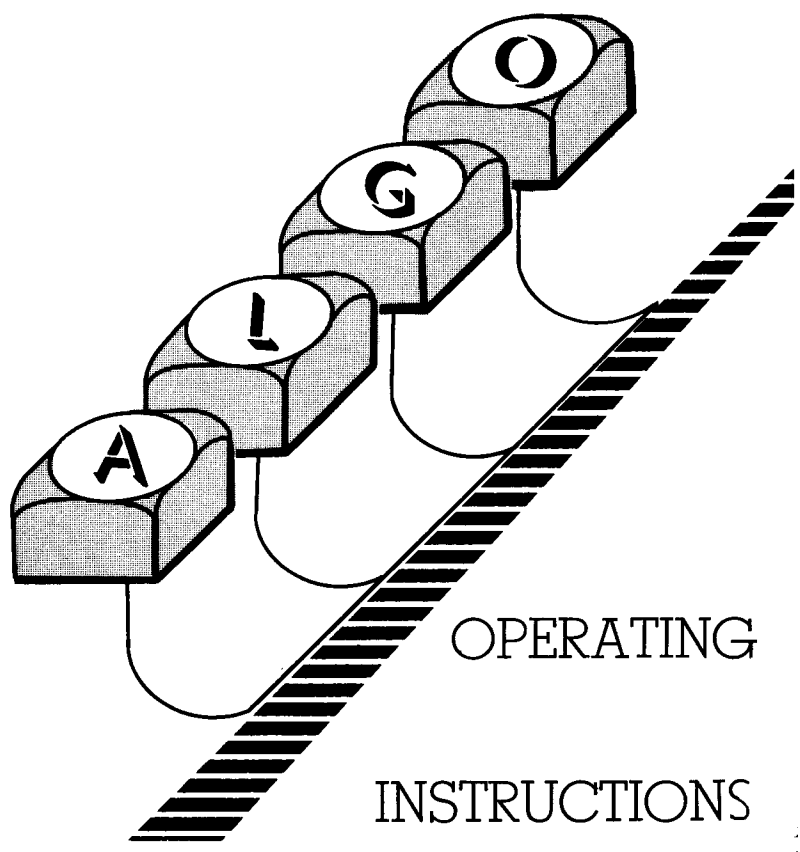
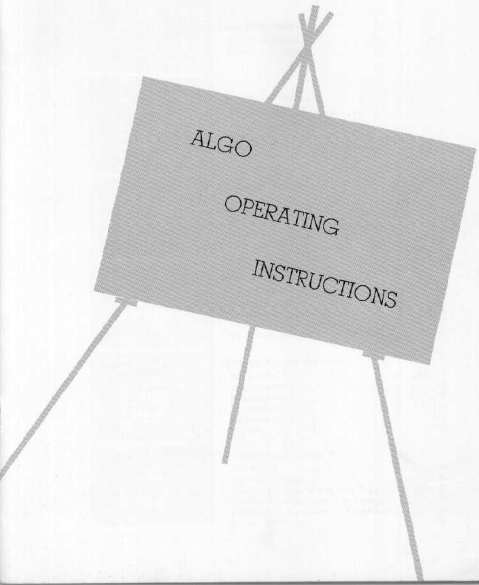






ALGO

OPERATING

INSTRUCTIONS

ORGANIZATION OF ALGO OPERATING MANUAL

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GENERAL INTRODUCTION

INTRODUCTION

Algo is an algebraic compiling system for the Bendix G-15 computer. The Algo language and programming are discussed in a separate manual, Bendix publication T21-1 which should be read before this manual.

ALGO COMPONENTS

The basic Algo system consists of six components, contained in six paper tape magazines. The first three components, designated as Magazines No. 1, No. 2, and No. 3, interpret a problem written in the Algo language and develop an object program coded in a language which the computer understands. A fourth component, designated Magazine No. 4, operates on the object program and produces a solution to the problem. When Algo completes the interpretation of the Algo language program, the object program is on the drum of the G-15 Computer. At the option of the operator, the object program may be produced on paper tape and run at a later time.

The two other components, designated as the Updater and the Housekeeper, broaden the facilities of the Algo system. The Updater, the corrector component of the Algo system, permits the programmer to add information to or delete information from the Algo language program. The programmer may also correct or modify the existing declarations and statements of the program.

The Housekeeper, an Algo service routine, permits the operator to transfer the Algo system to magnetic tape or to modify or expand the existing Algo system.

The Housekeeper is not transferred to magnetic tape. The Algo master is then the five components designated as Magazines No. 1, No. 2, No. 3, No. 4, and Updater. The five paper tape magazines, which contain these components, are called a "paper tape master." When transferred to magnetic tape, the five are called a "magnetic tape master."

MODES OF OPERATION

The operator has a choice of four modes of operation with the Algo system—two with a paper tape master and two with a magnetic tape master.

While preparing the object program, Algo stores intermediate results on either paper tape or magnetic tape. The tapes, containing the intermediate results, are called "scratch pads." Either type of master tape may operate with either type of scratch pad tape. The four modes of operation are then:

<i>Master</i>		<i>Scratch Pad</i>
Paper Tape	to	Paper Tape
Paper Tape	to	Magnetic Tape
Magnetic Tape	to	Magnetic Tape
Magnetic Tape	to	Paper Tape

In conjunction with the two modes using a magnetic tape master, the operator needs the Bendix Application's Project No. 61—Magnetic Tape Service Routine.

In the operating instructions Algo directs the operator to perform certain operations. In referring to the master tapes, Algo calls the tapes Magazine No. 1, Magazine No. 2, Magazine No. 3, and Magazine No. 4. In referring to the scratch pads, Algo calls the tapes No. 1 Output or No. 2 Output.

The Magnetic Tape to Magnetic Tape mode of operation is designed to use two Magnetic Tape Units (MTA-2). The Magnetic Tape to Paper Tape Mode or the Paper Tape to Magnetic Tape Mode are designed for one Magnetic Tape Unit (MTA-2).

OPERATING

PAPER TAPE TO PAPER TAPE MODE

NOTE: Explanations of the steps are inside the fold-out sheet.

Operator

1. Load Magazine No. 1.
3. Type: 2 tab (S).
5. Type program title followed by: tab (S).
Rewind Magazine No. 1.
7. Type each line of the Algo language program and follow each by: tab (S).
10. Place paper tape on photo reader and cycle the Compute switch.
13. Put Paper Tape switch to REWIND and type: AAA tab BBB tab (S), where AAA and BBB are the key numbers typed by the computer.
15. Cycle the Compute switch.
17. To execute the object program, type: 01 tab (S).
19. Type the numeric value of the quantity specified as a KEYBD variable. Follow the numeric value by: tab (S).

INSTRUCTIONS

Computer

2. Computer types: MODE?
4. The computer types: 1. TITLE.
6. The computer returns the carriage, types the next entry number, and rings a bell.
8. The computer punches tape at intervals. After executing a carriage return, the computer types: LOAD No. 2.
9. After reading Magazines No. 2, the computer types: MOUNT No. 1 Output.
11. The computer reads tape, types information and punches another tape. The computer then types: LOAD No. 3.
12. The computer reads the contents of Magazine No. 3 and types:
TYPE KEY NUMBERS
REWIND No. 3.
14. The computer types: MOUNT No. 2 Output
16. The computer reads tape and types:
LOAD No. 4.
If the Compute switch is at GO, the computer punches the object program on tape, transfers control to the manual mode, halts, and rings a bell.
If the Compute switch is at BP, the computer halts. Cycle the Compute switch. The computer finishes reading the contents of Magazine No. 4, halts, transfers control to the manual mode, and rings a bell. The object program is in the computer memory.
18. The computer halts and rings a bell for each quantity specified as a KEYBD variable in the Algo language program.

Explanation

1. When directed to LOAD a particular tape by either the computer or the instructions, put the indicated tape on the photo reader of the computer and type: p. When the photo reader light goes out, put the Enable switch off and return the Compute switch to GO (or BP).

UNDERScoreD CHARACTERS have a distinct meaning in the operating instructions. The underscoring indicates that the operator puts the Compute switch off and the Enable switch ON and then types the indicated characters. After the characters are typed, the operator puts the Enable switch off and returns the Compute switch to GO (or BP) unless given other instructions.

3. The "2 tab S" indicates a paper tape scratch pad.
5. When directed to REWIND a tape by either the computer or the instructions, the operator may use either the Paper Tape switch on the typewriter base or the Input Tape Control switch on the computer face. In either case, put the switch in the REWIND position. The rewind operation may occur simultaneously with input-output via the typewriter.
6. The computer types one more entry number than there are lines in the Algo language program.
7. Check each line before typing "tab S". If a typographical error is present type: → (the upper case I). If an error is noted after striking "tab S", the operator may correct the error by means of the Updater.

The computer may indicate errors from time to time. See Chapter 5 on Error Detection and Correction - Magazine No. 1, - Updater.

9. When directed to MOUNT a tape by either the instructions or the computer, remove the tape from the punch unit and place the tape on the computer photo reader.

If the paper tape is misread, the computer rings the bell and halts. Manually reverse the tape one block and cycle the Compute switch. If the computer again halts and rings a bell, assume there has been a punch failure and return to the beginning of the program.

10. When directed to CYCLE the Compute switch, put the switch to off and return it to GO (or BP).
11. When the output tape from Magazine No.1 has been read, the computer types information at intervals regarding the program. See Chapter 3 on Purpose and Type-outs - Magazine No. 2. The computer also gives error indications. See Chapter 5 on Error Detection and Correction - Magazine No. 2, - Updater. The computer automatically rewinds Magazine No. 2.

The last type-outs before the computer directs the operator to load Magazine No. 3 are two numbers called "key numbers". The computer types a 3-digit number, AAA, executes a carriage return and types a second number, BBB. Leading zeros are suppressed.

14. The computer reads the output tape from Magazine No. 2 and types information at intervals regarding the program. See Chapter 3 on Purpose and Type-outs - Magazine No. 3. The computer also gives error indications. See Chapter 5 on Error Detection and Correction - Magazine No. 3, - Updater.

If the paper tape is misread, the computer types R, rings the bell and halts. Manually reverse the tape one block and cycle the Compute switch. If the computer again halts and rings a bell, assume there has been a punch failure and proceed to Chapter 4 on Interrupting Algo - Starting at Magazine No. 2.

