Data at lower frequencies is spin modulated by the spacecraft. For these signals, data is sampled 512 times in one spin and also processed by logarithmically-spaced Fourier transform techniques. A fourth microcomputer performs this task and coordinates all operations. This microcomputer requires 5 kilowords of read-only-memory and 3.5 kilowords of random address memory. The computer also performs data averaging, peak detection, data formatting, output compression, and ground commanded tasks.

FREQUENCY – Hz

FREQUENCY – Hz

SOUNDER PULSE

VIDEO

| 15 ms | 15 ms | 15 ms | 15 ms |
| A | B | D | C |

CYCLES IN SAMPLE TIME →

| 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 |

TRANSLATED FREQUENCY

640 704 768 832 896 960 1024 1088 1152 1216 1280 1344

58
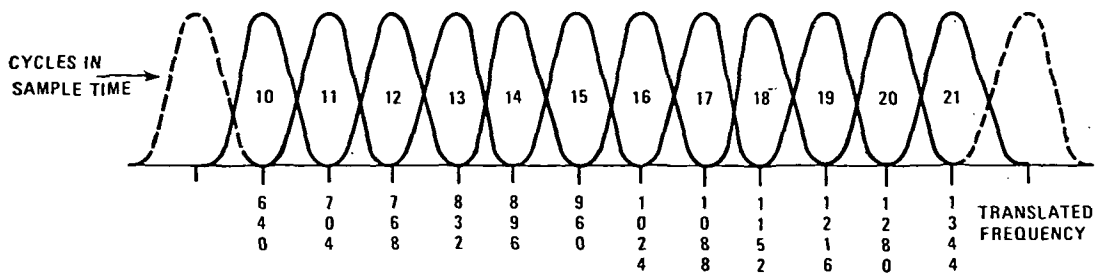
Functional block diagram of SPM-FFT Processor

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COMMANDS

MICRO NO. 4

16-BIT S.R.

