WYLE LABORATORIES
PRODUCTS DIVISION

THE WYLE **SCIENTIFIC** ELECTRONIC CALCULATOR

INSTRUCTION MANUAL

INTRODUCTION

The Wyle SCIENTIFIC provides capabilities and features unique in a desk calculator. 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. Proof of the number just entered is visible and 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, you can pick out that digit and correct it.

And there are a great many more features, explained in this manual, that make the Wyle SCIENTIFIC the most flexible and powerful calculator 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.

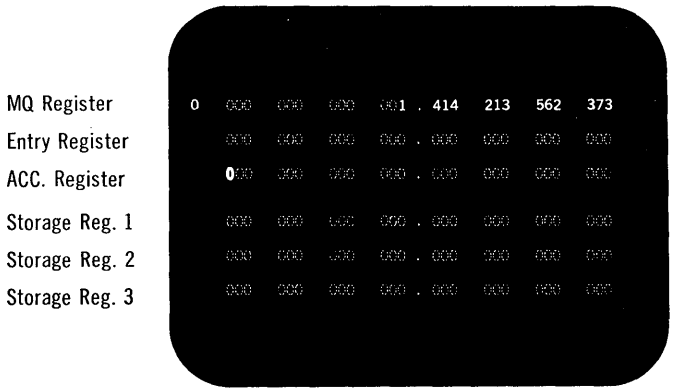
The purpose of this book is to acquaint you with the basic operations of the Wyle SCIENTIFIC. Each key, each function, and each section of the display is explained in full. These examples demonstrate the possible applications and others will become apparent as you use the machine in day-to-day operations.

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.

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 in the normal addition operation.



Wyle SCIENTIFIC Visual Display

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. Numbers can be transferred to any of these registers from any other register and from any of these registers to any other register. They are used to store constants or intermediate answers which may be required at a later stage in the calculation.

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. When the TRANSFER key is depressed, the contents of the register, the FROM register, will automatically be transferred to the TO register.

In one register, one of the 24 digits will appear unusually bright. This is the register selected as the TO register. In the illustration, this is shown as the initial zero of the Accumulator Register. The position which is shown as bright 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.

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 calculator 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

(Entry) + (Acc.) → (Acc.)

This is read as: The contents of the Entry Register are added to the contents of the Accumulator Register and the results appear in the Accumulator Register. In summary

(Entry) is read as "Contents of the Entry Register"

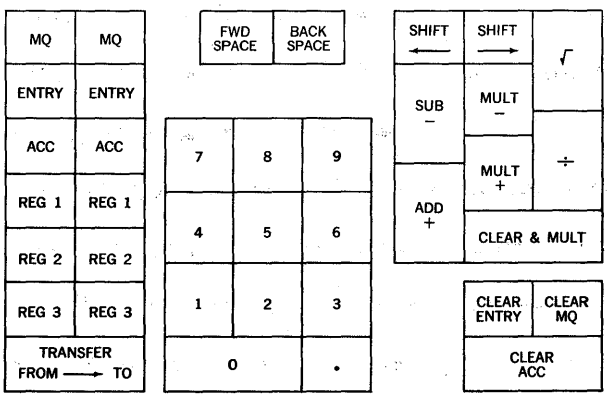
Entry is read as "The Entry Register"

Some additional examples will further clarify this system of notation

(MQ) x (Entry) → Acc. is read "Contents of the MQ Register are multiplied by the contents of the Entry Register and the results appear in the Accumulator Register."

(Entry) → R1 is read "Contents of the Entry Register are transferred to the Storage Register 1."

(Acc) - (Entry) → Acc. is read "Contents of the Entry Register are subtracted from the contents of the Accumulator Register and the difference appears in the Accumulator Register."



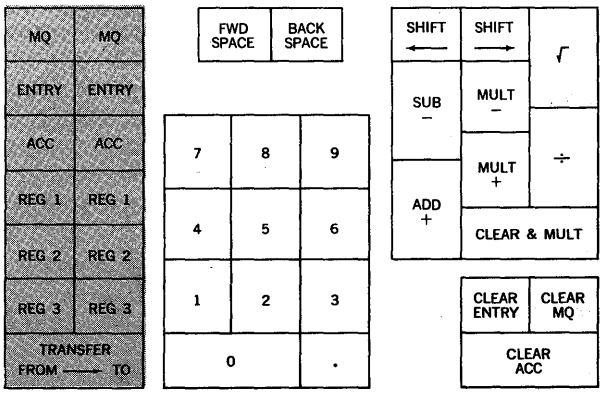
Wyle SCIENTIFIC Keyboard

BASIC OPERATIONS

The following pages describe the basic operations of the Wyle SCIENTIFIC calculator. 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.

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.



KEYBOARD NO. 1

Exercise 1

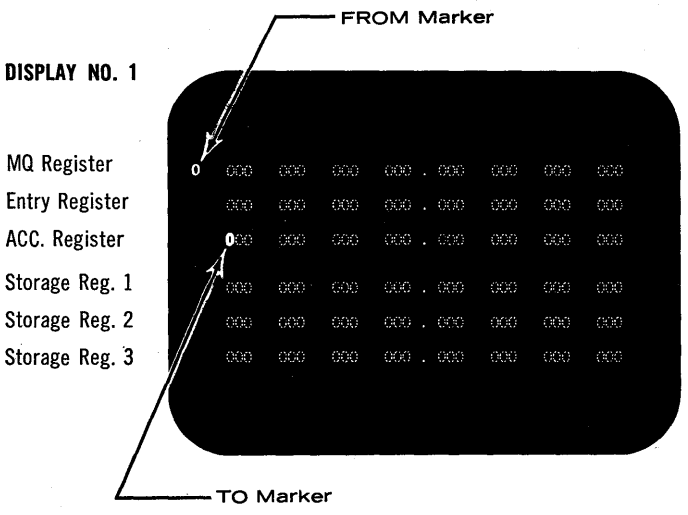
Depress FROM MQ
FROM ENTRY
FROM ACC
FROM R1
FROM R2
FROM R3

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.)



