Canon
Canola
SX-300 SERIES
Programmable Calculator

Instructions

English Edition

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I Specifications

§ 1. Specifications of the Calculator

1. Outlines

1-1 Output System

Display: LED 7 segment

Mantissa part, 14 digits, floating minus, zero suppression

Exponent part, 2 digits, 1-digit sign

Built-in Thermal Printer

5 x 7 dots

Thermal paper

Roll paper for 24 digits

Roll paper for 48 digits

Both are available.

1-2 Input System

Direct input from the keyboard and input from a cartridge tape

1-3 Program System

Stored program system

1-4 Data Memory

Full word:

14-digit mantissa and 1 digit sign

2-digit exponent and 1 digit sign

Short word:

6-digit mantissa and 1 digit sign

2-digit exponent and 1 digit sign

1-5 Memory Capacity

Standard: 30 data memories, 500 program steps

Internal and external expansion of data memories and/or steps are possible

1-6 Calculation

1) Calculation Capacity

14-digit mantissa, and sign of mantissa. 2-digit exponent and sign of exponent.

Dynamic range 10^{-99} to 10^{+99}.

2) Types of calculation

Ordinary calculation:

Following the algebraic logic order.

Addition, subtraction, multiplication, and division.

Parentheses (Up to double parentheses)

Functional calculation: a^x, $\sqrt{\ }$, 1/a, a^2,

3) Calculation Accuracy of Functions

Significant digits of accuracy; 12 digits

4) Rounding and Decimal Point Selection

Manual calculation:

By Decimal Point Selector Dial and Round Form Slide Switch

Programmed calculation:

By program instruction

1-7 Option

External expanded memory, I/O devices others

1-8 General Specifications

Size: 415mm wide x 500mm deep x 155mm high (16-5/16" x 19-11/16" x 6-1/8")

Weight: 14.5 kg (32 lbs.)

Power Source: AC 100/115/220/240 V (±10%) 50/60 Hz 65 ~ 68 W

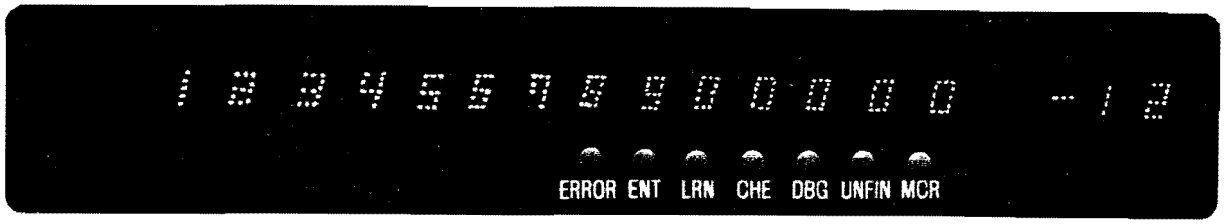
Usable Temperature: 0°C~40°C (32°F~104°F)

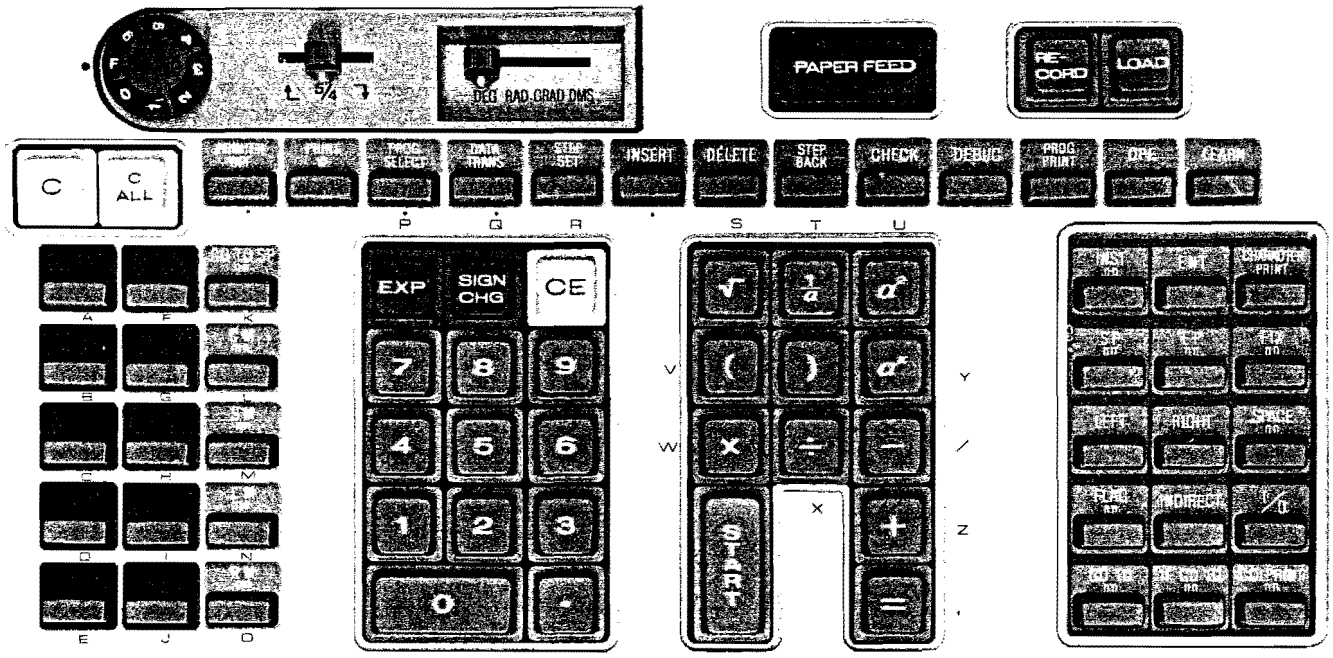
Elements: LSI, TTL

Subject to alterations without notice.

2 Keyboard

2-1 Keyboard Block Chart





2-2 Explanation of the Keyboard

Display

Mantissa Part:

Displays mantissa with scientific floating point system and its sign, or value with fixed decimal point system and its sign. Displays the step number in the Learning, Checking modes or step setting in the Operation mode.

Exponent Part:

Displays an exponent and its sign.

When a value is represented in the fixed decimal point system, this part is blank.

Status Indicating Lamps

ERROR	Indicates error state. (See I §1. 3-3 P7)	
ENT	Indicates entry state.	
LRN	Indicates Learn Mode.	(See IV §1. 1 P13)
CHE	Indicates Check Mode.	
DBG	Indicates Debug Mode.	
UNFIN	Indicates that a combination instruction is not yet finished.	
MCR	Indicates running of magnetic tape cartridge reader.	

Round-Form Slide Switch

Used for round-up, round-off, or round-down to the preselected decimal digits of the results in manual calculation. Rounding is performed, according to designation, at the stage of obtaining the final result. Set the switch to the left for rounding up, to the center for rounding off, and to the right for rounding down.

- ↰ Round up
- 5/4 Round off
- ↱ Round down

Decimal Point Selector dial

Used for designating the decimal point position in the manual calculation result. Designated settings are 0, 1, 2, 3, 4, 5, 6, and F (Scientific floating point) positions below the decimal point.

Control Block

PAPER FEED — Feeds the roll paper continuously.

LOAD — Instructs loading from the cartridge tape.

RE-CORD — Instructs recording on the cartridge tape.

C — Has a clearing function. (See I §1. 3-4 P8 for details)

C ALL — Clears the entire program steps or data area when used in combination with the C key. The order of the key operation; C C ALL (See I §1. 3-4 P8 for details)

PRINTER OFF (lock key) — By locking this key, the auto print function of the built-in thermal printer is turned off. (For further details, see I § 2. 1-4 P8)

PRINT ◇ — Prints out a value on the display or in the buffer register with the ◇ symbol.

PROG SELECT (lock key) — This is a users' program selection key. When this key is locked, the desired program can be searched out and executed by one key depression in the function block. (For further details, see IV §1. 6 P17)

DATA TRANS (lock key) — Transfers data between calculator and cartridge tape with this key locked. For program step transferring, unlock this key.

STEP SET — Desired step setting is done by depressing three-digit number following this key. This key can be used in any mode.

* The four keys shown below are related to "mode". (See IV §1. 1 P13)

OPE — Sets the operation mode. In this mode, all the status indicating lamps are turned out.

LEARN — Sets the learn mode. Indicates with the LRN lamp on.

CHECK — Sets the check mode. Indicates with the CHE lamp on.

DEBUG — Sets the debug mode. Indicates with the DBG lamp on.

* The four keys described below are used in "amending or editing, and confirming the program". (See IV §1. 5 P14)

STEP BACK — LEARN / CHECK: Used to go back one step for examining the program. Plural step backs by continuous depression of this key.

INSERT (lock key) — CHECK: Used to insert additional instructions by locking this key during the amendment or editing of the program.

DELETE — CHECK: Used to delete an instruction during amendment or editing of the program.

PROG PRINT — Used for program printing. Ranges from the designated step to the step where the code 00 is read twice in series.

Ten-Key Block

0 ~ 9 — Used for entering numerals.

. — Used for entering a decimal point.

EXP — Used to specify entry of the exponent part of a value. When no mantissa is entered, number 1 is automatically set as the mantissa.

SIGN CHG — Used for changing the signs of a value.

CE — Used for clearing an erroneous entry or an error state.

Calculation Block

+ − × ÷ — Used for performing addition, subtraction, multiplication and division, respectively.

(— Used for opening parentheses.

) — Used for closing parentheses and for performing a calculation in the parentheses.

= — Used for obtaining results of calculations.

a^x — Used for power calculation. The value entered before operating the a^x key (including the calculated results or intermediate results) is received as base and the value entered after operating the a^x key is the exponent. (Refer to III §2. 4 P12)

$\sqrt{}$ — Used for finding the square root of a figure in the buffer register.

$\frac{1}{x}$ — Used for finding the inverse number of a figure in the buffer register.

a^2

Used for finding the square of a figure in the buffer register.

START

OPE: Used to begin execution of a program.

LEARN / **CHECK**: Used to advance program instructions by one step.

DEBUG: Used to advance program execution step by step.

Function Block

Memory Section

GO TO SP nn — Used in combination with a two-digit numeral representing a symbol.

OPE: Starts program execution after jumping to an SPnn having the same symbol as GO TO SP nn. (See IV §1. 6-2 P18)

LEARN: Program instruction of subroutine jump. (See IV §2. 1-6 P20)

CM nn — Clears a memory. Used in combination with a two-digit figure representing the memory address to be cleared.

ΣM nn — Accumulates the contents of the buffer register into a memory. Used in combination with a two-digit number representing the memory address where the contents are to be accumulated.

RM nn — Recalls the contents of a memory to the buffer register. Used in combination with a two-digit number representing the memory address from which the contents are to be recalled

SM nn — Stores the contents of the buffer register in a memory. Used in combination with a two-digit number representing the memory address where the contents are to be stored.

Program Instruction Block

Used only in the learning and checking modes.

(For further details, see IV §2. 1 P18)

INST nn — Used to input the instruction which has no corresponding key, to amend the numeric part of a program instruction. (character code, symbol, memory address, etc.)

ENT — Data input instruction.

FIX nn — Enters the round instruction in combination with one of the following keys;

0 — Round-down

5 5/4 — Round-off

9 — Round-up

SP nn — Program start instruction

EP nn — Program end instruction

GO TO nn — Unconditional jump instruction

IF GO TO nn — Makes variant conditional jumps in combination with one of the following keys;

= — Non-zero jump instruction

\+ — Positive or zero jump instruction

\- — Negative jump instruction

ENT — Entry jump instruction

CE — Error jump instruction

FLAG nn — Jump destination

LEFT — Left-side memory instruction

RIGHT — Right-side memory instruction

INDIRECT — Indirect memory address instruction

CHARACTER PRINT — Character print instruction (Can also be used at the OPE mode. See II §2. P11)

SPACE nn — Space n-digit instruction

COL PRINT nn — Column print n-digit instruction

I / O — Used in combination with numeral, becomes I/O instructions to select or operate the I/O.

Makes other instructions in combination with the following keys;

0 — Line feed instruction

F — Branch instruction

3. Mathematical Operation

3-1 Mathematical Operation System

(1) Follows algebraic expressions

By depressing the keys following algebraic Parentheses (up to double parentheses) execute the calculations according to their priority in the mathematical operations.

The order of calculation priority

1. Parentheses (up to double parentheses)
2. Functions
3. Multiplications and Divisions
4. Additions and Subtractions

(2) Key operation

You may depress the keys following algebraic expressions. Only in function calculations, the keys for numerals must be depressed before those for the function symbol.

Example: $\sqrt{30} \longrightarrow 30$ [√]

(3) Parentheses

Can execute the calculation containing up to a double parentheses.

Note: The Calculator executes the calculations judging the order of priority in mathematical operations while memorizing the parts which must be calculated later.

An example of maximum use of parentheses:

$a + b \times (c + d \times (e + f \times g^h)) =$

3-2 Data

(1) Entering Numerals

Format on data entry is free, and numerals can be entered free of the Decimal Point Selector. There are three ways of entering; ordinary floating point, scientific floating point, mixed notation. It's available in both manual and program calculations.

For example,

1) 123.4 (Ordinary floating point)
2) 1.23×10^2 (Scientific floating point)
3) 12.34×10^1 (Mixed notation)

(2) Data inside of the Machine

In order to extend the operating range and to improve the accuracy of the calculations, all data are converted to the numerals with scientific floating point system inside of the machine. (as shown in (1) – 2))

(3) Methods of Indication

In the program calculation, the scientific floating point system is applied unless otherwise instructed.

In manual calculation, indication is made with the integer priority system unless otherwise set. In the case of data that cannot be indicated with this system, indication will be automatically changed to the scientific floating point.

Note: In a manual operation, suppose you stored the data, $10^{-13} \leqq x < 10^{-14}$, in a memory with the scientific floating system. When this data is called back, it will be indicated with the integer priority system.

3-3 Error

(1) Kinds of errors

1) Overflow

When the operation result exceeds $9.9999999999999 \times 10^{99}$.

2) Offense against the input conditions.

Negative logarithm, exponential function to the negative base, division by zero, or $\sin^{-1}$ $\cos^{-1}$ functions when the absolute value of the input exceeds 1.

3) Double key touch
4) Error in round instruction. (by dial or by program instruction)

When the number of digits above the decimal point exceeds fourteen digits.

5) Error in the COL-PRINT instruction.

When the number of digits in the data exceeds the number of digits instructed by COL-PRINT instruction.

6) Offense against the condition to calculate following the algebraic expressions.

When a mathematical operation is executed using more working registers than those prepared to execute the operations following the algebraic expressions.

(2) When an error occurs

The Calculator stops and the ERROR Lamp lights. To release the error, depress either the [C] or the [CE] key.

If you want to continue the program execution even after such an error has occured, it is possible to avoid the automatic interlock function of the calculator with SET ERROR DISABLE program instruction. (See IV §2. 1-8 P24)

3-4 Clear

(1) **Kinds of clear instruction**

1) Clear
2) Clear Entry
3) Clear All

(2) **Functions and operations**

Operation / Mode	1) Clear [C]	2) Clear entry [CE]	3) Clear all [C] & [C ALL]
OPE	○ To clear the display, working registers and the step counter. ○ To release the error state	○ To clear the display ○ To release the error state	○ To clear the display, the working registers and the step counter. ○ To release the error state ○ To clear the entire memory area
DBG	Same as OPE	Sale as OPE	Same function as just the [C] key depressed
LRN	Same as OPE	○ To input as an instruction for cleaning the display.	○ To clear the display, the working registers and the step counter. ○ To release the error state ○ To clear the entire step area
CHE	Same as OPE	Same as LRN	Same function as just the [C] key depressed

§ 2. Thermal Printer

1. Specifications

1-1 Printing Speed

One digit: 30 m sec.
Value data: (24 digits, max)
960 m sec (1 line/sec)
Program print: (8 digits, max.)
360 m sec (2.8 step/sec)

1-2 Number of Digits Printed Out

Either 24 digits or 48 digits

1-3 Function

Alphanumeric output function
Function of making tables
Automatic printing OFF function

1-4 Function of the [PRINTER OFF] key

Functions	[PRINTER OFF] Key	
	UNLOCK	LOCK
• Automatic printing in manual calculation.	○	×
• Printing by manual operation of the [PRINT ◇] key.	○	○
• Character printing by manual operation of the [CHARACTER PRINT] keys and Character Codes.	○	○
• Paper feeding by manual operation of the [PAPER FEED] key.	○	○
• Automatic printing for the input data.	○	×
• Instructions for the printer in the Program. (PRINT ◇, LINE FEED, SPACE nn, COLUMN PRINT nn, CHARACTER PRINT)	○	○
• Program printing.	○	○
• Automatic printing in Check mode.	○	×
• Automatic printing in Learn mode.	○	×

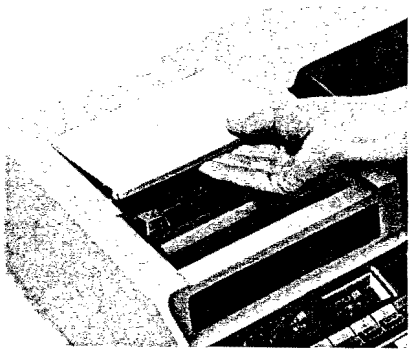
○; Available

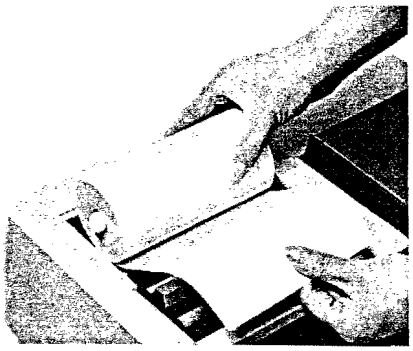
2. Handling of Thermal Printer

2-1 How to Set Thermal Paper

1. Lift up this end of the cover on the Printer.
2. Pass the rod through the Roll Paper and place the Roll Paper in the holder. As printing is done on the outside of the Roll Paper, set the roll paper as the picture shows.
3. Insert the tip of the Roll Paper straight into the feeder.
4. Advance the Roll Paper forward by depressing the PAPER FEED key.