16. When the computer halts and rings the bell after reading Magazine No. 4, the object program is in the computer memory and the computer is in the manual mode. The light configuration is:

00000 Source

Command Line 000 00000 Destination

00000 Input-Output

If the Compute switch is at GO, the computer automatically punches the object program on tape after reading the library routines.

If the Compute switch is at BP, the computer halts after reading the library routines. Cycling the Compute switch causes the computer to resume reading Magazine No. 4. The computer then halts in the manual mode and rings a bell.

17. The instruction ".1 tab S" transfers control to the automatic mode. The computer starts at the first object program command.
18. The computer halts and accepts the value for each quantity specified as a KEYBD variable. The computer accepts each quantity one at a time in the sequence in which they occurred in the Algo language program. The operator may type the numeric values of the KEYBD variables in either fixed-point or floating-point notation.
19. A "+" sign must not precede a positive number. If the "+" sign is typed, an error results.

If the operator notes an error before striking the "tab S", he may retype the value by typing: 000.

After the 000, the computer executes a carriage return and rings the bell. The operator may now type the correct numerical value.

If the error is noted after the "tab S", the operator may type: Scf and return to Step. 17.

PAPER TAPE TO MAGNETIC TAPE MODE

NOTE: Explanations of the steps are inside the fold-out sheet.

Operator

1. Load Magazine No. 1.
3. Type either: 1 tab Ⓢ
or: 1 tab DDD tab Ⓢ.
5. Cycle the Compute switch.
7. Type the program title followed by: tab Ⓢ.
Rewind Magazine No. 1.
9. Type each line of the program
followed by: tab Ⓢ.
13. When the computer begins to read from magnetic tape, rewind Magazine No. 3.
15. Rewind No. 4.
16. To execute the program, type: 01 tab Ⓢ.
18. Type the numeric value of the quantity specified as a KEYBD variable. Follow the numeric value by: tab Ⓢ.

Computer

2. Computer types: MODE?
4. Computer types: SET MAG SW = 1
6. The computer searches for clean tape and types: DDD, the file number of the block used as a scratch pad. The computer continues to read paper tape and then types: 1. TITLE
8. The computer executes a carriage return and types the next entry number.
10. The computer writes at intervals on magnetic tape.
11. The computer types: LOAD No. 2
The computer reads the contents on Magazine No. 2, types information at intervals, and writes on magnetic tape.
12. The computer types: LOAD No. 3
The computer reads Magazine No. 3, types information at intervals and writes on magnetic tape.
14. The computer types: LOAD No. 4
The computer reads the contents of Magazine No. 4.
If the Compute switch is at GO, the computer punches the object program on tape, halts, transfers control to the manual mode, and rings a bell.
If the Compute switch is at BP, the computer halts. Cycle the Compute switch. The computer finishes reading the contents of Magazine No. 4, halts, transfers control to the manual mode, and rings a bell. The object program is in the computer memory.
17. The computer halts and rings a bell for each quantity specified as a KEYBD variable in the Algo language program.

Explanation

1. When directed to LOAD a particular tape by either the computer or the instructions, put the indicated tape on the computer photo reader and type: p. When the photo reader light goes out, return the Compute switch to GO (or BP).

UNDERSCORED CHARACTERS have a distinct meaning in the operating instructions. The underscoring indicates that the operator puts the Compute switch off, the Enable switch ON, and then types the indicated characters. After the characters are typed, the operator puts the Enable switch off and returns the Compute switch to GO (or BP) unless given other instructions.

3. Either form of the instruction indicates a magnetic tape scratch pad. If the first form is used, Algo automatically searches magnetic tape for the first available identification block. The computer then types out the number of the identification block. Leading zeros are suppressed. If no identification block is found, the computer, upon finding clean tape, inserts and types a file number of 1.

In the second form, the number DDD ranges from 000 to 999 and is the file identification number consistent with the Magnetic Tape Service Routine, Application's Project No. 61.

4. Check the Tape Unit Selector switch on the magnetic tape unit and put the switch in the 1 position if necessary. The switch indicates the unit addressed by internal commands. The unit, used as a scratch pad, is always 1.
5. When directed to CYCLE the Compute switch, put the switch to off and return it to GO (or BP).
7. When directed to REWIND a tape either by the computer or the instructions, the operator may use either the Paper Tape switch on the typewriter base or the Input Tape Control switch on the computer face. In either case, put the switch in the Rewind position. The rewind operation may occur simultaneously with input-output via the typewriter.
8. The computer types one more entry number than there are lines in the Algo program.
9. Check each line before typing "tab Ⓢ". If a typographical error is present, type: →, (the upper case I). If an error is noted after striking "tab Ⓢ", the operator may correct the error by means of the Updater.

The computer may also indicate errors from time to time. See Chapter 5 on Error Detection and Correction - Magazine No. 1, - Updater.

11. The computer, after reading Magazine No. 2, types information regarding the program. See Chapter 3 on Purpose and Type-outs - Magazine No. 2. The computer automatically rewinds Magazine No. 2. The computer also gives error indications. See Chapter 5 on Error Detection and Correction - Magazine No. 2, - Updater.

12. The computer, after reading Magazine No. 3, types information at intervals. See Chapter 3 on Purpose and Type-outs - Magazine No. 3. The computer also indicates errors which may be in the program. See Chapter 5 on Error Detection and Correction - Magazine No. 3, - Updater.

If the computer types "R", there has been a reading or writing error on magnetic tape. To correct the error, see Chapter 5 "Error Detection and Correction - Updater".

14. When the computer halts and rings the bell after reading Magazine No. 4, the object program is in the computer memory and the computer is in the manual mode. The light configuration is:

00000 Source
Command Line 000 00000 Destination
00000 Input-Output

If the Compute switch is at GO, the computer automatically punches the object program on tape after reading the library routines.

If the Compute switch is at BP, the computer halts after reading the library routines. Cycling the Compute switch causes the computer to resume reading Magazine No. 4. The computer then halts in the manual mode and rings a bell.

16. The ".1 tab Ⓢ" transfers control to the automatic mode. The ".1 tab Ⓢ" starts the computer at the first object program command.
17. The computer halts and accepts the value for each quantity specified as a KEYBD variable. The computer accepts each quantity one at a time in the sequence in which they occurred in the Algo language program. The operator may type the numeric values of the KEYBD variables in either fixed-point or floating-point notation.
18. A "+" sign must not precede a positive number. If a "+" sign is typed, an error results.

If the operator notes an error before striking the "tab Ⓢ", he may retype the value by typing:
000. The computer executes a carriage return and rings the bell. The operator may now type the correct numerical value.

If the error is noted after the "tab Ⓢ", the operator may type Ⓢ cf and return to Step 16.

MAGNETIC TAPE TO MAGNETIC TAPE MODE

NOTE: Explanations of the steps are inside the fold-out sheet.

Operator

1. Put the Tape Unit Selector switch on the Magnetic Tape Unit containing the magnetic tape master to the 2 position.
2. Load the Magnetic Tape Service Routine.
3. When the computer halts, type: 2DDD tab Ⓢ.
5. Rewind and remove the Magnetic Tape Service Routine from the photo reader.
6. Type either: 1 tab Ⓢ
or: 1 tab DDD tab Ⓢ
8. Cycle the Compute switch.
10. Type program title followed by: tab Ⓢ
12. Type each line of the Algo language program and follow each by: tab Ⓢ
16. To execute the object program, type:
.1 tab Ⓢ
18. Type the numeric value of the quantity specified as a KEYBD variable. Follow the numeric value by: tab Ⓢ.

Computer

4. The computer searches the tape until the block containing Magazine No. 1 is located and then reads information on the tape, and types: MODE?
7. The computer types SET MAG SW = 1 and halts.
9. The computer searches for clean tape and types: DDD, the file number of the block used as a scratch pad. The computer then reads Magazine No. 1 from the second Magnetic Tape Unit and types: 1. TITLE
11. The computer executes a carriage return and types the next entry number.
13. The computer writes on magnetic tape at intervals and reads the contents of Magazine No. 2 from magnetic tape.
14. The computer again writes on magnetic tape, types information at intervals, and reads the contents of Magazine No. 3 from magnetic tape. The computer types information at intervals and reads the output from Magazine No. 2 from tape. After the computer reads Magazine No. 3 the operator may put the Compute switch to BP and the object program will not be punched on tape.
15. The computer reads the contents of Magazine No. 4 from magnetic tape.
If the Compute switch is at GO, the computer punches the object program on tape, reads magnetic tape, transfers control to the manual mode, halts, and rings a bell.
If the Compute switch is at BP, the computer halts. Cycle the Compute switch to resume operation. The computer again reads magnetic tape, transfers control to the manual mode, halts, and rings a bell.
17. The computer halts and rings a bell for each quantity specified as a KEYBD variable in the Algo language program.

Explanation

1. Check the Tape Unit Selector switch on the Magnetic Tape Unit containing the Magnetic Tape master and put in the 2 position if necessary. The switch indicates the unit addressed by internal commands. The unit, used for the master, is always 2.

When directed to LOAD a particular tape by either the computer or the instructions, put the indicated tape on the photo reader of the computer and type: p. When the photo reader light goes out, return the Compute switch to Go (or BP).

UNDERScoreD CHARACTERS have a distinct meaning in the Operating Instructions. The underscoring indicates that the operator puts the Compute switch off, the Enable switch ON and then types the indicated characters. After the characters are typed, the operator puts the Enable switch off and returns the Compute switch to GO (or BP) unless given other instructions.

Initially, the block of magnetic tape containing Magazine No. 1 must be located by means of the Magnetic Tape Service Routine, Application's Project No. 61.

3. The computer immediately halts after the Compute switch is returned to GO in Step 2.
The first digit 2 indicates the Magnetic Tape Unit. The 3 digits are the file numbers of the block on which the Housekeeper recorded Magazine No. 1. The computer installation should have a permanent record of the magnetic tape file numbers on which information is recorded. The operator must refer to this record to obtain the file number of the block on which Magazine No. 1 was recorded. For example, the Housekeeper recorded the Algo system in blocks 081, 082, 083, 084, and 085. The operator in Step 3 would type: 2081 tab S.
5. When directed to REWIND a tape by either the computer or the instructions, the operator may use either the Paper Tape switch on the typewriter base or the Input Tape Control switch on the computer face. In either case, put the switch in the REWIND position. The rewind operation may occur simultaneously with input-output via the typewriter.
6. Either form of the instruction indicates a magnetic tape scratch pad. If the first form is used, Algo automatically searches magnetic tape for the first available identification block. The computer then types the identification block number. Leading zeros are suppressed. If no identification block is found, the computer, upon finding clean tape, inserts and types a file number of 1.
In the second form, the number DDD ranges from 000 to 999 and is the file identification number consistent with the Magnetic Tape Service Routine, Application's Project No. 61.
7. Check the Tape Unit Selector switch on the magnetic tape unit used as a scratch pad and put the switch in the 1 position if necessary. The switch indicates the unit addressed by internal commands. The scratch pad unit is always 1.