DISPLAY NO. 1

Exercise 1

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.

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

Exercise 2

Depress CLEAR MQ

CLEAR ENTRY

CLEAR ACC.

Note that the contents of all three registers are eliminated.

Depress FROM ACC.

TO REG. 1

TRANSFER

Note that Register 1 is now cleared.

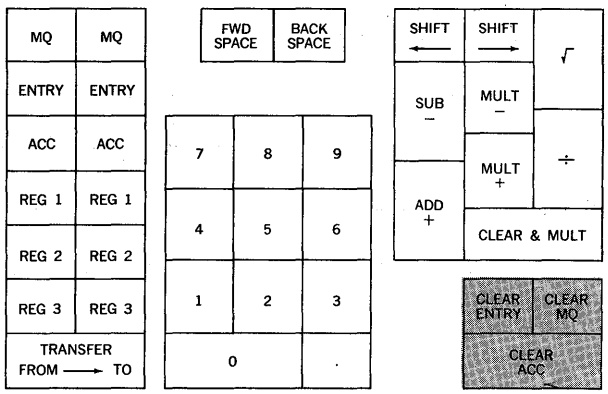
Depress TO REG. 2

TRANSFER

TO REG. 3

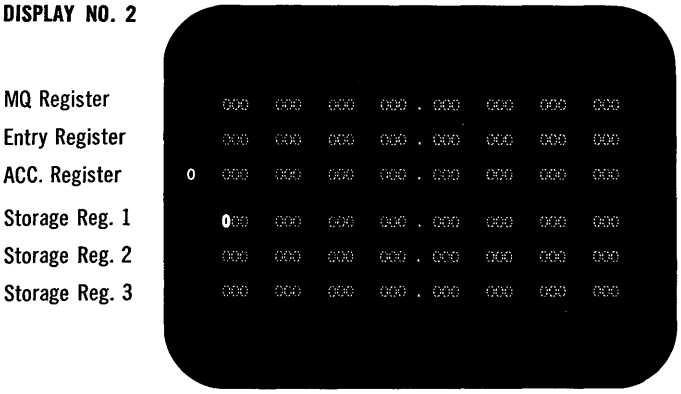
TRANSFER

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



KEYBOARD NO. 2

DISPLAY NO. 2



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 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 TO ACC.

(.)

2

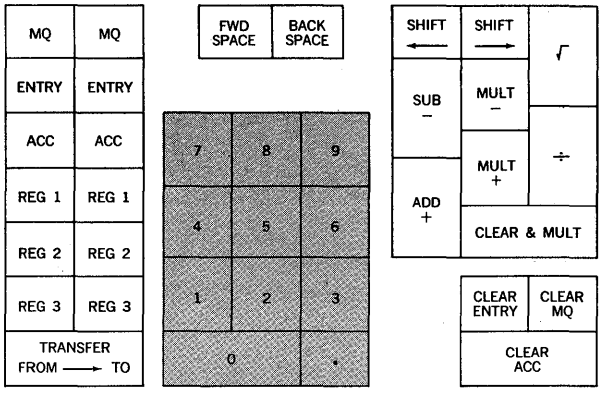
Note position of number .2 in ACC. REGISTER.

Depress TO MQ

2

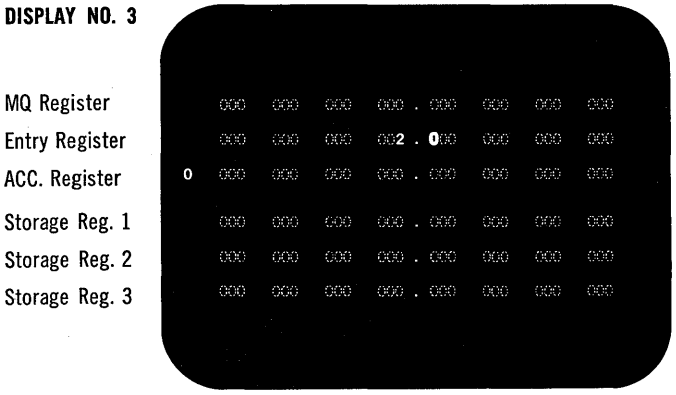
(.)

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

DISPLAY NO. 3



Exercise 3: Number 2. entered into ENTRY Register

Exercise 4

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 FORWARD 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 5

Clear all Registers

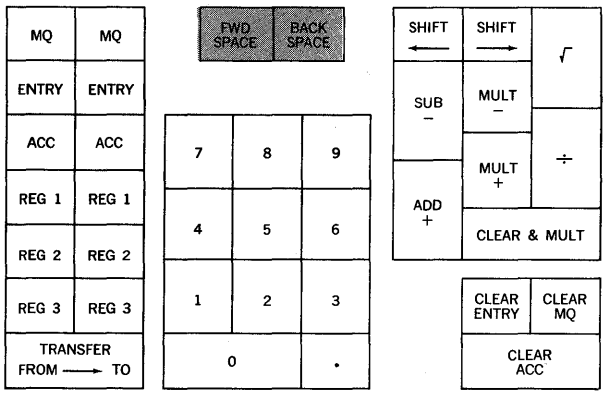
Depress	TQ ENTRY
Enter	999.999
Depress	FORWARD space 5 times
Depress	BACK space 7 times

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.