Note: To change the Roll Paper, cut off the tip of the paper from the roll, and depress the PAPER FEED key to remove the tip, and then, take the roll out of the holder.

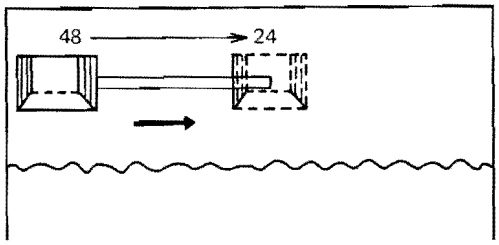


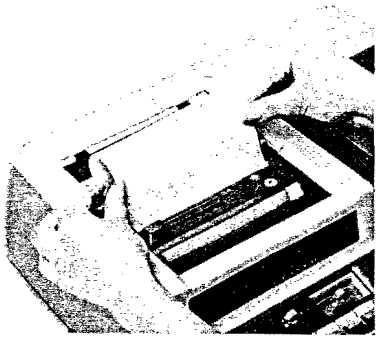


2-2 Changing the Roll Paper from 48-digit (24-digit) to 24-digit (48-digit)

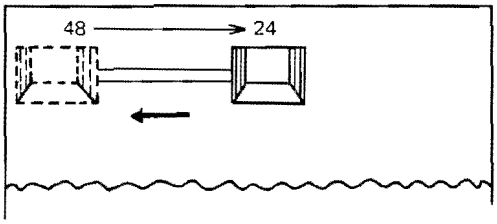
When changing Roll Paper to one with a different paper width, set the Digit Selection Knob according to the width, you intend to use.

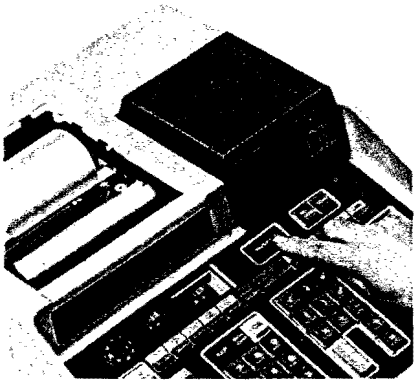
(1) In case of changing from the 48-digit paper to the 24-digit paper:





(2) In case of changing from the 24-digit paper to the 48-digit paper:





Note: Don't touch the Digit Selection Knob while the Roll Paper is still in the holder.
As for cleaning the printing head, see the description of "How to use the Printer Head Cleaner".

§ 3. Magnetic Tape Cartridge Reader

1. Cartridge Tape

Tape length: 1 meter (100 memories or 1000 steps)

1-1 On the Prevention of Overlapping Write

To keep the recorded contents, take off the lower left side plug of cartridge (Write enable plug). Rewriting is possible by putting into the plug again.

1-2 How to Insert into and Take out the Cartridge Tape

Put the magnetic tape cartridge into the Reader keeping the labeled side of the cartridge facing upward. When taking the cartridge out from the Reader, push the EJECT knob forward.

1-3 Handling the Magnetic Tape Cartridge

When the magnetic tape cartridge is not in use, keep it in the case. (See the notes written on the case.)

2. How to Operate the Magnetic Tape Cartridge Reader

2-1 Operation Mode

OPE, LRN, CHE and DBG modes are possible.

After loading or recording, the Reader is automatically switched to OPE mode.

2-2 Discriminating Data and Program

Instruct whether the transferred contents are data or program when loading or recording.

Locking the [DATA TRANS] key instructs that the transferred contents are data.

2-3 Program Transfer

A. LOAD (Transfers contents of cartridge to calculator.)

1. Set the cartridge to the unit.
2. Check that the [DATA TRANS] key is unlocked.
3. Set to the step where the loading start. (See IV § 1. 2 P13)
4. Depress the [LOAD] key.

B. RECORD (Transfers contents of calculator to cartridge.)

1. Set the cartridge to the unit.
2. Check that the [DATA TRANS] key is unlocked.
3. Set to the step where the recording starts. (See IV § 1. 2 P13)
4. Depress the [RECORD] key.

Note: Transferring is carried out from the designated step up to the capacity of cartridge. Although, if blank continues for two steps, or when a blank follows 00 for a symbol, transfer does not continue beyond that step. The step from which the next transfer will begin is displayed.

2-4 Data Transfer

A. **LOAD** (Transfers contents of cartridge to calculator.)

1. Set the cartridge to the unit.
2. Lock the [DATA TRANS] key.
3. Set to the memory address where the loading starts. (Note-1)
4. Depress the [LOAD] key.

B. RECORD (Transfers contents of calculator to cartridge.)

1. Set the cartridge to the unit.
2. Lock the [DATA TRANS] key.
3. Set to the memory address where the recording starts. (Note-1)
4. Depress the [RECORD] key.

Note-1: How to set memory address.

Memory address is set as same as program step setting, but since an address has two digits, input 0 for the third digit. When operation starts from address 00, the [C] key can be used as substitute.

Example: Set to address 12.

[STEP SET] [1] [2] [0]

Note-2: Area to be transferred

Transferring is carried out from the designated address up to the capacity of cartridge.

2-5 Notes for Operation

1. Errors are indicated in the following cases:
   (1) When key operations for recording and loading are performed without setting the magnetic tape cartridge.
   (2) When recording on cartridge which is forbidden rewriting.
   (3) When operating keys while the MCR lamp is lit.
   (4) When transferring error is detected.
2. When not performing recording and loading, be sure to remove the tape from the reader.

II Character Printing Function

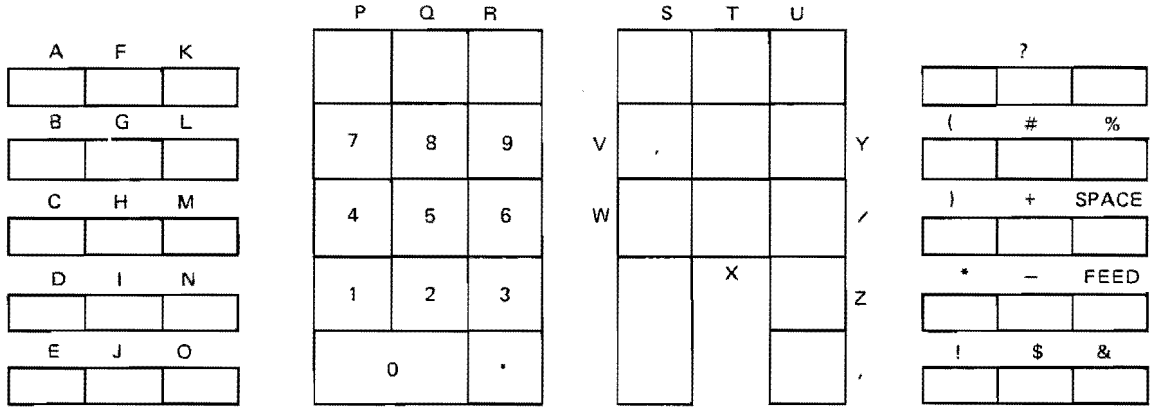
§ 1. Outline

1. Outline

Characters can be printed with the thermal printer. This function can be used in the same way for both manual and program.

Character designations are performed directly with the keys on the keyboard.

2. Arrangement of Character Keys



§ 2. Manual Operations

1. Operating Method

1-1 Printing of Characters

After depressing the [CHARACTER PRINT] key, depress the key of the character you want to print and one character will be printed each time a key is depressed. The printing characters will continue until the [CHARACTER PRINT] key is depressed once again. Line feed is not performed even after completion.

Example:
```
1 2 3 4 5 6 7 8 9 10 .....
CANONAB.....
```

Key operation: [CHARACTER PRINT] [C] [A] [N] [O] [N] [CHARACTER PRINT] [CHARACTER PRINT] [A] [B] .....

1-2 Line Feeding Method

Line feeding is performed in the following cases.

a. When characters have been printed the full width of the paper.

Example:
```
1 2 3 4 5 ..... 434445464748
                .....KEY
OPER.....
```

Key operation: [CHARACTER PRINT] ... [K] [E] [Y] [SPACE] [O] [P] [E] ... [CHARACTER PRINT]

b. When the [FEED] character key is depressed.

Example:
```
1 2 3 3 4 5 .....434445464748
A B C
D E F G.....
```

Key operation: [CHARACTER PRINT] [A] [B] [C] [FEED] [D] [E] [F] [G] .. [CHARACTER PRINT]

c. When the [PAPER FEED] key is used.

§ 3. Program Operations

Coding and input key operation are the same as in manual operation. In manual operaion, characters not on the keyboard cannot be used. In program operation, however, all characters on the character code table can be used. (See IV § 2. 1-7 P23)

III Manual Calculation

§ 1. Before Executing the Manual Calculation

1. Preparation

1-1 Round Functions

When executing manual calculation, rounding can be selected by setting the Round Form Slide Switch, and the number of digits from the decimal point can be selected by setting the Decimal Point Selector Dial. The digit next to the preselected position is round off, up or rounded down.

ROUND is performed when the [=] key is depressed, and the rounding function applies not only to the displayed result but also to the stored one in the butter register.

When the value rounded is composed of more than 14 digits, the result is represented in the integer priority system.

1-2 Preparation

1) Check that the Calculator is set in the operation mode.

Namely, check that all the status indicating lamps are turned off. If not, turn them off following the instructions shown below;

If the ERROR Lamp is ON . . . Depress the [C] key.

If the ENT, LRN, CHE, DBG, or UNFIN, lamp is ON . . . Depress the [OPE] key.

2) Set the Printer at ON or OFF.

3) Set both Decimal Point Selector Dial and Round Form Slide Switch.

2. Printing

When the Printer is ON, input data, symbols of the key operations, and their results in the following operations are automatically printed out.

a. Operations related to memory

b. Operations related to ordinary calculation

c. Operations with the keys related to functions

d. Operations of the [PRINT] key.

3. Display

Functional values and intermediate results (value of each term and value in each parentheses) are displayed during calculation. All values are displayed with the integer priority system and are free of the setting position of the Decimal Point Selector Dial. However, if the [=] key is depressed, the value shown in the Display will have been rounded according to setting of round form and digits below the decimal point.

§ 2. Calculation Examples

1. Simply combined calculation of additions, subtractions, multiplications, and divisions

$2 + 3 \times (-4) + 8 \div 2 - 5 + 7 = -4.00$

Decimal Point Selector Dial: 2

Round Form Slide Switch: ⅂

Depress the keys in the following order;

2 [+] 3 [×] 4 [SIGN CHG] [+] 8 [÷] 2 [−] 5 [+] 7 [=] (−4.00)

2. Calculation involving various input styles of numerals with parentheses

$30 + 4 \times (1.56 \times 10^3 - 2.07 \times 10^2)$

$= 5.4420000000000\ 03$

Decimal Point Selector Dial: F

Round Form Slide Switch: Any positions are available.

Depress the keys in the following order;

30 [+] 4 [×] [(] 1.56 [EXP] 3 [−] 2.07 [EXP] 2 [)] [=] (5.4420000000000 03)

3. Calculations using double parentheses

$1 + 2 \times (-3 + 4 \times (6 + 3)) = 67.0$

Decimal Point Selector Dial: 1

Round Form Slide Switch: 5/4

Depress the keys in the following order;

1 [+] 2 [×] [(] 3 [SIGN CHG] [+] 4 [×] [(] 6 [+] 3 [)] [)] [=] (67.0)

4. Power Calculation

$3 + 2 \times (1.3^{-(2.3 + 0.47)} + 0.70 \times (2.93 - 1.12 \times 10^2)) = -148.731$

Decimal Point Selector Dial: 3

Round Form Slide Switch: 5/4

Depress the keys in the following order;

3 [+] 2 [×] [(] 1.3 [a^x] [(] 2.3 [+] 0.47 [)] [SIGN CHG] [+] 0.70 [×] [(] 2.93 [−] 1.12 [EXP] 2 [)] [)] [=] (−148.731)

Example of Power Calculation (4):

Automatic Print		Display
3	+	3
2	×	2
	(	0
1.3	y^x	1.3
	(	0
2.3	+	2.3
0.47	)	2.77
	SC	−2.77
	+	0.483478219548
0.70	×	0.7
	(	0
2.93	−	2.93
1.12 02	)	−109.07
	)	75.865521780452
	=	−148.731
−148.731		−148.731

IV Programmed Calculation

§ 1. Before Executing the Program Calculation

1. Modes

In order to perform different sorts of operations, (program storing, executing, amending or editing, etc) an intended mode must be set by depressing a corresponding mode key.

The functions of each mode are as follows;

1-1 Operation Mode (OPE)

For execution of program calculation and ordinary manual calculations. When the power supply switch is turned ON, the Calculator is set automatically in this mode. None of the status indicating lamps are lit when set in this mode.

1-2 Learn Mode (LRN)

For storing program through the keyboard. When set in this mode, a status indicating lamp, the LRN Lamp, is lit. When an instruction key is depressed, the program instruction is given and memorized, and one program step advances automatically. An instruction incorrectly stored can be amended immediately after it is stored. Diaplay shows the step number.

1-3 Check Mode (CHECK)

For amending and listing a program. When set in this mode, a status indicating lamp, the CHE Lamp, is lit. The program does not step forward automatically except in the case of inserting. Program amendments, including rewriting, inserting, and erasing, are possible. (For further details, see IV § 1. 5-1. (2) P14)

1-4 Debug Mode (DEBUG)

For carrying out program calculation step by step. When set in this mode, a status indicating lamp, the DBG Lamp, is lit. Program execution does not step forward automatically and the [↓] key must be depressed if you wish to advance the program further. (For further details, see IV § 1. 5-2. (2) P17)

2. Step Setting

Step-set is setting the program step in order to start from the desired step in program input, amendment, editing, transffering, or executing. Step setting can be performed in any mode, and the step number will be retained in changing the mode. When a step is set, the Display indicates the step number. Step setting is made by depressing the [STEP SET] key. (See I § 1. 2-2 P5) But in case of step 000, it is substituted by depressing the [C] key.

3. Decimal Point Selector Dial

A programmed calculation is executed regardless of the position of the Decimal Point Selector Dial. Therefore, unless a round instruction is given (even if the Decimal Point Selector Dial is set) all operations will be executed with the scientific floatig point system.

4. Mathematical Operation System

Any programmed mathematical operation is executed following the algebraic expressions as in the manual calculation. The calculation priority is also selected automatically in program calculation.

5. Amendment or Editing, and Confirmation of the Program

5-1 Amendment, Editing of the Program

Generally, amendment or editing of the program is performed in the Check mode. However, the amendment can also be performed in the Learn mode while learning a sequence of key operations. The step number is displayed while learning or checking the program.

Note: If you wish to amend only one section of an instruction (i.e. character code, symbol, memory address number, or specified digits number), depress keys as follows, using INST nn instruction:

[INST nn] [n] [n]

(where [n] [n] represents character code, symbol, memory address, or specified digits.)

Example; (1) If you want to change instruction RM 10 to RM 11, set to the step where number 10 of the address part is stored, and depress keys as follows: [INST nn] [1] [1]

(11 is the number of memory address.)

(2) If you misspell characters as KFY istead of KEY, set to the step where character code F is stored, and depress keys as follows: [INST nn] [4] [5] (45 is the code for character E) (See P 28)

(1) Amendment in Learn Mode

On amendment in Learn Mode, you should take care that the step advances automatically after rewriting of instructions. You can designate the step where you want to change not only by step setting but also by back stepping using the [STEP BACK] key, which makes one step back. This back stepping function is useful when you find the mistaken key operation just after the completion of it. If you want to back more than one step, depress the [STEP BACK] key as many times as required and rewrite the instructions (i.e. input the correct instructions over the incorrect ones). If you want to step forward only, depress the [↑] key as many times as required.

Procedure for amendment in [LEARN] mode:

(In this mode only rewriting is available.)

1. a) [STEP SET] [n] [n] [n] (step number) or
   b) Depress the [STEP BACK] key as many times as required.
2. Rewrite the Instruction

Example;

Program amendment while learning a sequence of key operations. Correct the memory address at the 012 step from 06 to 07.

Key Operation	Display	Automatic Print
	009	
[SM]		0009 SM
	010	
[0] [3]		0010 03
	011	
[ΣM]		
	012	0011 ΣM
[0] [6]		
	013	0012 06
[ENT]		
	014	0013 E
[STEP BACK]		
	013	
[STEP BACK]		
	012	
[INST nn] [0] [7]		
	013	0012 07
[↑]		
	014	
[×]		0014 X

Automatic printing of above procedure in Learn mode.

```
0009 SM
0010 03
0011 ΣM
0012 06
0013 E
0012 07
0014 ×
```

(2) Amendment or Editing in Check Mode

In check Mode, you can amend or edit the program which has been entered, in three different ways: rewriting, inserting, and erasing. Every symbol, code, memory address, or digit number should be input using the [INST nn] key.

