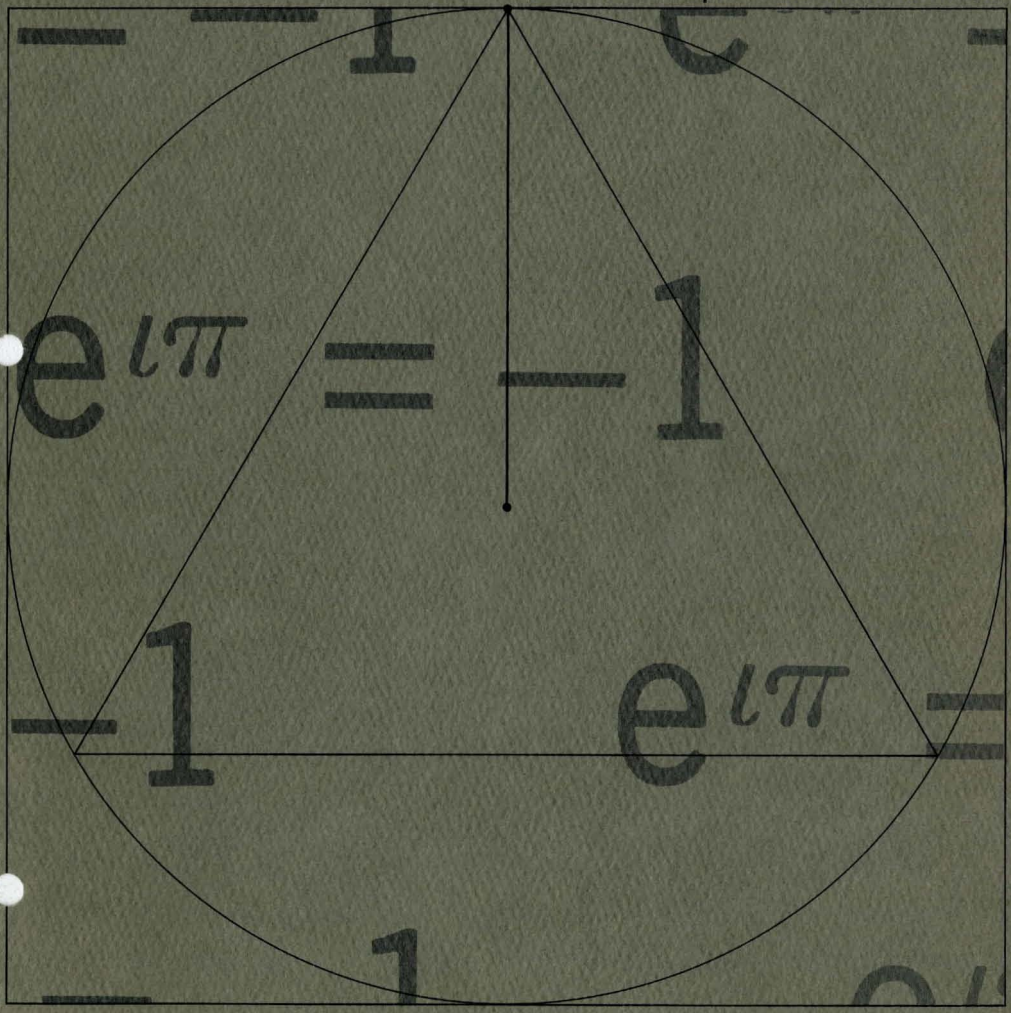
THE WYLE SCIENTIFIC | INSTRUCTION MANUAL



INTRODUCTION

The WYLE SCIENTIFIC provides capabilities and features unique in a desk-top machine. Some of these features are

- 3 storage registers – There is no need to write down intermediate results or commonly used constants, such numbers can be stored in one of these registers, and recalled at any time when needed.

- Automatic decimal alignment – The decimal point is entered at the place where it occurs in the number. The number is positioned automatically. And so are all answers.

- Full display of registers – The contents of all registers are displayed. Numbers may be visually verified as entered and storage locations are immediately apparent. You don't have to remember where you stored a number or what the number was.

- Correction capability – If any digit of a 24-digit number is entered incorrectly, that digit can be individually selected and changed.

And there are a great many more features, explained in this manual, that make the WYLE SCIENTIFIC the most flexible and powerful desk-top computational machine you can use.

In spite of this unusual capability, the operation of the WYLE SCIENTIFIC is easy to learn. Operation is straightforward and requires no complex routines or techniques, even for relatively complex operations. The basic operations can be mastered in minutes.

The purpose of this book is to acquaint you with the basic operations of the WYLE SCIENTIFIC. Each key, each function, and each section of the display is explained in full. These examples demonstrate the possible applications and others will become apparent as you use the machine in day-to-day operations.

All keys and registers are explained in detail in the following pages; however, a general explanation of the keyboard and display will acquaint you with what to look for when operating the SCIENTIFIC and will explain some terms that will be used in the following pages.

NOTE

Please observe the following precautions in using the WYLE SCIENTIFIC desk-top computer.

1. Keep dust cover on when machine is not in use.

2. Do not put dust cover on when machine is turned on. This blocks air flow to the machine and the internal rise in temperature may damage circuits.

3. Remove and clean the air filter (located on the bottom) every three months. Use vacuum cleaner or wash with soap and water. Be sure filter is dry before replacing it.

If your SCIENTIFIC does not operate properly, check the following possibilities.

1. If cooling fans are not running

   a. Check AC line cord and plug.

   b. Check AC outlet.

   c. Check fuse (on back of case).

2. If cooling fan is running but there is no display

   a. Be sure either a jumper plug or some input/output device is plugged into I/O socket on back of case.

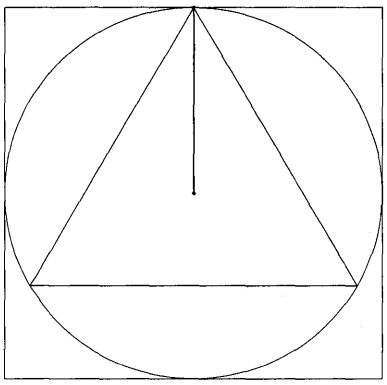
3. If display is bright but numbers cannot be entered from keyboard

   a. Check for a key stuck down.

   b. Machine may be locked in overflow. Press any TO key to resume normal operation.

If machine cannot be made to operate, contact the nearest Wyle Laboratories representative immediately. Do not remove the case. Any unauthorized attempt to repair malfunctions will void the warranty.

DISPLAY / KEYBOARD



Display

The top line of the display is the Multiplier-Quotient Register, abbreviated MQ. This register is used to hold the multiplier in multiplication operations, the quotient in division operations, and the answer in square root operations.

The ENTRY register holds the multiplicand in multiplication operations, the divisor in division operations, and the minuend in subtraction operations. It is the normal register for data entry and its contents are added to the contents of the accumulator register in the normal addition operation.

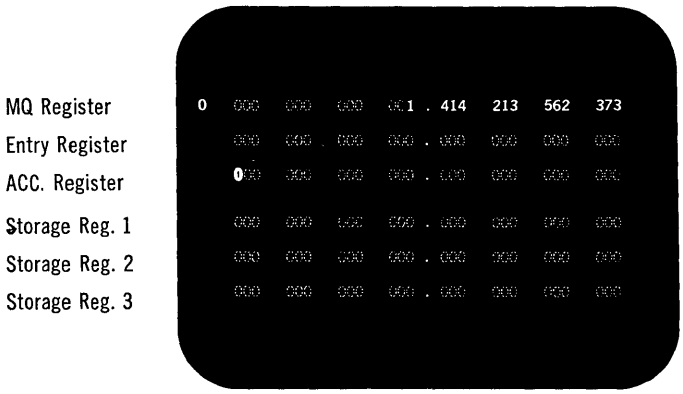
The accumulator register, abbreviated ACC, is used to hold the original number (radicand) in square root operations, the dividend in division operation, and the subtrahend in subtraction operations. The answers to all addition, subtraction, and multiplication operations of all types appear in this register.

The three storage registers are numbered 1, 2 and 3 from top to bottom. They are used to store constants or intermediate answers which may be required at a later stage in the calculation. Numbers can be transferred to any of these registers from any other register and from any of these registers to any other register.

An indicator zero appears on the far left; in the illustration it is shown aligned with the MQ Register. This indicates which register has been selected as the FROM register. In one register, one of the 24 digits will be intensified. This is the register selected as the TO register. When the TRANSFER key is depressed, the contents of the selected FROM register will automatically be transferred to the TO register. In the illustration, this is shown as the initial zero of the ACC register.

The digit position which is intensified can be moved right or left by the FORWARD SPACE and BACK SPACE keys. The position of the bright digit indicates the next position for number entry. If the number 2 key were depressed, the bright zero would be converted to a 2, and the next zero to the right would become the bright digit.

The operation of these various keys is explained in detail later in this book, as well as the use of these keys to correct erroneous data already entered.



Wyle SCIENTIFIC Visual Display

Keyboard

The labeling on the various keys is self-explanatory and the remainder of this book is devoted to illustrating the function and application of the keyboard.

For your convenience the keys are grouped by function. The left hand group of keys controls transfer operations, the central group of keys control data entry, and the right hand group of keys control arithmetic operations.

A quick reference list of the basic commands and operations is given on the back cover. Since the notation is used in other places throughout the book, it is explained in the following paragraphs.

As an example, consider the following "shorthand" notation

$$(\text{ENTRY}) + (\text{ACC}) \rightarrow \text{ACC}$$

This is read as: The contents of the ENTRY register are added to the contents of the ACC register and the results appear in the ACC register. In summary

(ENTRY) is read as "Contents of the ENTRY register"

ENTRY is read as "The ENTRY register."