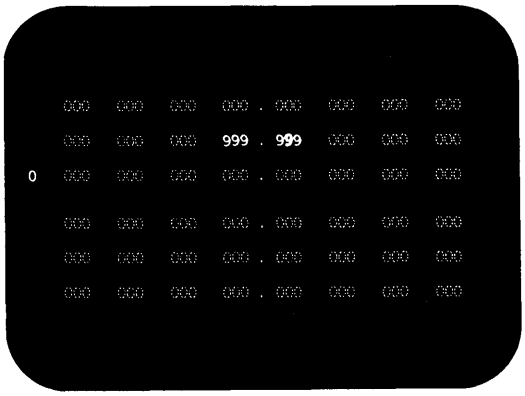
DISPLAY NO. 4

Exercise 4: Prior to first transfer operation



KEYBOARD NO. 4

DISPLAY NO. 5



Exercise 5: 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 6

Enter 1.25 in Reg. 3

Depress SHIFT LEFT five times

Depress SHIFT RIGHT six times

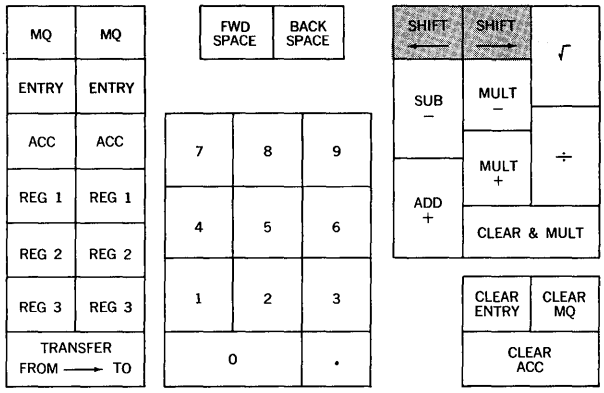
Perform these operations slowly and note the change of position of the number in Register 3.

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.

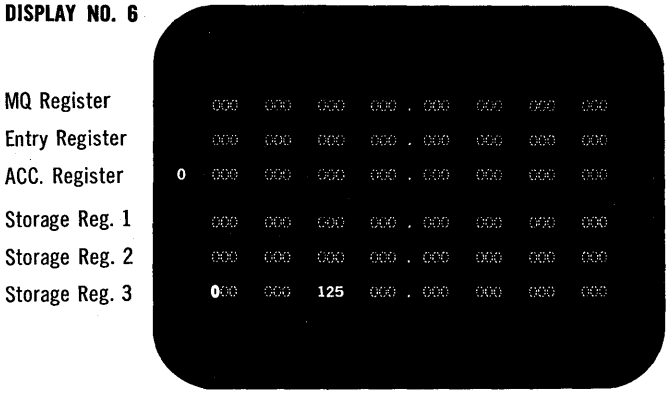
Exercise 7

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

DISPLAY NO. 6



Exercise 6: At end of SHIFT LEFT 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, the contents of the ENTRY register are added to the contents of the ACCUMULATOR. The sum appears in the ACCUMULATOR.

In symbolic notation:

(Entry) + (Acc) ⟶ ACC

Exercise 8 .

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.

8. Subtraction

When the SUB key is depressed, the contents of the ENTRY register are subtracted from the contents of the ACCUMULATOR register and the difference appears in the ACCUMULATOR. In symbolic notation:

(Acc) - (Entry) ⟶ ACC.

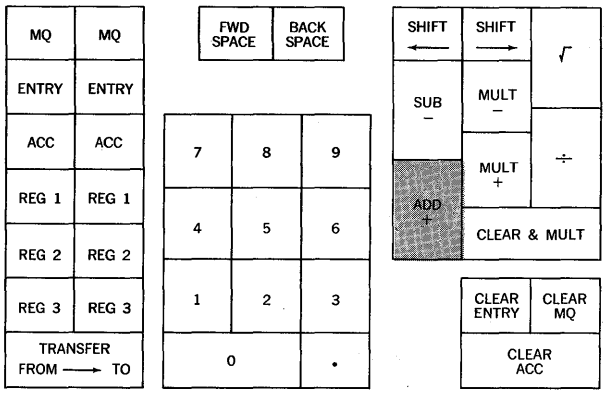
Exercise 9

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

Enter 18.

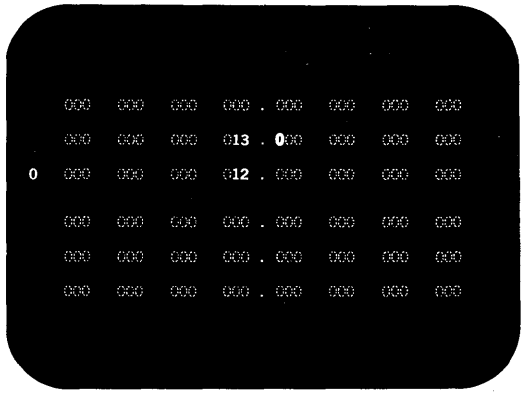
Depress SUB (-) key

Note: 25 – 18 = 7 appears in ACC.