A. Rewriting

Set to the step to be amended using the [STEP SET] key and rewrite the instructions depressing the correct keys. By entering the new instructions over the prior ones, the prior instructions are replaced by the new ones automatically. In this case, you must depress the [↓] key to advance the step number.

Operation Procedure

1. Set to Check Mode.
2. [STEP SET] [n] [n] [n]
3. Rewrite into the correct instructions.
4. Depress the [↓] key to advance the step.

B. Inserting

Set to the step from which additonal instructions will be inserted and lock the [INSERT] key. Then, insert additional instructions depressing corresponding keys. In this case, program step number advances automatically according to the insertion of program instructions. Every time an additional instruction is inserted, all the stored programs are moved backwards successively to be protected, automatically.

Example: In the following programs, insert the instructions of FIX 5/4 and 02 between 021 and 022 steps.

Program:

```
020 RM
021 01
022 PRINT ◊
023 LINE FEED
```

Key Operation	Display	Automatic Print
[STEP SET]	022	
[INSERT] (Lock)	022	
[FIX nn] [5]		022 FIX5
	023	023 02
[INST nn] [0] [2]		
[INSERT] (Unlock)	024	

Program Print:

Before inserting

```
0020 RM
0021 01
0022 ◊
0023 LF
```

After inserting

```
0020 RM
0021 01
0022 FIX5
0023 02
0024 ◊
0025 LF
```

C. Erasing (Deleting)

Set to the step to be erased. If you depress the [DELETE] Key, the instruction of the step already input will be erased. The trailing instruction will advance in turn. If you want to erase more than one step, depress the [DELETE] Key as many times as required.

Example: In the following program, delete the instructions of FIX ⌝ and 05 at the 007 and 008 steps.

Program:

005 RM
006 01
007 FIX ⌝
008 05
009 PRINT ◊
010 LINE FEED

Key Operation	Display
[STEP SET] [0] [0] [7]	007
[DELETE]	007
[DELETE]	007

Program Print:

Before erasing

```
0005 RM
0006 01
0007 FIX0
0008 05
0009 0
0010 LF
```

After erasing

```
0005 RM
0006 01
0007 0
0008 LF
```

5-2 Confirmation of the Program

There are two ways to confirm the contents of program; Program Print and Debugging.

(1) Program Print

This function performs the printing of the step-number together with the program instruction from the designated step by step setting until the code of 00 is read twice in series. This is carried on in check mode without relation to the Printer ON or OFF. When you want to stop the program printing on the way, depress the [C] key.

Operation Procedure

1. Set to Check Mode.
2. Set to the Step from which you wish to start program printing.
3. Depress the [PROG PRINT] key.

Example of program print:

```
0082 RM
0083 02
0084 -
0085 RM
0086 00
0087 =
0088 IF+
0089 01
0090 LF
0091 GT
0092 99
```

(2) Program Executing Every One Step

In Debug Mode, program calculation is examined every one step. (Debugging)

Operation Procedure

1. Set to Debug Mode.
2. Set to the step from which you wish to start debugging.
3. Depress the [!] key, then one instruction is executed, the step-number advances by one step, and the result is displayed.

6. Program Selection Fuction

6-1 Method of Using the [PROG SELECT] Key (User's Program Selection Key)

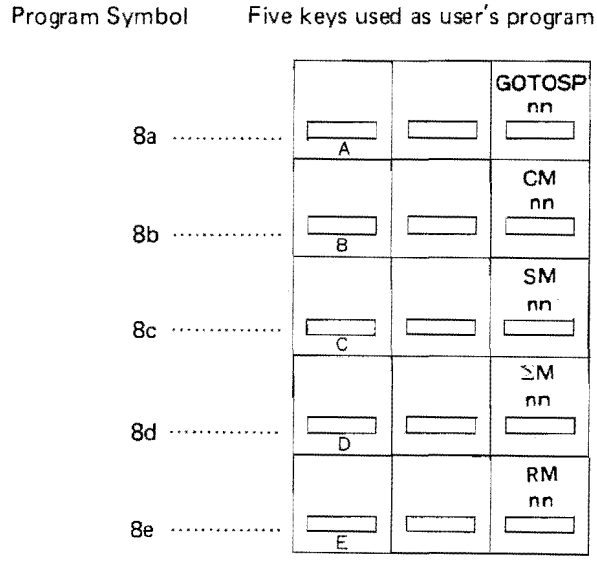
There are five user-definable keys which can be customed and labeled in your own language.

You should make your own program headed by SP instruction with the symboles as 8a, 8b, . . . , 8e.

With the [PROG SELECT] key locked, a single keystroke executes the program specified on the plate.

A note for user-definable keys A~E:

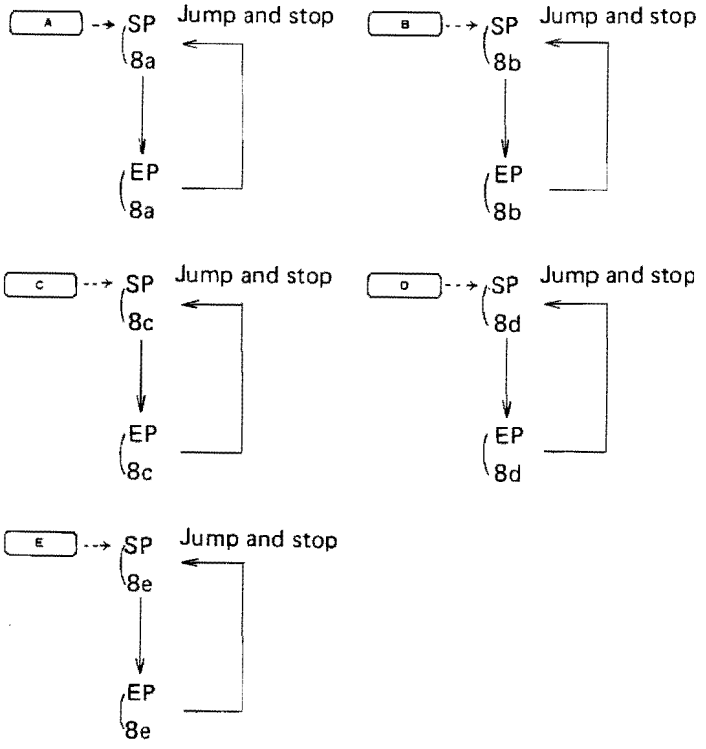
Once the SP instruction symbol of each program to be selected is given to correspond to the specified symbols respectively, other procedures can be carried out in the same manner as those for ordinary program execution. Since the SP instruction symbol is matched with the key as shown on the right, the special symbols such as 8a, 8b, . . . 8e, must be used.



Function Block

Operation Procedure

1. Set to Operation Mode
2. Lock the [PROG SELECT] key.
3. [A], [B], . . ., or [E]



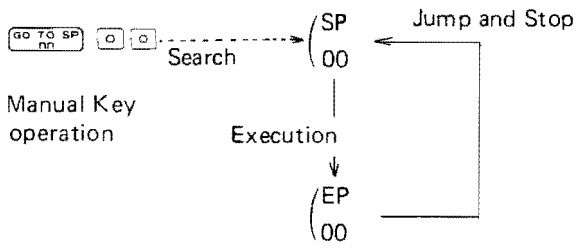
Program symbols 8a ~ 8e are used for the jumping from the [A] ~ [E] key as shown above.

6-2 Method of Using the [GO TO SP nn] Key

Desired program loaded already is searched and executed by depressing the [GO TO SP nn] key followed by the desired symbol [n] [n].

Example:

Execution of the program which starts with SP 00 instruction.



6-3 Method of Using the [STEP SET] Key and the [R/S] Key

By step setting using the [STEP SET] key, the starting step of the program to be executed can be designated.

The [R/S] key starts the execution.

Operation Procedure

1) Set at the step from which you intend to start the program execution.
2) Depress the [R/S] key.

7. Interrupted Manual Calculation During Entry Status in Program Calculation

It is possible to perform all the types of manual calculations during Entry Status.

However, the same working registers are used for both program and manual calculations. This must be taken into account.

Note: Erroneous depression of the [C] key during interrupted calculation causes the program calculation to stop and the step to return to the first.

§ 2. Programming

1. Explanation of Program Instructions

1-1 Instructions for Mathematical Operation

+	Instructs addition.
−	Instructs subtraction.
x	Instructs multiplication.
÷	Instructs division.
a^x	Instructs power calculation ($a > 0$)
(	Instructs opening parentheses.
)	Instructs closing parentheses and completion of calculation within the parentheses.
=	Instructs to complete the mathematical operations.

1-2 Instructions for Entering Numerals

0 ~ 9	Instructs to enter a numeral.
·	Instructs to enter a decimal point.
EXP	Instructs to enter a exponent.
SC	Instructs to change a sign.
CE	Instructs to clear out the display.
ENT	Instructs to enter a datum. A status indicating lamp, the ENT Lamp, is turned ON at the step in which this instruction is programmed while the calculator stops to wait for a datum to be received and the display indicates a value just prior to this instruction. By depressing the [R/S] key program execution resumes stepping forward.

1-3 Instructions for Functions

$\sqrt{\ }$	Instructs to obtain a square root. Input range: $[0, \infty)$
$1/a$	Instructs to obtain a inverse number. Input range: $(-\infty, \infty)$
a^2	Instructs to obtain a square value. Input range: $(-\infty, \infty)$

1-4 Round Instructions

This instruction carries out round-up, round-off, or round-down to the designated decimal digits of the value.

It is composed of 2 steps, one is for designating the sort of rounding and the other for the number of digits below the decimal point of the value.

Number of digits below the decimal point is instructed with a two-digit number from 00 to 13 after giving one of the following instructions.

It is effective only in steps where this programmed instruction is given.

FIX ⌊ nn Instructs to round up.
Input key operation: [FIX nn] [9]

FIX 5/4 nn Instructs to round off.
Input key operation: [FIX nn] [5]

FIX ⌉ nn Instructs to round down.
Input key operation: [FIX nn] [0]

1-5 Instructions Related to the Memory

It consists of a part that indicates the contents of a process (RM, SM, CM, ΣM), and a part that specifies memory address (nn). The instructions are entered in two steps.

The memory address is indicated with two-digit numerals from 00 to 99.

It is possible to use it together with right-left instructions that divide the memory in two and with indirect instruction for indirect addressing.

SM nn Stores the contents of the buffer register to the specified memory. The contents of the buffer register will not change.

RM nn Recalls the contents of the specified memory to the buffer register. The contents of the memory will not change after recalling.

CM nn Clears the specified memory.

ΣM nn Accumulates the contents of the buffer register into the specified memory. The contents of the buffer register will not change.

CM all Clears the entire memory area.
Input key operation: [INST nn] [F] [1]

Splitting memory:

Divides the memory in two and specifies the short word memory either on the right or left side. This system is very useful for mass data, as long as it is kept in mind that the digit of data is limited up to 6 digits.

RIGHT Divides the memory in two and specifies the short word memory on the right side.

LEFT Divides the memory in two and specifies the short word on the left.

Note: A divided memory has only 6 digits as a mantissa. Therefore, when a value is stored in a divided memory, the lower 8 digits of the full word value would be left out. However, since the data are changed to the scientific floating point, the order of the data will be retained.

Indirect addressing (IND)

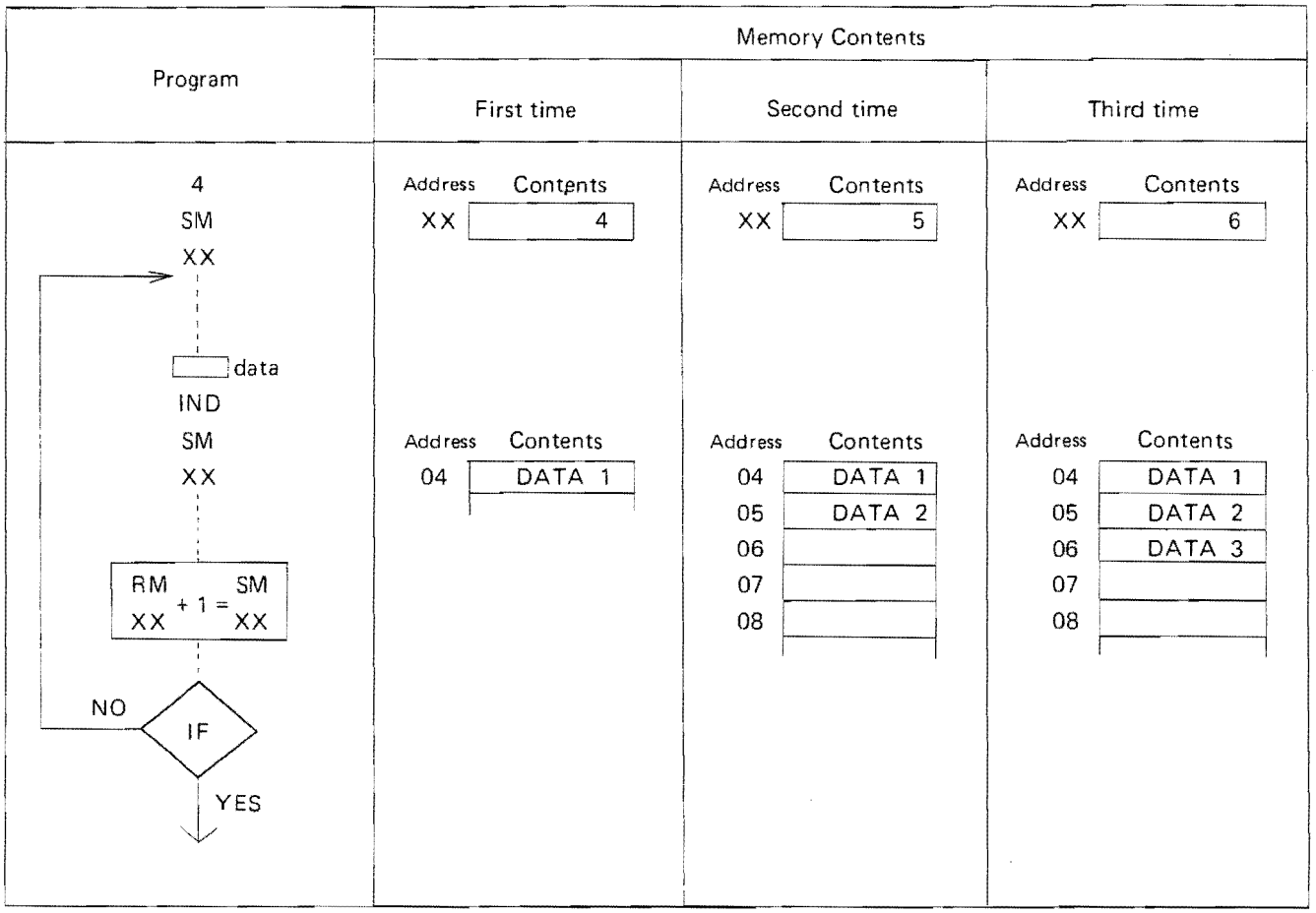
Indirect addressing is one of the address modification, and useful in the case of storing (or recalling) the calculated data sequentially to (or from) the designated memories in the iterative routine.

Procedure: Put IND instruction before memory instruction such as,

IND
SM
XX

and the data is stored in (or recalled from) the memory of which address number is stored in the XX memory. In the iterative routine, the number stored in that XX memory is increased (or decreased) one by one or two by two, at every excecution of the routine, so that you can store (or recall) the data sequentially to (or from) the memory address designated by indirect addressing system. In case of escaping from this iteration, use one of the conditional jumps of IF ≥ 0, $\neq 0$, < 0, or IF ENT. Contents of the indirect memory must take the full word format.

The procedure is illustrated as follows:



Note: Combination use of Indirect addressing and Splitted memories:

This combination is effective and useful to store mass data sequentially. It must be cared that the designated indirect memory XX should not be splitted in two. The indirect memory must be always used as a full word.

The order of the instructions is as follows:

n step	INDIRECT
n + 1 step	RIGHT (or LEFT)
n + 2 step	SM (RM, ΣM, or CM)
n + 3 step	nn

1-6 Jump Instructions

It consists of a part that indicates contents of instruction (GO TO, GO TO SP, IF GO TO, EP, SP, FLAG) and of a symbol (00 ~ 99).

The instruction is in 2 steps.

When a condition is satisfied, it will jump to the FLAG or SP instruction with the same symbol. When it is not satisfied, it will advance to the next instruction.

Two instructions FLAG nn and SP nn can be the destination of the Jump instructions. The combinations of the jump instructions and the destinations are as follows:

GO TO nn (Unconditional jump)
IF GO TO nn (Various conditional jumps) → FLAG nn

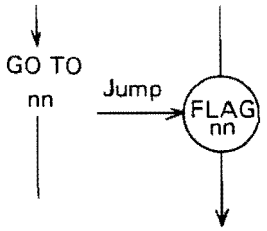
EP nn (End of program)
GO TO SP nn (Subroutine jump) → SP nn

Numbers of 2 digits from 00 to 99 are used as symbols.

The entire step area will be searched for destination, so the same symbol must not be repeatedly used with different meaning. However, it does not matter if the destination instruction FLAG and SP are used with same symbol.

GO TO nn "Unconditional jump"

Jumps to FLAG nn unconditionally.