Some additional examples will further clarify this system of notation

$$(\text{MQ}) \times (\text{ENTRY}) \rightarrow \text{ACC}$$

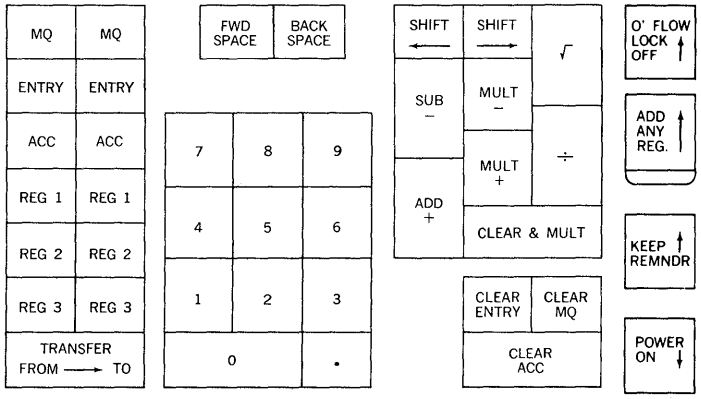
is read "Contents of the MQ register are multiplied by the contents of the ENTRY register and the results appear in the ACC register."

$$(\text{ENTRY}) \rightarrow \text{R1}$$

is read "Contents of the ENTRY register are transferred to storage REG 1."

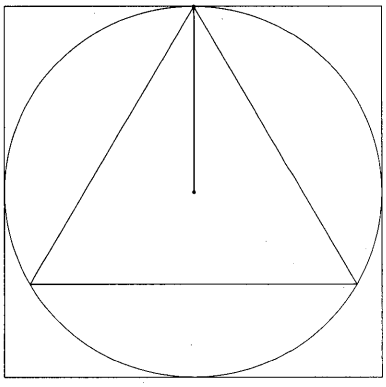
$$(\text{ACC}) - (\text{ENTRY}) \rightarrow \text{ACC}$$

is read "Contents of the ENTRY register are subtracted from the contents of the ACC register and the difference appears in the ACC register."



Wyle SCIENTIFIC Keyboard

BASIC OPERATIONS



BASIC OPERATIONS

The following pages describe the basic operations of the WYLE SCIENTIFIC. These are not the arithmetic operations but those operations which allow you to enter numbers into the registers, rearrange the contents of the registers, and prepare the machine for arithmetic operations.

Before turning on power, place the slide switches located above the power switch in the following configuration.

OVERFLOW LOCK OFF switch – UP
ADD FROM ANY REGISTER switch – DOWN
KEEP REMAINDERS switch – DOWN

These switches determine the various operating modes and their functions will be explained in detail, elsewhere in this manual.

Now turn on power switch and allow a few seconds for the machine to "warm up." When the numbers on the visual display (usually two or more zeros) appear bright and steady, the machine is ready to operate.

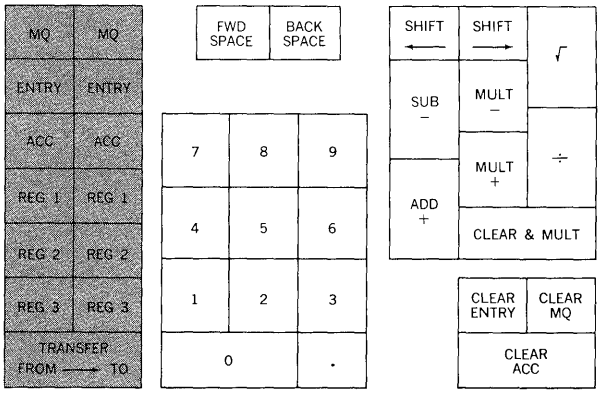
If more than two zeros and the decimal points show on the display, depress the two keys labeled MQ, located at the top left of the keyboard. The display should then consist of two zeros, one of normal intensity and one bright, and six decimal points.

1. Data Transfer Operations

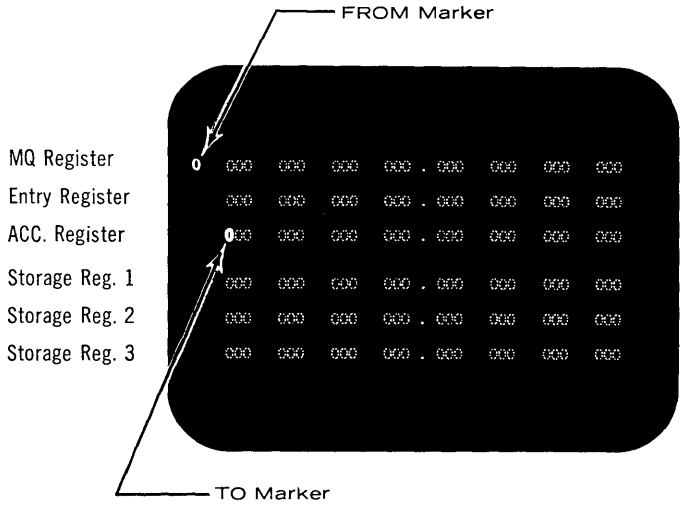
Six FROM keys and six TO keys, all located on the left hand side of the keyboard, define the data transfer operations (FROM a selected register TO a selected register). The actual transfer is initiated by the TRANSFER key, located below the TO and FROM keys.

Exercise 1

Depress		
	FROM	MQ
	FROM	ENTRY
	FROM	ACC
	FROM	R1
	FROM	R2
	FROM	R3



KEYBOARD NO. 1



Exercise 1: TO and FROM markers

Note the position of the FROM marker at each step (the indicator located at the left hand side of the display).

Depress		
	TO	MQ
	TO	ENTRY
	TO	ACC
	TO	R1
	TO	R2
	TO	R3

Note the position of the TO marker at each step (the bright digit of the register contents).

(Further transfer exercises are given after the explanation of the Data Entry.)

2. Clearing the Registers

The three arithmetic registers (MQ, ENTRY, ACC) are cleared, that is, the contents are eliminated by means of the three keys located in the lower right hand section of the keyboard. These are labeled

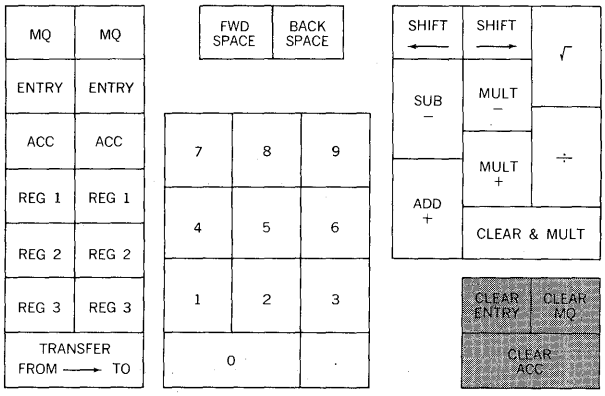
CLEAR ENTRY

CLEAR MQ

CLEAR ACC

and each key eliminates all data in the corresponding register. When a register is cleared it is automatically addressed TO.

To clear Registers 1, 2 and 3, TRANSFER TO the selected register from some other register which is already cleared.



KEYBOARD NO. 2

Exercise 2

Depress CLEAR MQ

CLEAR ENTRY

CLEAR ACC

Note that the contents of all three registers are eliminated, and that the TO marker always appears in the register just cleared.

Depress FROM ACC

TO REG 1

TRANSFER

Note that Register 1 is now cleared.

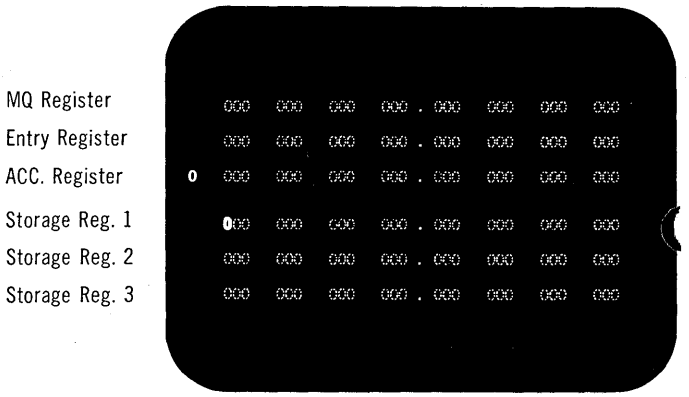
Depress TO REG 2

TRANSFER

TO REG 3

TRANSFER

Note that all six registers are now cleared. These operations should be performed slowly so that the marker positions can be noted.



Exercise 2: TO and FROM Markers for transferring zeros from ACC to REG. 1

3. Data Entry

Numerical data is entered via the numerical keys located in the center of the keyboard. Data will appear in the selected TO register. The TO register is identified by the TO marker and the position of this marker indicates the position where the next digit will be entered.

Numbers are entered exactly as read, including the decimal point. As an example, the following steps:

Depress TO ACC

4 KEY

3 KEY

5 KEY

DECIMAL POINT (.) KEY

0 KEY

1 KEY

4 KEY

will place 435.014 in the selected TO register, properly aligned about the preselected decimal point.

Exercise 3

Depress TO ENTRY

2

(.)

Note position of number 2 in ENTRY register.

Depress CLEAR ACC

(.)