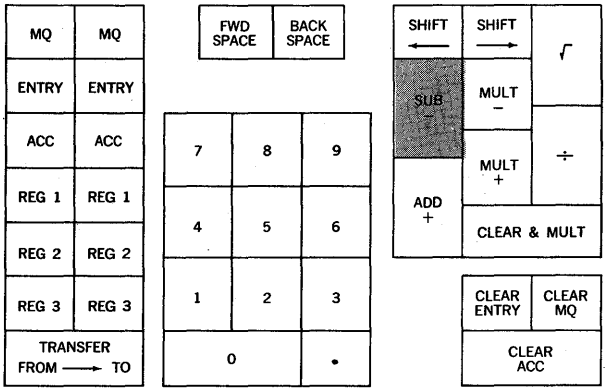


KEYBOARD NO. 6

DISPLAY NO. 7

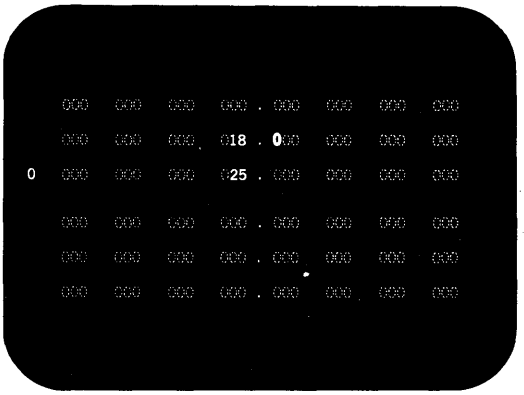


Exercise 8: Prior to depressing ADD (+) Key



KEYBOARD NO. 7

DISPLAY NO. 8



Exercise 9: 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) x (ENTRY) →ACC.

Exercise 10

Depress	TO MQ
Enter	15.
Depress	TO ENTRY
Enter	16.
Depress	CL & MULT.

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

Enter	7.
Depress	CL & MULT.

The product 105 (15 x 7) appears in the ACC.

10. MULTIPLY and ADD

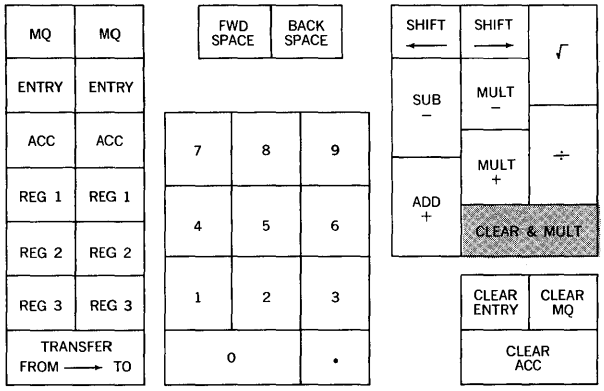
Depressing the MULT.+ key adds the product of the contents of the ENTRY register and the contents of the MQ register to the contents of the ACC register. The answer appears in the ACC register. In symbolic notation:

(ACC) + [(MQ) x (ENTRY)] →ACC.

Exercise 11

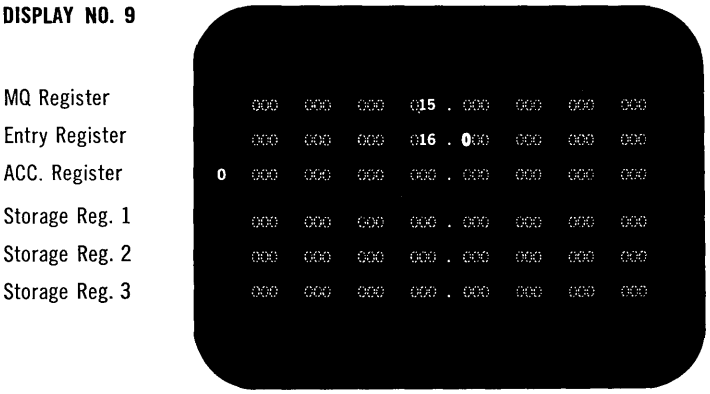
Enter	8.
Depress	MULT.+

The product 120 (15 x 8) is added to the ACC (105) giving 225 in the Accumulator.

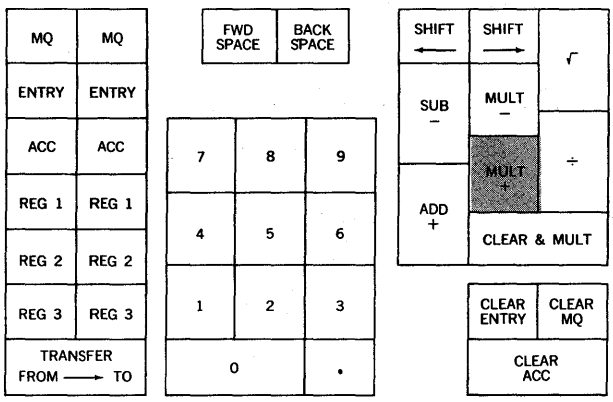


KEYBOARD NO. 8

DISPLAY NO. 9

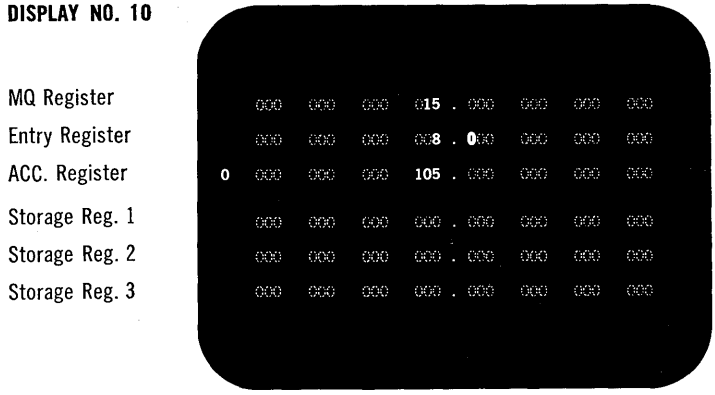


Exercise 10: Prior to depressing CLEAR & MULT Key



KEYBOARD NO. 9

DISPLAY NO. 10



Exercise 11: 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:

$$(ACC) - [(MQ) \times (ENTRY)] \longrightarrow ACC$$

Exercise 12

Enter 8.