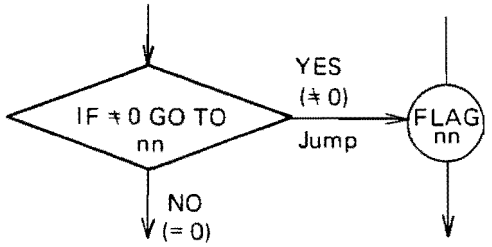


IF ≠ 0 GO TO nn

"Non-zero jump"

Jumps to FLAG nn when the value in the buffer register is not zero. Advances to the next instruction when it is zero.

Input key operation; [IF GO TO nn] [-] [n] [n]

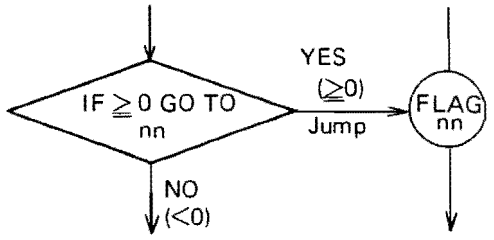


IF ≧ 0 GO TO nn

"Positive or zero jump"

Jumps to FLAG nn when the value in the buffer register is zero or positive. Advances to the next instruction when negative.

Input key operation; [IF GO TO nn] [+] [n] [n]



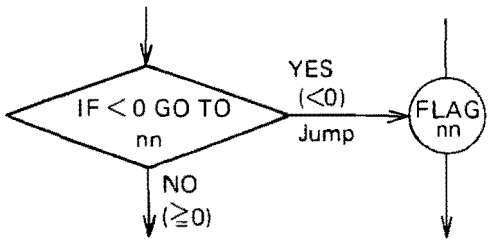
IF < 0 GO TO nn

"Negative jump"

Jumps to FLAG nn when the value in the buffer register is negative.

Advances to the next instruction when it is zero or positive.

Input key operation; [IF GO TO nn] [-] [n] [n]



IF ERROR GO TO nn

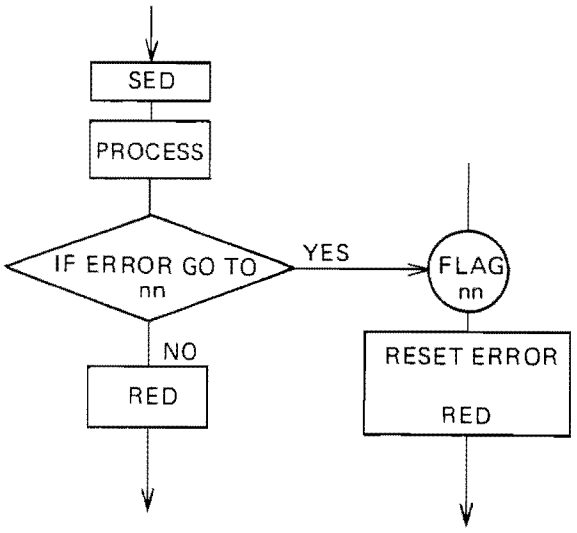
"Error jump"

This instruction judges if the machine satisfies one of ERROR conditions at this step, and jumps to FLAG nn when an error has occured. Advances to the next instruction when without error.

The following process is essential when using this instruction.

Usually, the calculator will stop when there is an error. Use the SET ERROR DISABLE (SED) instruction so that the calculator would not stop with an error. This is the preparation before checking an error.

1) When the calculator made a decision that an error had occured, clear the erroneous condition by RESET ERROR instruction and then reset SED function by RESET ERROR DISABLE (RED) instruction so that the next error would be traced out. RESET ERROR instruction should be put before RED instruction.
2) When an error had not occured, RED instruction should be put after judging IF ERROR to trace out the next error.



Input key operation; [IF GO TO nn] [CE] [n] [n]

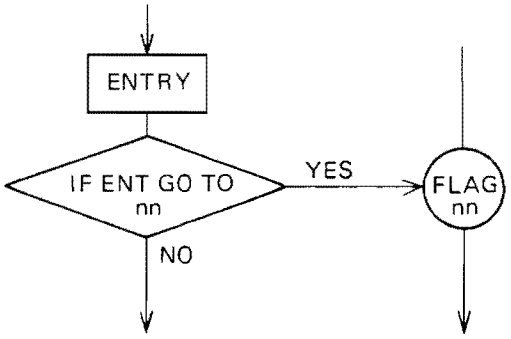
IF ENTRY GO TO nn

"Entry jump"

This instruction judges if a datum is entered before this instruction.

Jumps to FLAG nn when a datum is input at the entry instruction given immediately before this instruction. However, when the results of function calculation, ordinary calculation, or recalled data are input, the step will advance to the next instruction.

This instruction does not have the ENTRY function by itself, but makes only a decision and/or a jump. So always leave an ENTRY instruction directly before this.



Input key operation; [IF GO TO nn] [ENT] [n] [n]

FLAG nn This is the destination of the jump instruction.

SP nn "Start program"

Indicates the head of a main program and of a subroutine.

Has a function of entry.

a. Head of a program.

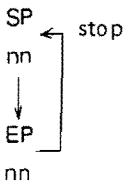
After manual key operations of [GO TO SP nn] [n] [n] or [PROG SELECT] [A] ([B]~[E]) to select the desired program, it searches the SP instruction with same symbol and executes the required program calculation.

b. Subroutine head.

This can be the destination from GO TO SP instruction used as a subroutine jump in a main program.

c. Entry function.

After reading EP instruction used as a main program end, the program step jumps to the SP instruction which has the same symbol, and stops at the SP instruction.



EP nn "End of program"

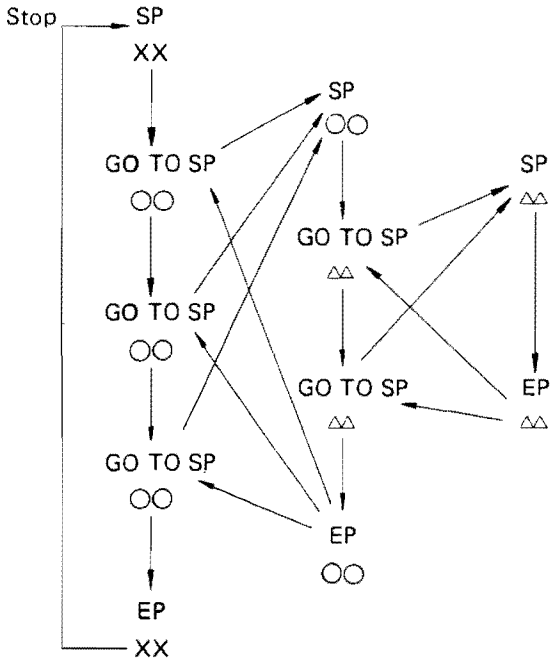
Indicates end of a main program and of a subroutine.

1) When a main program ends with EP nn instruction, program jumps to SP nn and stops.
2) When a subroutine ends with EP nn instruction, program returns to the instruction next to GO TO SP nn in main program and the following main program calculation goes on.

GO TO SP nn

"Subroutine jump"

Jumps to the subroutine program headed by SP nn and execute the subroutine program, then returns to the instruction next to GO TO SP nn to continue the main program execution. Depth of subroutine is up to two levels.



BRANCH "Unconditional jump"

This instruction takes the value in the buffer register as the destination step of jump, and jumps unconditionally.

Input key operation: [I/O] [F]

1-7 Instructions for the Printer

PRINT ◇ Prints the value of the buffer register with symbol ◇.

After completion of printing, line feeding is carried out for 24-digit paper. And for 48-digit paper, feeding every 24-digit is carried out.

LINE FEED Skips one line and returns the head to the starting point.

Input key operation: [I/O] [0]

SPACE nn Spaces columns by specified number with 2-digit number from 00 to 99.

COL-PRINT nn

Prints the value by the specified number of columns with 2-digit number from 00 to 16.

Will not do the line feeding and will stop after printing.

a. Sign and decimal point of the value are counted as one column. However the decimal point for integral data will not be printed, so it is not necessary to include this in the number of columns.

b. When the specified column number is 00, the data in the buffer register is printed out in the 20 columns including those for an exponent and spaces.

c. When the specified column number is from 01 to 16, output data is printed out having the specified column with the ordinary floating system, and round instruction must be given without fail just before this instruction.

d. When the specified column is shorter than that of the data, it becomes an error and the machine stops without printing.

e. When the specified column is longer than that of the data, spacing is carried out in higher columns to full the specified columns.

Example:

```
[        ]
FIX 5/4
05
COL
10
```

DATA in scientific floating mode:
−2.3 4 5 6 7 8 9 1 2 3 4 5 6 −01

Print

xx − 0.23457

10 colums

CHARACTER PRINT

The steps in between this instruction are interpreted as characters, and the output of one letter is done for every step. When a plurality of characters is to be printed, the CHARACTER PRINT instruction is only required at the beginning and end of character codes. Line feeding is not done after printing the letters.

Program coding for the character output is done in the same way as manual printing of the characters. However, in program, print of the characters which have no corresponding keys are available by inputting them using [INST nn] key as [INST nn] [m] [n]

Refer to the Character Code Table to input the character code. (P28)

Example:

Coding	Key operation	Output
CHARACTER PRINT	[CHARACTER PRINT]	
1	[1]	1
2	[2]	2
3	[3]	3
SPACE	[SPACE]	
A	[A]	A
B	[B]	B
C	[C]	C
SPACE	[SPACE]	
a	[INST nn] [A] [A]	a
b	[INST nn] [A] [B]	b
c	[INST nn] [A] [C]	c
CHARACTER PRINT	[CHARACTER PRINT]	

1-8 Other Instructions

Since the following instructions don't have their own keys, input is done by using the [INST nn] key.

SET ERROR DISABLE

SED Instruction

Prevents the calculator from stopping even when there is an error. This is essential before using the IF ERROR GO TO instruction.

Input key operation: [INST nn] [F] [9]

RESET ERROR DISABLE

RED instruction

Resets SED instruction.

Input key operation: [INST nn] [F] [7]

SET ERROR

Set error instruction

Sets to the erroneous conditon.

Input key operation: [INST nn] [F] [5]

RESET ERROR

Reset error instruction

Resets erroneous condition

Input key operation: [INST nn] [F] [3]

(Regarding the usage of above four instructions, please see IV §2. 1-6 P20)

NON OPERATION

Non operation instruction

Input key operation: [INST nn] [0] [0]

PROGRAM-PAGE n

Instructs program page.

Input key operation: [INST nn] [9] [n]

$(0 \leqq n \leqq 3)$

DATA-PAGE n

Instructs data page.

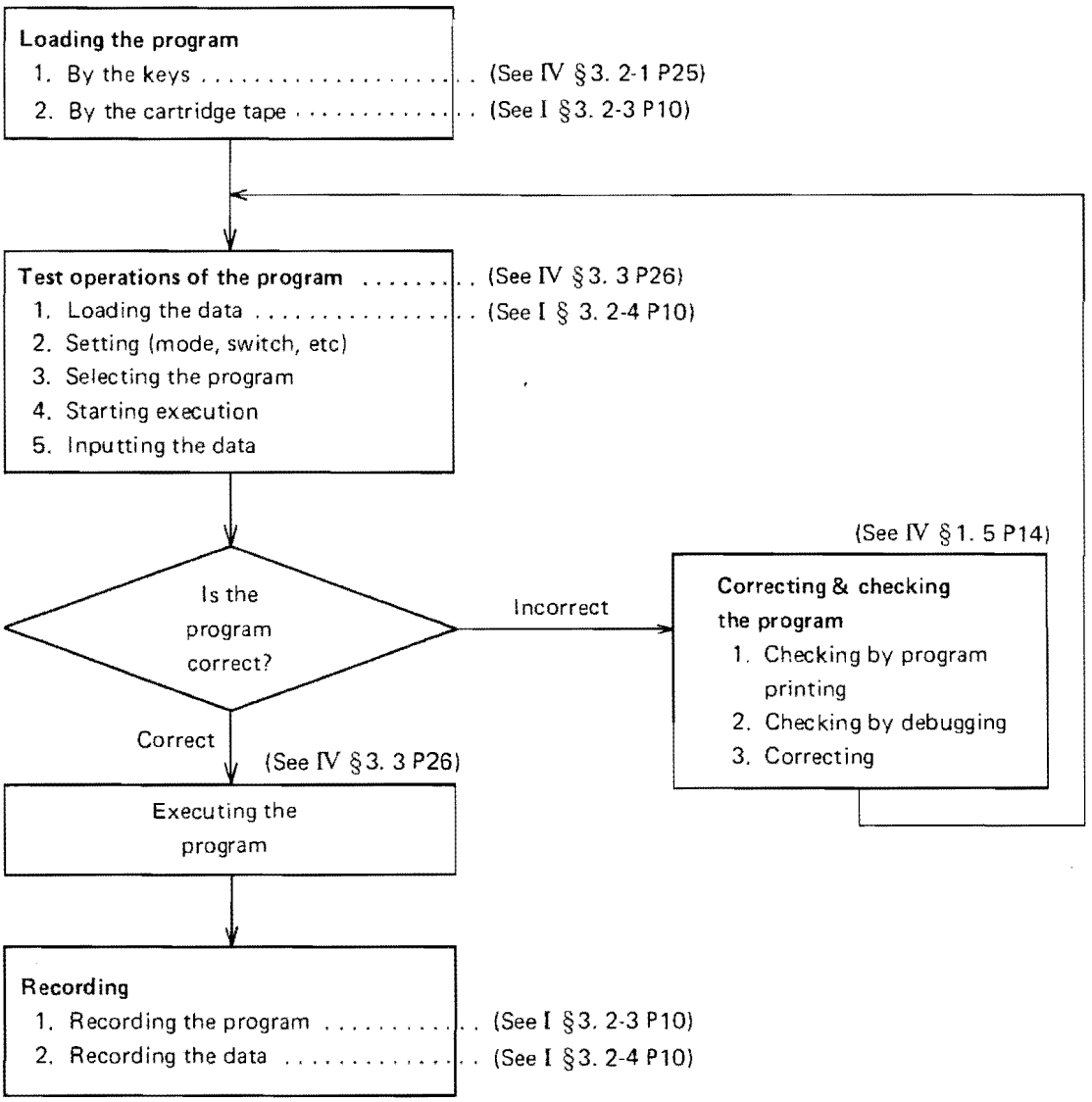
Input key operation: [INST nn] [7] [n]

$(0 \leqq n \leqq 4)$

(For details and information about pages, see IV P 39).

§ 3. Manual Operations Related to the Program Calculation

1. General Procedure



2. Input Procedures

After clearing the program area as the occasion demands, set at the step from which you intend to start inputting. Inputting is made from the keys or cartridge tape.

2-1 Input Through Keyboard

Input through keyboard is to be done in Learn mode.

(1) Input Procedure by Keys.

1. Set to Learn mode.
   To clear the entire program step area, depress the C CE keys sequentially in Learn mode.
2. Set to the head step of desired program.
3. Learn the program instructions by depressing corresponding keys
   Note: If there is no key for the instruction needed, use a combination of keys.
   If UNFIN lamp lights while you are entering the instruction, pay attention to depressing keys because this indicates that the instruction is not completed yet.

(2) Display and Automatic Printing

Display shows number of each step with 3 digits. When the Printer is ON, each instruction entered is automatically printed out with the instruction symbol and the step number.

2-2 Input Through Cartridge Tape

This can be made in any mode.

Input Procedure by Cartridge Tape.

1. If you wish to clear the entire program step area, set the mode to Learn and depress the [C] [C ALL] keys sequentially.
2. Set to the head step to start the program loading.
3. Transfer the program from Cartridge Tape to the calculator.
   (For details, see I §3. 2-3 P10)

3. Execution of the Program

3-1 Operation Procedure

1. Set to Operation mode. Confirm that all the Status Indicating Lamps are out.
2. If there are data to be input to the memories in advance, store these data through Cartridge Tape or by manual key operations.
3. Set the following keys and/or switches as occasion demands.
   - [PRINTER OFF] key
   - [PROG SELECT] key
   - Slide switches for functions
4. Set the head of a program and begin the execution.
   There are three methods as follows to set the head of a program, and begin the execution.
   a. Users' program selection by a single keystroke with the [PROG SELECT] key locked.
   b. Program selection and execution, using the [GO TO SP nn] key.
   c. Step setting using the [STEP SET] key, and starting calculation by depressing the [R/S] key.
5. For the repetitions of the program execution, you can start it by depressing the [R/S] key or entering numerals, according to the program contents.

3-2 Data Input

There are two methods for data input.

The first is input to the memory by use of Cartridge Tape, the other is input through keys during the "Entry Status".

"Entry Status"

(1) Halting state before starting the program execution.
   Namely,
   1) Resting state of the calculator to which no operation is given yet,
   2) Halting state at the SP (START PROGRAM) instruction after locking of the [PROG SELECT] key,
   3) Halting state at the SP instruction before depressing the [GO TO SP nn] [n] [n] keys,
   4) Halting state at the program head after step setting.

(2) When the program execution halts at ENT instruction.

Therefore, in the case of a or b in 3-1. 4 (P26), it is possible to enter the numerals before depressing the user definable keys or the [GO TO SP nn] [n] [n] keys, respectively. And in the case of c, before depressing the [R/S] key.

3-3 Automatic Printing for the Input Data (Printer ON)

Entering numerals when the printer is ON, the numerals just as entered and the symbol E are printed out automatically. When there is no data entry, it prints nothing.

