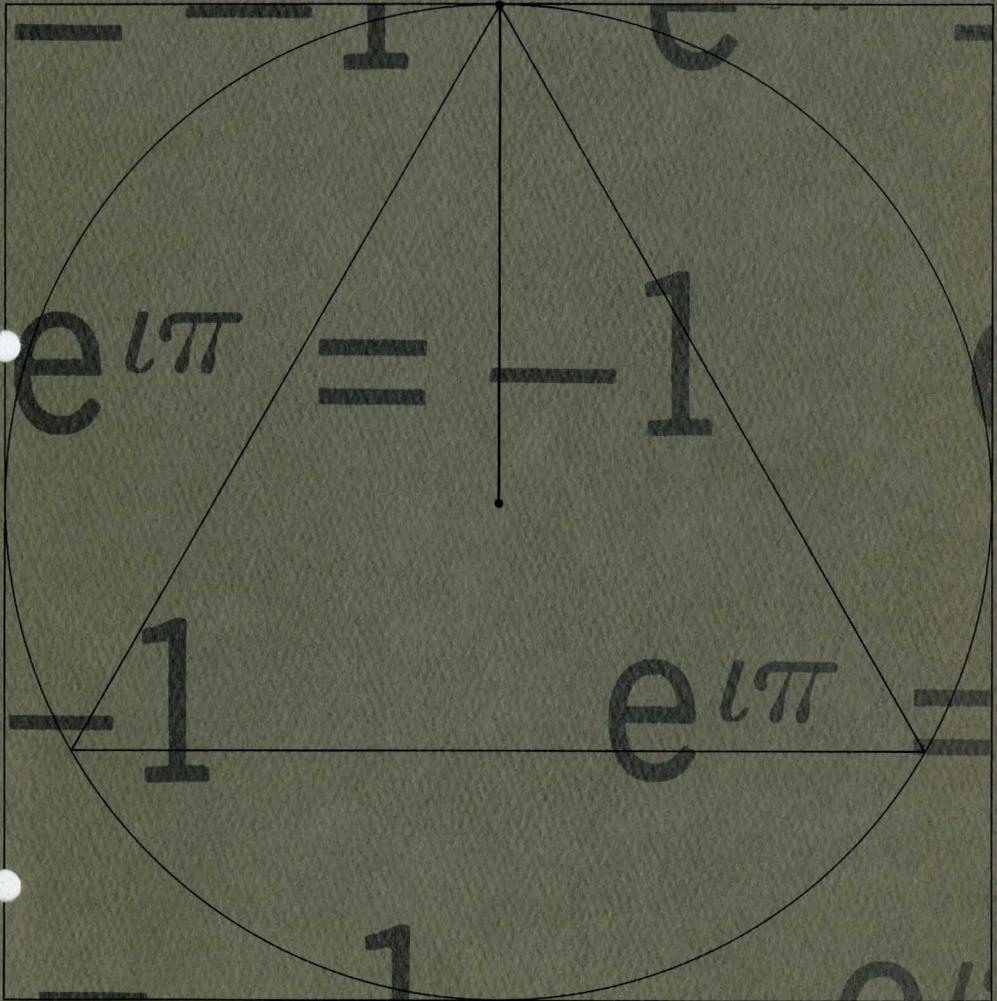


THE WYLE SCIENTIFIC | INSTRUCTION MANUAL



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.

INTRODUCTION

NOTE

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

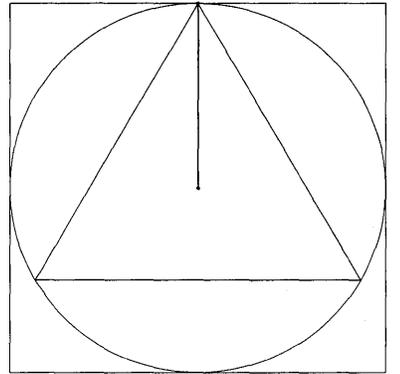
1. Keep dust cover on when machine is not in use.
2. Do not put dust cover on when machine is turned on. This blocks air flow to the machine and the internal rise in temperature may damage circuits.
3. Remove and clean the air filter (located on the bottom) every three months. Use vacuum cleaner or wash 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.

