GENERAL

General Precision's LGP-21 was designed as a compact: mobile computerwith particular application potential to the problems of the small businessman, engineering firm, or scientific research group. The LGP-21 is not merely economical to own, but simple to program and operate. These skills can be acquired by qualified personnel within a two-week training course which is provided at no charge by General Precision, Inc. This programming manual is provided as an adjunct to the regular programming class, and should serve as a useful reference text thereafter.
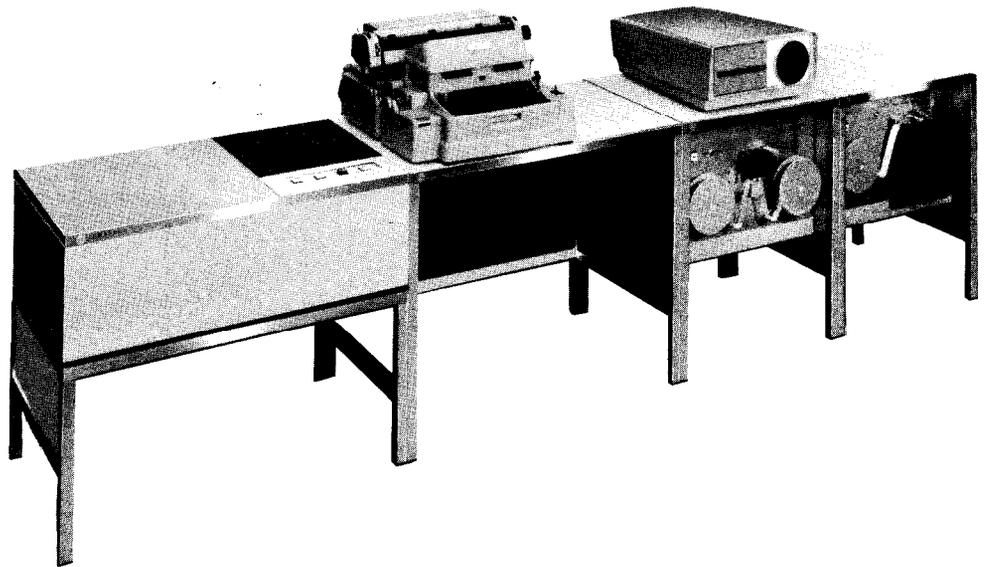

FIGURE 1 .1 LGP-21 Computer System

When the new LGP-21 programmer has finished his course, he will also be aware of the fact that a large library of programs and subroutines is available to assist him in his programming tasks. However, a discussion of the program library falls beyond the scope of this manual and should be conducted by each customer with his General Precision salesman/analyst.

COMPUTER ELEMENTS

A number of computer elements are of particular interest to the programmer as they provide for the storage and manipulation of information. They are the memory, arithmetic and control units and will be discussed below with particular emphasis upon their function in the program-execution process.

Memory

The LGP-21 memory unit is a disc with a total information storage capacity of 4096 computer words. For programming purposes, these words are considered as stored on 64 tracks in main memory, each track being divided into 64 sectors or storage locations. Both tracks and sectors are numbered from 00 through 63. This constitutes a simple means of locating information in memory: the combination of a word's track and sector number provides the address of the computer word. For example, the address of a word stored in Track 17, Sector 05, is "1705"; while the address 0261 refers to Track 02, Sector 61. There is no break in continuity of addresses from one track to the next, or from one sector to the next. Thus, consecutive addresses in computer memory can be said to range from 0000, 0001, 0002.. . .0063, into the next track, 0100, 0101.. . . etc. through 6363. . . . after which the next address would be 0000 again.
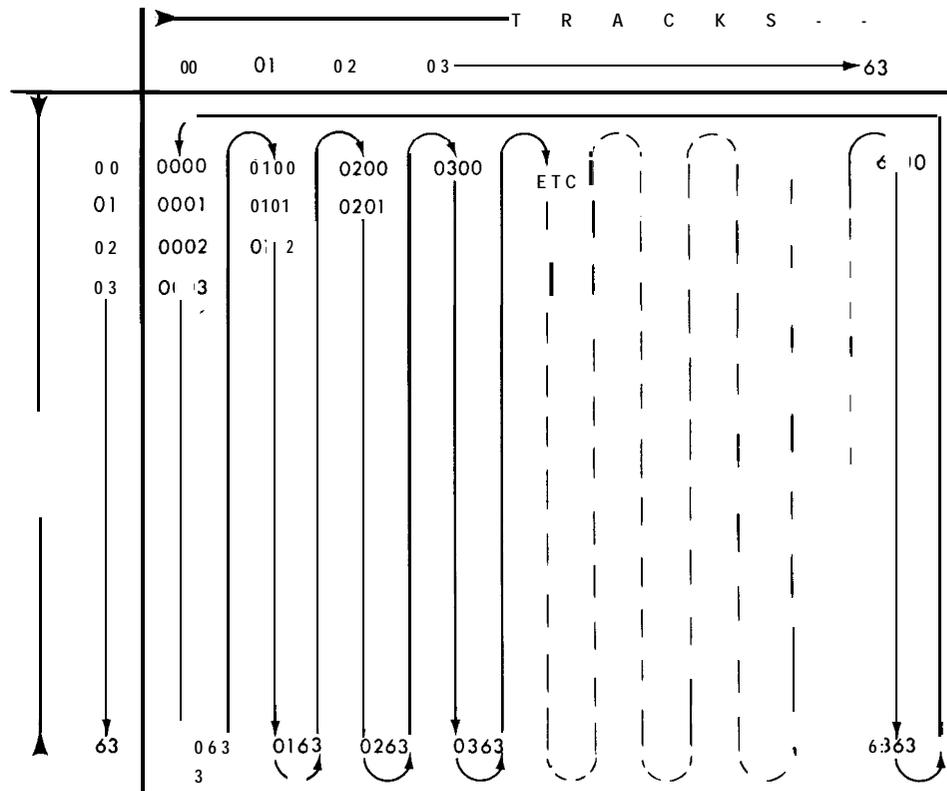