8. When directed to CYCLE the Compute switch, put the switch to off and return it to GO (or BP).
11. The computer types one more entry number than lines in the Algo language program.
12. Check each line before typing "tab S". If a typographical error is present, type: → (the upper case 1). If an error is noted after striking the "tab S", the operator may correct the error by means of the Updater. The computer may indicate errors from time to time. See Chapter 5 on Error Detection and Correction - Magazine No. 1, - Updater.
13. The type-outs which occur after the computer has read the contents of Magazine No. 2 are discussed in the section "Purpose and Type-outs - Magazine No. 2". The computer also gives error indications. See Chapter 5 on Error Detection and Correction - Magazine No. 2, - Updater.
14. The type-outs which occur after the computer has read the contents of Magazine No. 3 are discussed in Chapter 3, "Magazine No. 3, - Purpose and Type-outs". The computer may also type error indications. See Chapter 5 on Error Detection and Correction - Magazine No. 3, - Updater.

If the computer types "R", there has been a reading or writing error on magnetic tape. To correct the error, see Chapter 5 on Error Detection and Correction - Updater.

15. When the computer halts and rings the bell after reading Magazine No. 4, the object program is in the computer memory and the computer is in the manual mode. The light configuration is:

00000 Source
 Command Line 000 00000 Destination
 00000 Input-Output

If the Compute switch is at GO, the computer automatically punches the object program on tape after reading the library routines.

If the Compute switch is at BP, the computer halts after reading the library routines. Cycling the Compute switch causes the computer to resume reading Magazine No. 4. The computer then halts in the manual mode and rings a bell.

16. The instruction ".1 tab S" transfers control to the automatic mode. The computer starts at the first object program command.
17. The computer halts and accepts the value for each quantity specified as a KEYBD variable. The computer accepts each quantity one at a time in the sequence in which they occurred in the Algo language program. The operator may type the numeric values of the KEYBD variables in either fixed-point or floating-point notation.
18. A "+" sign must not precede a positive number. If the "+" is typed, an error results.

If the operator notes an error before striking the "tab S", he may retype the value by typing: ...
The computer executes a carriage return and rings the bell. The operator may now type the correct numerical value.

If the error is noted after the "tab S", the operator may type S cf and return to Step 16.

MAGNETIC TAPE TO PAPER TAPE MODE

NOTE: Explanations of the steps are inside the fold-out sheet.

Operator

1. Put the Tape Unit Selector switch on the Magnetic Tape Unit containing the magnetic tape master to the 2 position.
2. Load the Magnetic Tape Service Routine, Application's Project No. 61.
3. When the computer halts, type: 2DDD tab Ⓢ .
5. Rewind and remove the Magnetic Tape Service Routine from the photo reader.
6. Type: 2 tab Ⓢ .
8. Type the program title followed by: tab Ⓢ .
10. Type each line of the Algo language program and follow each by: tab Ⓢ
12. Cycle the Compute switch.
14. Type: AAA tab BBB tab Ⓢ where AAA and BBB are the key numbers typed by the computer.
16. Cycle the Compute switch.
18. To execute the object program, type: 01 tab Ⓢ
20. Type the numeric value of the quantity specified as a KEYBD variable. Follow the numeric value by: tab Ⓢ .

Computer

4. The computer searches magnetic tape until the block containing Magazine No. 1 is located. The computer then reads information from the tape and types: MODE?
7. The computer reads information from magnetic tape and types: 1. TITLE
9. The computer returns the carriage and types the next entry number. The computer punches tape at intervals.
11. The computer reads the contents of Magazine No. 2 from magnetic tape and types: MOUNT No. 1 Output
13. The computer types at intervals, punches tape and types: TYPE KEY NUMBERS
15. The computer types: MOUNT No. 2 Output
17. The computer reads paper tape, reads the content of Magazine No. 3 from magnetic tape, and types at intervals. If the operator now puts the Compute switch to BP, the computer will not punch the object program on tape. The computer reads the contents of Magazine No. 4 from magnetic tape.
If the Compute switch is at GO, the computer punches the object program on tape, transfers control to the manual mode, halts, and rings a bell.
If the Compute switch is at BP, the computer halts. Cycle the Compute switch. The computer continues to read the contents of Magazine No. 4 from magnetic tape, transfers control to the manual mode, halts, and rings a bell.
19. The computer halts and rings a bell for each quantity specified as a KEYBD variable in the Algo language program.

Explanation

1. Check the Tape Unit Selector switch on the Magnetic Tape Unit containing the magnetic tape master and put the switch in the 2 position if necessary. The switch indicates the unit addressed by internal commands. The unit, used for the master, is always 2.
2. When directed to LOAD a particular tape by either the computer or the instructions, put the indicated tape on the computer photo-reader and type: p. When the photo reader light goes out, return the Compute switch to GO (or BP).
 UNDERSCORED CHARACTERS have a distinct meaning in the operating instructions. The underscoring indicates that the operator puts the Compute switch off, the Enable switch ON and types the indicated characters. After the characters are typed, the operator puts the Enable switch off and returns the Compute switch to GO (or BP) unless given other instructions.
 Initially, the block of magnetic tape containing Magazine No. 1 must be located by means of the Magnetic Tape Service Routine, Application's Project No. 61.
3. The computer immediately halts when the Compute switch is returned to GO in Step 2.
 The first digit 2 indicates the Magnetic Tape Unit. The last 3 digits are the file number of the block on which the Housekeeper recorded Magazine No. 1. The computer installation should have a permanent record of the magnetic tape file numbers on which information is recorded. The operator must refer to this record to obtain the file number of the block on which Magazine No. 1 was recorded. For example, the Housekeeper recorded the Algo system in blocks 081, 082, 083, 084, and 085. The operator in Step 3 would type: 2081 tab ⑤.
5. When directed to REWIND a tape by either the computer or the instructions, the operator may use either the Paper Tape switch on the typewriter base or the Input Tape Control switch on the computer face. In either case, put the switch in the Rewind position. The rewind operation may occur simultaneously with input-output via the typewriter.
6. "2 tab ⑤" indicates a paper tape scratch pad.
9. The computer types one more entry number than there are lines in the Algo language program.
10. Check each line before typing "tab ⑤". If a typographical error is present, type:→ (the upper case 1). If an error is noted after striking the "tab ⑤", the operator may correct the error by means of the Algo Updater. The computer may detect errors from time to time and type error indications. Chapter 5 on Error Detection and Correction - Magazine No. 1 discusses the different error indications typed by the computer.
11. When directed to MOUNT a tape by either the instructions or the computer, remove the tape from the punch unit if necessary and place the tape on the computer photo reader.
 If the paper tape is misread, the computer rings the bell and halts. Manually reverse the tape one block and cycle the Compute switch. If the

computer again halts and rings a bell, assume there has been a punch failure and return to the beginning.

12. When directed to CYCLE the Compute switch, put the switch to off and return it to GO (or BP).
13. The type-outs which occur after the computer has read the contents of Magazine No. 2 are discussed in Chapter 3, Purpose and Type-outs - Magazine No. 2. The computer also indicates errors. See Chapter 5 on Error Detection and Correction - Magazine No. 2, - Updater.
 The last type-outs, before the computer reads the contents of Magazine No. 3 from magnetic tape, are two numbers called "key numbers". The computer types a 3 digit number, AAA, executes a carriage return and types a second number, BBB. Leading zeros are suppressed.
15. The computer reads the output tape from Magazine No. 2 and types information at intervals regarding the program. See Chapter 3 on Purpose and Type-outs - Magazine No. 3. The computer also gives error indications. See Chapter 5 on Error Detection and Correction - Magazine No. 3, - Updater.
 If the paper tape is misread, the computer types "R", rings a bell and halts. Manually reverse the tape one block and cycle the Compute switch. If the computer again types R, rings the bell and halts, assume there has been a punch failure and proceed to Chapter 4, "Starting at Magazine No. 2".
17. When the computer halts and rings the bell after reading Magazine No. 4, the object program is in the computer memory and the computer is in the manual mode. The light configuration is:

00000 Source

Command Line 000 00000 Destination

00000 Input-Output

If the Compute switch is at GO, the computer automatically punches the object program on tape after reading the library routines.

If the Compute switch is at BP, the computer halts after reading the library routines. Cycling the Compute switch causes the computer to resume reading Magazine No. 4. The computer then halts in the manual mode and rings a bell.

18. The instruction ".1 tab ⑤" transfers control to the automatic mode. The computer starts at the first object program command.
19. The computer halts and accepts the value for each quantity specified as a KEYBD variable. The computer accepts each quantity one at a time in the sequence in which they occurred in the Algo language program. The operator may type the numeric values of the KEYBD variables in either floating-point or fixed-point notation.
20. A "+" sign must not precede a positive number. If the "+" sign is typed, an error results.
 If the operator notes an error before striking the "tab ⑤", he may retype the value by typing: 000. The computer executes a carriage return and rings the bell. The operator may now type the correct numerical value.
 If the error is noted after the "tab ⑤", the operator may type: ⑤ cf and return to Step 18.

Spaces are needed:

When a single variable follows a special arithmetic or library operator;

Between TITLE, LIBRARY, FORMAT, DATA, CONSTANT SUBSCRIPT, PROCEDURE, FUNCTION, IF, FOR, GO TO or DO and the following identifier;

Between a statement and a following BEGIN or END parenthesis;

Between two or more successive BEGIN or END parentheses;

Between a process identifier and the opening parenthesis in a process call statement; and

Between a process identifier and the preceding operator in a statement containing a process call.

There must be no space between a label and the following colon in a labeled statement. *No more than one space after colon*

The operator has the option of inserting or omitting all other spaces.

A statement which is too long for one line may be continued on the next line.