4. Tables

4-1 Instruction Table

Instruction	Interpretation	Key Operation	Print Symbol
+	Addition	[+]	+
−	Subtraction	[−]	−
x	Multiplication	[×]	×
÷	Division	[÷]	÷
a^x	Power Calculation	[a^x]	a^
(	Opening parentheses	[(]	(
)	Closing parentheses	[)]	)
=	Completion of calculation	[=]	=
0 ~ 9	Numerals	[0] ~ [9]	0~9
·	Decimal point	[·]	.
EXP	Exponent	[EXP]	EXP
SIGN CHANGE	Changing sign of a value	[+/− CHS]	SC
ENT	Data input	[ENT]	E
CE	Clearing the buffer register	[CE]	CE
$\sqrt{\ }$	Square root	[$\sqrt{\ }$]	√
$\frac{1}{a}$	Reciprocal	[$\frac{1}{x}$]	1/a
a^2	Square	[x^2]	a2
FIX ⌊ nn	Round-up	[FIX nn] [9] [n] [n]	FIX9
FIX 5/4 nn	Round-off	[FIX nn] [5] [n] [n]	FIX5
FIX ⌉ nn	Round-down	[FIX nn] [0] [n] [n]	FIX0
SM nn	Storing in a memory	[SM nn] [n] [n]	SM
RM nn	Recalling from a memory	[RM nn] [n] [n]	RM
CM nn	Clearing a memory	[CM nn] [n] [n]	CM
ΣM nn	Accumulation in a memory	[Σ+ M nn] [n] [n]	Σ+
CM ALL	Clearing all the memories	[INST nn] [F] [1]	f1
RIGHT	Designating the right side of the splitted memory	[RIGHT]	R
LEFT	Designating the left side of the splitted memory	[LEFT]	L
INDIRECT	Indirect memory addressing	[INDIRECT]	IND
GOTO nn	Unconditional jump	[GO TO nn] [n] [n]	GT
IF ≠ 0 GO TO nn	Jump if non-zero	[IF GO TO nn] [=] [n] [n]	IFNZ
IF ≧ 0 GO TO nn	Jump if equal to or greater than zero	[IF GO TO nn] [+] [n] [n]	IF+
IF < 0 GO TO nn	Jump if less than zero	[IF GO TO nn] [−] [n] [n]	IF−
IF ERROR GO TO nn	Jump if an error has occured	[IF GO TO nn] [CE] [n] [n]	IFER
IF ENT GO TO nn	Jump if data is input	[IF GO TO nn] [ENT] [n] [n]	IFE
FLAG nn	Destination of a jump instruction	[FLAG nn] [n] [n]	FLG
SP nn	Starting program	[SP nn] [n] [n]	SP
EP nn	Ending program	[EP nn] [n] [n]	EP
GO TO SP nn	Jump to a subroutine	[GO TO SP nn] [n] [n]	GS
BRANCH	Unconditional branch by absolute address system.	[I/O] [F]	10f
PRINT ◇	Printing the value in the buffer register	[PRINT ◇]	◇

Instruction	Interpretation	Key Operation	Print Symbol
LINE FEED	One line feeding	LINE FEED	LF
SPACE nn	Designating number of spacing	7 SPACE nn n n	→
COL-PRINT nn	Designating number of column and printing	COL. PRINT nn n n	COL
CHARACTER-PRINT	Designating print of characters	CHARACTER PRINT	CHR
SET ERROR DISABLE	Setting machine not to stop with an error	INST nn F 9	f9
RESET ERROR DISABLE	Resetting the above function	INST nn F 7	f7
SET ERROR	Setting to an error condition	INST nn F 5	f5
RESET ERROR	Resetting an error	INST nn F 3	f3
DATA-PAGE n	Designating page for data	INST nn 7 n	7 n
PROGRAM-PAGE n	Designating page for program	INST nn 9 n	9 n
NON OPERATION	Non effect instruction	INST nn 0 0	00

4-2 Character Code Table

Table of Character Codes (mn)

n \ m	0	1	2	3	4	5	a	b	c	d
0			ბ	0	@	P	ბ	ı		
1			!	1	A	Q	◦			
2			◇	2	B	R	⌜			
3			#	3	C	S	⌟			
4			$	4	D	T	π			
5			%	5	E	U	x^{-}			
6			&	6	F	V				
7			£	7	G	W	√			
8			(	8	H	X	x			
9			)	9	I	Y	÷			
a	LF		*	:	J	Z	a			
b			+	→	K	Σ	b			
c			,	<	L	¥	c			
d			–	=	M	g	d			
e			.	>	N	h	e			"
f			/	?	O	i	f			°

A character code is indexed by the order of m and n.

Example:

		m	n
Character	A:	4	1
	B:	4	2

§ 4. Program Examples

1. General Directions

1. Put SP nn instruction at the head step of a program (subroutine) and EP nn at the end of a program (subroutine).
2. Put ENT instruction at the step to input a variable.
3. To process these input data, write program instructions following the mathematical expressions as in manual calculations. But in functional calculations, the order of instructions of data and function should be exchanged.
4. The instruction of Round up, off, and down, are done by using program instructions FIX ↑—, 5/4, —↓, nn and Round Form Slide Switch are not effective to program calculations.
5. Jump destination (FLAG nn) should be one for one jump instruction through the entire program area, including main programs and subroutine programs.

2. Program Examples

2-1 Four Fundamental Operations for Complex Numbers

Arrange the program to perform the desired operation for the input complex numbers A+Bi and C+Di, selecting the program using the BRANCH instruction. Make the print-out format so that the kind of operation (addition, subtraction, multiplication, or division) and real part and imaginary part for input and output can be recognized.

Study Points;

1. BRANCH instruction.
2. Judging if the data is input. (IF ENT GO TO nn)
3. Input and output format.

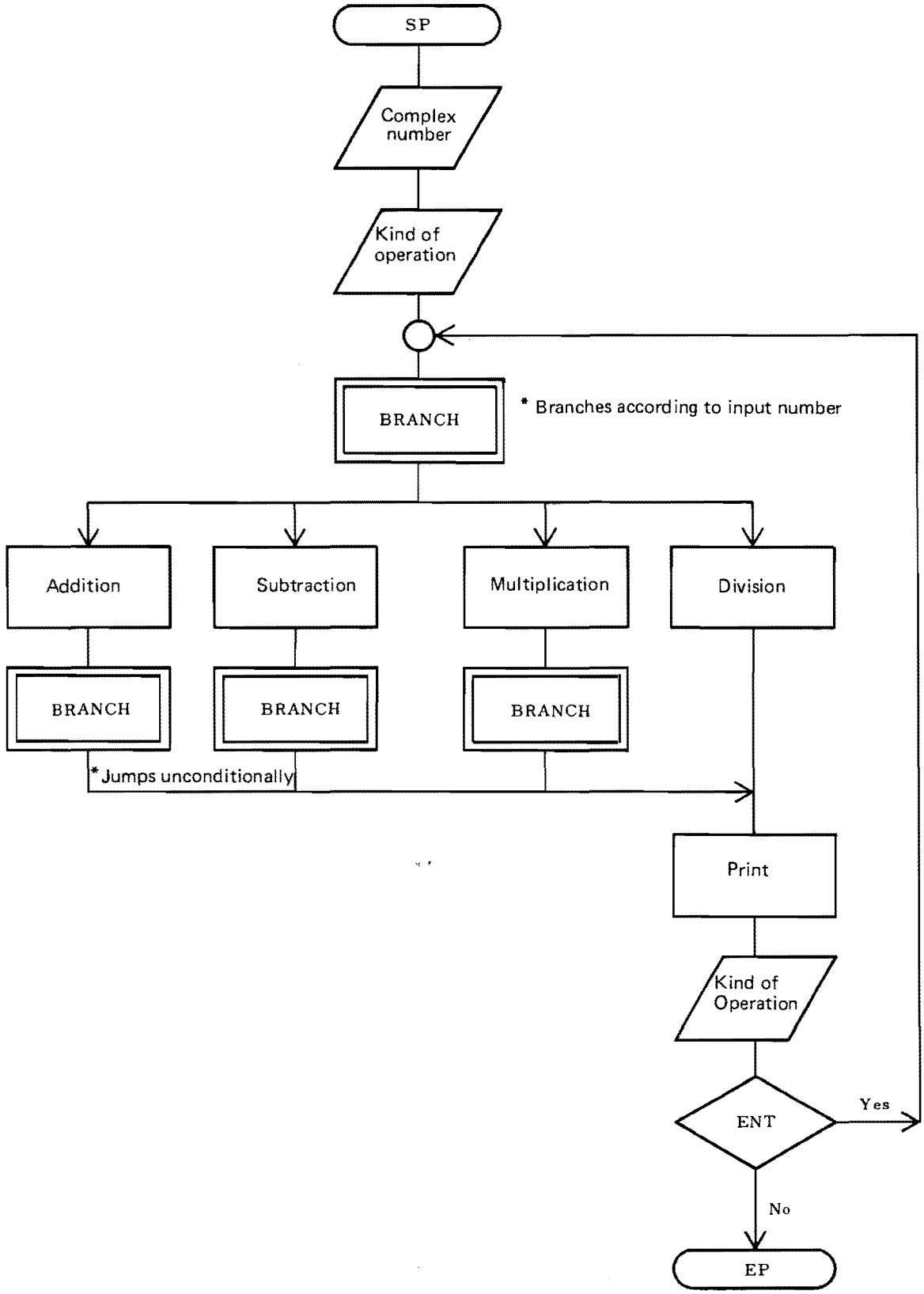
Output Format;

```
  1.000      2.000i          3.000      4.000i
ADD           4.000          6.000i
SUB          -2.000         -2.000i
MLT          -5.000         10.000i
DIV           2.200          3.200i

 -2.200      3.000i          1.500     -2.000i
ADD          -0.700          1.000i
SUB          -3.700          5.000i
DIV          -0.671         -0.671i

  2.200     -1.300i          2.000      5.000i
MLT          10.900          8.400i
DIV          -0.321         -0.331i
ADD           4.200          3.700i
SUB           0.200         -6.300i
```

Flowchart


SP
Complex number
Kind of operation
BRANCH
* Branches according to input number
Addition
Subtraction
Multiplication
Division
BRANCH
BRANCH
BRANCH
* Jumps unconditionally
Print
Kind of Operation
ENT
Yes
No
EP

Program Coding

Step: 226 Data memory: 8

Step	Instruction	Remark	Key Operation	Step	Instruction	Remark	Key Operation
000	SP	Input A	SP	050	3		3
1	30		3 0	1	=		=
2	SM		SM	2	BRANCH	Branch to the desired operation	I/O F
3	00		0 0	3	LF		I/O 0
4	FIX ↘		FIX 0	4	CHA		CHA-PRINT
5	03		0 3	5	A		A
6	COL		COL-PRINT	6	D		D
7	07		0 7	7	D		D
8	ENT	Input B	ENT	8	CHA		CHA-PRINT
9	SM		SM	9	RM		RM
010	01		0 1	,060	00		0 0
1	FIX ↘		FIX 0	1	+		+
2	03		0 3	2	RM	Real part Addition	RM
3	COL		COL-PRINT	3	02		0 2
4	10		1 0	4	=		=
5	CHA		CHA-PRINT	5	SM		SM
6	*i*		INST 5 F	6	04		0 4
7	CHA		CHA-PRINT	7	RM		RM
8	SPACE		SPACE	8	01		0 1
9	08		0 8	9	+	Imaginary part	+
020	ENT	Input C	ENT	070	RM		RM
1	SM		SM	1	03		0 3
2	02		0 2	2	=		=
3	FIX ↘		FIX 0	3	SM		SM
4	03		0 3	4	05		0 5
5	COL		COL-PRINT	5	RM		RM
6	07		0 7	6	07	Branch for	0 7
7	ENT	Input D	ENT	7	BRANCH	output	I/O F
8	SM		SM	8	LF		I/O O
9	03		0 3	9	CHA		CHA-PRINT
030	FIX ↘		FIX 0	080	S		S
1	03		0 3	1	U		U
2	COL		COL-PRINT	2	B		B
3	10		1 0	3	CHA		CHA-PRINT
4	CHA		CHA-PRINT	4	RM		RM
5	*i*		INST 5 F	5	00		0 0
6	CHA		CHA-PRINT	6	–	Real part Subtraction	–
7	2		2	7	RM		RM
8	0		0	8	02		0 2
9	2		2	9	=		=
040	SM		SM	090	SM		SM
1	07		0 7	1	04		0 4
2	ENT	Select the operation	ENT	2	RM		RM
3	FLAG		FLAG	3	01	Imaginary part	0 1
4	03		0 3	4	–		–
5	×		×	5	RM		RM
6	2		2	6	03		0 3
7	5		5	7	=		=
8	+		+	8	SM		SM
9	5		5	9	05		0 5

Program Coding

Step: 226 Data memory: 8

Step	Instruction	Remark	Key Operation	Step	Instruction	Remark	Key Operation
100	RM		RM	150	CHA		CHA-PRINT
1	07		0 7	1	D		D
2	BRANCH		I/O F	2	I		I
3	LF		I/O 0	3	V		V
4	CHA		CHA-PRINT	4	CHA		CHA-PRINT
5	M		M	5	(		(
6	L		L	6	RM		RM
7	T		T	7	00		0 0
8	CHA		CHA-PRINT	8	x		x
9	RM		RM	9	RM		RM
110	00		0 0	160	02		0 2
1	x		x	1	+		+
2	RM	Multiplication	RM	2	RM		RM
3	02	Real part	0 2	3	01		0 1
4	–		–	4	x		x
5	RM		RM	5	RM		RM
6	01		0 1	6	03	Real part	0 3
7	x		x	7	)		)
8	RM		RM	8	÷		÷
9	03		0 3	9	(		(
120	=		=	170	RM		RM
1	SM		SM	1	00		0 0
2	04		0 4	2	a^2		a^2
3	RM		RM	3	+	Division	+
4	00	Imaginary part	0 0	4	RM		RM
5	x		x	5	01		0 1
6	GO TO		GO TO	6	a^2		a^2
7	00		0 0	7	)		)
8	CE		CE	8	SM		SM
9	1	Branch to subtraction	1	9	06		0 6
130	4		4	180	=		=
1	9		9	1	SM		SM
2	BRANCH		I/O F	2	04		0 4
3	FLAG		FLAG	3	(		(
4	00		0 0	4	RM		RM
5	RM		RM	5	00		0 0
6	03		0 3	6	x		x
7	+		+	7	RM		RM
8	RM		RM	8	02		0 2
9	01	Imaginary part Multiplication	0 1	9	+		+
140	x		x	190	RM		RM
1	RM		RM	1	01		0 1
2	02		0 2	2	x		x
3	=		=	3	RM	Imaginary part	RM
4	SM		SM	4	03		0 3
5	05		0 5	5	)		)
6	RM		RM	6	÷		÷
7	07	Branch for output	0 7	7	RM		RM
8	BRANCH		I/O F	8	06		0 6
9	LF		I/O 0	9	=		=

Program Coding

Step: 226 Data memory: 8

3/3

Step	Instruction	Remark	Key Operation	
200	SM		SM	
1	05			0 5
2	SPACE		SPACE	
3	06			0 6
4	RM		RM	
5	04			0 4
6	FIX ↘		FIX	0
7	03			0 3
8	COL		COL-PRINT	
9	09	Output		0 9
210	RM		RM	
1	05			0 5
2	FIX ↘		FIX	0
3	03			0 3
4	COL		COL-PRINT	
5	12			1 2
6	CHA		CHA-PRINT	
7	*i*		INST	5 F
8	CHA		CHA-PRINT	
9	ENT	Select the operation	ENT	
220	IFE		IF	ENT
1	03			0 3
2	LF		I/O	0
3	LF		I/O	0
4	EP		EP	
5	30			3 0

Operation Procedure

1. [LEARN]
2. [C] [C ALL]
3. Learn the program
4. [OPE]
5. Lock the [PRINTER OFF] key
6. [C]
7. Input A
8. [A]
9. Input B
10. [B]
11. Input C
12. [C]
13. Input D
14. [D]
15. Input the figure representing the kind of operation.
    Input 0 when performing addition
    Input 1 when performing subtraction
    Input 2 when performing multiplication
    Input 3 when performing division
16. [E]
17. When performing next operations, repeat from operation 15.
    When changing data, repeat from operation 7.

2-2 Sales Amount Table

Sales amount for some items are given. Arrange a program to obtain a percentage of the total amount for each item. Make the print-out format so that the correspondence of the sales amount and percentage for each item may be clear.