MQ Register	0	000	000	000	001	414	213	562	373
Entry Register		000	000	000	000	000	000	000	000
ACC. Register	0	000	000	000	000	000	000	000	000
Storage Reg. 1		000	000	000	000	000	000	000	000
Storage Reg. 2		000	000	000	000	000	000	000	000
Storage Reg. 3		000	000	000	000	000	000	000	000

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 "short-hand" notation

$$(ENTRY) + (ACC) \rightarrow ACC$$

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

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

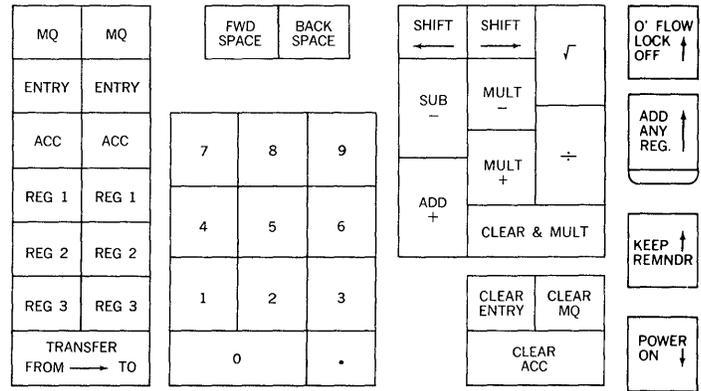
is read "Contents of the MQ register are multiplied by the contents of the ENTRY register and the results appear in the ACC register."

$$(ENTRY) \rightarrow R1$$

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

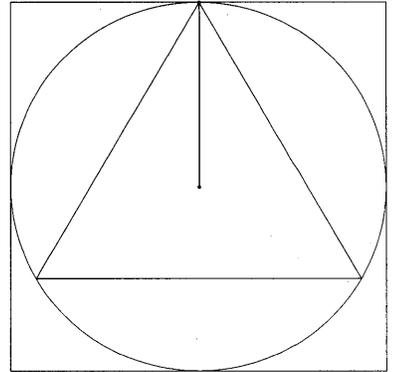
$$(ACC) - (ENTRY) \rightarrow ACC$$

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 - UP
switch
ADD FROM ANY REGISTER - DOWN
switch
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.

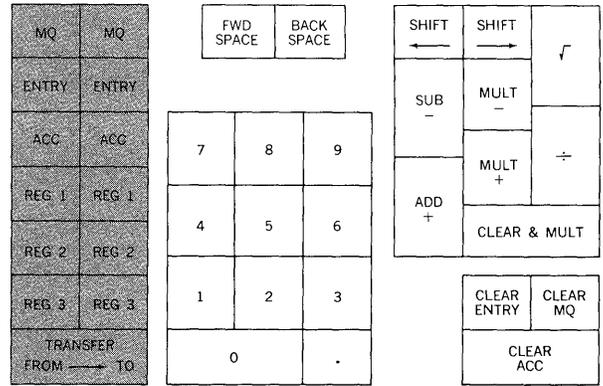
If more than two zeros and the decimal points show on the display, depress the two keys labeled MQ, located at the top left of the keyboard. The display should then consist of two zeros, one of normal intensity and one bright, and six decimal points.

1. Data Transfer Operations

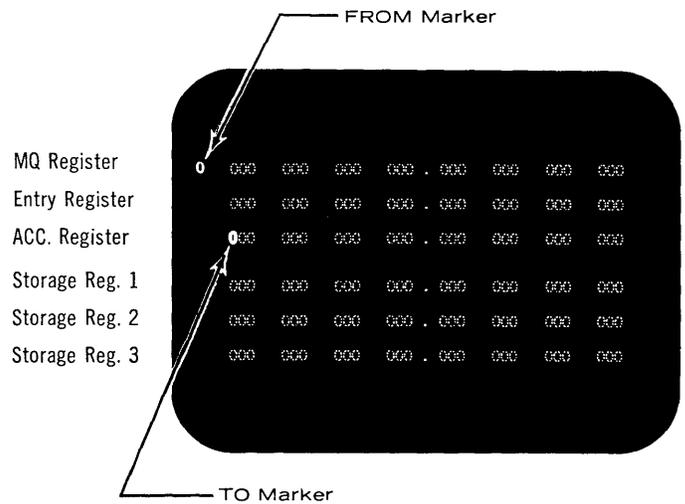
Six FROM keys and six TO keys, all located on the left hand side of the keyboard, define the data transfer operations (FROM a selected register TO a selected register). The actual transfer is initiated by the TRANSFER key, located below the TO and FROM keys.

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.

Exercise 2

Depress CLEAR MQ
 CLEAR ENTRY
 CLEAR ACC

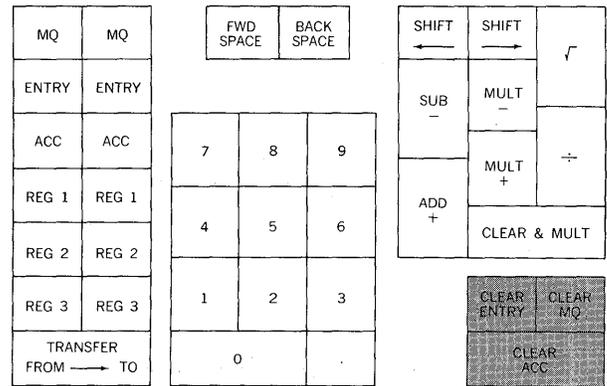
Note that the contents of all three registers are eliminated, and that the TO marker always appears in the register just cleared.