2

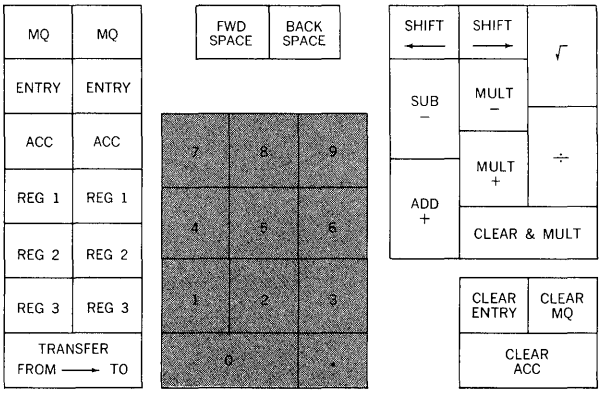
Note position of number .2 in ACC register.

Depress TO MQ

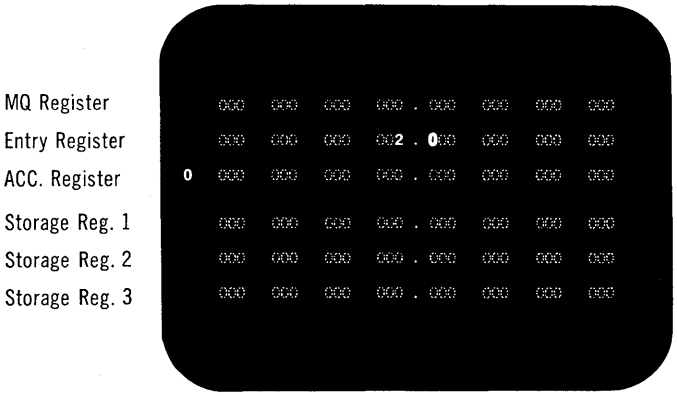
2

(.)

Note position of the digit 2 in the various registers and the fact that the TO marker indicates the position of the next digit to be entered.



KEYBOARD NO. 3



Exercise 3: Number 2. entered into ENTRY Register

Exercise 3-A

Depress CLEAR MQ

CLEAR ENTRY

CLEAR ACC

TO ENTRY

ENTER 123.456

FROM ENTRY

TO ACC

Depress TRANSFER

TO REG. 1

TRANSFER

Perform this series of operations slowly, noting the positions of the TO marker and FROM marker. Learning to interpret the status of the machine from the positions of these markers can save time and unnecessary operations.

4. FORWARD and BACK Space

The FWD SPACE and BACK SPACE keys, located in the top center section of the keyboard, position the TO marker one digit at a time. This enables you to correct an erroneous entry without re-entering the data.

Exercise 4

Clear all Registers

Depress TO ENTRY

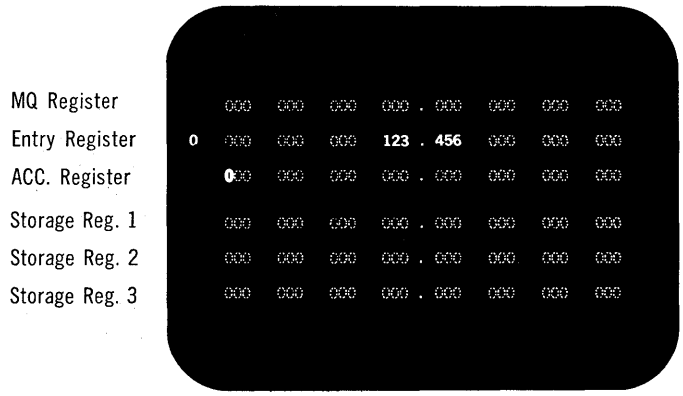
Enter 999.999

Depress FWD SPACE 5 times

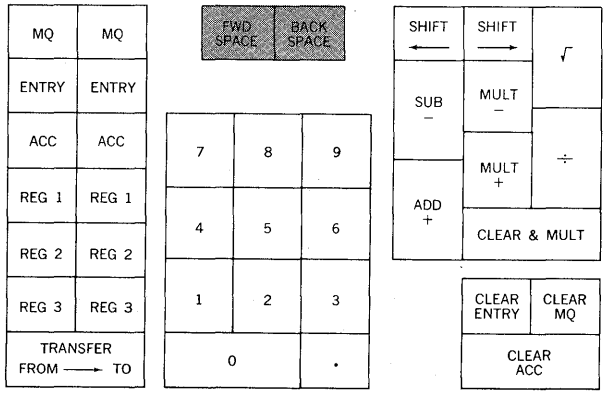
BACK SPACE 7 times

Note the position of the TO marker as the forward space and back space keys are depressed.

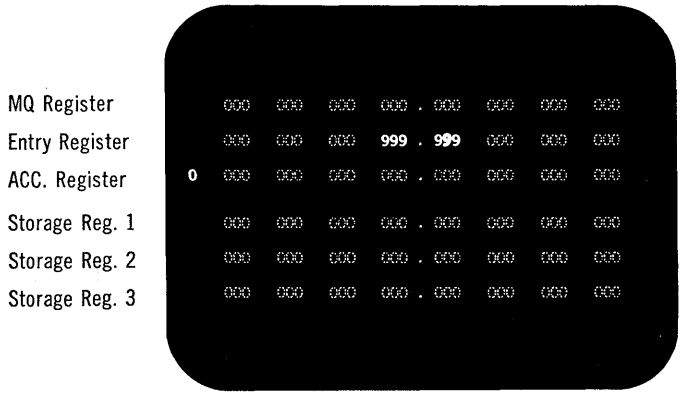
Now, enter the digit 5. (Do not depress the decimal point key.) Note that the number which was intensified has changed to 5 and the next digit is now the bright position. Depress FWD SPACE once. The TO marker skips the last 9 and additional numbers may now be entered following the number 999.959.



Exercise 3A: Prior to first transfer operation



KEYBOARD NO. 4



Exercise 4: Prior to entering digit 5 in place of digit 9

5. Shift Left and Shift Right

These keys move the entire number in the selected TO register to either the left or right, one space each time the keys are depressed.

Exercise 5

Clear all Registers

Enter 1.25 in Reg. 3

Depress SHIFT LEFT 5 times

SHIFT RIGHT 6 times

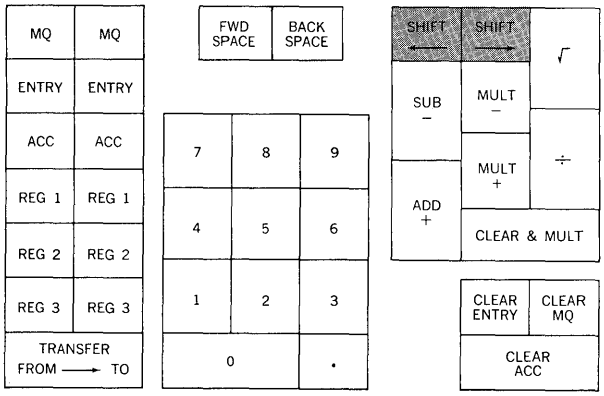
Perform these operations slowly and note the change of position of the number in Register 3.

6. Decimal Point

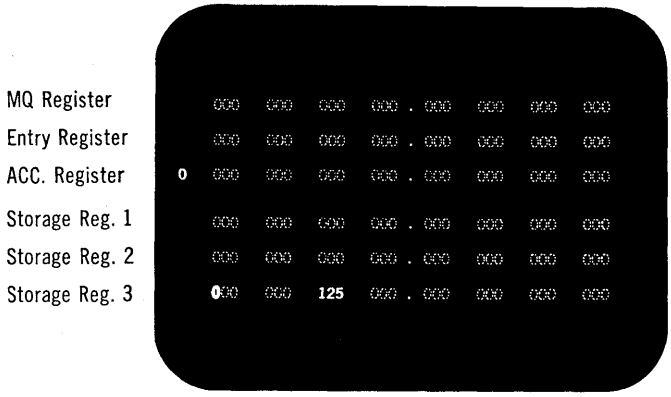
The WYLE SCIENTIFIC handles the decimal point automatically; however, as a convenience, the decimal point may be positioned in steps of three digits. This permits calculations using numbers through the range between a 3-digit whole number with a 21-digit fraction and a 21-digit whole number with a 3-digit fraction.

Exercise 6

Rotate the decimal point switch so decimal point moves throughout its range. Return to mid-point position 12, and leave in this position. The decimal point switch is located at the bottom of the case, directly beneath the display.

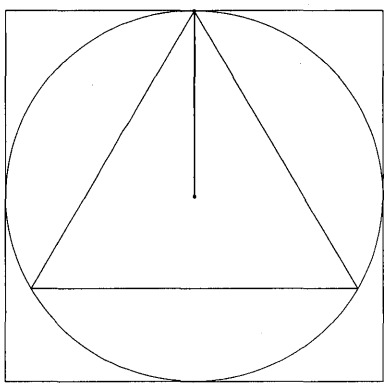


KEYBOARD NO. 5



Exercise 5: At end of SHIFT LEFT operations

MATHEMATICAL OPERATIONS



MATHEMATICAL OPERATIONS

The next section describes the arithmetic operations; the steps used in actual calculations. Before studying these operations you should be fully acquainted with the basic manipulations described in the preceding section.

7. Addition

When the ADD (+) key is depressed with the "Add Any Register" switch off (down), the contents of the ENTRY register are added to the contents of the ACC register. The sum appears in the ACC display.

In symbolic notation:

(ENTRY) + (ACC) → ACC

Exercise 7

Clear all Registers

Depress TO ENTRY

Enter 12.

Depress ADD (+)

(12 + 0 appears in ACC)

Enter 13.

Depress ADD (+)

Note that the sum (25) appears in the ACC, and that the number being added is lost.