Study Points;

1. Indirect addressing (INDIRECT)
2. Judging the sign of the value in the buffer register (IF $\geqq 0$ GO TO nn, IF < 0 GO TO nn, and IF $\neq 0$ GO TO nn, In this example, the last one is used.)
3. Technique to make a table

Output Format;

```
INPUT SALES


        NO. 1                100000     E
        NO. 2                125000     E
        NO. 3                350000     E
        NO. 4                227000     E
        NO. 5                143000     E
        NO. 6                 10000     E
        NO. 7                 63400     E
        NO. 8

 NO.          SALES     COMPOSITION RATIO
  1      $    100000          9.8 %
  2      $    125000         12.3 %
  3      $    350000         34.4 %
  4      $    227000         22.3 %
  5      $    143000         14.0 %
  6      $     10000          1.0 %
  7      $     63400          6.2 %
```

Program Coding

Step: 175

Step	Instruction	Remark	Key Operation		Step	Instruction	Remark	Key Operation	
000	SP		SP		050	02			0 2
1	00			0 0	1	1		1	
2	LF		I/O	0	2	ΣM	IND +1	ΣM	
3	SPACE		SPACE		3	00			0 0
4	04			0 4	4	ΣM	Count the number of data	ΣM	
5	CHA		CHA-PRINT		5	01	(Counter)		0 1
6	I			I	6	ΣM		ΣM	
7	N			N	7	03	No. +1		0 3
8	P			P	8	LF		I/O	0
9	U			U	9	SPACE		SPACE	
010	T			T	060	11			1 1
1	SPACE			SPACE	1	CHA		CHA-PRINT	
2	S			S	2	N			N
3	A			A	3	O			O
4	L			L	4	·		INST	2 E
5	E			E	5	CHA		CHA-PRINT	
6	S			S	6	RM		RM	
7	CHA		CHA-PRINT		7	03			0 3
8	LF		I/O	0	8	FIX ↘		FIX	0
9	LF		I/O	0	9	00			0 0
020	CM ALL		INST	F 1	070	COL		COL-PRINT	
1	1		1		1	02			0 2
2	SM	For No.	SM		2	SPACE		SPACE	
3	03			0 3	3	04			0 4
4	4		4		4	ENT	Input sales	ENT	
5	SM	Head address for	SM		5	IFE		IF	ENT
6	00	indirect storing		0 0	6	00			0 0
7	LF		I/O	0	7	LF		I/O	0
8	SPACE		SPACE		8	LF		I/O	0
9	11			1 1	9	SPACE		SPACE	
030	CHA		CHA-PRINT		080	05			0 5
1	N			N	1	CHA		CHA-PRINT	
2	O			O	2	N			N
3	·		INST	2 E	3	O			O
4	CHA		CHA-PRINT		4	·		INST	2 E
5	RM		RM		5	CHA		CHA-PRINT	
6	03			0 3	6	SPACE		SPACE	
7	FIX ↘	Print the No.	FIX	0	7	07			0 7
8	00			0 0	8	CHA		CHA-PRINT	
9	COL		COL-PRINT		9	S			S
040	02			0 2	090	A			A
1	SPACE		SPACE		1	L			L
2	04			0 4	2	E			E
3	ENT	Input sales	ENT		3	S			S
4	FLAG		FLAG		4	CHA		CHA-PRINT	
5	00			0 0	5	SPACE		SPACE	
6	IND		INDIRECT		6	04			0 4
7	SM	Indirect storing	SM		7	CHA		CHA-PRINT	
8	00			0 0	8	C			C
9	ΣM	Accumulate for total	ΣM		9	O			O

Program Coding

Step: 175

Step	Instruction	Remark	Key Operation		Step	Instruction	Remark	Key Operation	
100	M			M	150	=		=	
1	P			P	1	FIX 5/4		FIX	5
2	O			O	2	01			0 1
3	S			S	3	COL	Print the composition ratio	COL-PRINT	
4	I			I	4	10			1 0
5	T			T	5	CHA		CHA-PRINT	
6	I			I	6	SPACE			SPACE
7	O			O	7	%			%
8	N			N	8	CHA		CHA-PRINT	
9	SPACE			SPACE	9	I		I	
110	R			R	160	ΣM	IND +1	ΣM	
1	A			A	1	00			0 0
2	T			T	2	ΣM	No. +1	ΣM	
3	I			I	3	03			0 3
4	O			O	4	SC		SIGN	CHA
5	CHA		CHA-PRINT		5	ΣM	Counter −1	ΣM	
6	4		4		6	01			0 1
7	SM	Head address for	SM		7	RM		RM	
8	00	indirect recalling		0 0	8	01			0 1
9	1		1		9	IF≠0	If all the data are output?	IF	=
120	SM	For No.	SM		170	01			0 1
1	03			0 3	1	LF		I/O	0
2	FLAG		FLAG		2	LF		I/O	0
3	01			0 1	3	EP		EP	
4	LF		I/O	0	4	00			0 0
5	RM		RM						
6	03	Print the No.		0 3					
7	FIX ↘		FIX	0					
8	00			0 0					
9	COL		COL-PRINT						
130	07			0 7					
1	SPACE		SPACE						
2	05			0 5					
3	CHA		CHA-PRINT						
4	$		INST	2 4					
5	CHA		CHA-PRINT						
6	IND		INDIRECT						
7	RM		RM						
8	00	Print the sales		0 0					
9	FIX ↘		FIX	0					
140	00			0 0					
1	COL		COL-PRINT						
2	09			0 9					
3	÷		÷						
4	RM		RM						
5	02			0 2					
6	x		x						
7	1		1						
8	0		0						
9	0		0						

Operation Procedure

1. [LEARN]
2. [C] [C ALL]
3. Learn the program
4. [OPE]
5. Unlock the [PRINTER OFF] key. (Printer ON)
6. [C]
7. [÷]
8. Input sales
9. [÷]

⋮

10. Input sales
11. [÷]
12. [÷]

Repeat from operation 7 to perform the next calculations.

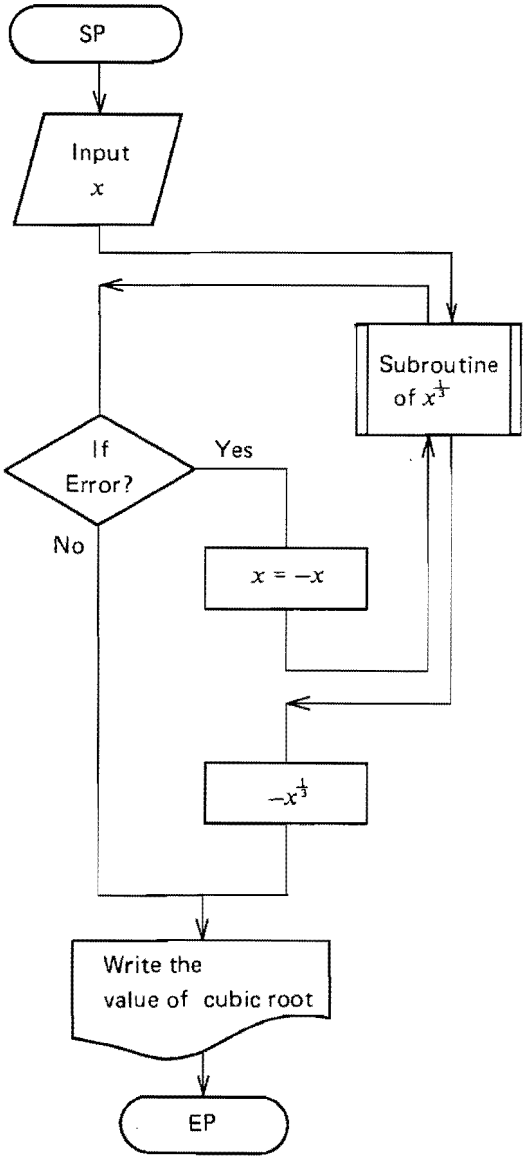
2-3 Cubic Root Calculation

Obtain the cubic root of a real number by using the [A] key.

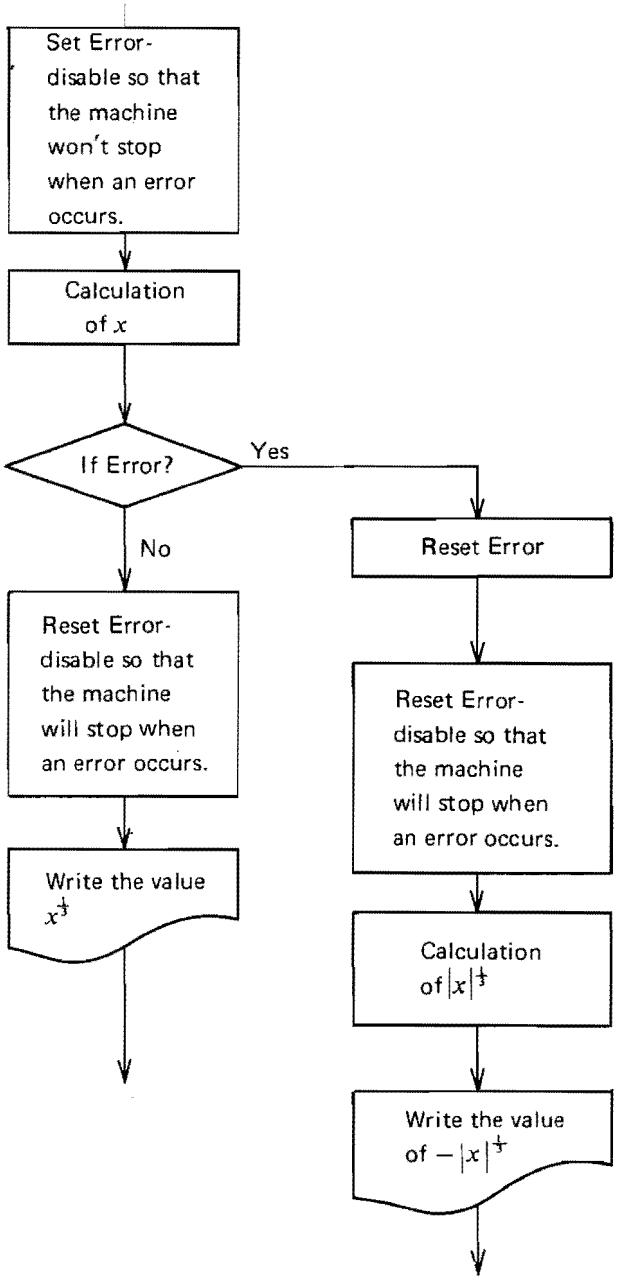
Study points:

1. Subroutine .
2. IF ERROR GO TO nn instruction
3. Usage of the [PROG SELECT] key

Flowchart



Precise Flowchart of Error-Check



This example can be rewrite to the program which uses the Sign Judgement for the input-data.

Program Coding

Step: 39 Data memory: 1

Step	Instruction	Remark	Key Operation
000	SP		SP
1	8a		8 a
2	SM		SM
3	00		0 0
4	SED	SET ERROR DISABLE	INST F 9
5	GO TO SP		GO TO SP
6	20		2 0
7	IF ER	IF ERROR	IF CE
8	22		2 2
9	RED	RESET ERROR DISABLE	INST F 7
010	FLAG		FLAG
1	21		2 1
2	FIX 5/4		FIX 5
3	04		0 4
4	◇		PRINT ◇
5	EP		EP
6	8a		8 a
7	FLAG		FLAG
8	22		2 2
9	RE	RESET ERROR	INST F 3
020	RED	RESET ERROR DISABLE	INST F 7
1	RM		RM
2	00		0 0
3	SC		SIGN CHG
4	GO TO SP		GO TO SP
5	20		2 0
6	SC		SIGN CHG
7	GO TO		GO TO
8	21		2 1
9	SP		SP
030	20		2 0
1	a^x		a^x
2	(		(
3	3		3
4	1/a		1/a
5	)		)
6	=		=
7	EP		EP
8	20		2 0

Operation Procedure

1. [LEARN]
2. [C] [C ALL]
3. Learn the program
4. [OPE ▪]
5. Unlock the [PRINTER OFF] key. (Printer ON)
6. Lock the [PROG SELECT] key.
7. Input the data and depress the [A] key.

Repeat the operation 7 to calculate the cubic root for the other data.

V Page

§ 1. Page

1. Capacity of One Page

100 data memories make one data page. 1000 steps make one program page.

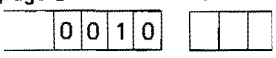
2. Key Operation and Display

When expanded information exceeds one page, the following changes take place in the display, key operations and the [C] key operation.

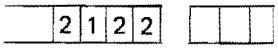
2-1 Display of Step-Number

When a step is set with LEARN or CHECK mode, the page number is displayed in the highest of the 4 digits, along with the step number.

Example: Step 10 in page 0 display



Step 122 in page 2



2-2 [STEP SET] Key

Numerals depressed after [STEP SET] key have 4 digits, one for the page and 3 for the step. The arrangement is the same as displayed, with the highest digit indicating the page.

Key Operation: [STEP SET] [m] [n] [n] [n]

Page Step

Example: Set to step 23 in page 1

[STEP SET] [1] [0] [2] [3]

2-3 [RM nn], [CM nn], [SM nn], and [ΣM nn] Keys

When the pages are expanded, enter 3-digit numerals after depressing one of the above memory keys. The highest digit indicates page. This is different from the basic operation.

Namely, as [RM nn] [m] [n] [n]

Page Data address

Example: Recall address 50 in page 0

[RM nn] [0] [5] [0]

Store in address 01 in page 1

[SM nn] [1] [0] [1]

2-4 [C] Key

Designated memory page and program page are cleared and both become page 0.

3. Using Cartridge Reader

Transferring can be accomplished regardless of the change of pages. The operation of the reader is the same with the case that the page is not extended, except that the setting methods of step and data memory are different.

Example: Step 800 in page 0

[STEP SET] [0] [8] [0] [0]

Address 20 in page 1

[STEP SET] [1] [2] [0] [0]

§ 2. Programmed Calculation Using Pages

1. Manual Operations Concerning Program

1-1 Selection Methods of Program

There are three methods to select a program manually as in case of without expanding pages.

1) Selection using the [PROG SELECT] lock key
2) Selection using the [GO TO SP nn] key
3) Selection using the [STEP SET] key

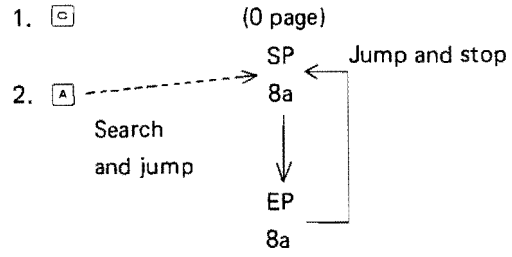
In manual selection of a program under "Entry Status" (See IV §3. 3-2 P27), program page searched for is restricted by page instruciton given in the program. Therefore, when jumping to another page, setting program page is required in the cases of (1) and (2). Program page is set by setting to the 000 step in the desired page using the [STEP SET] key. However, when setting to the 0 page, depressing the [C] key takes the place of step setting.

(1) Selection using the [PROG SELECT] lock key

With the [PROG SELECT] key locked, select the desired program by depressing the corresponding key ([A], [B], . . . or [E]) after operating [C] key or after performing the designation of the program page by using the [STEP SET] key.

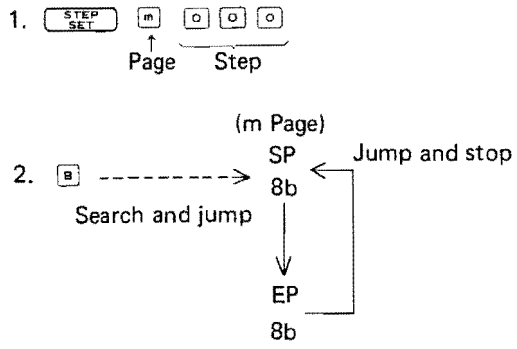
a. When SP instruction is in page 0

Key operation:



b. When SP instruction is in another page (except 0 page)

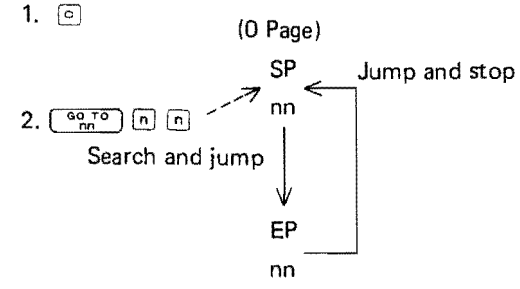
Key operation:



(2) Selection using the GO TO SP nn key

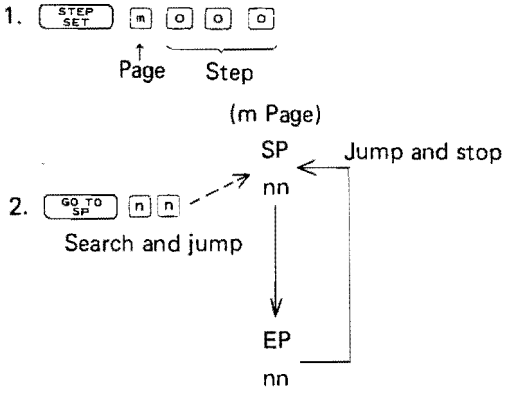
a. When SP instruction is in page 0, use the GO TO SP key after depressing the C key.

Key operation:



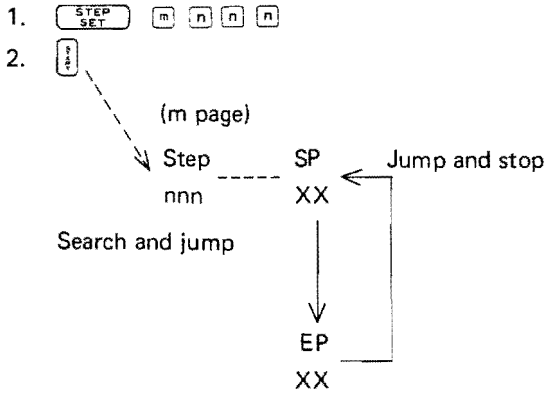
b. When SP instruction is in another page, except 0 page, use this key after setting to the first step of the page by using the STEP SET key as follows.

key operation:



(3) Selection using the STEP SET key

Key operation:



1-2 Program Input Through Keyboard

When instructions are entered up to 999 step, set to the first step of the next page by using the [STEP SET] key and enter the successive instructions.