Depress MULT.-

The product 120 (15 x 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:

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

Exercise 13

Depress CLEAR ACC

Depress TO ACC

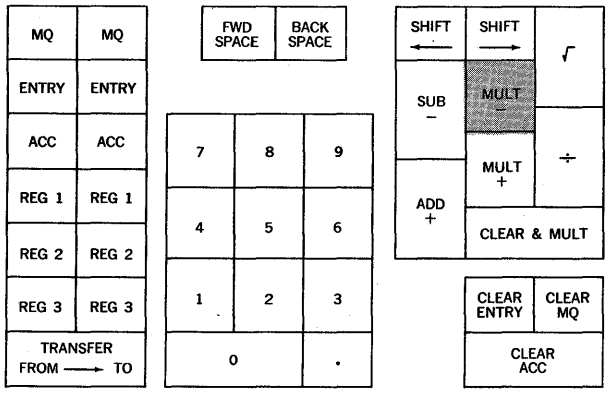
Enter 144.

Depress TO ENTRY

Enter 13.

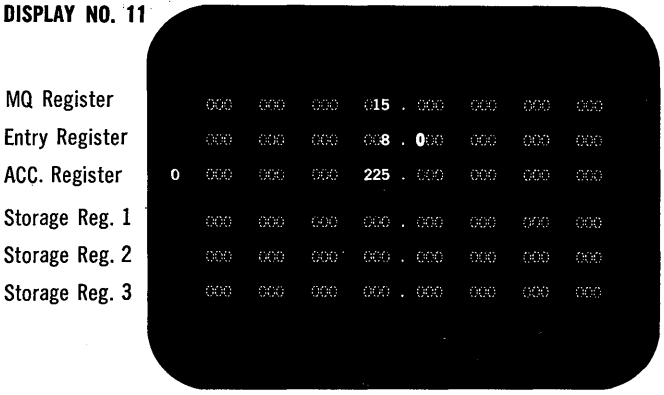
Depress DIVIDE (÷)

The quotient 11. 076 923 076 923 appears in the MQ register. The divisor (13) remains in the ENTRY register.

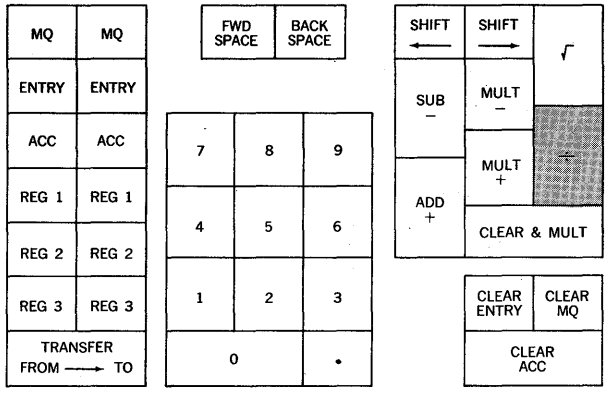


KEYBOARD NO. 10

DISPLAY NO. 11

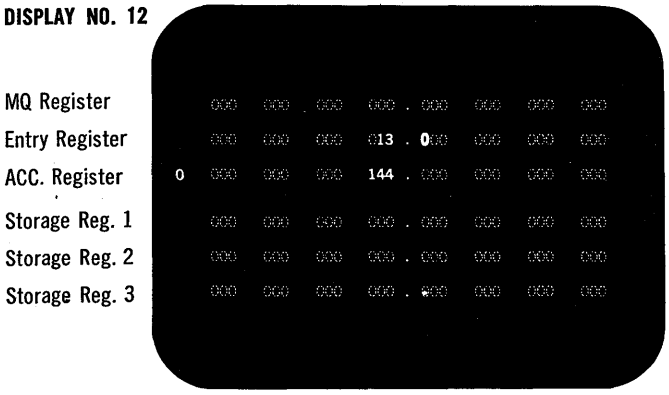


Exercise 12: Prior to depressing MULT (—) Key



KEYBOARD NO. 11

DISPLAY NO. 12



Exercise 13: 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:

$$\sqrt{(ACC.)} \longrightarrow MQ$$

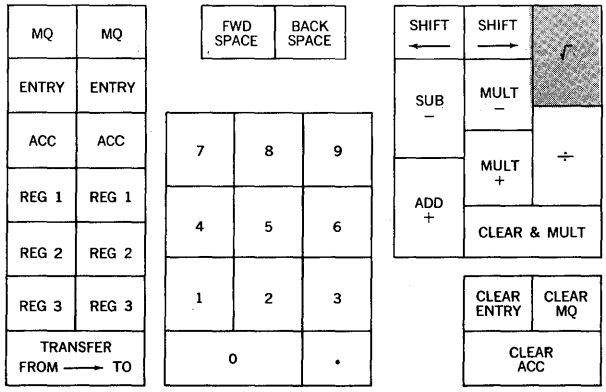
Exercise 14

Depress TO ACC

Enter 2.