Depress FROM ACC
 TO REG 1
 TRANSFER

Note that Register 1 is now cleared.

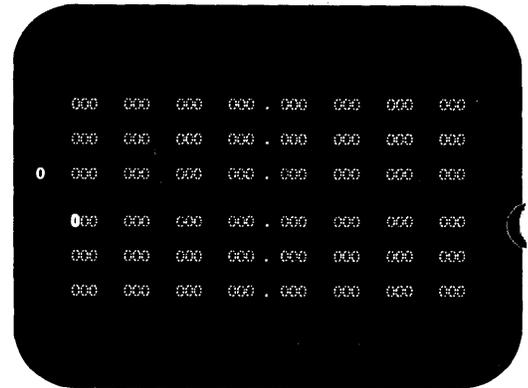
Depress TO REG 2
 TRANSFER
 TO REG 3
 TRANSFER

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



KEYBOARD NO. 2

MQ Register
 Entry Register
 ACC. Register
 Storage Reg. 1
 Storage Reg. 2
 Storage Reg. 3



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
- (.)

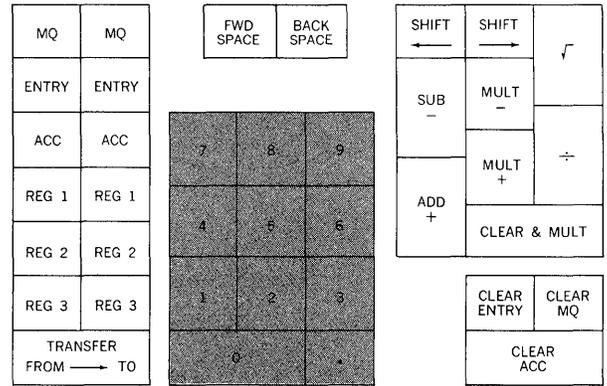
Note position of number 2 in ENTRY register.

- Depress CLEAR ACC
- (.)
- 2

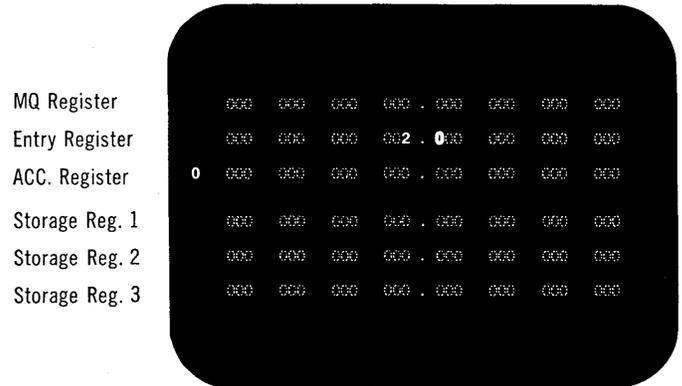
Note position of number .2 in ACC register.

- 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.

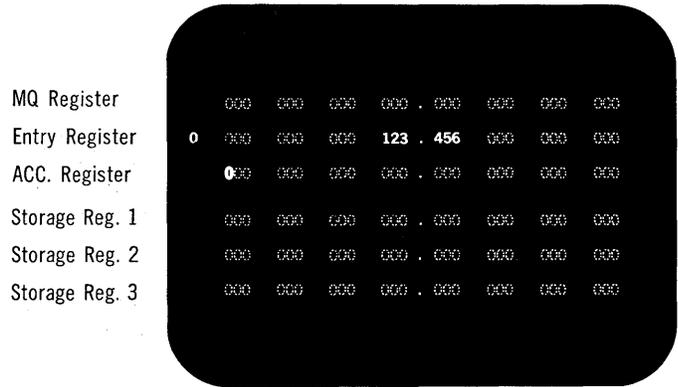
Exercise 4

Clear all Registers

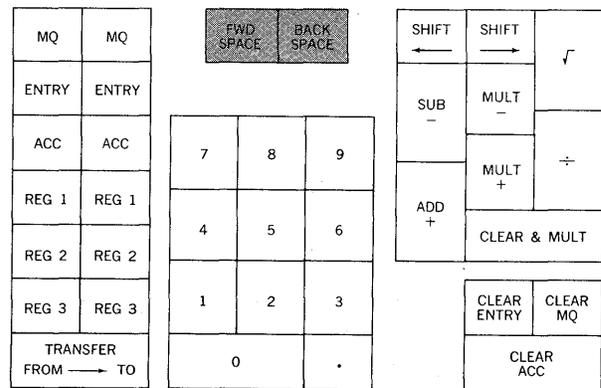
Depress TO ENTRY
 Enter 999.999
 Depress FWD SPACE 5 times
 BACK SPACE 7 times