FIGURE 1.2 Track/Sector Numbering System

Mounted above the surface of the memory disc are 32 read/write heads which "read" or "write" information into the various memory locations as the disc revolves. Each head serves two tracks which are assigned alternate sectors in a circle. Thus, read/write head 0 reads the first sector of Track 00, then the first sector of Track 01; then the second sector of Track 00, and the second sector of 01, etc. Read/write head 1 serves Tracks 02 and 03; head 5 serves tracks 10 and 11, and so on.

It should be mentioned at this point, that the engineering characteristics of the memory disc are disregarded for most programming purposes. One exception, optimizing, represents a programming refinement which may be of limited interest to most LGP-21 programmers. It is therefore ignored for the time being, and will not be discussed until the end of the manual, in Chapter 8. Other exceptions will be pointed out as they occur. Suffice it to say that while the

memory disc actually consists of 32 tracks with 128 sectors each, it will be treated as a 64 track/64 sector unit for most programming purposes. This concept makes the LGP-21 fully compatible with other General Precision computers with which the programmer may already be familiar.
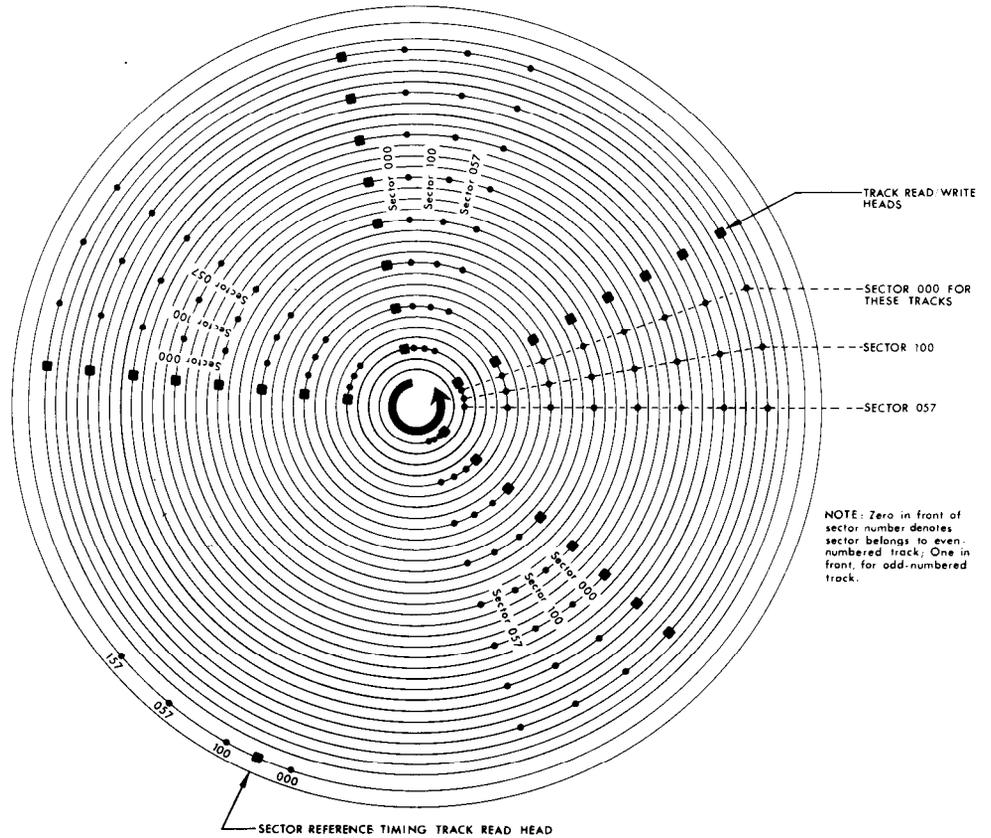