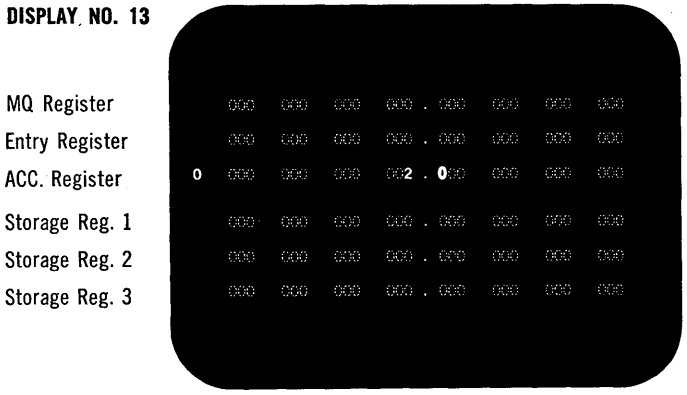
Depress $\sqrt{\ }$

1.414--- ($\sqrt{2}$) appears in MQ.



KEYBOARD NO. 12

DISPLAY NO. 13



Exercise 14: 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 15

Depress FROM MQ

TO REG. 1

TRANSFER

The contents of the MQ (1.414) is in Reg. 1. The contents of the MQ is unchanged.

Depress TO ENTRY

TRANSFER

1.414 is now in ENTRY and MQ.

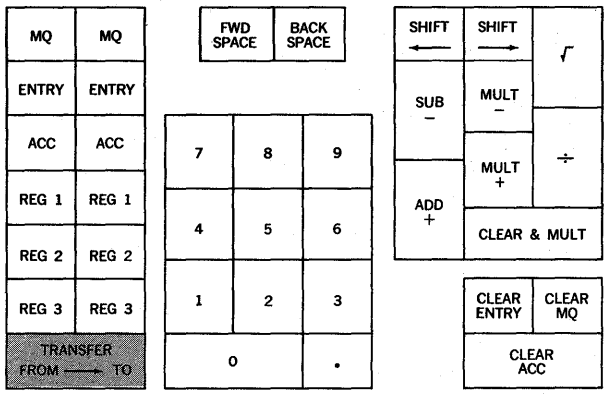
Depress CL & MULT.

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

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

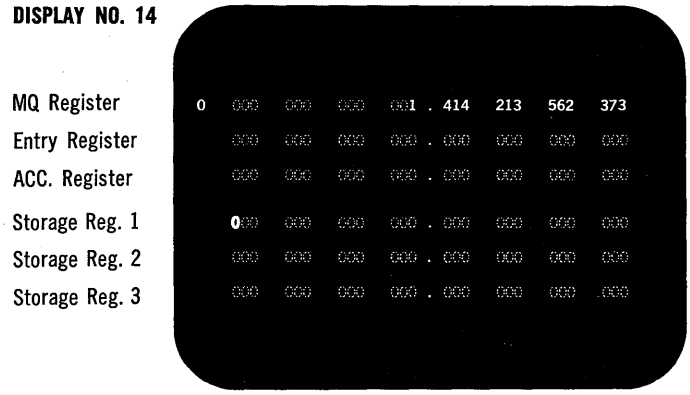
1.999 999 999 987

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



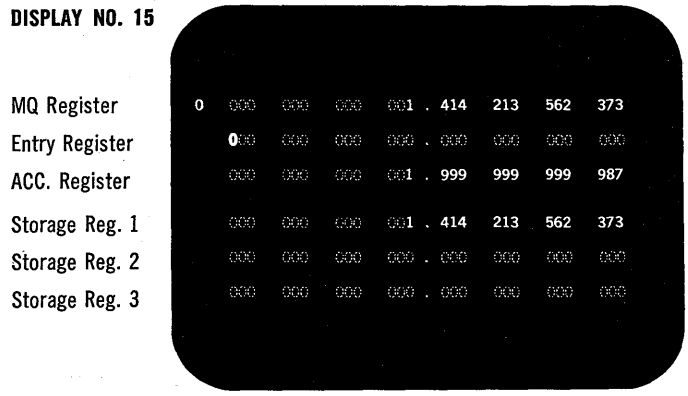
KEYBOARD NO. 13

DISPLAY NO. 14



Exercise 15: Prior to TRANSFER of $\sqrt{2}$ to REG. 1

DISPLAY NO. 15



Exercise 15: After completion of all 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 calculator.

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. 14

Exercise 16

Clear all Registers.

Place ADD FROM ANY REG. key in "on" position.

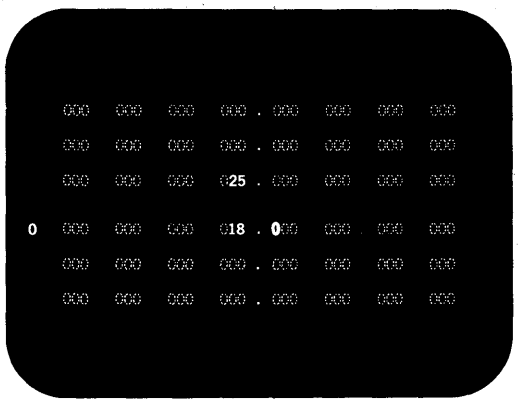
Depress	TO ACC.
Enter	25.
Depress	TO R1
Enter	18.
Depress	FROM R1
Depress	ADD

25 + 18 = 43 appears in ACC.