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

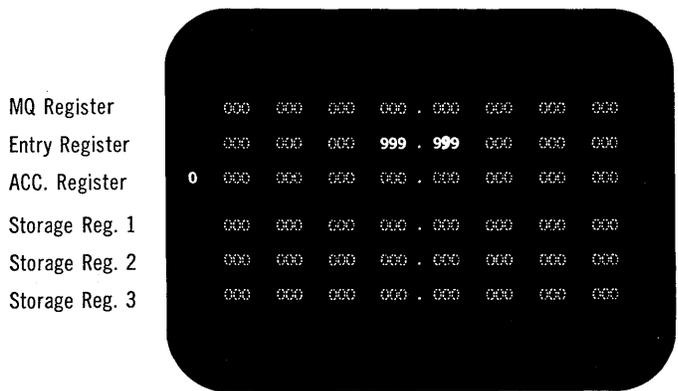
Now, enter the digit 5. (Do not depress the decimal point key.) Note that the number which was intensified has changed to 5 and the next digit is now the bright position. Depress FWD SPACE once. The TO marker skips the last 9 and additional numbers may now be entered following the number 999.959.



Exercise 3 A: Prior to first transfer operation

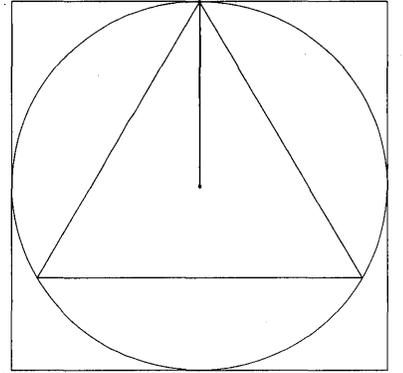


KEYBOARD NO. 4



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

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:

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

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:

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

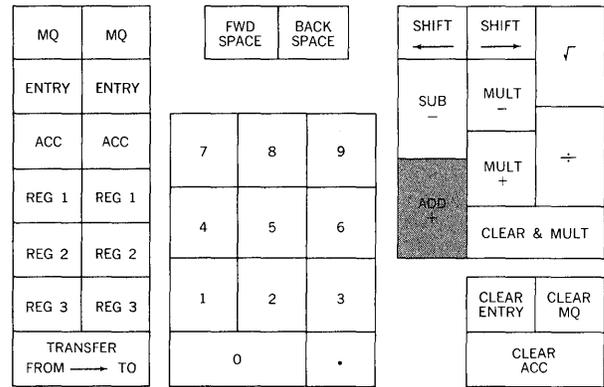
Exercise 8

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

Enter 18.

Depress SUB (-) key

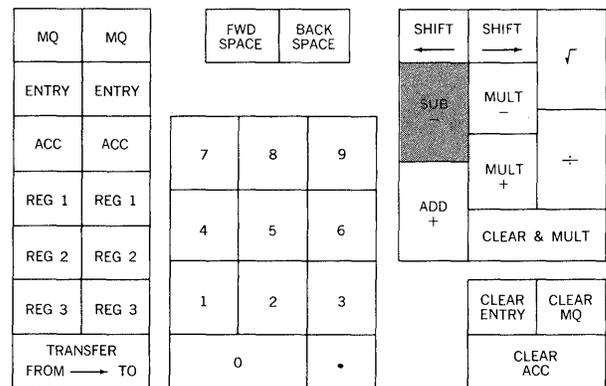
Note: 25 - 18 = 7 appears in ACC



KEYBOARD NO. 7

MQ Register 000 000 000 000 . 000 000 000 000
 Entry Register 000 000 000 013 . 000 000 000 000
 ACC. Register 0 000 000 000 012 . 000 000 000 000
 Storage Reg. 1 000 000 000 000 . 000 000 000 000
 Storage Reg. 2 000 000 000 000 . 000 000 000 000
 Storage Reg. 3 000 000 000 000 . 000 000 000 000

Exercise 7: Prior to depressing ADD (+) Key



KEYBOARD NO. 8

MQ Register 000 000 000 000 . 000 000 000 000
 Entry Register 000 000 000 018 . 000 000 000 000
 ACC. Register 0 000 000 000 025 . 000 000 000 000
 Storage Reg. 1 000 000 000 000 . 000 000 000 000
 Storage Reg. 2 000 000 000 000 . 000 000 000 000
 Storage Reg. 3 000 000 000 000 . 000 000 000 000

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:

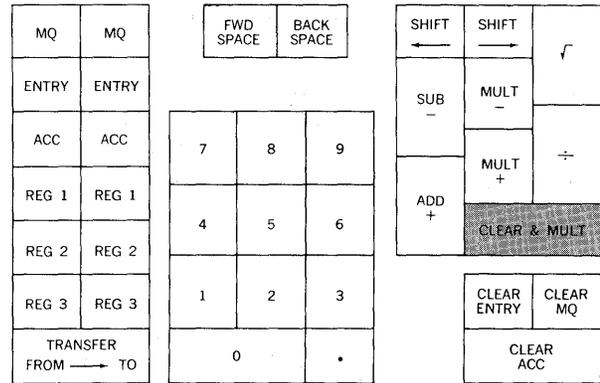
$$(ACC) + [(MQ) \times (ENTRY)] \rightarrow ACC$$

Exercise 10

Enter 8.