8. Subtraction

When the SUB key is depressed with the "Add Any Register" switch off (down), the contents of the ENTRY register are subtracted from the contents of the ACC register and the difference appears in the display. In symbolic notation:

(ACC) - (ENTRY) → ACC

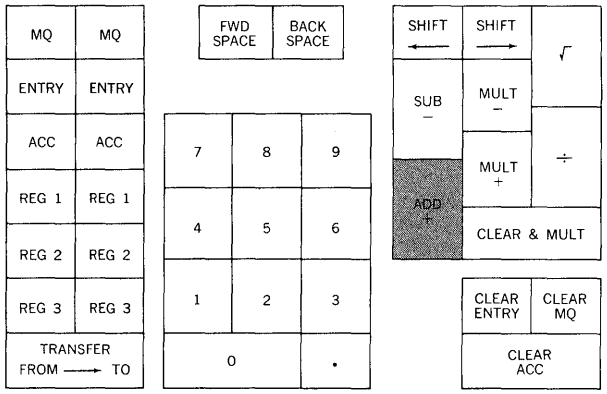
Exercise 8

Do NOT clear registers. Retain all answers from previous exercises. (25 in ACC)

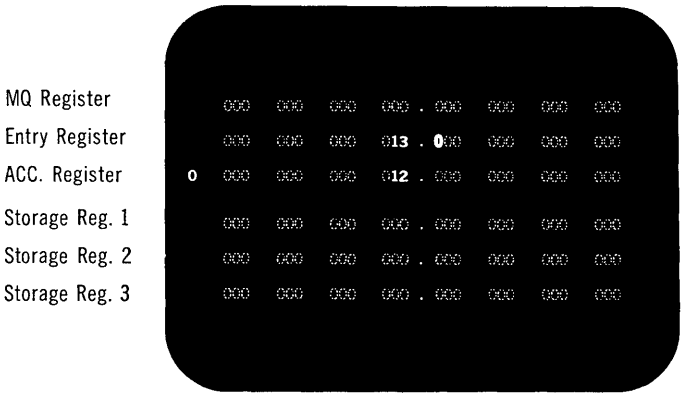
Enter 18.

Depress SUB (-) key

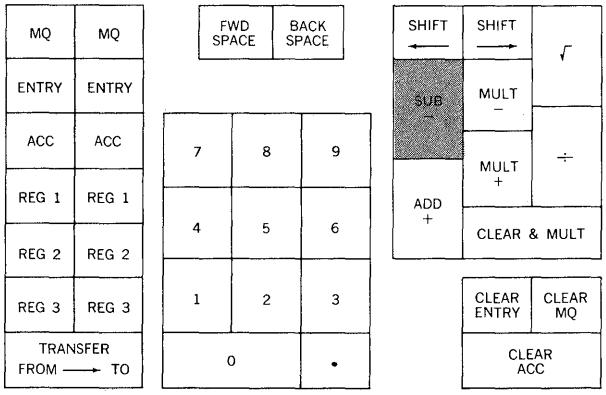
Note: 25 - 18 = 7 appears in ACC



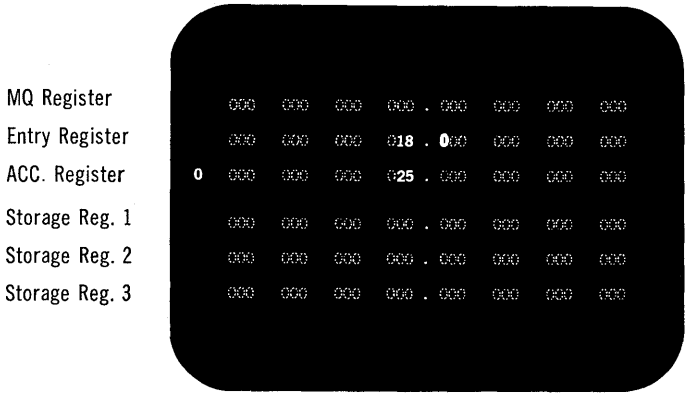
KEYBOARD NO. 7



Exercise 7: Prior to depressing ADD (+) Key



KEYBOARD NO. 8



Exercise 8: Prior to depressing SUBTRACT (—) Key

9. CLEAR and MULTIPLY

Depressing this key first clears the ACC to zero and then adds into the ACC register the product of the number in the ENTRY register and the number in the MQ register.

In symbolic notation:

$$(MQ) \times (ENTRY) \rightarrow ACC$$

Exercise 9

Clear all Registers

Depress TO MQ

Enter 15.

Depress TO ENTRY

Enter 16.

Depress CLEAR & MULT

The product 240 appears in the ACC and 15, the multiplier, remains in the MQ.

Enter 7.

Depress CLEAR & MULT

The product 105 (15 × 7) appears in the ACC. Any number previously in ACC is erased. The multiplier is retained as a constant.

10. MULTIPLY and ADD

Depressing the MULT + key adds the product of the contents of the ENTRY register and the contents of the MQ register to the contents of the ACC register. The answer appears in the ACC register. In symbolic notation:

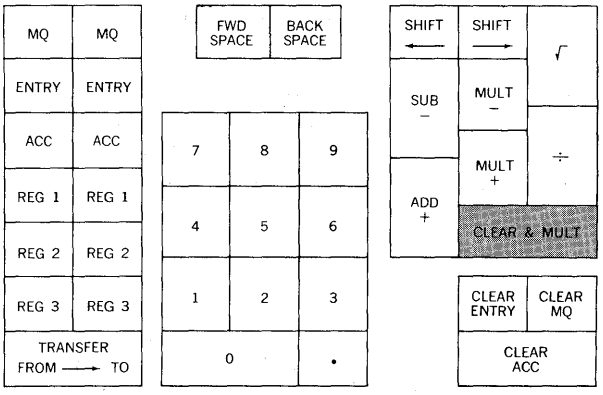
$$(ACC) + \left|(MQ) \times (ENTRY)\right| \rightarrow ACC$$

Exercise 10

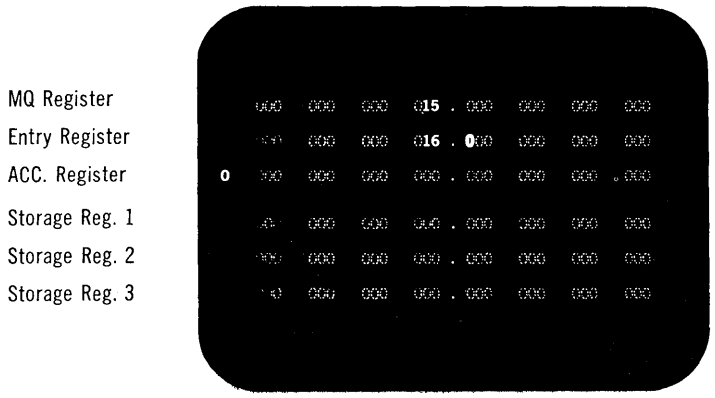
Enter 8.

Depress MULT +

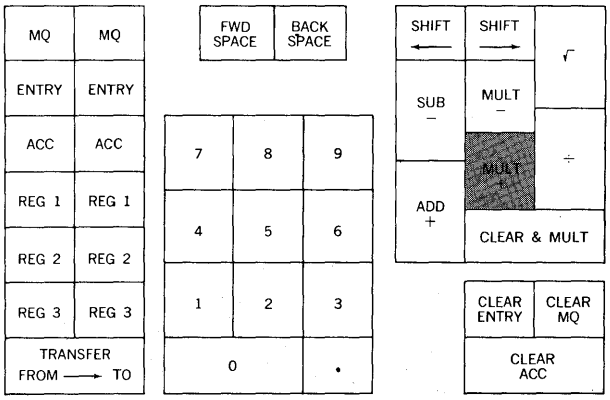
The product 120 (15 × 8) is added to the contents of the ACC (105), giving 225 in the ACC. The multiplier remains in the MQ and the multiplicand is lost.



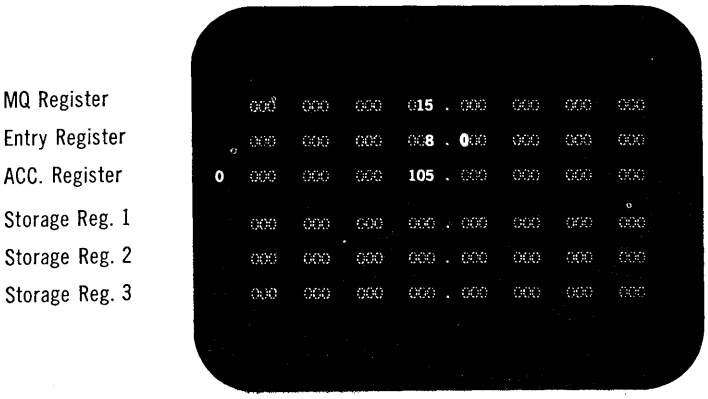
KEYBOARD NO. 9



Exercise 9: Prior to depressing CLEAR & MULT Key



KEYBOARD NO. 10



Exercise 10: Prior to depressing MULT + Key

11. MULTIPLY and SUBTRACT

Depressing the MULT - key multiplies the contents of the MQ register by the contents of the ENTRY register and subtracts the product from the contents of the ACC register. The answer appears in the ACC register. In symbolic notation:

$$(ACC) - \left|(MQ) \times (ENTRY)\right| \rightarrow ACC$$

Exercise 11

Enter 8.

Depress MULT -

The product 120 (15 × 8) is subtracted from the ACC (225) giving 105 in the ACC.