Note: Contents of R1 added to contents of ACC.

Answer appears in ACC. (R1) + (ACC) → ACC.

DISPLAY NO. 16



Exercise 16: Prior to adding (REG. 1) + (ACC)

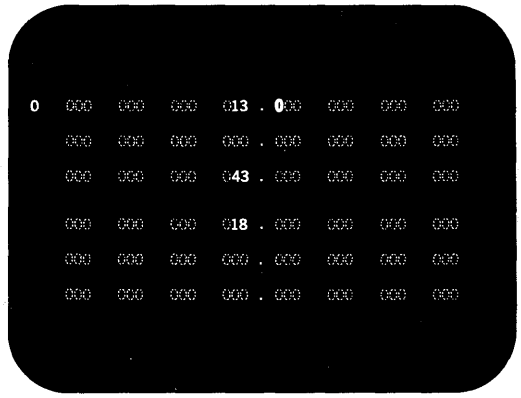
Depress	TO MQ
Enter	13.
Depress	FROM MQ
Depress	SUB

43 - 13 = 30 appears in ACC.

Note: Contents of MQ subtracted from contents of ACC.

Answer appears in ACC. (ACC) - (MQ) → (ACC)

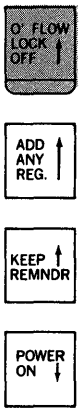
DISPLAY NO. 17



Exercise 16: 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.



KEYBOARD NO. 15

Exercise 17

Multiply 786 357 1. by 843 621 1. with decimal point set at middle position. Overflow occurs. The correct answer is 66 338 036 448 091, 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, 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 Step 17A.

Perform Exercise 17A with Overflow Lock "ON" (down).

DISPLAY NO. 18

MQ Register	0	000	007	863	571	. 000	000	000	000	0
Entry Register		436	211	000	000	. 000	000	000	000	0
ACC. Register		000	000	000	000	. 000	000	000	000	0
Storage Reg. 1		000	000	000	000	. 000	000	000	000	0
Storage Reg. 2		000	000	000	000	. 000	000	000	000	0
Storage Reg. 3		000	000	000	000	. 000	000	000	000	0

Exercise 17: Overflow indication

Exercise 17A

Clear MQ, ENTRY and ACCUMULATOR

Depress TO ENTRY

Enter 15.

ADD

Enter 16.

SUBTRACT

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

Enter 2.

ADD

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

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 SUBTRACT, and both negative and positive cumulative multiplication operation in the negative number region, the answer being in true form if it is positive and in tens complement form if it is negative.

DISPLAY NO. 19

MQ Register	000	000	000	000 .	000	000	000	000	0
Entry Register	000	000	000	000 .	000	000	000	000	0
ACC. Register	000	000	000	001 .	000	000	000	000	0
Storage Reg. 1	000	000	000	000 .	000	000	000	000	0
Storage Reg. 2	000	000	000	000 .	000	000	000	000	0
Storage Reg. 3	000	000	000	000 .	000	000	000	000	0

Exercise 17A: Overflow on adding 2. to 999 999 999 999 (the tens complement of —1)

17. COMPLEMENTING

When the answer is in complement form (negative) the re-complementing operation is as follows. Perform Exercise 17A up to the first subtraction, then perform Exercise 18.

Exercise 18

Depress	FROM ACC
	TO ENTRY
	TRANSFER
	CLEAR ACC
	SUBTRACT

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

18. KEEP REMAINDERS

When the "Keep Remainder" switch is "on" (up) 10 times the remainder of a division operation is retained in the accumulator register. Also, twice the root is retained in the Entry register after a square root operation, as well as 10 times the true remainder. For example, with Keep Remainder "on", perform Exercise 19.

Exercise 19

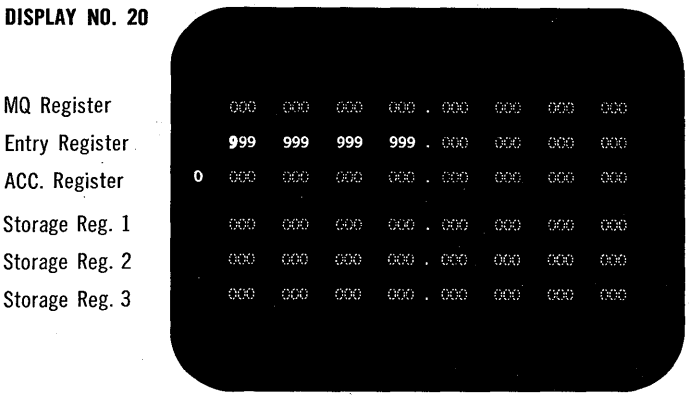
Depress	CLEAR ACC
Depress	TO ACC
Enter	144.
Depress	TO ENTRY
Enter	13.
Depress	DIVIDE (÷)

The quotient, 11.076 923 076 923 appears in the MQ register. The remainder X10 appears in the ACC register.

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.

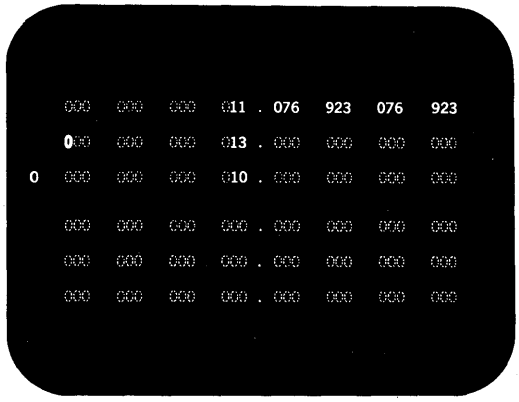
DISPLAY NO. 20



Exercise 18: Prior to final subtract (—) operation

KEYBOARD NO. 16

DISPLAY NO. 21



Exercise 19: Result of division (÷) operation showing quotient, divisor and remainder x 10

18A. FOR SQUARE ROOT, operation is similar.