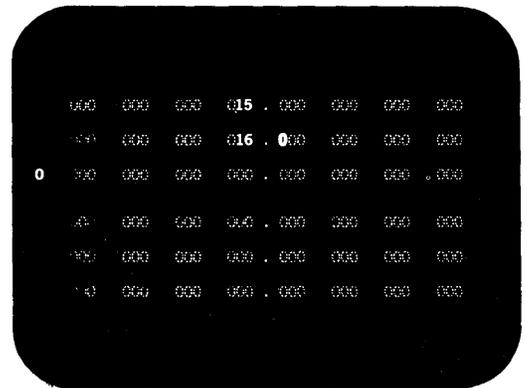
Depress MULT +

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.

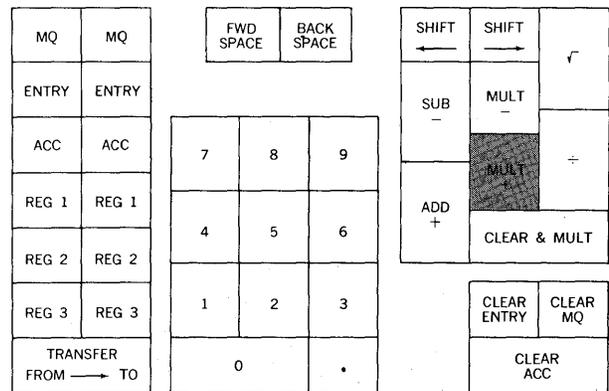


KEYBOARD NO. 9

MQ Register
Entry Register
ACC. Register
Storage Reg. 1
Storage Reg. 2
Storage Reg. 3

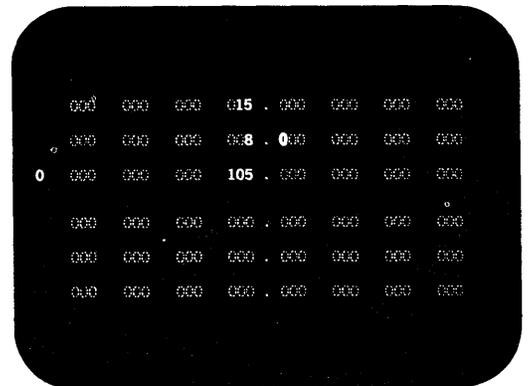


Exercise 9: Prior to depressing CLEAR & MULT Key



KEYBOARD NO. 10

MQ Register
Entry Register
ACC. Register
Storage Reg. 1
Storage Reg. 2
Storage Reg. 3



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:

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

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

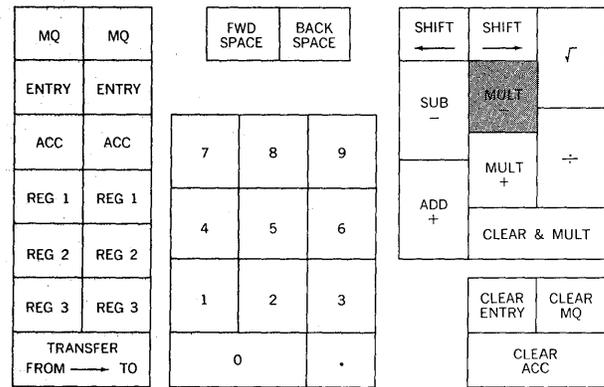
Enter 144.

Depress TO ENTRY

Enter 13.

Depress DIVIDE (÷)

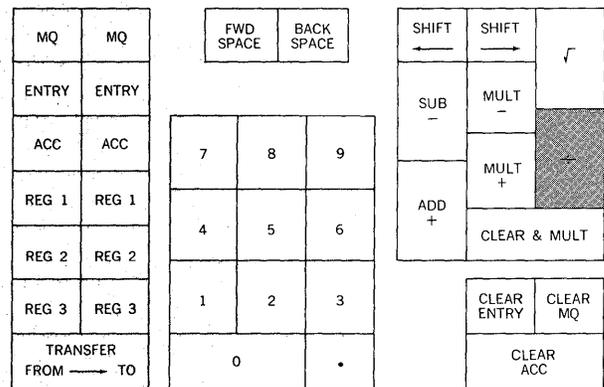
The quotient 11.076 923 076 923 appears in the MQ register.