Remember:

The maximum number of:

Fixed point formats in a program is 7,

Constants in one array is 255;

Library routines is 12;

Data in one array is 255;

Data arrays in one declaration is 16;

Subscripts is 20 with no more than 16 in one declaration;

Subordinate processes is 9;

Declared parameters is 15 for one process;

Declared parameters is 30 for a program;

Labels is 20 in one process;

Label and BEGIN statements in a program is 40;
and

Variables in a procedure or in a master and its functions is 49.

PURPOSE AND TYPE-OUTS

INTRODUCTION

During operation with each magazine, the computer types information and instructions to the operator. The following sections discuss briefly the purpose of each magazine and explain the type-outs which occur during the operation of each magazine.

MAGAZINE NO. 1

Magazine No. 1 partially edits the information of the Algo language program typed by the operator. Initially, Magazine No. 1 is read from either paper tape or magnetic tape. The computer then types at intervals the following information.

MODE?	The computer asks the operator to indicate either a paper tape or magnetic tape scratch pad.
SET MAG SW = 1	If the operator indicates a magnetic tape scratch pad, the computer directs the operator to put the Tape Unit Selector switch on the Magnetic Tape Unit to the 1 position.
DDD	The computer types the file identification number of the block on magnetic tape used as a scratch pad.
1. TITLE	The computer is now ready for the Algo language program. After the operator types the title of the Algo language program followed by "tab Ⓢ," the computer executes a carriage return and types the entry number of the next line of the program. After each line and "tab Ⓢ," the computer executes a carriage return and types the next entry number. The computer types one more entry number than there are lines in the program.
LOAD No. 2	The computer is now ready for Magazine No. 2. The operator puts Magazine No. 2 on the photo reader.

Other type-outs in Magazine No. 1 are error indications. See Chapter 5 on Error Detection and Correction - Magazine No. 1.

MAGAZINE NO. 2

Magazine No. 2 allocates memory locations and transmits to Magazine No. 3 the information received from Magazine No. 1. It also further edits the program information for errors and organizes the logical flow of the object program.

During the processing of the information in Magazine No. 2, there are a series of type-outs. The following discussion presents the various type-outs and their meaning.

Mount No. 1 Output	The computer indicates that it is ready for the information punched on tape during the operation of Magazine No. 1.
DDD tab DDD	If there is either a data or constant array, the computer types the entry number of the declaration. The computer then tabs (tabulates) and types the memory location of the first element of the array. Leading zeros are not typed.
Identifier DDD Label AA	The computer types each variable and its location in memory. The computer also types the process labels and a number assigned by Magazine No. 2 to the label. Both type-outs occur in the sequence in which the variables and labels first appear in the process.
2 CARRIAGE RETURNS	The computer executes two carriage returns after encountering the END statement of each process.
AAA BBB	The computer, after encountering the END statement of the master process executes two carriage returns and types two numbers. The two numbers are called "Key Numbers" and are used by the operator in Magazine No. 3. Leading zeros are suppressed.
LOAD No. 3	The computer now indicates that it is ready for Magazine No. 3.

Other type-outs in Magazine No. 2 are error indications. See Chapter 5 on Error Detection and Correction - Magazine No. 2.

MAGAZINE NO. 3

Magazine No. 3 translates and analyzes material transmitted by Magazine No. 2 and builds the commands of the object program from the information.

AA BBBOCCC The type-out concerns the labels of the Algo language program. The AA is the number typed after the label in Magazine No. 2. The BBBOCCC is actually two numbers separated by a zero. The BBB is the memory location of the first command of the object program necessary to solve the labelled statement. The CCC is the memory location of a command which, at the option of the operator, types-out the results of the labelled statement. The command is called a "snapshot" command and the CCC is the location of the "snapshot."

For example, an Algo language program has the following labelled statement:

ALPHA: $x = y * z \uparrow 2 + \text{EXP}(y + z)$

In Magazine No. 2, the compiler typed:

ALPHA 11

In Magazine No. 3, the computer types:

11 0640085

The 064 indicates the location of the first command associated with the label. The 085 indicates the location of the snapshot command. The use of the snapshot command is discussed in Magazine No. 4.

TYPE KEY NUMBERS The computer indicates to the operator that it wishes the two numbers typed in Magazine No. 2. The operator types the numbers in the form "AAA tab BBB tab Ⓢ."

REWIND No. 3 The computer directs the operator to rewind Magazine No. 3. The operator may use the Paper Tape switch on the base of the typewriter or the Input Tape Control switch on the front of the computer.

MOUNT No. 2 Output The computer indicates that it is ready for the information punched on tape during the operation of Magazine No. 2.

Error halts occur in Magazine No. 3. The operator may then cause the computer to type information regarding the type of error halt. See Chapter 5 on Error Detection and Correction - Magazine No. 3.

MAGAZINE NO. 4

Magazine No. 4 contains the library routines and operates on the object program to produce a solution to the program. Operation in Magazine No. 4 may be in one of two modes, automatic or manual.

Automatic Mode

In the automatic mode, the computer halts, rings a bell, and waits for the operator to type the numeric value of the quantity specified as a KEYBD variable in the Algo language program. The computer accepts the value for each KEYBD variable one at a time in the sequence in which they occur in the program. The operator may type the number in fixed-point or floating-point notation. A "tab Ⓢ" follows each number. A "+" sign must not precede a positive number. If a "+" sign is typed, an error results. See Chapter 5 on Error Detection and Correction.

The snapshot commands, discussed in the section on Magazine No. 3, permit the operator to look at the results of a labelled statement. In the automatic mode, the Paper Tape switch on the typewriter base must be in the PUNCH position for the computer to obey the snapshot and to type-out the results of a labelled statement. If the switch is put in the PUNCH position at the beginning of the operation in Magazine No. 4, the computer automatically types-out the results of every labelled statement. The form of the type-out is:

CCC F±DD.DDDDD

The CCC is the location of the snapshot command and the F±DD.DDDDD is a floating-point value.

If the Compute switch is at BP, the computer will automatically stop at the snapshot command. The operator may then put the Paper Tape switch in the PUNCH position. The operator cycles the Compute switch to resume operation.

The status of a snapshot command may be altered in the manual mode. Other type-outs in Magazine No. 4, which occur in the automatic mode, are error indications and are discussed in Chapter 5.

Manual Mode

The computer transfers control to the manual mode after reading the contents of Magazine No. 4. The operator starts the program by typing "01, tab Ⓢ." The operator may use the manual mode to inspect or correct the contents of a memory location or to insert information into a memory location.

To transfer control to the manual mode during the execution of the object program, the operator types: Ⓢ cf. After the Compute switch is returned to GO, the computer halts and waits for instructions from the typewriter keyboard.

If the operator types "S cf" at any arbitrary point during the execution of the object program, the operator must exercise caution when resuming operation in the automatic mode. If the transfer to the manual mode occurs during the computation of program variable, the current value of the variable may be in error and the operator should go to the beginning of the program when returning to the automatic mode.

The operator may also go to the manual mode by first putting the Compute switch to BP and waiting for the computer to halt on a snapshot command. The operator may then type: S cf and return the Compute switch to GO. In this manner, the operator avoids losing the contents of a memory location.

To inspect the current value of a program variable in location DDD, type: -DDD tab S. The number DDD is the memory location associated with the variable and typed in Magazine No. 2. The computer types the contents in floating-point notation and executes a carriage return. The form of the type-out is: F±DD..DDDDD.

To insert information into location DDD, first inspect the location by means of the "-DDD tab S" instruction. Then put the Paper Tape switch in the PUNCH

position and type the information to be inserted. In the manual mode, any number typed with the Paper Tape switch in the PUNCH position is automatically entered into the location inspected by the "-DDD tab S" instruction.

A zero may not be inserted using a "-DDD tab S." A small, floating-point number such as 12.001 is effectively zero for most purposes.

The "-DDD tab S" instruction also alters the status of a snapshot command where the DDD is the address of the snapshot command. The instruction causes a snapshot command to be ignored. If the operator previously altered a snapshot command, he may again change the snapshot command to the original status by the instruction.

To return to the automatic mode from the manual mode the operator types one of the following:

- tab S computation resumes at the point where interrupted;
- .1 tab S computation starts at the beginning of the program;
- DDD tab S computation starts at location DDD.

In either the "-DDD tab S" or the "DDD tab S" instruction, leading zeros need not be typed.

INTERRUPTING OPERATION

INTRODUCTION

In the Paper Tape to Paper Tape mode, the operator may interrupt an Algo program at the end of Magazine No. 1 or No. 2 and resume operation later at the next successive magazine. The output tape from Magazines No. 1 and No. 2 must be saved if the program is interrupted at the end of either of these magazines.

The operator should not halt a program between Magazines No. 3 and No. 4. However, he may start at Magazine No. 4 if he has previously run the program and has the object program on paper tape. Using Magazine No. 1, the operator may enter several Algo language programs before proceeding to Magazine No. 2. After the first program is entered, the computer has punched an output tape and typed "LOAD No. 2," the operator may type: Ⓢ cf, and return to the point where the computer types "1. TITLE." The operator may now enter the second program. To avoid confusion, he must clearly mark the output tape for each program.

STARTING AT MAGAZINE NO. 2

The operator must have the output tape from Magazine No. 1.

1. Load Magazine No. 2. When the photo reader light goes out, return the Compute switch to BP.
2. The computer reads tape and halts.
3. Cycle the Compute switch to GO.
4. Return to Step 9 of the Operating Instructions for the Paper Tape to Paper Tape mode.

STARTING AT MAGAZINE NO. 3

The operator must have the output tape produced during operation with Magazine No. 2.

1. Load Magazine No. 3. When the photo reader light goes out, return the Compute switch to BP.
2. The computer reads tape and halts.
3. Cycle the Compute switch to GO.
4. Return to Step 12 of the Operating Instructions for the Paper Tape to Paper Tape mode.

STARTING AT MAGAZINE NO. 4

The operator may run an object program, previously punched on paper tape, at any time using Magazine No. 4.

1. Put the object program tape on the photo reader and type: p.
2. Return the Compute switch to GO when the photo reader light goes out.

3. If Magazine No. 4 is in memory, the computer halts and rings a bell. To start the program, type: Ⓢ1 tab Ⓢ.

If Magazine No. 4 is not in memory, the computer types: LOAD No. 4.

When mounting Magazine No. 4, cycle the Compute switch to BP (if to GO, the computer punches tape). When the computer halts on BP after reading the library routines, cycle the Compute switch. The computer reads tape, halts and rings a bell. To start the program, type: Ⓢ1 tab Ⓢ.