Exercise 19A

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 one division operation is valid.

19. MULTIPLE OPERATIONS

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

19A. Entering two Registers at the same time is accomplished by depressing two TO keys simultaneously.

Exercise 20

Depress TO MQ, TO ENTRY, simultaneously.

Enter 5.

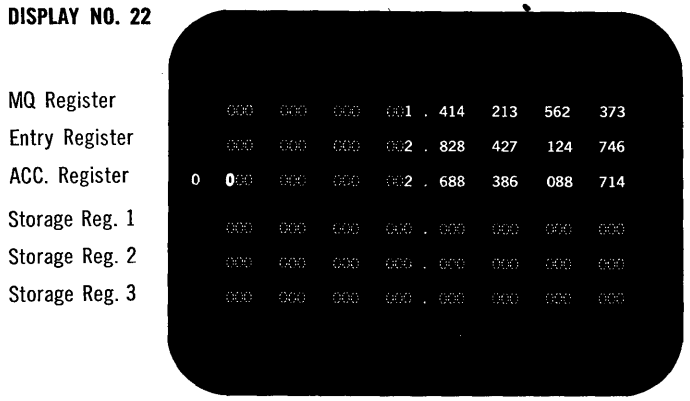
Depress MULT.+

(5 x 5) = 25 appears in ACC Register.

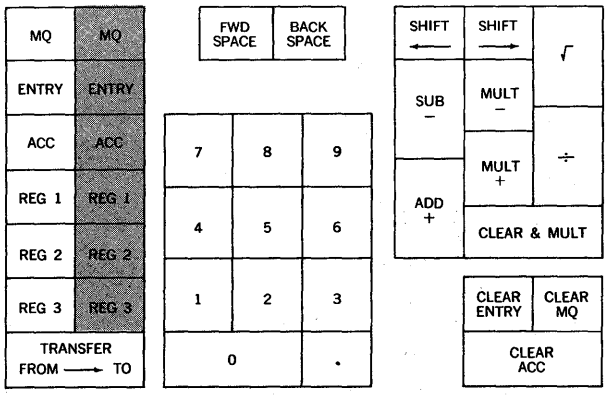
Only three registers can be entered simultaneously.

Only one of these can be a storage register.

DISPLAY NO. 22

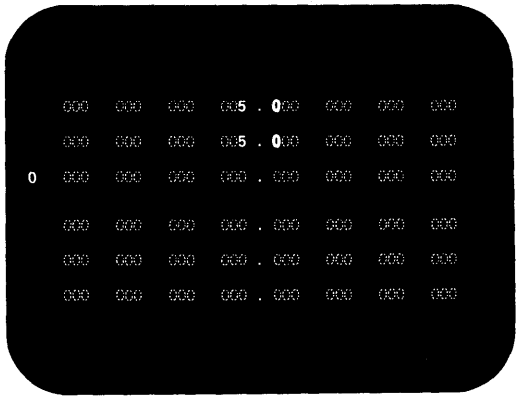


Exercise 19A: Result of $\sqrt{\ }$ operation showing $\sqrt{2}$ in MQ, $2 \times \sqrt{2}$ in ENTRY, remainder in ACC.



KEYBOARD NO. 17

DISPLAY NO. 23



Exercise 20: Prior to depressing CLEAR & MULT Key (Note two bright TO Markers)

This concludes the explanation of the operation of the Wyle SCIENTIFIC electronic calculator. With these operations clearly in mind, real mastery of the machine is only a matter of practice.

Please observe the following precautions in using the Wyle SCIENTIFIC electronic calculator.

1. Keep dust cover on calculator when machine is not in use.
2. Do not place dust cover on calculator when machine is turned on. This blocks air flow to the machine and the internal rise in temperature may damage circuits.
3. Do not lift or move the calculator while it is running. After turning the calculator off, allow two minutes before lifting or moving. Failure to observe these precautions may damage the memory disc.
4. Remove and clean the air filter (located on the bottom of the calculator) every three months. Use vacuum cleaner or wash with soap and water. Be sure filter is dry before replacing it in the calculator.

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

1. If cooling fan is not running
   a. Check AC line cord and plug.
   b. Check AC outlet.
   c. Check calculator fuse (on back of calculator 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 calculator case.
3. If display is bright but numbers cannot be entered from keyboard
   a. Check if any key is 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 calculator case. Any unauthorized attempt to repair calculator malfunctions will void the warranty.

SUMMARY OF OPERATIONS

NORMAL OPERATING CONDITIONS

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

ARITHMETIC OPERATIONS

1. Addition	(ACC.) + (Entry)	⟶ ACC.
2. Subtraction	(ACC.) − (Entry)	⟶ ACC.
3. Clear and Multiply	(MQ) X (Entry)	⟶ ACC.
4. Multiply +	(ACC.) + [(MQ) X (Entry)]	⟶ ACC.
5. Multiply −	(ACC.) − [(MQ) X (Entry)]	⟶ ACC.
6. Divide	(ACC.) ÷ (Entry)	⟶ MQ
7. Square Root	$\sqrt{(ACC.)}$	⟶ MQ