KEYBOARD NO. 11

MQ Register	000	000	000	015	.000	000	000	000
Entry Register	000	000	000	008	.000	000	000	000
ACC. Register	0	000	000	000	225	.000	000	000
Storage Reg. 1	000	000	000	000	.000	000	000	000
Storage Reg. 2	000	000	000	000	.000	000	000	000
Storage Reg. 3	000	000	000	000	.000	000	000	000

Exercise 11: Prior to depressing MULT (-) Key



KEYBOARD NO. 12

MQ Register	000	000	000	000	.000	000	000	000
Entry Register	000	000	000	013	.000	000	000	000
ACC. Register	0	000	000	000	144	.000	000	000
Storage Reg. 1	000	000	000	000	.000	000	000	000
Storage Reg. 2	000	000	000	000	.000	000	000	000
Storage Reg. 3	000	000	000	000	.000	000	000	000

Exercise 12: Prior to depressing (÷) Key

13. SQUARE ROOT

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

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

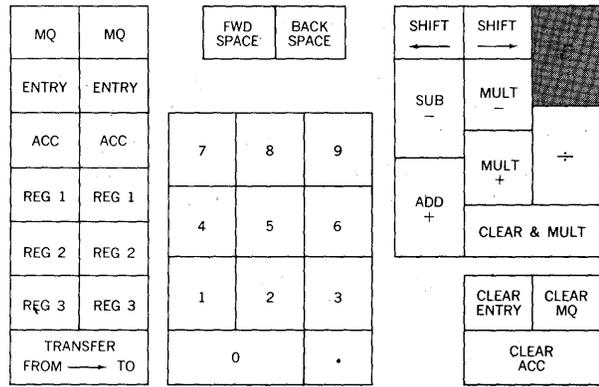
Exercise 13

Depress CLEAR ACC

Enter 2.

Depress $\sqrt{\quad}$

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



KEYBOARD NO. 13

MQ Register	000	000	000	000	000	000	000
Entry Register	000	000	000	000	000	000	000
ACC. Register	0	000	000	000	002	000	000
Storage Reg. 1	000	000	000	000	000	000	000
Storage Reg. 2	000	000	000	000	000	000	000
Storage Reg. 3	000	000	000	000	000	000	000

Exercise 13: Prior to depressing $\sqrt{\quad}$ 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.

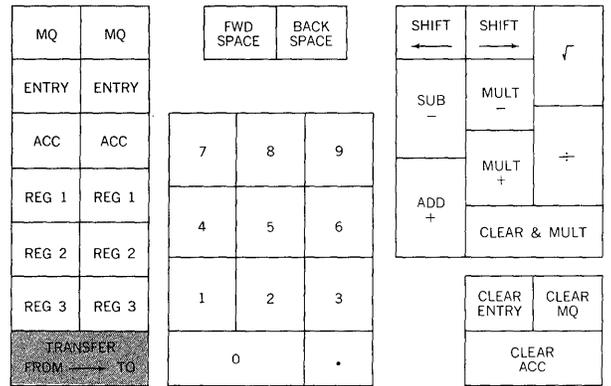
Depress CLEAR & MULT

$\sqrt{2} \times \sqrt{2}$ 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

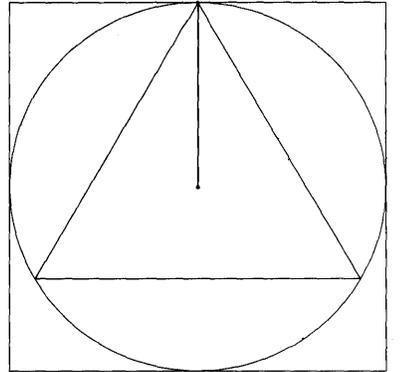
MQ Register 0 000 000 000 001 . 414 213 562 373
 Entry Register 000 000 000 000 . 000 000 000 000
 ACC. Register 000 000 000 000 . 000 000 000 000
 Storage Reg. 1 000 000 000 000 . 000 000 000 000
 Storage Reg. 2 000 000 000 000 . 000 000 000 000
 Storage Reg. 3 000 000 000 000 . 000 000 000 000

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

MQ Register 0 000 000 000 001 . 414 213 562 373
 Entry Register 000 000 000 000 . 000 000 000 000
 ACC. Register 000 000 000 001 . 999 999 999 987
 Storage Reg. 1 000 000 000 001 . 414 213 562 373
 Storage Reg. 2 000 000 000 000 . 000 000 000 000
 Storage Reg. 3 000 000 000 000 . 000 000 000 000

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.

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.