FIGURE 1.3 Memory Disc

Arithmetic Unit

All internal computations are performed in the arithmetic unit of the LGP-21. It consists of the Accumulator (A), and the Extended Accumulator (A*), which are recirculating lines on the memory disc.

The Accumulator (A) is a working register which is used for all manipulation of data. Through it passes all information which is transferred from one part of memory to another. Prior to the execution of an arithmetic operation, the Accumulator holds one of the operands (the other is stored in memory); following the execution of the instruction, the Accumulator holds the result of the arithmetic operation. In addition, all communications between the computer and its input/output devices pass through this register.

The Accumulator has one read- and one write-head, located one word-time apart. They continually copy information from one sector into the next, making the same word constantly available. On the same track is a two-word recirculating line, the Extended Accumulator (A*). It is not addressable by programming, but contains the intermediate results during multiplication and division operations. The track on which the recirculating lines are recorded is not one of the 64 tracks of main memory.

Control Unit

The control unit directs the operations of the computer. It consists of two registers: the Instruction Register (I) and the Counter Register (C). Each is a one-word recirculating line located on the same track as the Accumulator and the Extended Accumulator.
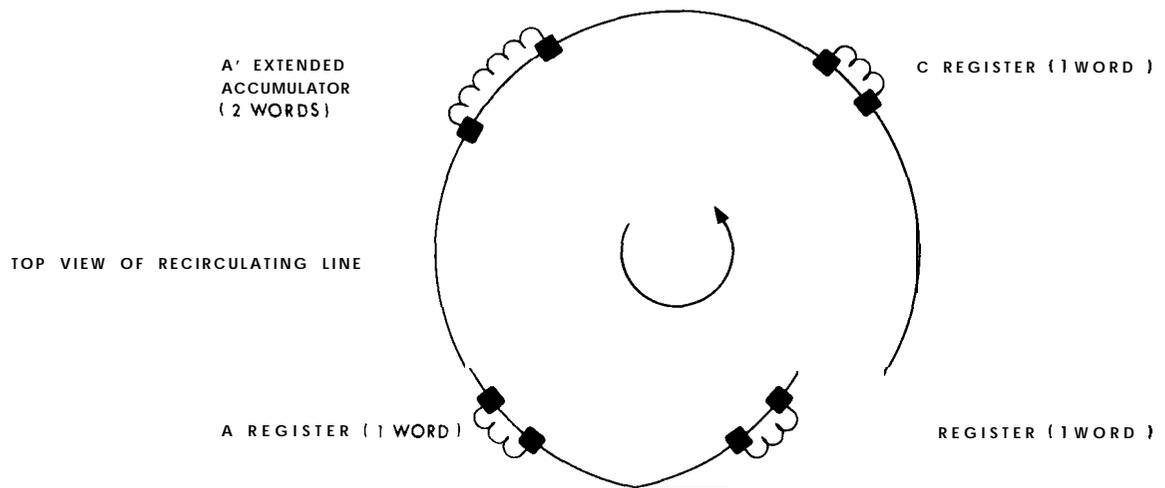
A' EXTENDED
ACCUMULATOR
(2 WORDS)

C REGISTER (1 WORD)

TOP VIEW OF RECIRCULATING LINE

A REGISTER (1 WORD)

REGISTER (1 WORD)

FIGURE 1.4 Control Registers

The Instruction Register(I) holds whatever instruction is to be executed. The two exceptions to this rule are the Multiply and divide instructions which depend upon continuous availability of the operand. To provide such continuous access, the multiplier or divisor -not the instruction — is copied from memory into the Instruction Register.

The Counter Register (C) contains the address of the next instruction to be executed. In other words, if the Counter Register reads 2438, it means that the next instruction to be executed is in Track 24, Sector 38. This register also holds the overflow indicator. (0verflow will be discussed in Chapter 6).

With this basic understanding of the various computer elements which are involved in the manipulation of information for the LGP-21, it is now possible to approach the actual programming procedures for the computer.