12. DIVIDE

Depressing the ÷ key divides the contents of the ACC register by the contents of the ENTRY register. The answer (quotient) appears in the MQ register. In symbolic notation:

$$(ACC) \div (ENTRY) \rightarrow MQ$$

Exercise 12

Depress CLEAR ACC

Depress TO ACC

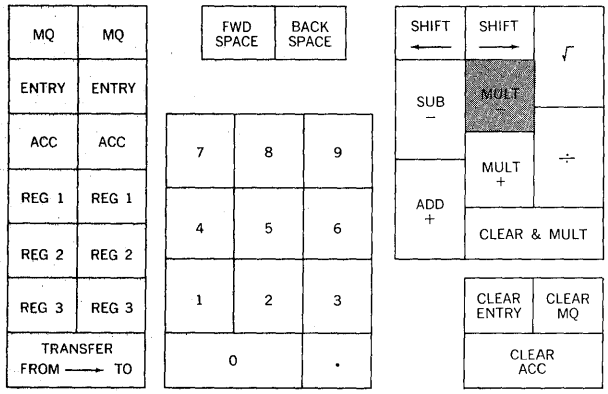
Enter 144.

Depress TO ENTRY

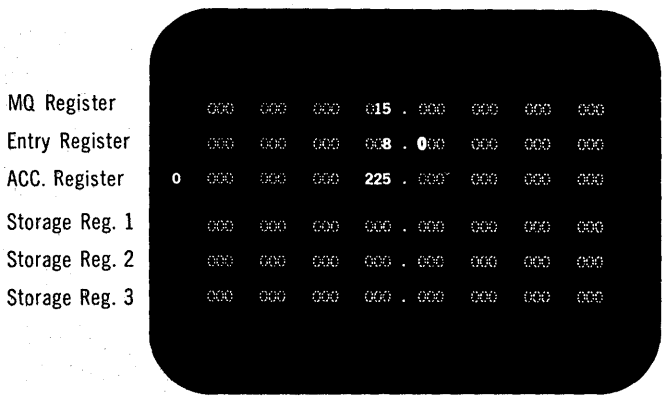
Enter 13.

Depress DIVIDE (÷)

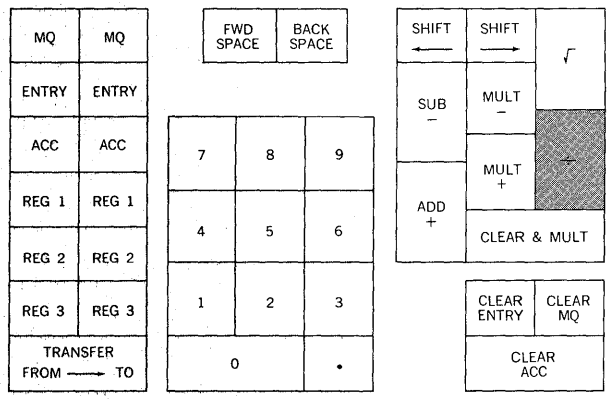
The quotient 11.076 923 076 923 appears in the MQ register.



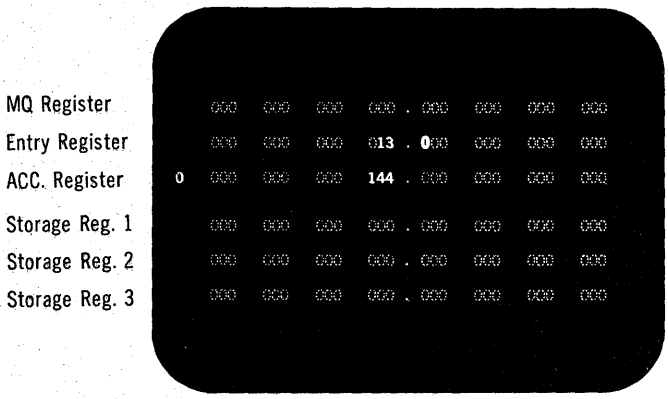
KEYBOARD NO. 11



Exercise 11: Prior to depressing MULT (—) Key



KEYBOARD NO. 12



Exercise 12: Prior to depressing (÷) Key

13. SQUARE ROOT

Depressing the $\sqrt{\ }$ key takes the square root of the contents of the ACC register and places the answer in the MQ register. In symbolic notation:

$$\sqrt{(ACC)} \rightarrow MQ$$

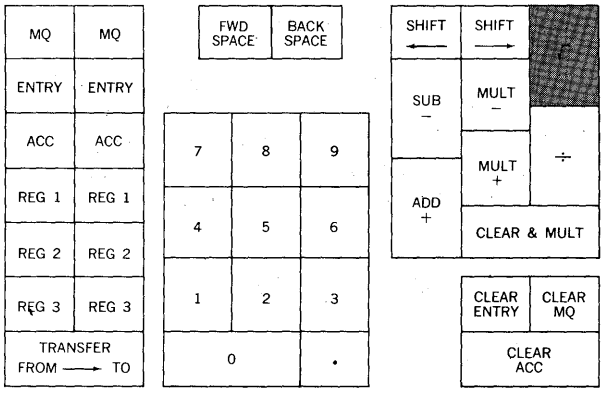
Exercise 13

Depress CLEAR ACC

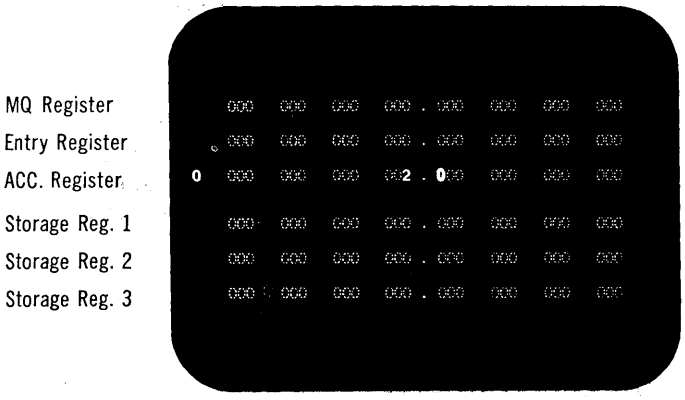
Enter 2.

Depress $\sqrt{\ }$

1.414 213 562 373 ($\sqrt{2}$) appears in MQ.



KEYBOARD NO. 13



Exercise 13: Prior to depressing $\sqrt{\ }$ Key

14. TRANSFER

Depressing the TRANSFER key will transfer the contents of the selected FROM register to the selected TO register. (See Section 1.)

Exercise 14

Depress FROM MQ

TO REG 1

TRANSFER

The contents of the MQ (1.414 213 562 373) is in Reg. 1. The content of the MQ is unchanged.

Depress TO ENTRY

TRANSFER

1.414 213 562 373 is now in ENTRY and MQ.

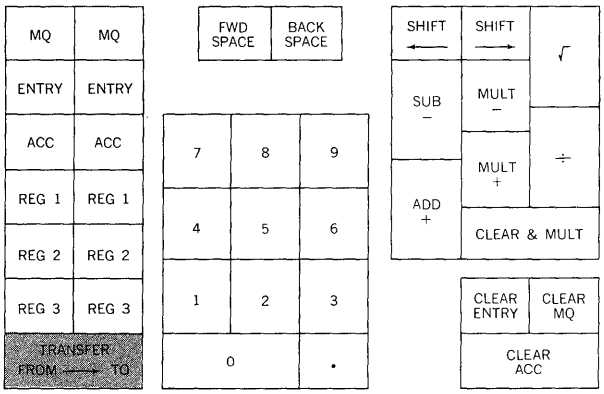
Depress CLEAR & MULT

$\sqrt{2} \times \sqrt{2}$ is now in the ACC register.

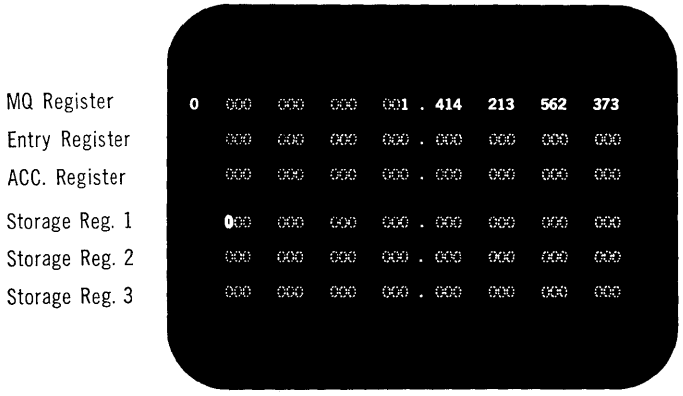
With the decimal point in the center position the ACC should read

1.999 999 999 987

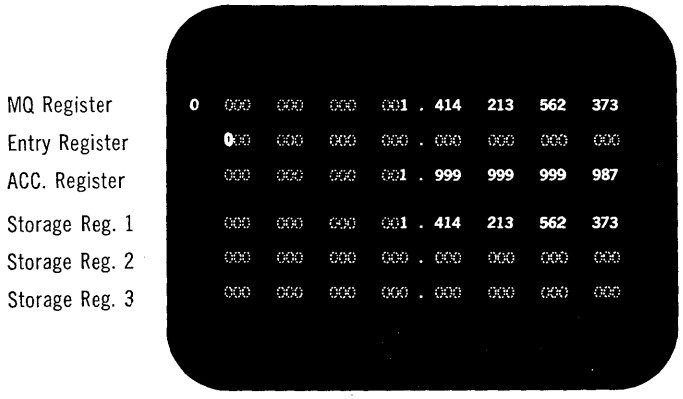
This routine may be used as a quick check of proper equipment operation.