KEYBOARD NO. 15

MQ Register	000	000	000	000	.000	000	000	000
Entry Register	000	000	000	000	.000	000	000	000
ACC. Register	000	000	000	025	.000	000	000	000
Storage Reg. 1	0	000	000	000	018	.000	000	000
Storage Reg. 2	000	000	000	000	.000	000	000	000
Storage Reg. 3	000	000	000	000	.000	000	000	000

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

MQ Register	0	000	000	000	013	.000	000	000
Entry Register	000	000	000	000	.000	000	000	000
ACC. Register	000	000	000	043	.000	000	000	000
Storage Reg. 1	000	000	000	018	.000	000	000	000
Storage Reg. 2	000	000	000	000	.000	000	000	000
Storage Reg. 3	000	000	000	000	.000	000	000	000

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

MQ Register	0	000	007	863	571	.	000	000	000	000	0
Entry Register		863	571	000	000	.	000	000	000	000	0
ACC. Register		900	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 16: Overflow indication

MQ Register		000	000	000	000	.	000	000	000	000	0
Entry Register		000	000	000	002	.	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 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.

MQ Register	000	000	000	000	000	000	000
Entry Register	999	999	999	999	000	000	000
ACC. Register	0	000	000	000	000	000	000
Storage Reg. 1	000	000	000	000	000	000	000
Storage Reg. 2	000	000	000	000	000	000	000
Storage Reg. 3	000	000	000	000	000	000	000

Exercise 17: Prior to final subtract (-) operation



KEYBOARD NO. 18

MQ Register	000	000	000	011	076	923	076	923
Entry Register	0	000	000	130	000	000	000	000
ACC. Register	0	000	000	100	000	000	000	000
Storage Reg. 1	000	000	000	000	000	000	000	000
Storage Reg. 2	000	000	000	000	000	000	000	000
Storage Reg. 3	000	000	000	000	000	000	000	000

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 $\sqrt{\quad}$

$\sqrt{2}$ 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 +

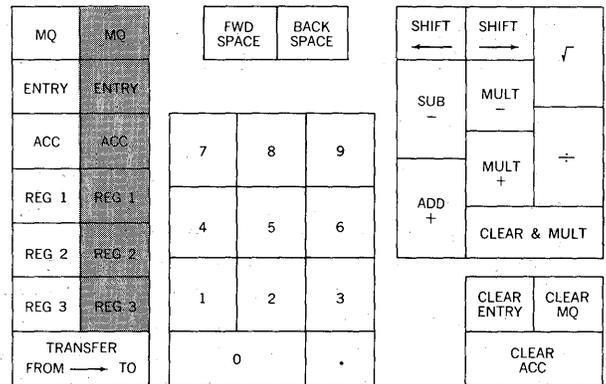
$(5 \times 5) = 25$ appears in ACC register.

Only three registers can be entered simultaneously.

Only one of these can be a storage register.

MQ Register	000	000	000	001	. 414	213	562	373
Entry Register	000	000	000	002	. 828	427	124	746
ACC. Register	0	000	000	002	. 688	386	088	714
Storage Reg. 1	000	000	000	000	. 000	000	000	000
Storage Reg. 2	000	000	000	000	. 000	000	000	000
Storage Reg. 3	000	000	000	000	. 000	000	000	000

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



KEYBOARD NO. 19

MQ Register	000	000	000	005	. 000	000	000	000
Entry Register	000	000	000	005	. 000	000	000	000
ACC. Register	0	000	000	000	. 000	000	000	000
Storage Reg. 1	000	000	000	000	. 000	000	000	000
Storage Reg. 2	000	000	000	000	. 000	000	000	000
Storage Reg. 3	000	000	000	000	. 000	000	000	000

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.

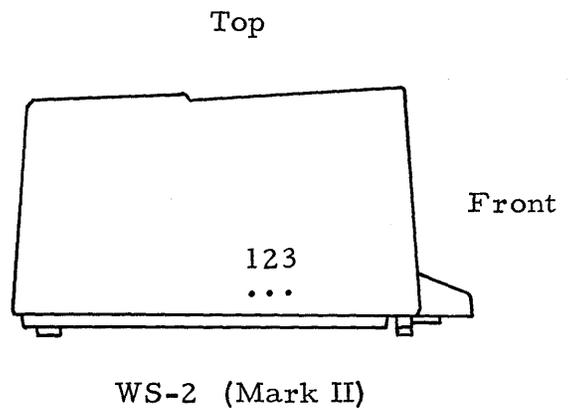
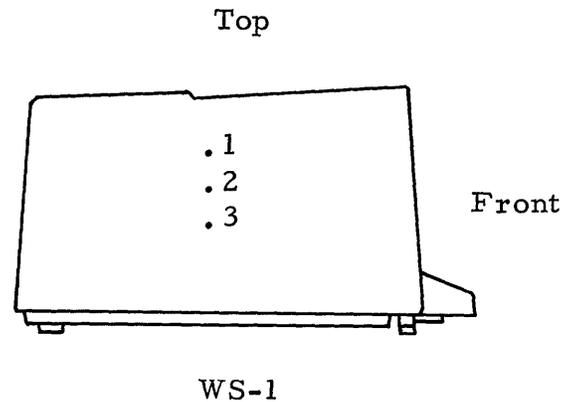
Adjust brightener control until desired brightness of "TO" indicator is obtained. Turning control counter-clockwise increases intensity.