S/C CMD DATA

S/C CMD GATE

MICRO NO.4 DATA BUSS

CMD INTERRUPT

MICRO NO. 1 - 3

MICRO NO. 4 DATA BUSS

M1-3 CMD

I/O PORT   IN   CK

MICRO NO.1   DB   INT   ID1   ID2

MICRO NO. 2   DB   INT   ID1   ID2

MICRO NO. 3   DB   INT   ID1   ID2

60

INPUT

61
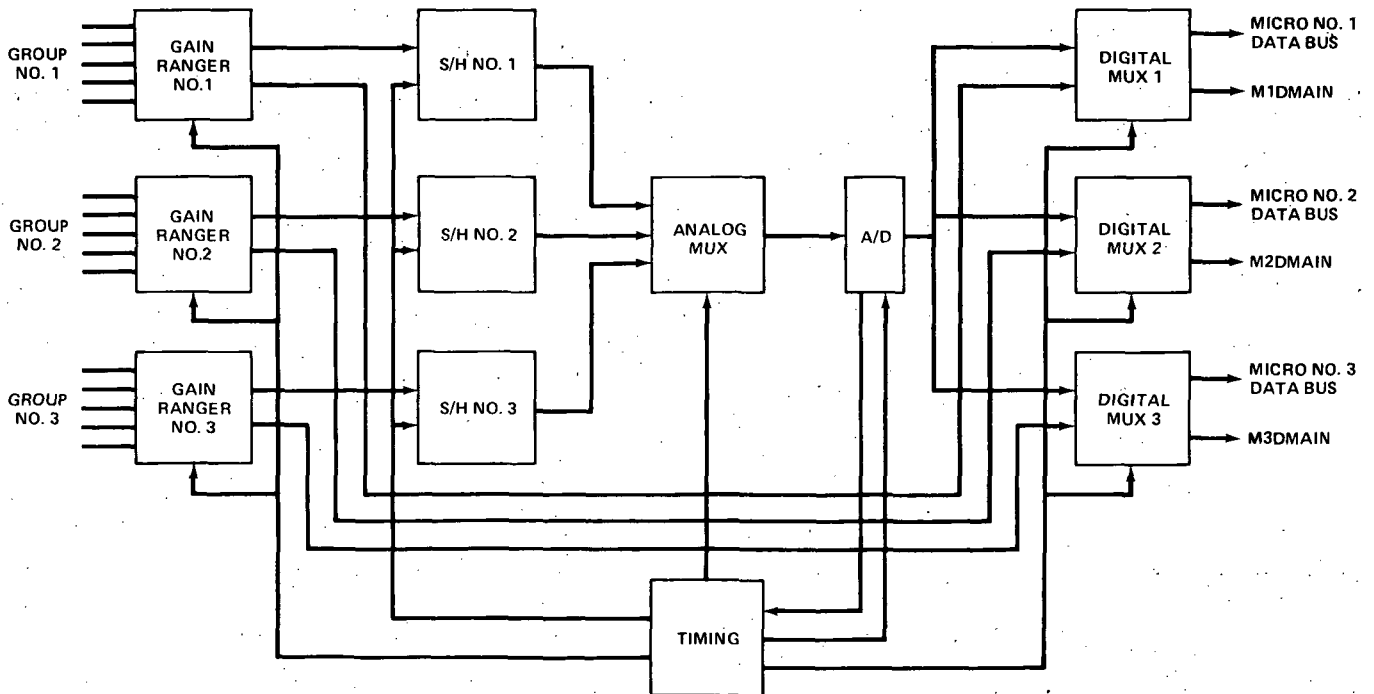
DMA CONTROL
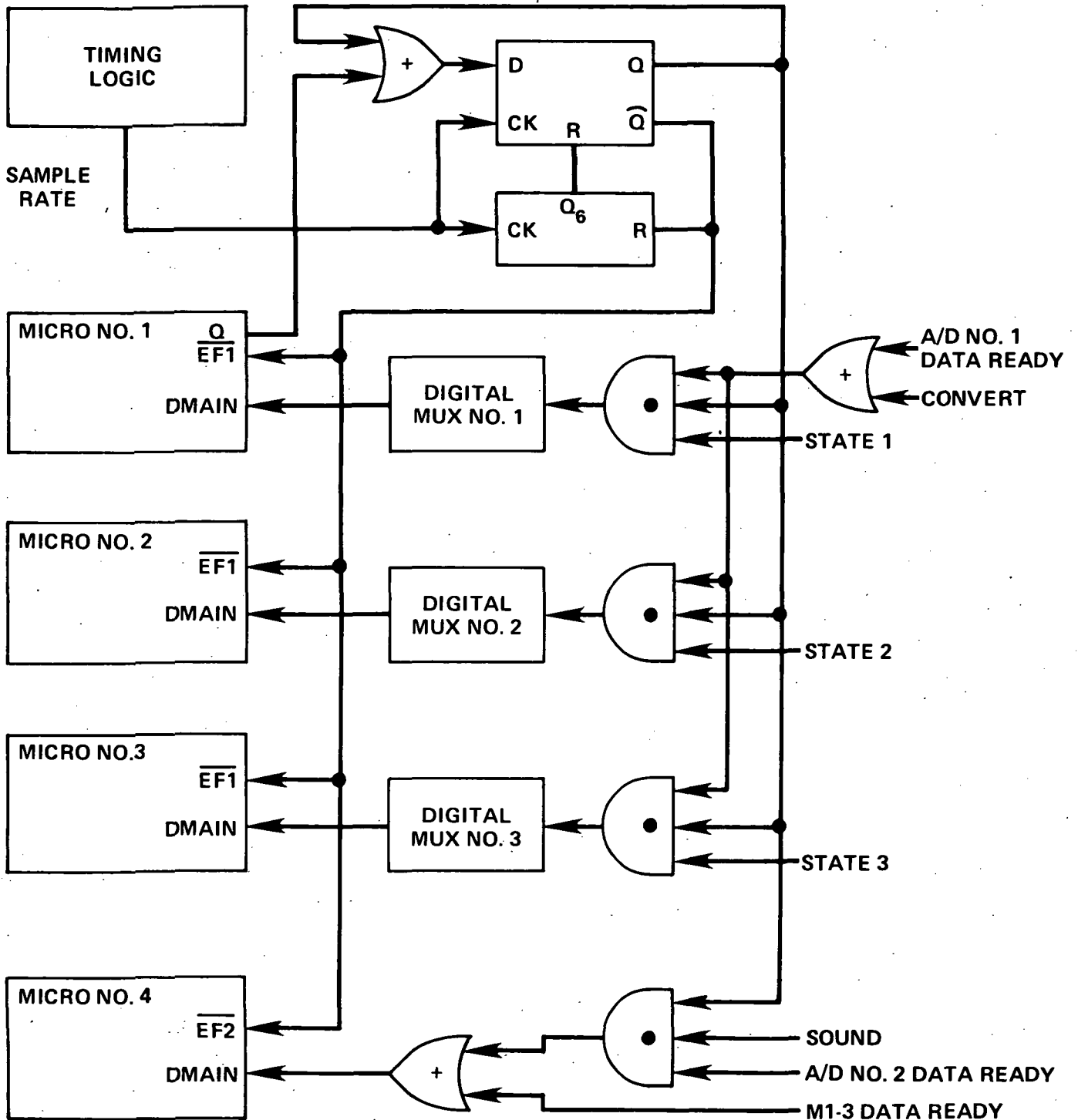
GAIN RANGING

INTERRUPT LOGIC