USING MAGAZINE NO. 4 FROM MAGNETIC TAPE

The operator may use Magazine No. 4 from a magnetic tape master to run an object program which was previously punched on paper tape.

1. Place the tape containing the object program on the computer photo reader.
2. Type: p. When the photo reader light goes out, return the Compute switch to GO.
3. The computer again reads tape and types:
LOAD No. 4
4. Remove the tape containing the object program and put the Magnetic Tape Service Routine—Application's Project No. 61 on the computer photo reader.
5. Type: p. When the photo reader light goes out, return the Compute switch to BP. (If to GO, the computer will punch the object program on tape). The computer immediately halts when the Compute switch is returned to BP.
6. Type: 2DDD tab Ⓢ.

The "2DDD" is the file number of the identification block on magnetic tape containing the contents of Magazine No. 4. The operator may obtain the number from the record maintained at the computer installation.

7. The computer searches magnetic tape and reads the contents of Magazine No. 4 into memory when the identification block is located.
8. When the computer halts after reading magnetic tape, cycle the Compute switch.
9. The computer again reads magnetic tape, rings a bell and halts.
10. Type: Ⓢ1 tab Ⓢ, to start the program.
11. Return to Step 17 of the Operating Instructions for Magnetic Tape to Magnetic Tape mode.

ERROR DETECTION AND CORRECTION

INTRODUCTION

In each of the four packages of the Algo system, the computer types error indications. These error indications guide the operator in checking and debugging the program.

The Updater part of the Algo system permits the operator to correct, delete or add to the Algo language program. Errors, not corrected during the entrance of the program in Magazine No. 1, may be corrected with the Updater.

The following sections list the error indications for each magazine and the method of using the Updater.

MAGAZINE NO. 1

Magazine No. 1 is the "editor" portion of the Algo system. The purpose of the magazine is to condense the program information for further processing in Magazines No. 2 and No. 3 and to check the typed information for errors.

In the interest of machine efficiency, check each line of the Algo language program before striking "tab Ⓢ." If an error is noted, type: $\rightarrow$ (the upper case of the numeral 1). The computer automatically returns the carriage and retypes the entry number of the line. Retype the line.

If the computer is still processing information from the previous line when receiving a $\rightarrow$, there may be a short delay. The operator must wait for the computer to return the carriage and retype the entry number before entering the declaration or statement in the correct form.

If an error is noted before "tab Ⓢ" while entering the constants of an array, type: $\dots$. The computer returns the carriage and retypes the entry number. Retype the constant.

Several typographical errors are quite common and the operator should check each declaration and statement for these errors before striking "tab Ⓢ." These errors are:

Omitting either an opening or closing parenthesis;
Striking the 5 (lower case) instead of the = (upper case);

Having too many commas within parentheses; and
Typing the wrong alphabetic characters.

In many instances, Magazine No. 1 detects an error after "tab Ⓢ." The computer then types: ERROR. The sequence of steps is as follows:

```
DDD      Line with error  tab Ⓢ
DDD + 1   Next Line
ERROR
DDD      Operator now types line correctly.
```

If the operator has started typing the next declaration or statement, the computer interrupts the typing by executing the carriage return. The operator need not be alarmed. He types the correct entry and then the computer types the next entry number. He then retypes this line of the Algo program.

Example 1

```
DDD      PROCEDURE   Polyx (r5sum) Ⓢ
DDD + 1   CONSTAnt   A (5) Ⓢ

ERROR

DDD      PROCEDURE   Polyx (r = sum) Ⓢ
DDD + 1   CONSTAnt   A (5) Ⓢ
```

In some instances an error, not detected in Magazine No. 1, is noticed after the "tab Ⓢ." The operator may correct the error by means of the Updater, or by returning to the beginning of the program. To return to the beginning, he types: Ⓢ cf. The computer then types: 1. TITLE.

LIBRARY The library declaration must be on line 2 of the program. A space must separate LIBRARY and the following identifier. Magazine No. 1 does not detect the lack of a space between LIBRARY and the following identifier. The operator may not use the Updater to correct an error in the library declaration. He types: Ⓢ cf and re-enters the program. If the library declaration occurs on some other line, the computer indicates an error. The operator must return to the beginning of the program by typing: Ⓢ cf, and re-entering the program with the library declaration on line 2.

Example 2

```
.....
6. LIBRARY SIN (0101000) Ⓢ
7.

ERROR
6. Ⓢcf
1. TITLE ..... Ⓢ
2. LIBRARY SIN (0101000) Ⓢ
```

LIBRARY If the closing parenthesis is omitted, the computer indicates an error.

Example 3

```
2. LIBRARY COS (0168000) Ⓢ
3.

ERROR
2. LIBRARY COS (0168000) Ⓢ
```

The code number of a library routine must be less than 0900000.

Example 4

A machine language subroutine to find the 4th root of a quantity has the check sum 0800000 and the entry point is at word time 85.

2. LIBRARY FOURT (0995000) Ⓢ

3.

ERROR

2. LIBRARY FOURT (0885000) Ⓢ

Four types of errors cause the computer to type:

TAPE SUBPROCEDURES CANNOT BE USED IN
THIS PACKAGE

ERROR

If the opening parenthesis is omitted the computer indicates an error.

Example 5

2. LIBRARY SIN (0101000) Ⓢ

3.

TAPE SUBPROCEDURES CANNOT BE USED IN
THIS PACKAGE

ERROR

2. LIBRARY SIN (0101000) Ⓢ

Only machine language subroutines may be used with the library declaration. The subroutines are added to Magazine No. 4 as discussed in the section, Library Expansion. The library declaration must not be used to identify Algo language subroutines.

Example 6

2. LIBRARY ALPHA Ⓢ

3.

TAPE SUBPROCEDURES CANNOT BE USED IN
THIS PACKAGE

ERROR

2.

If both the opening and closing parentheses are omitted or if the library declaration contains the identifier of a routine and not the code number, the computer indicates an error.

Example 7

2. LIBRARY SIN Ⓢ

3.

TAPE SUBPROCEDURES CANNOT BE USED IN
THIS PACKAGE

ERROR

2. LIBRARY SIN (0101000) Ⓢ

PROCEDURE
and
FUNCTION

If the opening parenthesis is omitted or the space between PROCEDURE and identifier or between FUNCTION and identifier is omitted, the error is not detected in Magazine No. 1. The operator may correct errors using the Algo Updater.

If the = operator within parentheses is mistyped, the computer types an error indication.

Example 8

4. PROCEDURE A (x, y5z) Ⓢ

5.

ERROR

4. PROCEDURE A (x, y = z) Ⓢ

The computer gives an error indication if the closing parenthesis is omitted.

Example 9

6. FUNCTION AA (x, y = z) Ⓢ

7.

ERROR

6. FUNCTION AA (x, y = z) Ⓢ

FORMAT

The declaration must not specify more than 26 characters in one format. There may not be more than 14 digits, tabs, periods, or carriage returns in one format.

Example 10

7. FORMAT ALPHA (S10D2P10DC4T) Ⓢ

8.

ERROR

7. FORMAT ALPHA (S6DP8DC4T) Ⓢ

The letter T or C may not precede a D.

Example 11

7. FORMAT AA (S5DPC4DT) Ⓢ

8.

ERROR

7. FORMAT AA (S5DP4DCT) Ⓢ

If the specified format contains an alphabetic character other than S, D, P, T or C, the computer indicates an error.

Example 12

7. FORMAT BB (S5EP3DC) Ⓢ

8.

ERROR

7. FORMAT BB (S5DP3DC) Ⓢ

If the closing parenthesis is omitted, the computer indicates an error.

Example 13

7. FORMAT BETA (S3DP2DT) Ⓢ

8.

ERROR

7. FORMAT BETA (S3DP2DT) Ⓢ

SUBSCripts

If the opening parenthesis is omitted, the operator must use the Updater to correct the error.

An Algo program may not have more than 20 subscripts in a program nor more than 16 subscripts in one declaration.

Example 14

```
8. SUBSCript  a, b, c, d, (e, f), g, h, i, j,
               (k, l), m, (n, p), q, r, s, t  (S)
9.
ERROR
9.
```

The programmer should reorganize the Algo language program to eliminate the excess subscripts and use the Updater to make the necessary program changes.

In paired subscripts, the omission of the closing parenthesis causes an error. The operator retypes the declaration starting with the paired subscripts where the error occurred.

If the opening parenthesis of paired subscripts is omitted, the operator corrects the error by means of the Updater.

Example 15

```
8. SUBSCript  a, b, c, (d, e, f  (S)
9.
ERROR
9. SUBSCript  (d, e), f  (S)
```

If more than one comma is present within the parentheses of paired subscripts, the computer indicates an error. The operator retypes the declaration from the paired subscripts containing the error.

Example 16

```
8. SUBSCript  a, b, c, (d, e,), f  (S)
9.
ERROR
9. SUBSCript  (d, e), f  (S)
```

CONSTant

In a constant declaration an alphabetic character within parentheses or the omission of a closing parenthesis causes the computer to give an error indication.

Example 17

```
9. CONSTant  A (w)  (S)
10.
ERROR
9. CONSTant  A (2)  (S)
10.
ERROR
9. CONSTant  A (2)  (S)
```

After the operator types the constant declaration, the computer returns the carriage and types the next entry number, rings a bell, and halts. Wait for the computer to retype the number before typing the constants.

Example 18

```
8. CONSTant  A (2)  (S)
9.
9. 1  (S)
10. 2  (S)
```

If an error is made while typing the constants, the operator should strike the `o` key three times.

Example 19

```
8. CONSTant  A (2)  (S)
9.
9. 1  oo
ERROR
9. o1  (S)
10. o2  (S)
```

Example 20

```
8. CONSTant  A (2)  (S)
9.
9. 50oo1  (S)
10. 51oo2  oo
ERROR
10. 50oo2  (S)
```

If an alphabetic character is typed instead of a numeric when entering the constants, type: `ooo`, to correct the error.

Example 21

```
8. CONSTant  A (2)  (S)
9.
9. Looo
ERROR
9. 1  (S)
10. 2  (S)
```

If more than one array is declared in a constant declaration, the computer accepts the values of each array in sequence and types the entry number for each element of the arrays. The entry numbers increase by 1 for each value of the array. However, the computer skips one entry number between the last value of one array and the first value of the next array.