Step	Instruction	
0995	RM	
0996	02	
0997	P-Page 1	
0998	GOTO	
0999	11	← Stop learning here to set to the first step of the next page.
1000	FLAG	
1001	11	
1002	X	Key operation: [STEP SET] [m] [0] [0] [0] (m page, 000 step)

1-3 Program Print

After printing up to 999 step, stop the operation and then start the printing again in the following way.

Key operation:

1. [C] (Stop the program printing)
2. [CHECK] mode
3. [STEP SET] [m] [0] [0] [0] (m page, 000 step)
4. [PROG PRINT]

1-4 Insert and Delete of Program

Shifting of the instructions caused by these keys operation are done within the same page.

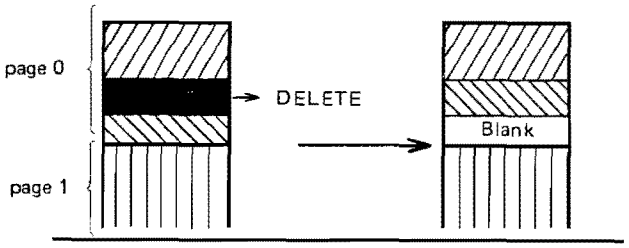
Namely,

[DELETE] key operation;

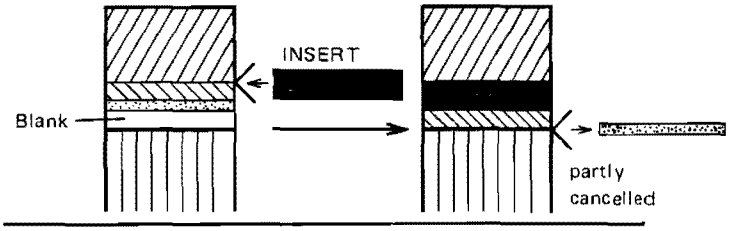
Makes the step blank in the rear of the page as many numbers as deleted.

[INSERT] key operation;

Instructions that cannot be accommodated in the page will be cancelled.



Deleting



Inserting

1-5 Manual Operations Under Entry Status

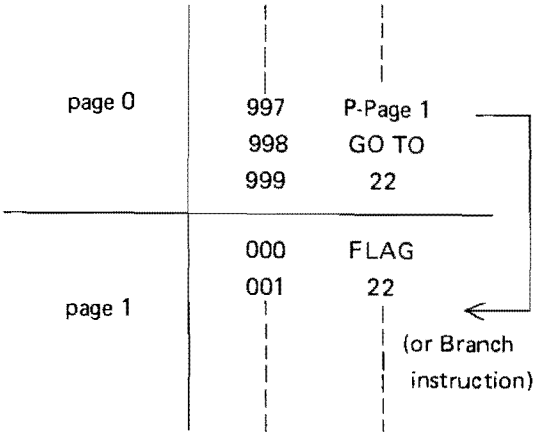
Calculating method is the same as when pages are not increased.

The data page changes when the data memory is used. Therefore, be careful when continuing program calculations.

2. Before Arranging Program

2-1 Program Extending Over Two Pages

Because the program execution roops within one page, unconditional jump instruction is required to jump to the next page program as shown on the right.



2-2 When Jumping Over to Another Page

When jumping over to FLAG, SP in another page, put the page instruction immediately before the jump instruction. (For details refer to the following "3. How to Use Page Instructions".)

In BRANCH instructions, the step of the jump destination is designated in four digits including PAGE, just as in step setting. Therefore, page instruction is not required.

Moreover, the symbol search for jump is performed within one page. Therfore, it does not matter even if the same symbol is on another page.

2-3 When Using Memory in Another Page

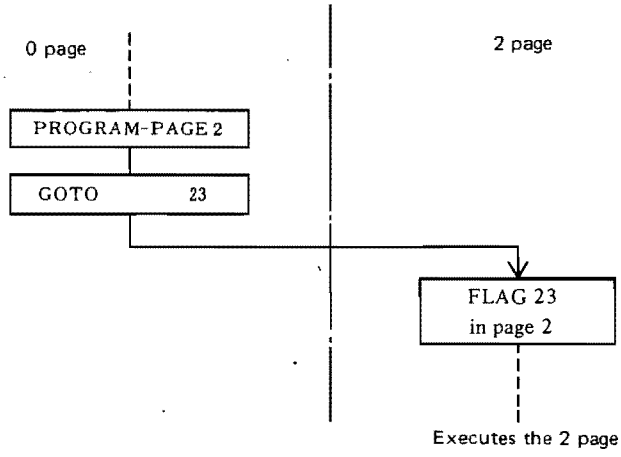
Change the data page using the DATA-PAGE instruction. This can also be performed by using the INDIRECT instruction. (Explained later. P43)

3. How to Use Page Instruction

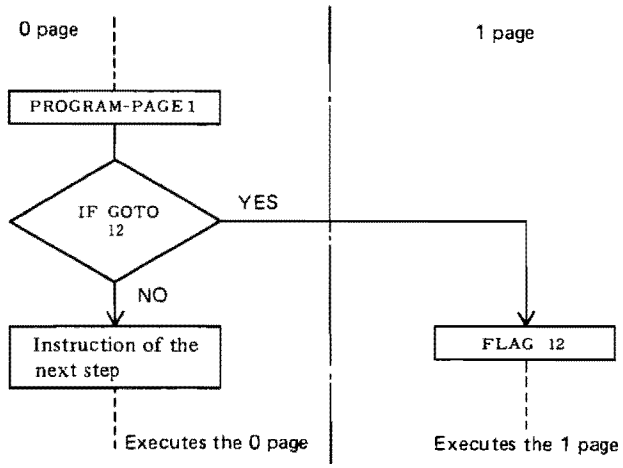
3-1 PROGRAM-PAGE n Instruction

Jump-symbol is searched for within the selected page. When jumping within a page, program page instruction is not necessary. Program page instruction is used when it is necessary to jump to another page during program execution. Page instruction is not used for manual selection of a program. (See V §2 1-1 P39)

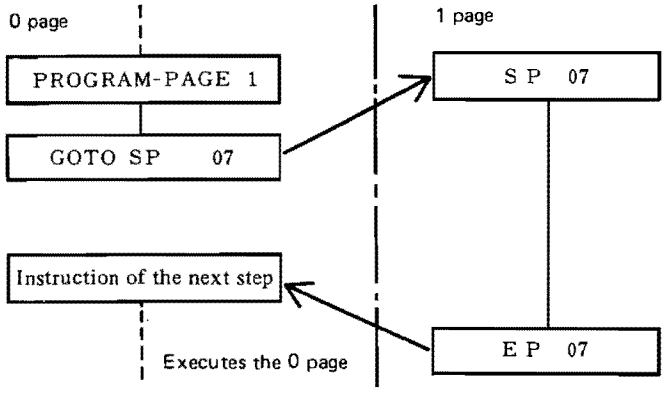
(1) Unconditional jump (GO TO nn): Set program page instruction before jump instruction and appoint page to jump.



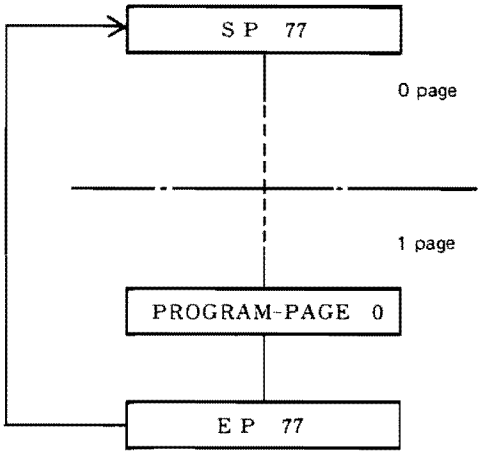
(2) Conditional jump (IF GO TO nn): Order of instructions is same as in (1). When the condition is met, it jumps to FLAG in instructed program page. When not, the program page instruction is nullified and it advances to the next instruction.



(3) Subroutine (GO TO SP nn): To jump to subroutine, place program page instruction before GO TO SP nn instruction. To return, program page instruction is not necessary. After returning, program page also returns to original page automatically.



(4) Jump from EP nn instruction to SP nn instruction: Put program page instruction before giving EP instruction to return to the paired SP instruction in the intended page.



3-2 DATA-PAGE n Instruction

(1) In Case of Direct Designation

Because memory designating instructions in direct addressing system have no function to specify the data page, put the DATA PAGE instruction before giving the memory designating instructions.

This is valid from the step with this instruction until the next instruction is given. If the [c] key is operated under "Entry Status" (See IV §3. 3-2 P26) data page is set at the page 0.

For manual operation, use the memory keys as mentioned in V §1. 2-3 P39 instead of page instruction.

```
DATA-PAGE 1 ..... Henceforth, data-page 1
                  is the object for addressing
  RM 12 ........ Address 12 of page 1
  SM 05
  ΣM 23
DATA-PAGE 0 ..... Henceforth, data-page 0
                  is the object for addressing
  RM 05
  CM 12 ........ Address 12 of page 0
  SM 25
  ΣM 12
```

(2) When Using INDIRECT Instructions

When designating the memory with INDIRECT instruction, the memories in any page can be selected, regardless of page instruction. Even when a different data page is used by INDIRECT method, the data page will not change thereafter because of it.

Moreover, the content of the INDIRECT memory is 3 digits including the page designation.

Example

Coding

1. When the contents of address 11 in page 1 (IND is used) is "90"; Address 90 in page 0 is recalled. Accumulate into address 20 in page 1

DATA-PAGE 1
IND
RM
11
ΣM
20

2. When the contents of address 11 in page 1 (IND is used) is "103"; Address 03 in page 1 is recalled. Accumulate into address 20 in page 1

4. Examples

Perform Cubic root calculation or Polynomial calculation of degree n.

Study Points;

1. Subroutine in another page.
2. Memory in another page.
3. INDIRECT instruction.

4-1 Cubic Root Calculation

Performed by the sign judgment method of the input data.

Operation Procedure:

1. Lock the [PROG SELECT] key.
2. [C] (or [STEP SET] [0] [0] [0] [0]); Set at page 0.
3. Input the data.
4. [A]

   Operations 3, 4 are repeated for the next calculations.

4-2 Polynomial Calculation of Degree n

The main program is in page 0 and the subroutine is in page 1. 8a is used as the subroutine symbol. Memories in page 1 are used.

Operation Procedure:

1. Lock the [PROG SELECT] key.
2. [C] or [STEP SET] [0] [0] [0] [0] ; Set at page 0.
3. [B]
4. Input the coefficient of degree n.
5. [↑]

   ⋮ Input in order from coefficients of higher degrees.
6. Input the coefficient of degree 0.
7. [↑]
8. [↑]
9. Input x
10. [↑]

    Perform operations 9, and 10, when the value of the polynomial in another x is required. When it is not required, depress the [↑] key to return to the head of the program.

When using the subroutine alone.

1. Lock the [PROG SELECT] key.
2. [STEP SET] [1] [0] [0] [0] ; Set at page 1.
3. [A]

   Perform the above operations 4 to 10 hereafter.

Output Format; Cubic Root Calculation

```
 99    E          4.6261    0
-27    E         -3.0000    0
 -8    E         -2.0000    0
 56    E          3.8259    0
```

Output Format; Polynomial Calculation of Degree n

```
POLYNOMIAL OF DEGREE N
  INPUT COEFFICIENTS
        1    E                  2    E
        3    E                  4    E

      INPUT X                   0    E
            Y=        4.000
      INPUT X                   1    E
            Y=       10.000
      INPUT X                   2    E
            Y=       26.000
      INPUT X
```

Program Coding

Step	Instruction	Remark	Key Operation	
000	SP		SP	
1	8a			8 A
2	IF>0		IF	+
3	00			0 0
4	SC		SIGN	CHG
5	a^x		a^x	
6	(		(	
7	3		3	
8	$1/a$		$1/a$	
9	)		)	
010	=	Cubic root	=	
1	SC	calculation	SIGN	CHG
2	GO TO		GOTO	
3	01			0 1
4	FLAG		FLAG	
5	00			0 0
6	a^x		a^x	
7	(		(	
8	3		3	
9	$1/a$		$1/a$	
020	)		)	
1	=		=	
2	FLAG		FLAG	
3	01			0 1
4	FIX 5/4		FIX	5
5	04			0 4
6	◇		◇	
7	EP		EP	
8	8a			8 A
9	SP		SP	
030	8b	Main program of		8 B
1	P-PAGE 1	Polynomial calculation	INST	9 1
2	GOTOSP	of degree n	GOTOSP	
3	8a			8 A
4	EP		EP	
5	8b			8 B

Step	Instruction	Remark	Key Operation	
1000	SP	Subroutin of Polynomial	SP	
1	8a	calculation of degree n		8 A
2	D-PAGE 1		INST	7 1
3	1	Head address for indirect storing	1	
4	0		0	
5	5		5	
6	SM		SM	
7	00			0 0
8	CM		CM	
9	01			0 1
1010	CM		CM	
1	02			0 2
2	LF		I/O	0
3	SPACE		SPACE	
4	05			0 5
5	CHA		CHA-PRINT	
6	P			P
7	O			O
8	L			L
9	Y			Y
1020	N			N
1	O			O
2	M			M
3	I			I
4	A			A
5	L			L
6	SPACE			SPACE
7	O			O
8	F			F
9	SPACE			SPACE
1030	D			D
1	E			E
2	G			G
3	R			R
4	E			E
5	E			E
6	SPACE			SPACE
7	N			N
8	CHA		CHA-PRINT	
9	LF		I/O	0
1040	SPACE		SPACE	
1	07			0 7
2	CHA		CHA-PRINT	
3	I			I
4	N			N
5	P			P
6	U			U
7	T			T
8	SPACE			SPACE
9	C			C

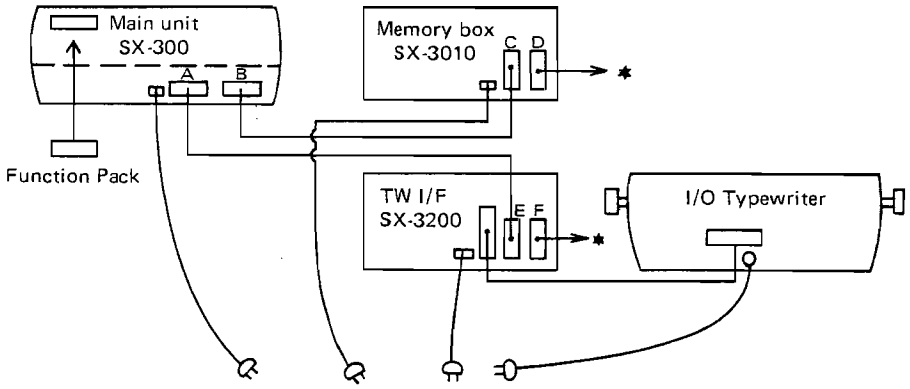
Program Coding

Step	Instruction	Remark	Key Operation	Step	Instruction	Remark	Key Operation
1050	O		O	1100	1		1
1	E		E	1	0		0
2	F		F	2	5		5
3	F		F	3	SM		SM
4	I		I	4	00		0 0
5	C		C	5	FLAG		FLAG
6	I		I	6	02		0 2
7	E		E	7	RM		RM
8	N		N	8	02		0 2
9	T		T	9	x		x
1060	S		S	1110	RM		RM
1	CHA		CHA-PRINT	1	03		0 3
2	LF		I/O 0	2	+	Calculation of $f(x)$	+
3	ENT	Input the coefficient of degree n	ENT	3	IND	(roop)	INDIRECT
4	FLAG		FLAG	4	RM		RM
5	00		0 0	5	00		0 0
6	IND		INDIRECT	6	=		=
7	SM		SM	7	SM		SM
8	00		0 0	8	02		0 2
9	1		1	9	1		1
1070	ΣM	IND+1	ΣM	1120	ΣM	IND+1	ΣM
1	00		0 0	1	00		0 0
2	ΣM	Count the degree	ΣM	2	SC		SIGN CHG
3	01		0 1	3	ΣM		ΣM
4	ENT	Input the coefficients	ENT	4	04		0 4
5	IFE		IF ENT	5	RM		RM
6	00		00	6	04		0 4
7	LF		I/O 0	7	IF≠0		IF =
8	SPACE		SPACE	8	02		0 2
9	14		1 4	9	SPACE		SPACE
1080	CHA		CHA-PRINT	1130	20		2 0
1	I		I	1	CHA		CHA-PRINT
2	N		N	2	Y		Y
3	P		P	3	=		INST 3 d
4	U		U	4	CHA		CHA-PRINT
5	T		T	5	RM		RM
6	SPACE		SPACE	6	02		0 2
7	x		x	7	FIX	Print Y	FIX 0
8	CHA		CHA-PRINT	8	03		0 3
9	SPACE		SPACE	9	COL		COL-PRINT
1090	03		03	1140	13		1 3
1	ENT	Input X	ENT	1	LF		I/O 0
2	FLAG		FLAG	2	SPACE		SPACE
3	01		0 1	3	14		1 4
4	SM		SM	4	CHA		CHA-PRINT
5	03		0 3	5	I		I
6	RM		RM	6	N		N
7	01		0 1	7	P		P
8	SM		SM	8	U		U
9	04		0 4	9	T		T

Program Coding

Step	Instruc-tion	Remark	Key Operation	
1150	SPACE			SPACE
1	x			x
2	CHA		CHA-PRINT	
3	SPACE		SPACE	
4	03			0 3
5	CM		CM	
6	02			0 2
7	ENT	Input X	ENT	
8	IFE		IF	ENT
9	01			0 1
1160	EP		EP	
1	8a			8 A

(Back view of the connected example)



Note: Connecters for Input/Output
A ≠ B C = D E = F
A: Output for Interface
B: Output for Memory Box SX-3010

Remark: * to other interface
⊟—⊟ Cable unit

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Foreword

Welcome to the ranks of Canon program calculator owners. We have prepared this instruction booklet to make you familiar with the machine in any operating situation. Detailed explanations for executing complicated calculations are given as well as a full explanation of the operating methods and of functions of the calculator in ordinary usage. It also may be used as a dictionary of terms and functions related to this machine.