KEYBOARD NO. 14

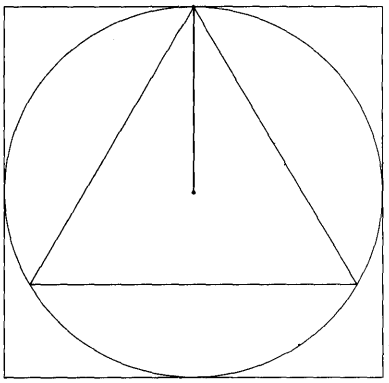


Exercise 14: Prior to TRANSFER of $\sqrt{2}$ to REG. 1



Exercise 14: After completion of all operations

SPECIAL OPERATIONS

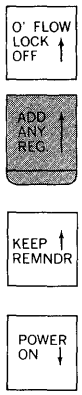


SPECIAL OPERATIONS

The preceding sections have described those operations which must be mastered to use the WYLE SCIENTIFIC with a degree of competence. This section describes operations which are useful in more complex problems and which extend appreciably the capabilities of the machine.

15. ADD FROM ANY REGISTER

When this switch is in the "on" (up) position, the contents of the selected FROM register may be added to or subtracted from the contents of the ACC register. In the "off" (down) position, only the contents of the ENTRY register can be added to or subtracted from the contents of the ACC register.



KEYBOARD NO. 15

Exercise 15

Clear all Registers.

Place ADD (from) ANY REG. key in "on" (up) position.

Depress	TO ACC
Enter	25.
Depress	TO R1
Enter	18.
Depress	FROM R1
	ADD

25 + 18 = 43 appears in ACC

Note: Contents of R1 added to contents of ACC.

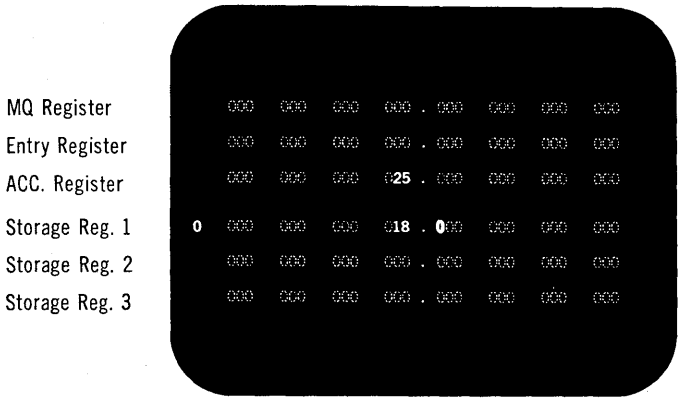
Answer appears in ACC (R1) + (ACC) → ACC. Note that the number being added is not erased in this mode of operation.

Depress	TO MQ
Enter	13.
Depress	FROM MQ
	SUB

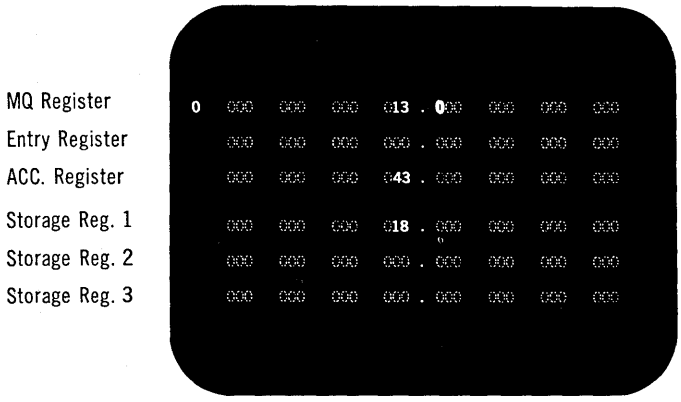
43 - 13 = 30 appears in ACC.

Note: Contents of MQ subtracted from contents of ACC.

Answer appears in ACC (ACC) - (MQ) → (ACC). Note that the number being subtracted is not erased in this mode of operation.



Exercise 15: Prior to adding (REG. 1) + (ACC)



Exercise 15: Prior to subtracting (ACC) — (MQ)

16. OVERFLOW

When the "Overflow Lock Off" switch is in the "off" (up) position, the overflow lockout is inhibited. Overflow normally occurs when the answer to an operation exceeds the capacity of the machine, as for example, when two seven digit numbers are multiplied together with the decimal in the center position (only 12 digits available for product). Overflow indication consists of all digits in the display intensified, plus a line of zeros at the far right edge of the display. Overflow unlocked by depressing the TO ACC (or any "TO" key). The problem may be repeated after moving the decimal point appropriately.

Exercise 16

Place Overflow Lock down.

Multiply 7 863 571 . by 8 436 211 . with decimal point set at middle position. Overflow occurs. The correct answer is 66 338 744 169 481, obtained by moving the decimal point 3 places to the right and repeating the operation. With the decimal point in the center position and overflow lock off (up), repeat the multiplication. The answer in the accumulator is incorrect.

This exercise shows that the overflow lock should be "on" (down) when performing large number operations. It should be "off" only under conditions shown in Exercise 16A.

Perform Exercise 16A with overflow lock "ON" (down).

Exercise 16A

Clear MQ, ENTRY and ACCUMULATOR

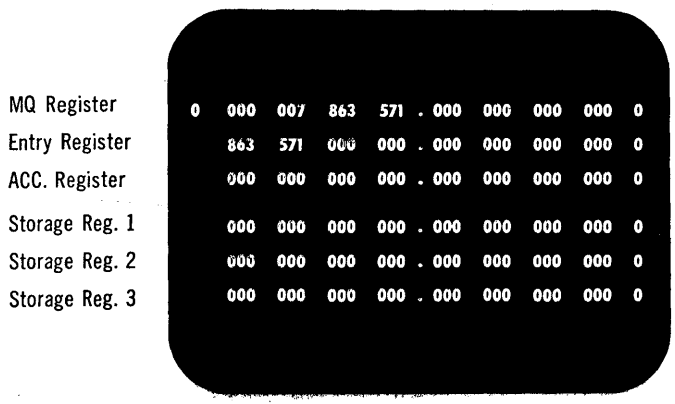
Depress	TO ENTRY
Enter	15.
Depress	FROM ENTRY
	ADD
	CLEAR ENTRY
Enter	16.
Depress	SUB

The accumulator contains the tens complement of the Answer -1.

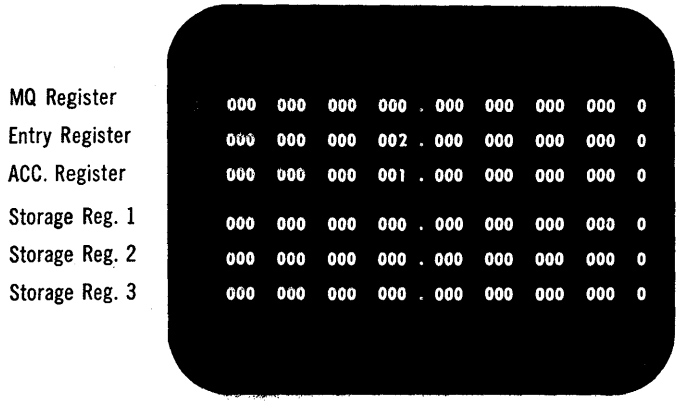
Depress	CLEAR ENTRY
Enter	2.
Depress	ADD

The machine overflows since we were adding 2. to 999 999 999 999.

KEYBOARD NO. 16



Exercise 16: Overflow indication



Exercise 16A: Overflow on adding 2. to 999 999 999 999 (the tens complement of —1)

Repeat this exercise with overflow lock "Off" (up). The correct answer (-1. + 2. = 1.) appears in the accumulator.

The example illustrates that the overflow lock, when off, permits ADD and SUB, and both negative and positive cumulative multiplication operation in the negative number region, the answer being in true form if it is negative.

17. COMPLEMENTING

When the answer is in complement form (negative) the re-complementing operation is as follows. Perform Exercise 16A up to the first subtraction, then perform Exercise 17.

Exercise 17

Depress	FROM ACC
	TO ENTRY
	TRANSFER
	CLEAR ACC
	FROM ENTRY
	SUB

The correct answer 1. appears in the ACC. It should be remembered that it is negative.

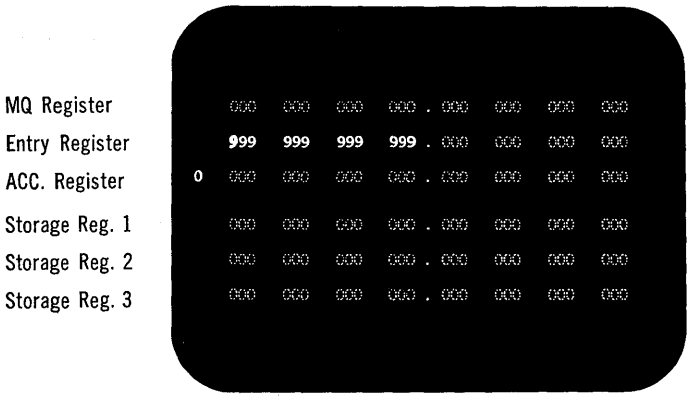
18. KEEP REMAINDERS

When the KEEP REMNDR switch is on (up), both the divisor and the remainder are displayed after all division operations. The divisor stays in the ENTRY register but is shifted left so that the first digit of the divisor is one place to the left of the first digit of the quotient. The remainder appears in the ACC register and is shifted left one more time than the divisor is shifted. Also, twice the root is retained in the ENTRY register after a square root operation, and 10 times the true remainder is retained in the ACC register. For example, with KEEP REMNDR "on", perform Exercise 19.