Example 22

```
8. CONSTant  A (2), B (2)  (S)
9.
9. 1  (S)
10. 2  (S)
12. 1o1  (S)
13. 1o2  (S)
```

If, in the declaration of more than one array, an error is made in an array other than the first, the computer accepts the values of the array or arrays preceding the array in error. The operator then retypes the constant declaration from the array in error.

Example 23

```
9. CONSTANT A (2), B (2), C (2) ⑤
10.
11. 1 ⑤
12. 2 ⑤
13. 1.0 ⑤
14. 1.1 ⑤
ERROR
15. CONSTANT C (2) ⑤
16.
17. 2.0 ⑤
18. 2.1 ⑤
```

If the array is two dimensional, and if there is more than one comma within parentheses, the computer indicates an error.

Example 24

```
8. CONSTANT AA (2, 2), B (2) ⑤
9.
ERROR
8. CONSTANT AA (2, 2), B (2) ⑤
9.
9. 1.5 ⑤
10. ....
```

If an error is noted in the value of one of the elements of the array after "tab ⑤," the operator may correct the error by means of the Updater.

DATA

The data declaration must have the array identifier and a number or numbers enclosed in parentheses. If the closing parenthesis is omitted or an alphabetic character typed within the parentheses, the computer indicates an error.

Example 25

```
9. DATA ALPHA (5) ⑤
10.
ERROR
9. DATA ALPHA (R) ⑤
10.
ERROR
9. DATA ALPHA (5) ⑤
```

If the array is two dimensional, more than one comma within the parentheses causes an error.

Example 26

```
9. DATA BETA (6, 6) ⑤
10.
ERROR
9. DATA BETA (6, 6) ⑤
```

If the declaration specifies more than one array and an error is made in an array other than the first, the entire declaration must be retyped.

Example 27

```
9. DATA ALPHA (5), BETA (5, 5), GAMMA (5, 5) ⑤
10.
ERROR
9. DATA ALPHA (5), BETA (5, 5), GAMMA (5, 5) ⑤
```

Mechanical Statements

```
BELLS (n)
PERIOD (n)
TABS (n)
CARR (n)
```

If the opening or closing parenthesis is omitted or if an alphabetic character is written in the parentheses, the computer indicates an error.

Example 28

```
20. BELLS 5) ⑤
21.
ERROR
20. BELLS (R) ⑤
21.
ERROR
20. BELLS (5) ⑤
```

If the number within parentheses is greater than 14, the computer indicates an error.

Example 29

```
20. PERIOD (20) ⑤
21.
ERROR
20. PERIOD (14) ⑤
```

Typewriter Output
PRINT ()

If either or both parentheses are omitted in a PRINT statement, an error results which must be corrected by means of the Updater.

If the format identifier is omitted entirely, the print statement is interpreted as an algebraic statement. For example:

```
30. PRINT = x ⑤
```

Algo will interpret PRINT as an identifier. The statement may be corrected by means of the Updater.

If nothing follows PRINT, the computer indicates an error.

Example 30

```

30. x = LOG y ⑤
31. PRINT ⑤
32.
ERROR
31. PRINT (FL) = x ⑤

```

Tape Input-
Output
READ ()
WRITE ()

If either the opening or closing parenthesis is omitted, or if an alphabetic character other than P is enclosed in the parentheses, the computer indicates an error.

Example 31

```

20. READ (P A ⑤
21.
ERROR
20. READ (L) A ⑤
21.
ERROR
20. READ (P) A ⑤

```

Control
Statements
DO
GO TO
IF

The computer indicates an error if the DO, GO TO, and IF statements are not immediately followed by a space.

Example 32

```

25. GO TOLAMBDa ⑤
26.
ERROR
25. GO TO LAMBDa ⑤

```

If a space does not follow the IF and the relationship following IF is an equal relationship, Algo accepts the statement as an algebraic statement.

For example:

```

20. IFA = B + C ⑤

```

The statement is incorrectly interpreted by Algo. The statement may be corrected by means of the Updater.

In statements which call a process, Algo gives an error indication if the space between the process identifier and the opening parenthesis is omitted.

Example 33

```

20. ALPHA(A = B) tab ⑤
21.
ERROR
20. ALPHA (A = B) tab ⑤

```

MAGAZINE NO. 2

Magazine No. 2 allocates memory locations for all the identifiers of an Algo language program. Magazine No. 2 also gives some error indications which are alphanumeric type-outs accompanied by the entry number of the declaration or statement con-

taining the error. Leading zeros are suppressed on the entry numbers. The form of the type-out is:

ABC (tab) ddd

The following discussion gives the meaning and method of correcting each of the error indications.

Dic (tab) 2

More than 12 library routines are present in the Algo language program. The programmer must reorganize the program to eliminate the excess library routines and re-enter the entire program. An error in the library declaration may not be corrected by means of the Updater.

Fmt (tab) ddd

The program has more than 7 fixed-point output formats. The ddd is the entry number of the format declarations. The computer types the "Fmt (tab) ddd" for every format after the seventh. Reduce the number of formats and use the Algo Updater to correct the program.

Pio (tab) ddd

The program has more than 30 input-output process variables. The ddd indicates the entry number of the process declaration containing the excess input-output variables. The computer repeats the error indication for each variable in excess of 30. Use the Updater to correct the program.

PT1 (tab) fff

The program contains more than 9 subordinate processes. The number, fff, is the entry number of the BEGIN statement of the process. For every subordinate process in excess of 9, the error type-out occurs. Reorganize the program and make the changes by means of the Updater.

La1 (tab) ddd

A process, whether master or subordinate, contains more than 20 labels. The ddd is the entry number of the labelled statement. The type-out occurs for every labelled statement in excess of 20 in the process. Use the Updater to make the necessary program changes.

St1 (tab) ddd

The program, including master and subordinate processes, has more than 40 labelled and BEGIN statements. The ddd is the entry number of the labelled or BEGIN statement in excess of 40. Correct the program by means of the Updater.

Var (tab) ddd

There are more than 49 variables in a Procedure, or in a Function and its master process, or in a master process alone. The ddd is the entry number of the statement containing the variable in excess of 49. The type-out continues for every variable in excess of 49. Use the Updater to make the necessary changes.

LGE (tab) ddd

The Algo language program is too large for the computer memory. The ddd is the entry number of the declaration or statement where the Algo language program exceeded the capacity of the internal memory. Check the size of declared arrays and reduce the number of elements of the array, and use the Updater to alter the program.

PT2 (tab) ddd

The process identifier following a DO is not found. The ddd is the entry number of the DO statement. Recheck the identifier in the DO statement and process declaration. Use the Updater to correct the statement or declaration.

FT2 (tab) ddd

The format specified in a print statement is not found. The ddd is the entry number of the print statement. Recheck the format declaration and print statement to see if the format identifiers agree. Use the Algo Updater to correct the error.

La2 (tab) ab (carriage return) eee

A label used in a process is not declared in the process. The ab is the number assigned by Magazine No. 2 to the label (see Chapter 3 on Purpose and Type-outs-Magazine No. 2). The eee is the entry number of the END statement in the process containing the label. Recheck the labelled and GO TO statements. Use the Algo Updater to make the necessary changes to the program.

DT2 (tab) ddd

An END parenthesis is followed by something other than another END parenthesis. The ddd is the entry number of the statement where Algo detected the error. Check the program for incorrect or extraneous information. Use the Updater to correct the statement in error.

Brk (tab) ddd

The identifier after an opening bracket is not a de-

clared subscript. The ddd is the entry number of the statement in error. Check the contents of the brackets and also look for the closing bracket. Use the Algo Updater to make the necessary correction.

-ln (tab) ddd

A FOR statement using a subscript has a negative value for either the base, difference, or limit. The ddd is the entry number of the FOR statement in the Algo language program. Check the FOR statement and the values initially assigned to the base, difference and limit. Use the Algo Updater to correct the error.

lcc (tab) ddd

The program has an inconsistent character. The ddd is the entry number of the declaration or statement containing the error. Check for a hollow point in alphanumeric characters or for an alphanumeric character in numbers. Use the Algo Updater to correct the error.

SPn (tab) eee

The error indicates that the BEGIN and END parentheses are not equal. The eee is the entry number of the END statement of the process containing unpaired BEGIN or END parenthesis. Check the program to see that the BEGIN and END parentheses are paired. Use the Algo Updater to correct the error.

PBE (tab) 511

The BEGIN and END statements in the program are not equal. Check the program for the omission of either a BEGIN or END statement. Correct the error by means of the Algo Updater.

MAGAZINE NO. 3

Magazine No. 3 translates and analyzes the material transmitted from Magazine No. 2. If an error is detected, the computer rings a bell and halts. The operator may determine the type of error as follows:

1. Type: ta
2. Put the Enable switch off. The computer types out a 7 digit number, abddddd. The first 2 digits ab indicate the type of error. The other 5 digits, dddddd, are of no concern to the operator.

Table 1 lists the numbers and explains the type of

error for each number. The operator may correct the errors by means of the Algo Updater.

Typed- Number	Type of Error
5yddddd	Double operator the second of which is not a "-". The error occurs with the following operators: +, -, *, /, >, <, =.
04ddddd	Program is too large for computer memory.
2xddddd	More than one opening bracket, [, before a closing bracket,].
56ddddd	Quantity within brackets is neither subscript nor constant.
15ddddd	Operators within brackets are not "+" or "-".
62ddddd	Subscripts used are not paired.
21ddddd	Subscripts separated by character other than comma.
16ddddd	Omission of an operator, parenthesis, or misspelled operator.

Table 1

MAGAZINE NO. 4

Magazine No 4 executes the object program to produce a solution for the program. The error indications in Magazine No. 4 occur during the execution of the object program.

For each quantity specified as a KEYBD variable, the computer halts, rings a bell and waits for the operator to type the numeric value of the quantity. The operator may type the numbers in fixed-point or floating-point notation. The operator types "tab Ⓢ" after each number. A "+" sign before a positive number causes an error.

If an error is detected before striking the "tab Ⓢ", type: 000. The computer types: ...64..., executes a carriage return and waits for the number to be re-typed.

If the error is detected after the "tab Ⓢ", type: Ⓢcf. The computer transfers control to the manual mode. Return the Compute switch to GO and type: Ⓢl tab Ⓢ. The program starts at the beginning.

During the execution of the program, errors may occur which the computer indicates by typing a number of the form ...dd... and executing a carriage return.

...0u...

The program has tried to divide a quantity by zero.

...0v...

The program has tried to take the square root of a

negative number.