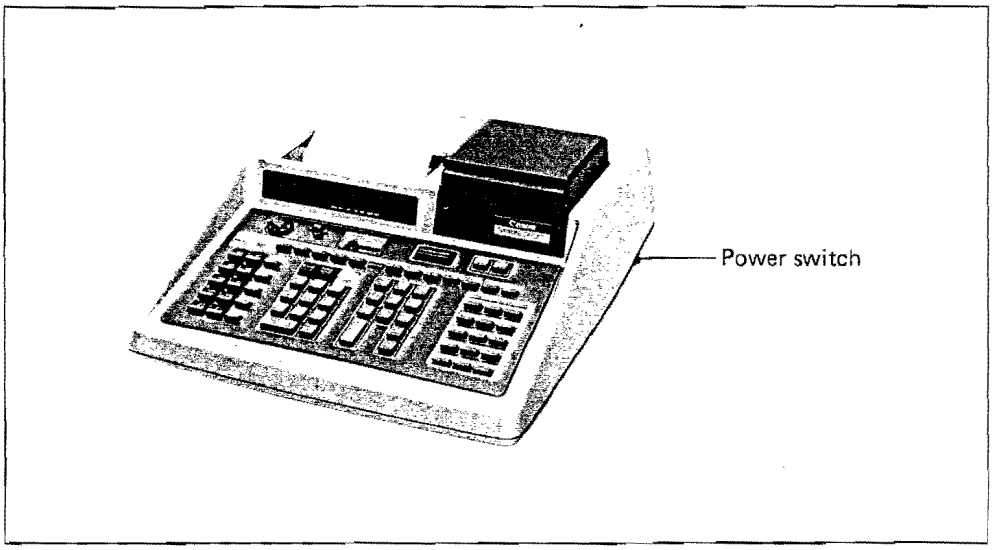
Please read this booklet carefully before using the machine, and refer to it often in order to use your machine to the best possible advantage.

CANON INC.

Contents of the Binder

1. An instruction sheet—How to use the Test Run Program
2. An instruction sheet—How to use the Tape Head Cleaning Set
3. An instruction sheet—How to use the Printer Head Cleaner
4. Printer Head Cleaner 1 sheet
5. SX-300 Series Instruction Booklet
6. An instruction booklet—How to use the Scientific Functions
7. Vinyl bags 5 bags
8. Plate for the Function Block 1 sheet
9. Cover sheet 1 sheet

Before using the calculator:



First, set the thermal paper on the printer.
(An explanation of how to set the thermal paper is shown in I. § 2. 2 on P.9 of the instruction booklet of the SX-300 Series.)

Before using the calculator, set the thermal paper and turn the power switch to ON, and then check the calculator by means of the Test Run Program to see if it is in a normal condition.

How to Use the Test Run Program

Check to see if the calculator is normal, using the procedure shown below.

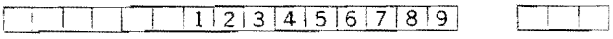
Operation Procedure

1. Depress the [C] key.
2. Check to see if the [DATA TRANS] key is not locked.
3. Set the Test Run Program Tape in the cartridge reader while keeping the labeled side of the cartridge upward.
4. Depress the [LOAD] key. When the MCR lamp is turned off and loading is finished, take the cartridge tape out by pushing the EJECT knob forward.
5. Depress the [C] key.
6. Depress the [1] key.

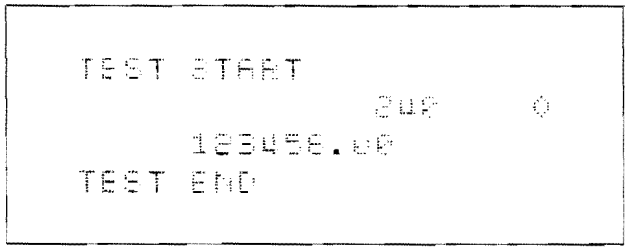
Remark: The Angle Form Slide Switch must be set at the DEG mode.

Indication and printing shown below should be obtained.

Indication:



Printing:



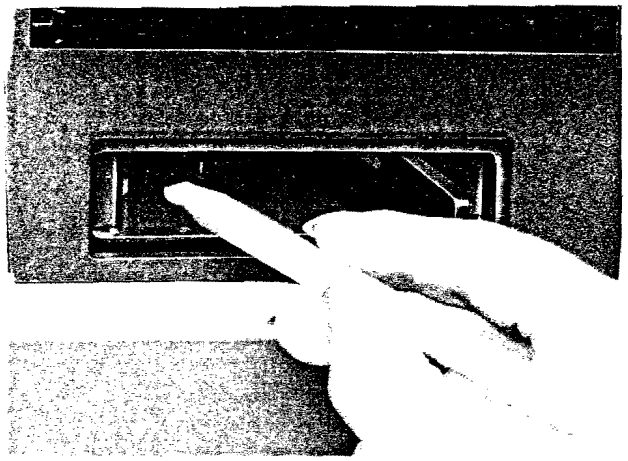
If the result shown above can't be obtained even when you carry out a correct operation, inform the dealer or the service shop.

How to Use the Tape Head Cleaning Set

Any particles on surface of Cartridge Reader head that tape runs on will scratch and damage tape or cause faulty writing, reading or driving of tape. Before using the cartridge tape, wipe surface of head.

Operation Procedure

1. Hold up door flap with bar as the picture shows.
2. Spread pen with cleaning fluid and carefully wipe surface of head.



Note 1. Always keep cap on bottle when not in use to prevent cleaning fluid from evaporating.

2. When the felt tip of pen becomes dirty, pull out dirty felt tip and insert spare tip taking from inside penholder.

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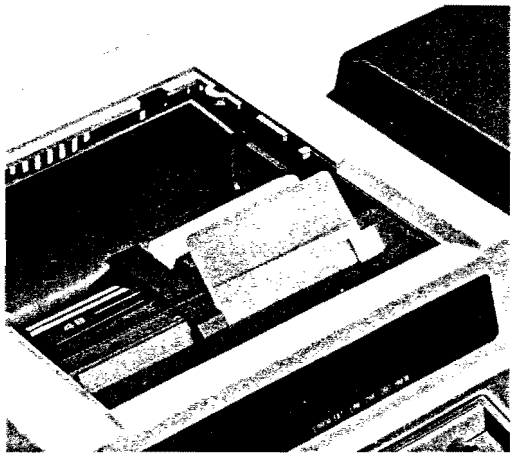
How to Use the Printer Head Cleaner

If the printing is uneven, unclear, or not dark enough, clean the printer head by the Printer Head Cleaner.



Operation Procedure

1. After taking the thermal paper out of the printer, slide the digit selection knob to position "24".
   Note: When taking the thermal paper out of the printer, don't pull the roll but remove the paper by means of the [PAPER FEED] key, after cutting the paper off from the roll.
2. Insert the cleaner into the feeder for the thermal paper, keeping the glossy side on which PRINTER HEAD CLEANER is printed up. Then, advance and set it by the [PAPER FEED] key.
3. Operations should be carried out as in the printing of all digits. Any key may be depressed, but the Decimal Point Selector Dial must be set at the F position. Too many lines of printing will cause damage to the head, so printing should be made in no more than 10 lines.

   Example 1) 9 [÷] [÷] ..... [÷]
   Example 2) 0.1 [000] [SM nn] 00 [RM nn] 00
   .... [RM nn] 00

4. Advance the Printer Head Cleaner by means of the [PAPER FEED] key to remove the cleaner.

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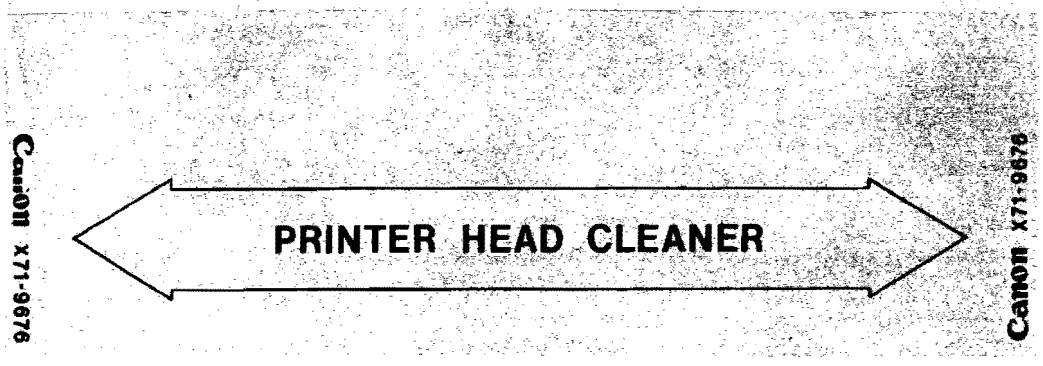
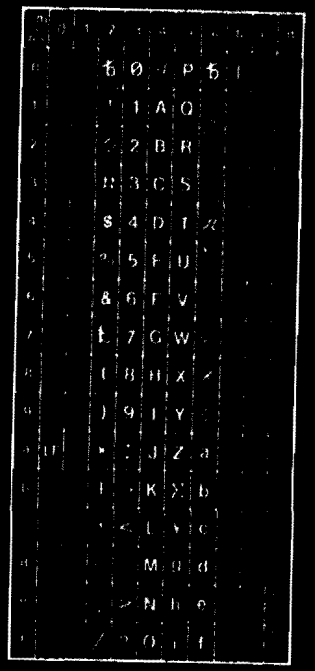


INPUT OPERATION 4

$\sin^{-1}$	arc sin	FRACTION	INST nn	8 7
$\cos^{-1}$	arc cos	INTEGER	INST nn	8 8
$\tan^{-1}$	arc tan	|a|	INST nn	8 6
to DMS	arc a→	SET ERROR DISABLE	INST nn	F 9
e	arc e^x	RESET ERROR DISABLE	INST nn	F 7
π	arc arc	SET ERROR	INST nn	F 5
FIX ↑	FIX nn 9	RESET ERROR	INST nn	F 3
FIX 5/4	FIX nn 5	CM ALL	INST nn	F 1
FIX ↓	FIX nn 0	NON OPERATION	INST nn	0 0
IF ≥0 GO TO	IF GO TO nn +	PROGRAM PAGE n	INST nn	9 n
IF ≠0 GO TO	IF GO TO nn =	DATA PAGE n	INST nn	7 n
IF <0 GO TO	IF GO TO nn −	LINE FEED	1/0	0
IF ENT GO TO	IF GO TO nn ENT	BRANCH	1/0	F
IF ERROR GO TO	IF GO TO nn CE			

86-3756

TABLE OF CHARACTER CODE (mn) 4



86-3756

INPUT OPERATION 4

$\sin^{-1}$	arc sin	FRACTION	INST nn 8 7
$\cos^{-1}$	arc cos	INTEGER	INST nn 8 8
$\tan^{-1}$	arc tan	|a|	INST nn 8 6
to DMS	arc a⁻⁻	SET ERROR DISABLE	INST nn F 9
e	arc e^x	RESET ERROR DISABLE	INST nn F 7
π	arc arc	SET ERROR	INST nn F 5
FIX ↑	FIX nn 9	RESET ERROR	INST nn F 3
FIX 5/4	FIX nn 5	CM ALL	INST nn F 1
FIX ↓	FIX nn 0	NON OPERATION	INST nn 0 0
IF ≥0 GO TO	IF GO TO nn +	PROGRAM-PAGE n	INST nn 9 n
IF ≠0 GO TO	IF GO TO nn =	DATA-PAGE n	INST nn 7 n
IF <0 GO TO	IF GO TO nn −	LINE-FEED	1/0 0
IF ENT GO TO	IF GO TO nn ENT	BRANCH	1/0 F
IF ERROR GO TO	IF GO TO nn CE		

86-3756

TABLE OF CHARACTER CODE (mn) 4

n \ m	0	1	2	3	4	5	a	b	c	d
0			ゎ	0	((d	P	ゎ	｜		
1			!	1	A	Q	｡			
2			◇	2	B	R	｢			
3			#	3	C	S	｣			
4			$	4	D	T	π			
5			%	5	E	U	ｽ			
6			&	6	F	V				
7			ｧ	7	G	W	√			
8			(	8	H	X	×			
9			)	9	I	Y	÷			
a	LF		*	:	J	Z	a			
b			+	→	K	Σ	b			
c			,	<	L	Y	c			
d			−	=	M	g	d			
e			.	>	N	h	e			″
f			/	?	O	i	f			°

86-3756

CANON CANOLA SX SERIES
TABLE OF CHARACTER CODE

CHA	CODE	CHA	CODE	CHA	CODE	CHA	CODE
A	41	V	56	(blank)	20	0	30
B	42	W	57			1	31
C	43	X	58	◇	22	2	32
D	44	Y	59	=	23	3	33
E	45	Z	5a	▭	df	4	34
F	46	a	aa	▫	a1	5	35
G	47	b	ab	⌊	b0	6	36
H	48	c	ac	⌐	a2	7	37
I	49	d	ad	⌋	a3	8	38
J	4a	e	ae	$	24	9	39
K	4b	f	af	£	27	+	2b
L	4c	g	5d	¥	5c	−	2d
M	4d	h	5e	∞	40	×	a8
N	4e	i	5f	→	3b	÷	a9
O	4f	&	26	π	a4	=	3d
P	50	·	2e	°	a5	<	3c
Q	51	,	2c	√	a7	>	3e
R	52	?	3f	Σ	5b	(	28
S	53	!	21	%	25	)	29
T	54	//	de	LF (line feed)	0a	:	3a
U	55	✱	2a			/	2f

CLEAR FUNCTIONS & OPERATIONS

Operation / Mode	1) Clear all [C] & [CA]
• OPE	○ To clear the entire memory area. ○ To clear the display, the working registers and the step counter (set at the step 000). ○ To release the error state.
• LRN	○ To clear the entire step area. ○ To clear the display, the working registers and the step counter. ○ To release the error state.

Operation / Mode	2) Clear [C]
• OPE • DBG • LRN • CHE	○ To clear the display, working registers and the step counter (set at the step 000). ○ To release the error state.

Canon

CANON CANOLA SX SERIES
TABLE OF CHARACTER CODE

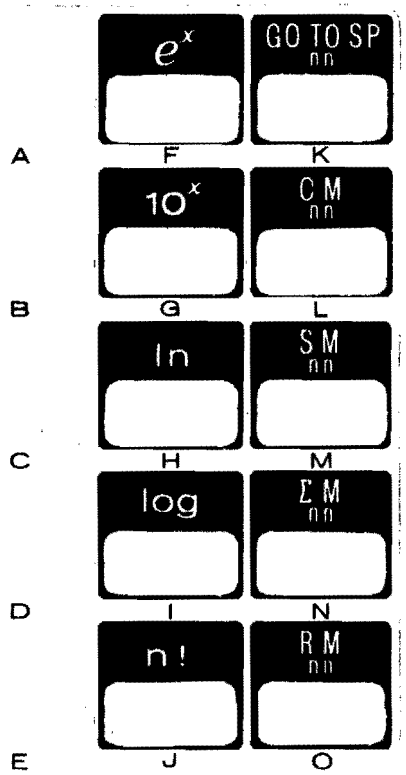
CHA	CODE	CHA	CODE	CHA	CODE	CHA	CODE
A	41	V	56	(blank)	20	0	30
B	42	W	57			1	31
C	43	X	58	◇	22	2	32
D	44	Y	59	#	23	3	33
E	45	Z	5a		df	4	34
F	46	a	aa	°	a1	5	35
G	47	b	ab	|	b0	6	36
H	48	c	ac	┌	a2	7	37
I	49	d	ad	┘	a3	8	38
J	4a	e	ae	$	24	9	39
K	4b	f	af	£	27	+	2b
L	4c	g	5d	¥	5c	−	2d
M	4d	h	5e	@	40	×	a8
N	4e	i	5f	→	3b	÷	a9
O	4f	&	26	π	a4	=	3d
P	50	.	2e	ˣ	a5	<	3c
Q	51	,	2c	√	a7	>	3e
R	52	?	3f	Σ	5b	(	28
S	53	!	21	%	25	)	29
T	54	//	de	LF	0a	:	3a
U	55	*	2a	(line	feed)	/	2f

CLEAR FUNCTIONS & OPERATIONS

Operation / Mode	1) Clear all [C] & [C ALL]
• OPE	○ To clear the entire memory area. ○ To clear the display, the working registers and the step counter (set at the step 000). ○ To release the error state.
• LRN	○ To clear the entire step area. ○ To clear the display, the working registers and the step counter. ○ To release the error state.

Operation / Mode	2) Clear [C]
• OPE • DBG • LRN • CHE	○ To clear the display, working registers and the step counter (set at the step 000). ○ To release the error state.

Canon


e^x
GO TO SP nn
A
F
K
10^x
CM nn
B
G
L
ln
SM nn
C
H
M
log
Σ M nn
D
I
N
n!
RM nn
E
J
O