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

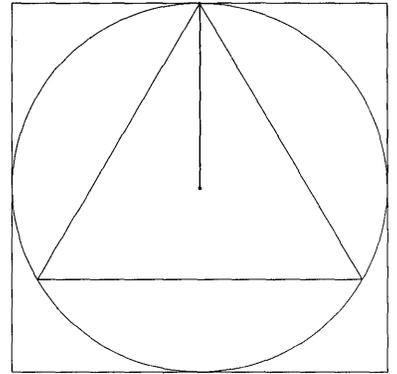
SPECIAL NOTE

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.



PROGRAMMED AUTOMATIC CARD INPUT SYSTEM
PC-01 CARD READER



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

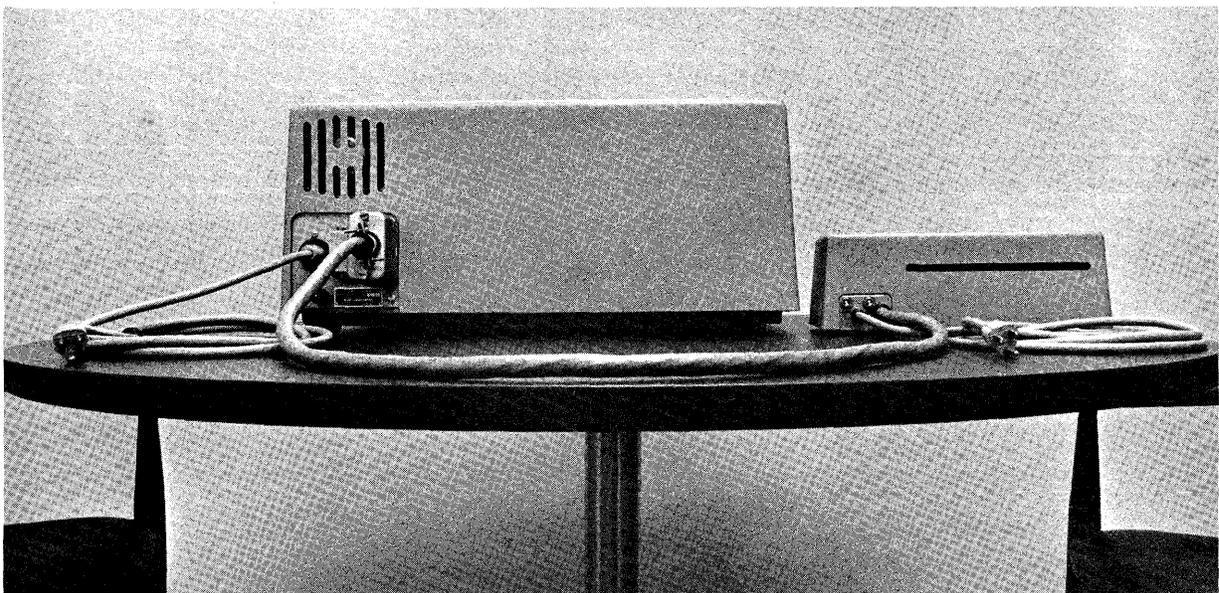
The PAC input system allows programmed operation, eliminating time-consuming manual operation of repetitive problems and minimizing the opportunity for operator errors. The basic device for programmed operation is the Model PC-01 punched card reader. The PC-01 is a photoelectric reader which reads a 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	$b^2 \rightarrow \text{Acc}$
5.	CLEAR MQ	
6.	TO MQ - TO ENTRY	
7.	STOP	Manually enter c.
8.	MULTIPLY +	$b^2 + c^2 \rightarrow \text{Acc}$
9.	SQUARE ROOT ($\sqrt{\quad}$)	$\sqrt{b^2 + c^2} \rightarrow \text{MQ} = a$
10.	STOP	Answer appears in MQ register

STEP	FROM	TO	NUMBER	OPERATION	EDIT	CLEAR	
1							1
2				D +	C M M ÷	S S S S	2
3				E -	L U U √	P P H H	3
4				C	E L L	A A I I	4
5	MQ	MQ		I	A T T	C C F F	5
6	ENT	ENT		M	R I I	E E T T	6
7	ACC	ACC	0 1 2 3 4	A	P P		7
8	R1	R1		L	& L L	F B L R	8
9	R2	R2		R	Y Y	R A E I	9
10	R3	R3		P	M	W C F G	10
11				T	U + -	D K T H	11
12					L	T	12

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 + $(ACC) + [(MQ) \times (ENTRY)] \longrightarrow ACC$
5. Multiply - $(ACC) - [(MQ) \times (ENTRY)] \longrightarrow ACC$
6. Divide $(ACC) \div (ENTRY) \longrightarrow MQ$
7. Square Root $\sqrt{(ACC)} \longrightarrow MQ$