...0w...

The value of a subscript has exceeded 1023.

...0x...

The program tried to find the logarithm of zero or a negative number.

...0y...

The program has more than 8 process calls without encountering a RETURN statement.

...0z...

The results of computation have exceeded $\pm 10^{38}$.

UPDATER

The Updater permits the operator to correct errors made while writing or entering the Algo language program. The operator may use the Updater to change, delete or insert a program declaration or statement.

The Updater functions in each of the four modes of operation previously discussed. The operator chooses the mode to correspond with the mode in which the program was originally run.

The operator may make the program modifications after the completion of any one of the four magazines. To make the modifications, the operator must have the output from Magazine No. 1 on either magnetic or paper tape. After the changes have been made, the computer produces a new output tape and continues to process the new information using Magazine No. 2, No. 3, and No. 4.

The operator must exercise caution. If he makes changes after Magazine No. 1 and discovers additional errors in Magazines No. 2, No. 3 or No 4, he must use the original output from Magazine No. 1 and re-enter any changes which he made after Magazine No. 1.

In addition entry numbers, typed by the computer after an error indication in Magazine No. 2, may not correspond with the entry numbers on the program sheet. The entry numbers may be greater if insertions were made or less if deletions were made.

The Updater does not correct two declarations, TITLE and LIBRARY. The operator should re-enter the Algo language program from the beginning.

If a subscript declaration is to be changed or inserted, all the program subscripts, including those in other declarations, must be re-entered. If a subscript declaration is to be deleted, follow the delete instructions.

A constant array may be completely deleted by designating the entry number of the array declaration. An entire constant array, including the declaration and the elements of the array, may be inserted.

An individual element of an array may be changed. However, an individual element of a constant array cannot be inserted or deleted. To delete a single element of a constant array, the operator deletes the entire array and re-enters as an insertion the array and the elements minus the element to be deleted. He uses the entry number of the original constant array to delete the array and to make the insertion, he uses the entry number of the last element of the array plus the insertion number.

If a labelled statement is modified or inserted, the operator must exercise caution. There must be no space after the colon in the labelled statement. For example, he would write:

```
ALPHA:GO TO START
not
ALPHA: GO TO START
```

An operator specifies the declaration or statement to be changed or deleted by the entry number of the declaration or statement.

To insert a declaration or statement, the operator types a number of the form DDD.EEE. The DDD to the left of the hollow point is the entry number of the declaration or statement preceding the insertion. The EEE to the right of the hollow point is a number from 1 to NNN and is the number of the insertion. Leading zeros need not be typed. As many insertions as desired may be made between two lines of an Algo language program.

For example, to insert a constant array of 12 elements between lines 6 and 7 of a program, the operator types: 6.1; 6.2; . . . 6.10; 6.11; 6.12; 6.13. However, if the operator inserts a statement between lines 6 and 7 and between lines 15 and 16, he types: 6.1 and after following the instructions for the insertion, he types: 15.1 for the next insertion.

A statement may not be inserted between the next to the last and the last statement. To enter an insertion at this point, the operator makes an insertion between the next to the last statement and the preceding statement. He re-enters the next to the last

statement as an insertion and the new statement as a change. For example:

```
16.PRINT (FL)= x
17. PRINT (FL)= y
18.END
```

The operator wishes to insert a statement between lines 17 and 18 to have the computer execute two carriage returns. He then makes the insertion and change as follows:

```
16.1 PRINT (FL)= y
17 CARR (2)
```

Paper Tape-to-Paper Tape

The operator may use the Updater after any of the first four magazines of the Algo system. The operator makes the necessary changes, deletions, or insertions in the sequence in which they occur in the Algo language program.

1. Load the Updater magazine on the computer photo reader. When the photo reader light goes out, return the Compute switch to GO.
2. The computer types: MODE?
3. Type: 2 tab Ⓢ, which indicates a paper tape scratch pad.
4. The computer types: Mount Old No. 1 Output
5. Cycle the Compute switch after the output tape is on the computer photo reader.
6. The computer reads one block of the output tape, rings the bell twice, executes a carriage return and halts. Make the changes, deletions or insertions in the sequence in which they occur in the program.

To change a declaration or statement, proceed to Step 7.

To delete a declaration or statement, proceed to Step 8.

To insert a declaration or statement proceed to Step 9.

During the updating of the program, the computer may read more tape and will also punch a new output tape.

7. To change a line of the program, type the entry number of the declaration or statement to be changed followed by: tab Ⓢ.
- 7a. The computer tabs twice. Type the complete

declaration or statement incorporating the change and follow by: tab Ⓢ .

- 7b. After the "tab Ⓢ ", the computer executes a carriage return, rings a bell and halts.
- 7c. If there are no more changes, deletions or insertions, proceed to Step 10.
8. To delete a line of the program, type the entry number of the declaration or statement to be deleted followed by: tab Ⓢ .
- 8a. The computer tabs twice. Type: tab Ⓢ .
- 8b. After the "tab Ⓢ ", the computer executes a carriage return, rings a bell, and halts.
- 8c. If there are no further changes, deletions, or insertions, proceed to Step 10.
9. To insert a line, type: DDD.EEE tab Ⓢ . The DDD to the left of the hollow point is the entry number of the declaration or statement preceding the insertion. The EEE to the right of the hollow point is the number of the insertion starting with 1. Leading zeros need not be typed. As many insertions as desired may be made between any two lines. For instance, to insert two statements between lines 6 and 7 of a program, the operator types: 6.1 tab Ⓢ .

After Steps 9a and 9b, he then types: 6.2 tab Ⓢ . However, if the operator is inserting a statement between lines 6 and 7 and another statement between lines 15 and 16, he types: 6.1 tab Ⓢ . After Steps 9a and 9b, he types: 15.1 tab Ⓢ .

- 9a. The computer tabs twice. Type the insertion followed by: tab Ⓢ .
- 9b. After the "tab Ⓢ ", the computer executes a carriage return, rings a bell and halts.
- 9c. If there are no other changes, deletions, or insertions, proceed to Step 10.
10. To terminate, type: tab Ⓢ .

The computer punches a new output tape and instructs the operator in all successive operations. Return to Step 8 of the Operating Instruction for the Paper Tape to Paper Tape Mode.

Paper Tape-to-Magnetic Tape

The operator may use the Updater to correct errors detected in any of the four operating magazines of the Algo system and may make the corrections following the completion of any one of the four magazines. The operator makes the changes, deletions

or insertions in the sequence in which they occur in the Algo language program.

1. Load the Updater on the computer photo reader. When the photo reader light goes out, return the Compute switch to GO.
2. The computer types: MODE?
3. Type: 1 tab DDD tab Ⓢ , where DDD is the file number of the output of Magazine No. 1. Leading zeros need not be typed.
4. The computer types: SET MAG SW = 1.
5. Cycle the Compute switch.
6. The computer searches for the original output from Magazine No. 1 and reads and writes the contents of the block containing the output on another block of tape. The computer types the file number of the new location of the original output of Magazine No. 1. The computer rings a bell twice and halts.

To change a declaration or statement, proceed to Step 7.

To delete a declaration or statement, proceed to Step 8.

To insert a declaration or statement, proceed to Step 9.

During the updating of the program, the computer may read from tape and will write on magnetic tape.

7. To change a line of the program, type the entry number of the declaration or statement to be changed followed by: tab Ⓢ .
- 7a. The computer tabs twice. Type the complete declaration or statement, incorporating the change, followed by: tab Ⓢ .
- 7b. After the "tab Ⓢ ", the computer executes a carriage return, rings the bell and halts.
- 7c. If there are no more changes, deletions or insertions, proceed to Step 10.
8. To delete a line of the program, type the entry number of the declaration or statement to be deleted followed by: tab Ⓢ .
- 8a. The computer tabs twice. Type: tab Ⓢ .
- 8b. After the "tab Ⓢ ", the computer executes a carriage return, rings the bell and halts.
- 8c. If there are no other changes, deletions or insertions, proceed to Step 10.
9. To insert a line, type: DDD.EEE tab Ⓢ . The

DDD to the left of the hollow point is the entry number of the declaration or statement preceding the insertion. Leading zeros need not be typed. The EEE to the right of the hollow point is the number of the insertion starting with 1. As many insertions as desired may be made between any two lines. For instance, to insert two statements between lines 6 and 7 of a program, the operator types: 6.1 tab $\textcircled{S}$. After Steps 9a and 9b, he then types: 6.2 tab $\textcircled{S}$. However, if the operator is inserting a statement between lines 6 and 7 and another statement between lines 15 and 16, he types: 6.1 tab $\textcircled{S}$. After Steps 9a and 9b, he types: 15.1 tab $\textcircled{S}$.

- 9a. The computer tabs twice. Type the insertion followed by: tab $\textcircled{S}$.
- 9b. After the "tab $\textcircled{S}$ ", the computer executes a carriage return, rings the bell and halts.
- 9c. If there are no other changes, deletions or insertions, proceed to Step 10.
10. To terminate, type: tab $\textcircled{S}$.

The computer writes on magnetic tape and instructs the operator in all successive operations. Return to Step 11 of the Operating Instructions for the Paper Tape to Magnetic Tape Mode.

Magnetic Tape-to-Magnetic Tape

In the magnetic tape to magnetic tape mode, the operator may make changes in the Algo language program after any of the four operating magazines of the Algo system. The operator makes the changes, deletions or insertions in the sequence in which they occur in the program.

1. Load the Magnetic Tape Service Routine, Application's Project No. 61.
2. When the Compute switch is returned to GO after the photo reader light goes out, the computer halts. Type: 2DDD tab $\textcircled{S}$. The DDD is the file number of the identification block of magnetic tape containing the Updater. The DDD is equal to the file number for Magazine No. 1 plus 4.
3. The computer searches and reads magnetic tape and types: MODE?
4. Type: 1 tab DDD tab $\textcircled{S}$, where DDD is the file number of identification block of magnetic tape used as a scratch pad.
5. The computer types: SET MAG SW = 1.

6. Cycle the Compute switch.
7. The computer searches for the original output from Magazine No. 1, reads the contents of the block containing the output and re-writes the contents on another block of tape. The computer types the file number of the new location of the original output from Magazine No. 1. The computer rings a bell twice and halts.

To change a declaration or statement, proceed to Step 7.

To delete a declaration or statement, proceed to Step 8.

To insert a declaration or statement, proceed to Step 9.

During the updating of the program, the computer may read from tape and will write on magnetic tape.