Exercise 18

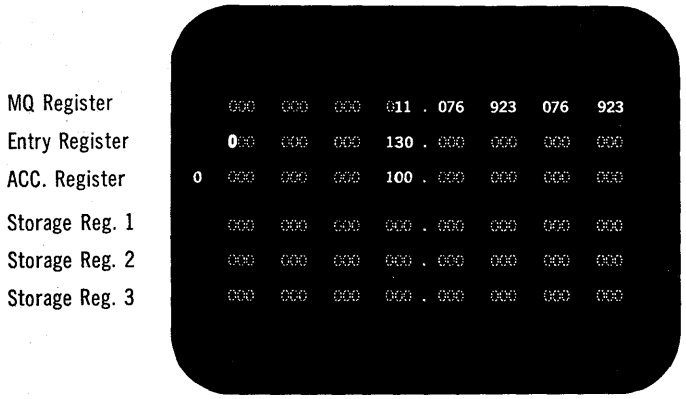
Depress	CLEAR ACC
Depress	TO ACC
Enter	144.
Depress	TO ENTRY
Enter	13.
Depress	÷

The quotient, 11.076 923 076 923 appears in the MQ register. The divisor is in the ENTRY register but is shifted left one place so that the first digit is one place to the left of the first digit of the quotient. The divisor therefore appears as 130. The remainder of 1. is in the ACC register but is shifted left two places (one more than the divisor is shifted) and appears as 100.



Exercise 17: Prior to final subtract (—) operation

KEYBOARD NO. 18



Exercise 18: Result of division (÷) operation showing quotient, divisor and remainder x 10

Depress	TO ACC
Depress	SHIFT RIGHT
Depress	DIVIDE (÷)

The digits to the right of the decimal are additional digits of the quotient. This operation may be continued indefinitely for any precision of division that may be required.

18A. FOR SQUARE ROOT, operation is similar.

Exercise 18A

Depress TO ACC

Enter 2.

Depress $\sqrt{\ }$

$\sqrt{2}$ appears in MQ

$2 \times \sqrt{2}$ appears in the ENTRY

The remainder appears in ACC.

Depress SHIFT RIGHT

Depress ÷

Digits to the right of the decimal point in MQ are the next significant digits of the root. In this case, only the first division operation will give additional significant digits of the root.

19. MULTIPLE OPERATIONS

In this type of operation, various keys may be operated simultaneously providing a flexible solution to some problems.

Entering two Registers at the same time is accomplished by depressing two TO keys simultaneously.

Exercise 19

Depress TO MQ, TO ENTRY, simultaneously.

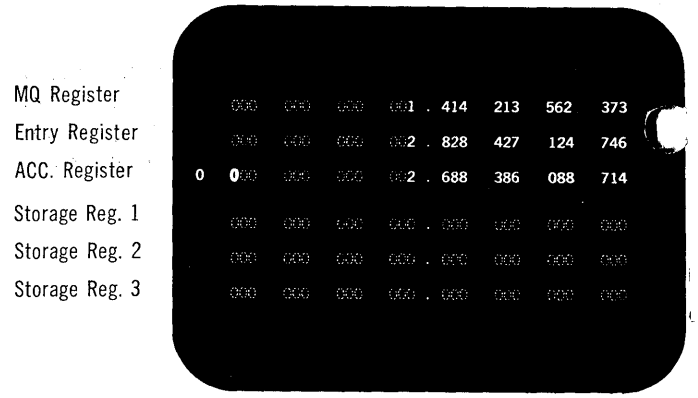
Enter 5.

depress MULT +

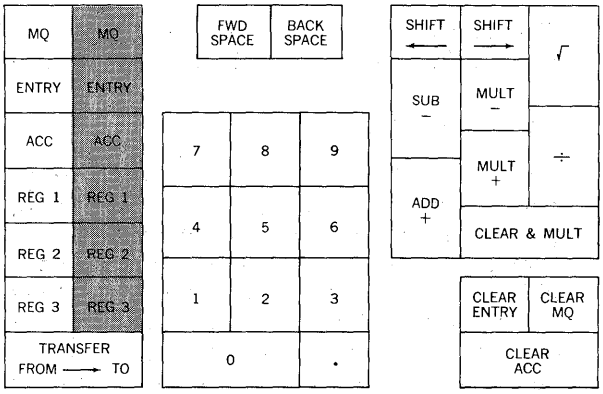
$(5 \times 5) = 25$ appears in ACC register.

Only three registers can be entered simultaneously.

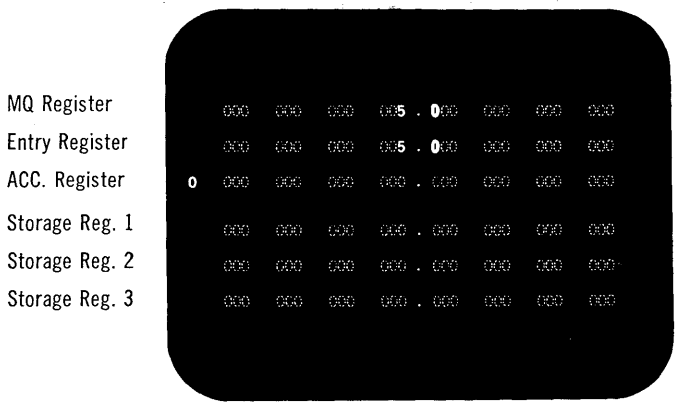
Only one of these can be a storage register.



Exercise 18A: Result of $\sqrt{\ }$ operation showing $\sqrt{2}$ in MQ, $2 \times \sqrt{2}$ in ENTRY, remainder in ACC.



KEYBOARD NO. 19



Exercise 19: Prior to depressing CLEAR & MULT Key (Note two bright TO Markers)

20. DISPLAY-BRIGHTNESS ADJUSTMENT

The WYLE SCIENTIFIC has three controls to adjust the brightness of the numerals as seen in the display. The identification and function of each control is as follows:

1. Intensity Adjustment

   Controls over-all brightness of display.

2. Dim Adjustment

   Controls brightness of non-significant zeros, which may be varied from condition of complete blanking of CRT to same brightness as numeral display.

3. Brightener Adjustment

   Controls brightness of indicator (designator of register in which information is to be entered). Brightness may be varied from condition of maximum to same as numerals displayed. Brightness should always be of greater intensity than numerals displayed.

Procedure of Adjustment

Enter any numerals into any or all registers.

Adjust intensity control until desired brightness of numerals is obtained. Turning control clockwise increases intensity.

Adjust dim control until desired brightness of non-significant zeros is obtained. Turning control clockwise decreases intensity.

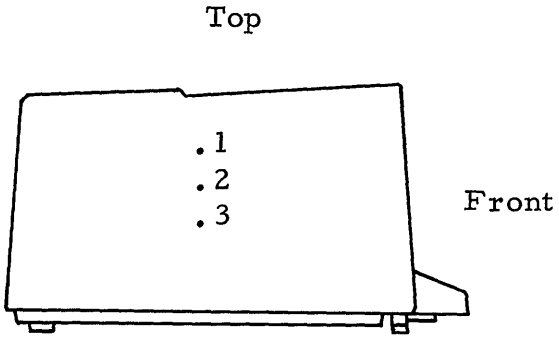
Adjust brightener control until desired brightness of "TO" indicator is obtained. Turning control counter-clockwise increases intensity.

Recommended adjustment tool would be plastic rod with screwdriver tip, similar to tips used for scope or TV adjusting tool.

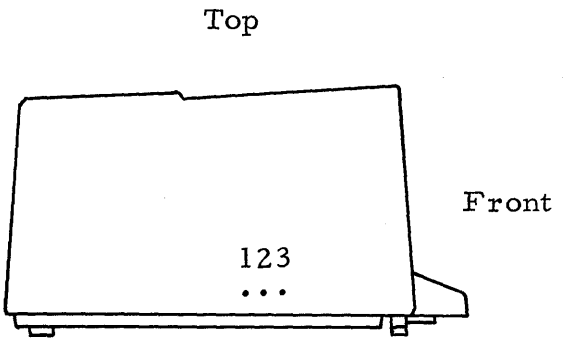
SPECIAL NOTE

SCIENTIFICS serial number 1001 through 1050 may require a repetition of the adjustment procedure due to interaction of the controls.

2. Adjustments may be required if unit is moved and the line voltage varies.

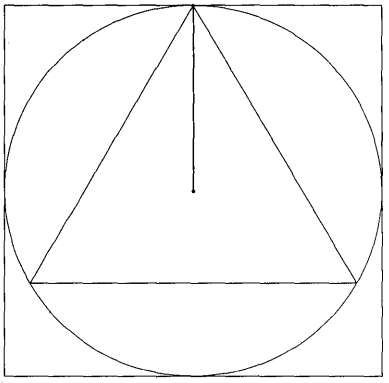


WS-1



WS-2 (Mark II)