8. To change a line of the program, type the entry number of the declaration or statement to be changed followed by: tab $\textcircled{S}$.
- 8a. The computer tabs twice. Type the complete declaration or statement incorporating the change and follow by: tab $\textcircled{S}$.
- 8b. After the "tab $\textcircled{S}$ ", the computer executes a carriage return, rings the bell and halts.
- 8c. If there are no more changes, deletions, or insertions, proceed to Step 11.
9. To delete a line of the program, type the entry number of the declaration or statement to be deleted followed by: tab $\textcircled{S}$.
- 9a. The computer tabs twice. Type: tab $\textcircled{S}$.
- 9b. After the "tab $\textcircled{S}$ ", the computer executes a carriage return, rings the bell and halts.
- 9c. If there are no further changes, deletions, or insertions, proceed to Step 11.
10. To insert a line, type: DDD.EEE tab $\textcircled{S}$. The DDD to the left of the hollow point is the entry number of the declaration or statement preceding the insertion. Leading zeros need not be typed. The EEE to the right of the hollow point is the number of the insertion starting with 1. As many insertions as desired may be made between any two lines. For instance, to insert two statements between lines 6 and 7 of a program, the operator types: 6.1 tab $\textcircled{S}$. After steps 10a, and 10b, he then types: 6.2 tab $\textcircled{S}$. However, if the operator is inserting a statement between lines 6 and 7 and another statement between lines 15 and 16, he types: 6.1 tab $\textcircled{S}$.

After Steps 10a and 10b, he types: 15.1 tab **Ⓢ**.

- 10a. The computer tabs twice. Type the insertion followed by: tab **Ⓢ**.
- 10b. After the "tab **Ⓢ**," the computer executes a carriage return, rings the bell and halts.
- 10c. If there are no other changes, deletions, or insertions, proceed to Step 11.
- 11. To terminate, type: tab **Ⓢ**.

The computer writes on magnetic tape and instructs the operator in all successive operations. Return to Step 13 of the Operating Instructions for the Magnetic Tape to Magnetic Tape Mode.

Magnetic Tape to Paper Tape

In the magnetic tape to paper tape mode, the operator may make changes in the Algo language program after any of the four operating magazines of the Algo system. The operator makes the changes, deletions or insertions in the sequence in which they occur in the program.

- 1. Load the Magnetic Tape Service Routine, Application's Project No. 61.
- 2. When the Compute switch is returned to GO, the computer halts. Type: 2DDD tab **Ⓢ**. The DDD is the file number of the identification block of magnetic tape containing the Updater. The DDD is equal to the file number for Magazine No. 1 plus 4.
- 3. The computer searches and reads magnetic tape and types: MODE?
- 4. Type: 2 tab **Ⓢ**.
- 5. The computer reads magnetic tape and types:
Mount Old No. 1 Output
- 6. Cycle the Compute switch.
- 7. The computer reads one block of the output tape, rings the bell twice, executes a carriage return, and halts. Make the necessary changes, deletions, or insertions in the sequence in which they occur in the program.

To change a declaration or statement, proceed to Step 8.

To delete a declaration or statement, proceed to Step 9.

To insert a declaration or statement, proceed to Step 10.

During the updating of the program, the computer may read more tape and will also punch

a new output tape.

- 8. To change a line of the program, type the entry number of the declaration or statement to be changed followed by: tab **Ⓢ**.
- 8a. The computer tabs twice. Type the complete declaration or statement, incorporating the change, followed by: tab **Ⓢ**.
- 8b. After the "tab **Ⓢ**" the computer executes a carriage return, rings the bell, and halts.
- 8c. The computer executes a carriage return, rings the bell and halts. Repeat Steps 8 and 8a for each additional change. If there are no more changes, deletions or insertions, proceed to Step 11.
- 9. To delete a line of the program, type the entry number of the declaration or statement to be deleted followed by: tab **Ⓢ**.
- 9a. The computer tabs twice. Type: tab **Ⓢ**.
- 9b. After the "tab **Ⓢ**" the computer executes a carriage return, rings the bell, and halts.
- 9c. If there are no other changes, deletions, or insertions, proceed to Step 11.
- 10. To insert a line, type: DDD.000 tab **Ⓢ**. The DDD to the left of the hollow point is the entry number of the declaration or statement preceding the insertion. Leading zeros need not be typed. The 000 to the right of the hollow point is the number of the insertion starting with 1. As many insertions as desired may be made between any two lines. For instance, to insert two statements between lines 6 and 7 of a program, the operator types: 6.1 tab **Ⓢ**. After Steps 10a and 10b, he then types : 6.2 tab **Ⓢ**. However, if the operator is inserting a statement between lines 6 and 7 and another statement between lines 15 and 16, he types: 6.1 tab **Ⓢ**. After Steps 10a and 10b, he types: 15.1 tab **Ⓢ**.
- 10a. The computer tabs twice. Type the insertion followed by: tab **Ⓢ**.
- 10b. After the "tab **Ⓢ**" the computer executes a carriage return, rings the bell, and halts.
- 10c. If there are no other changes, deletions, or insertions, proceed to Step 11.
- 11. To terminate, type: tab **Ⓢ**

The computer writes on magnetic tape and instructs the operator in all successive operations. Return to Step 11 of the Operating Instructions for the Magnetic Tape to Paper Tape Mode.

Correcting Tape Reading Errors

If the output from Magazine No. 1 has a recording error, the operator must return to the beginning and re-enter the Algo language program. If the output from No. 2 has an error, the operator may correct the error.

If in the Paper Tape-to-Paper Tape mode, the operator follows the instructions for "Starting at Magazine No. 2" and uses the output from Magazine No. 1. If in any of the other three modes of operation, the operator uses the Updater.

If in the Paper Tape-to-Magnetic Tape mode, the operator follows the instructions for the Updater. At Step 6 when the computer rings the bell twice and halts, the operator types: tab **Ⓢ**. The Updater will instruct the operator in each successive operation.

If in the Magnetic Tape-to-Magnetic Tape mode, the operator follows the instructions for the Updater. At Step 7 when the computer rings the bell twice and halts, the operator types: tab **Ⓢ**. The Updater will instruct the operator in each successive operation.

If in the Magnetic Tape-to-Paper Tape mode, the operator follows the instructions for the Updater. At Step 7 when the computer rings the bell twice and halts, the operator types: tab **Ⓢ**. The Updater will instruct the operator in each successive operation.

HOUSEKEEPER AND LIBRARY

INTRODUCTION

The Housekeeper is an added Algo facility which permits the operator to transfer the contents of the Algo paper tape master to magnetic tape. In addition, the Housekeeper has facilities to revise the paper tape or magnetic tape master.

CORRECTION TAPE

The Bendix Computer Division sends correction tapes to the User's computer installation. The purpose of these tapes is to add to or to modify the existing Algo system.

TRANSFERRING ALGO TO MAGNETIC TAPE

To transfer an Algo paper tape master to magnetic tape:

1. Put the Tape Unit Selector switch on the Magnetic Tape Unit containing the magnetic tape master to the 2 position.
2. Load the Housekeeper on the computer photo reader. Be sure the tape is rewound.
3. The computer reads tape and types:
ANY CORRECTIONS?
4. Type: NO tab ⑤
5. The computer directs the operator in all successive operations. The operator must follow the instructions given by the computer.

REVISING THE ALGO PAPER TAPE MASTER

When revising the Algo paper tape master, the Housekeeper provides a new tape incorporating the changes or additions in the Algo system.

To revise the paper tape master:

1. Load the Housekeeper on the computer photo reader. Be sure the tape is rewound.
2. The computer reads tape and types:
ANY CORRECTIONS?
3. Type: YES UPDATE PAPER TAPE tab ⑤.
4. The computer types: MOUNT CORRECTION TAPE.
5. Cycle the Compute switch.
6. Follow the instructions given by the computer for all successive operations.

REVISING THE ALGO MAGNETIC TAPE MASTER

When revising the Algo magnetic tape master, the Housekeeper transfers the revised contents of Magazines 1, 2, 3 and 4 to new file blocks on the magnetic tape.

To revise the Algo magnetic tape master:

1. Put the Tape Unit Selector switch on the Magnetic Tape Unit containing the magnetic tape master to the 2 position.
2. Load the Housekeeper on the computer photo reader. Be sure the tape is rewound.
3. The computer reads tape and types:
ANY CORRECTIONS?
4. Type: YES tab ⑤.
5. The computer types: MOUNT CORRECTION TAPE.
6. Cycle the Compute switch.
7. Follow the instructions given by the computer for all successive operations.

The computer will type the file number of the block containing the contents of Magazine No. 1.

LIBRARY EXPANSION

The library contains machine language subroutines for use as needed. The programmer may expand the library by adding machine language subroutines to the current system.

The machine language subroutines must have one of the following check sums:

0100000
0200000
0300000
0400000
0500000
0600000
0700000
0800000

The subroutines must be contained in words 00 thru 99. The current library contains three routines, sine, cosine and arctangent with check sum 0100000. The

programmer may use check sum 0100000 only if these routines are removed.

The programmer must balance the line to zero when the program is completed. The balancer may be placed in any word, u0 thru u3 or u5 thru u7. The check sum must be put in u4.

The subroutines operate from line 05 and exit to line 01, word 85. Short lines 21 and 23 may be used. If short lines 20 and 22 are saved and later restored, they may be used.

The accumulator for the subroutines is the MQ two-word register. Either word of the register may be used. The sign of the contents of the accumulator is in the MQ register and not in the IP register.

Before exiting from the subroutine, the overflow indicator must be turned off and line 19 must be cleared. The least significant bit of the even-word of the ID two-word register must be cleared. Lines 20 and 22 must be restored.

Attach the block of tape to the last block of Magazine No. 4. When used, the subroutine must be identified in the library declaration. The code word of the declaration is composed of the check sum of the subroutine and the word number which indicates the starting location. The word number is put in the third and fourth location from the left of the code word. For example, a subroutine has a check sum of 0300000 and starts at word time 71. The code word would be (0371000).

The identifier used in the library declaration becomes the operator in the algebraic statements.

Example 35

A machine language subroutine to find the cube root of a quantity has a check sum of 0400000. The starting location is 27.

2. LIBRARY CBRT (0427000) Ⓢ

.....

21. $X = \text{CBRT } Y$ Ⓢ

The rules for alphanumeric operators apply to the subroutine identifier operator.

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