PROGRAMMED AUTOMATIC CARD INPUT SYSTEM
PC-01 CARD READER



PROGRAMMED AUTOMATIC CARD (PAC)
INPUT SYSTEM AND PC-01 CARD READER

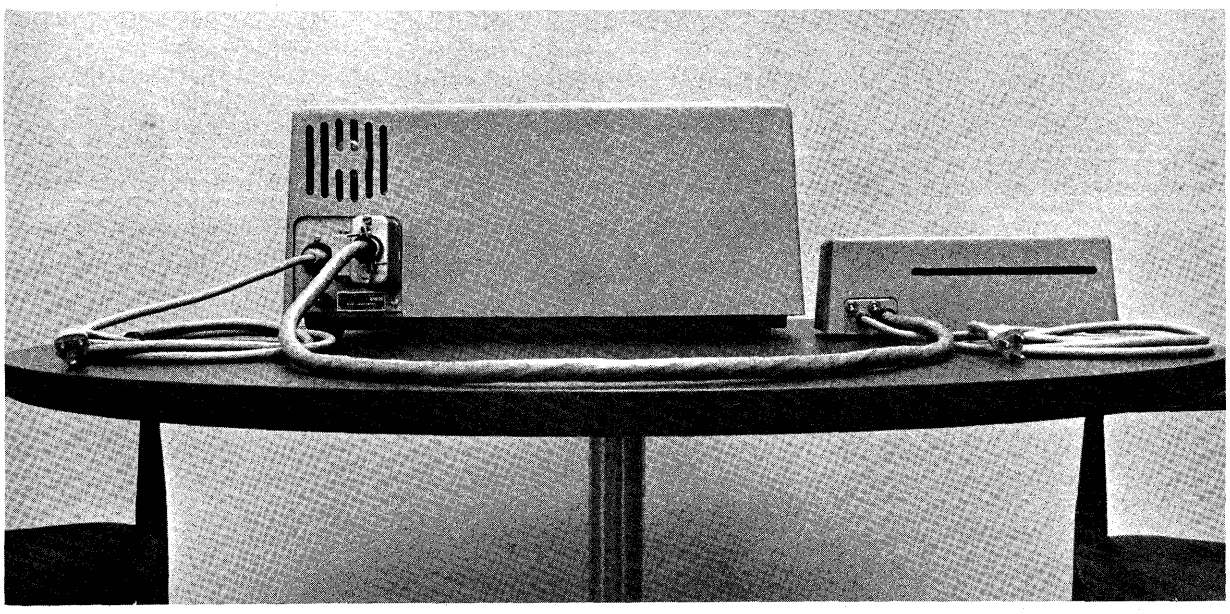
The PAC input system allows programmed operation, eliminating time-consuming manual operation of repetitive problems and minimizing the opportunity for operator errors. The basic device for programmed operation is the Model PC-01 punched card reader. The PC-01 is a photo-electric reader which reads a row at a time at the rate of approximately 8 rows per second.

The use of the PC-01 and the programming techniques are described in the following paragraphs.

1. Connection of PC-01

The Wyle Model PC-01 punched card reader is supplied with two connecting cables. The first and smaller cable supplies a.c. power to the card reader motor. This cable is terminated in a conventional three-pin plug which may be inserted in any wall socket providing 115 ±10 volt, 60 cps power. The second and larger cable is terminated in a 104-pin electrical connector. This connector mates with the larger of the two connectors on the rear of the SCIENTIFIC and carries both data signals and d.c. power. Threaded guide pins prevent wrong insertion of the connector and assure a tight connection. The SCIENTIFIC'S power should be off while connecting the card reader.

A toggle switch on the rear of the PC-01 controls a.c. power to the SCIENTIFIC. This switch should be off (down) while connecting the card reader.



2. Operating Controls

A lighted push-button switch, located on top of the PC-01, is the PC-01 RESUME control. When a STOP command is read from the punched card the PC-01 will stop reading and the switch will light. Pressing the button will cause the PC-01 to resume reading.

A second toggle switch on the rear of the PC-01 is the mode control switch. When this step is in the "Auto" position (up) the PC-01 will automatically read and execute a new instruction as soon as the preceding instruction has been completed. When the switch is in the "Step" position (down) the PC-01 will read and execute one instruction each time the RESUME button is depressed. This mode is particularly useful in checking new programs.

3. Punched Card Programming

Programs to be executed are punched on one or more 40-column cards of the type shown below. This is a conventional card, overprinted with a pattern which identifies the various columns. The PC-01 reads a row at a time and there are 39 possible punch positions in each row. The 40th column is a strobe column (located in the center of the card) and is punched in all rows.

Thirty-eight of the columns correspond to the 38 keys on the SCIENTIFIC keyboard. A punch in the far right hand column, the STOP column, causes the PC-01 to stop reading so that data or instructions can be entered manually from the keyboard. Holes are punched in the card in the same sequence as the manual keyboard would be operated to accomplish the same task.

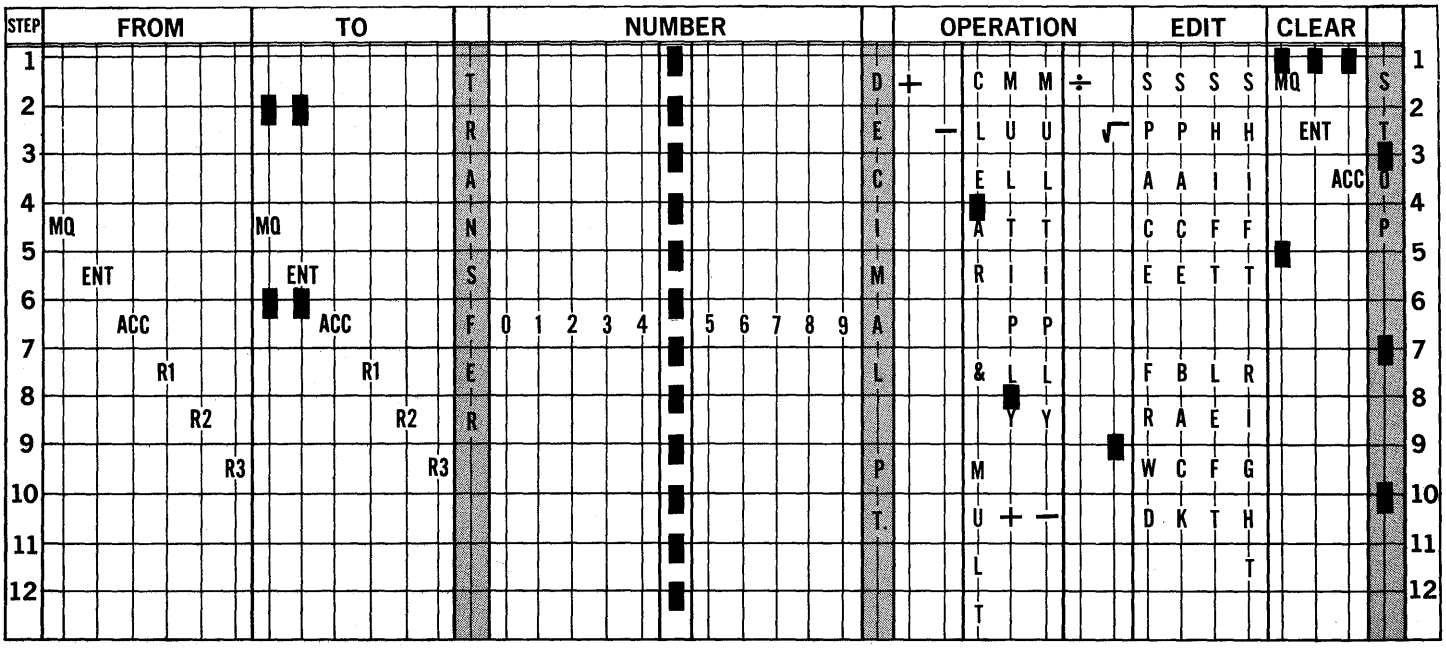
Cards are pre-scored and can be punched with a simple stylus or a ball point pen. Unscored cards are also available and cards can be duplicated on conventional keypunch equipment.

If a program requires more than one card, as is usually the case, cards can be taped together, edge to edge, with black tape. Transparent, or semi-opaque tape should not be used for this purpose since the photoelectric reading circuits may react to light passed through the tape.

4. Sample Program

The card shown below is punched with the program to compute a, where $a^2 = b^2 + c^2$.

Step No.	Instruction	Notes
1.	CLEAR MQ – CLEAR ENTRY	Two CLEAR instructions may be punched on a single row. Up to 3 registers may be addressed TO in a single row.
2.	TO MQ – TO ENTRY	
3.	STOP	Manually enter b.
4.	CLEAR AND MULTIPLY	$b^2 \rightarrow$ Acc
5.	CLEAR MQ	
6.	TO MQ – TO ENTRY	
7.	STOP	Manually enter c.
8.	MULTIPLY +	$b^2 + c^2 \rightarrow$ Acc
9.	SQUARE ROOT ($\sqrt{}$)	$\sqrt{b^2 + c^2} \rightarrow$ MQ = a
10.	STOP	Answer appears in MQ register



5. Programming Restrictions

Multiple Addressing – Any 3 registers can be addressed by punches in a single row. These can all be TO addresses, all FROM addresses, or any combination.

Transfers – Both the TO and FROM addresses and the TRANSFER command can be punched in a single row.

Add-Subtract – In the ADD ANY REGISTER mode, both the FROM address and the ADD (or SUB) command may be punched in a single row.

Multiple Transfer – Data can be transferred to more than one register with all instructions punched in a single row. As an example:

FROM R1 - TO ENTRY - TO MQ - TRANSFER may all be punched in a single row.

6. Program Library

Wyle has developed a library of programs for various applications including statistics, civil engineering, education, etc. Contact Wyle Laboratories Products Division for further details. Wyle's programming staff is also available to assist in solving specific customer problems.

SUMMARY OF OPERATIONS

NORMAL OPERATING CONDITIONS

1. Decimal point in center (12th) position.
2. "Overflow Lock" Switch on (up).
3. "Add From Any Register" switch (up).
4. "Keep Remainders" switch off (down).

ARITHMETIC OPERATIONS

1. Addition	(ACC) + (ENTRY)	$\longrightarrow$ ACC
2. Subtraction	(ACC) - (ENTRY)	$\longrightarrow$ ACC
3. Clear and Multiply	(MQ) $\times$ (ENTRY)	$\longrightarrow$ ACC
4. Multiply +	(ACC) + $\lfloor$(MQ) $\times$ (ENTRY)$\rfloor$	$\longrightarrow$ ACC
5. Multiply -	(ACC) - $\lfloor$(MQ) $\times$ (ENTRY)$\rfloor$	$\longrightarrow$ ACC
6. Divide	(ACC) $\div$ (ENTRY)	$\longrightarrow$ MQ
7. Square Root	$\sqrt{(ACC)}$	$\longrightarrow$ MQ

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