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## Use of the Hewlett-Packard 9810 Calculator System in Water Quality Analysis

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# USE OF THE HEWLETT-PACKARD 9810 CALCULATOR SYSTEM IN WATER QUALITY ANALYSIS

BY

JERALD S. FIFIELD

## USE OF THE HEWLETT-PACKARD 9810 CALCULATOR SYSTEM IN WATER QUALITY ANALYSIS

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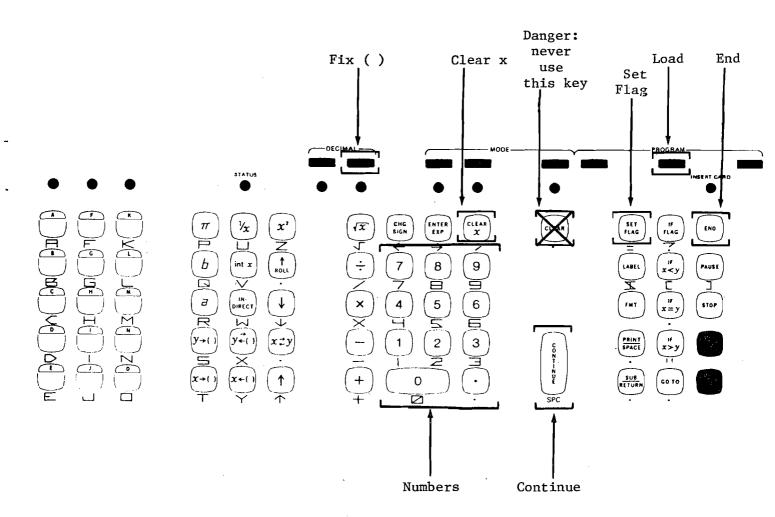
## Introduction

It is the purpose of this manual to illustrate the utilization of the Hewlett-Packard, Model 9810A calculator for analyzing water quality data. Familiarization of each program's capabilities is essential for successful application, thus the user should read over the section used before beginning. Each section is complete with instructions and illustrative examples.

INITIALIZATION PROCEDURE INSTRUCTIONS

## INITIALIZATION PROCEDURE

Listed below are the keys which may be used for this section.



- 1. Turn on computer.
- 2. Turn on cassette memory and insert tape.
- 3. Push END.
- 4. Insert magnetic card in the Reader, push LOAD and remove magnetic card.
- 5. Push END.
- 6. Push CONTINUE.
- 7. Enter one of the following numbers, then CONTINUE.

Number	<u>Program</u>	
0	alkalinity	
1	calcium	
2	total hardness	
3	C.O.D.	
4	iron standard curve	
6	ammonia standard curve	
8	orthophosphate standard curve	
10	nitrite standard curve	
12	mean, S.D., and C.V. for $NH_3$ , Fe, N, or P	
14	D.O. and/or B.O.D.	
16	graphs (includes linear regression)	

8. Follow instructions printed by the computer and/or those stated in the manual.

PLOTTER BOARD INSTRUCTIONS

### PLOTTER BOARD INSTRUCTIONS

#### INITIALIZATION

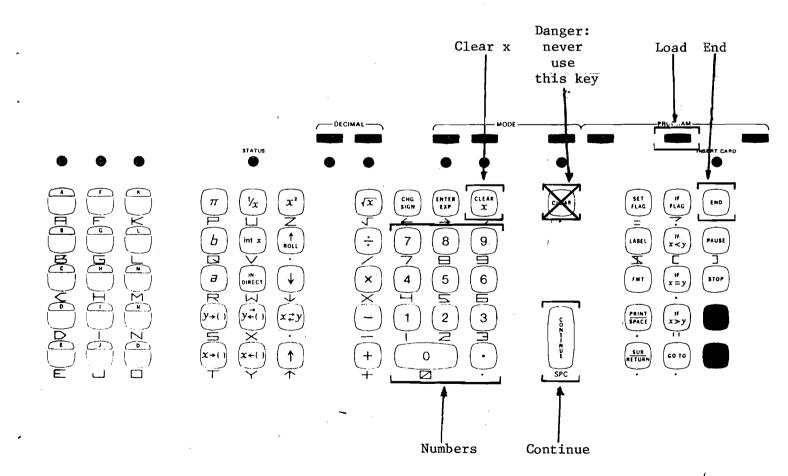
- 1. Push LINE ON. The button should stay down.
- 2. Push CHART HOLD. The button should stay down.
- Push UPPER RIGHT.
- 4. Push CHART HOLD. The button should stay up.
- 5. Place your paper on the board. Remove the plastic tip from the pen and put it in the plotting position (i.e., the tip facing the paper).
- 6. Push CHART HOLD. The button should stay down.
- 7. Push LOWER LEFT. Adjust the pen to the desired position on the lower left section of your paper by manipulating the two knobs located at the immediate left of the LOWER LEFT button.
- 8. Push UPPER RIGHT. Adjust the pen to the desired position on the upper right section of your paper by manipulating the two knobs located at the immediate right of the UPPER RIGHT button.
- 9. Push LOWER LEFT to check the position of the pen. Repeat steps 7 and 8 until you are satisfied with the position of the pen.
- 10. Continue with the desired program.

#### TERMINATION

- 1. Push UPPER RIGHT.
- 2. Replace the plastic cap on the pen. Remove the pen from the plotting position (i.e., the tip nob facing the paper).
- 3. Push CHART HOLD. The button should stay up.
- Remove your graph.
- 5. If another graph is to be developed, proceed to step 5 of the initialization procedure above.
- 6. If no more graphs are to be drawn, push LINE ON. The button should stay up.

Number	Program
0	alkalinity
1	calcium
2	total hardness
3	C.O.D.
4	iron standardization curve
6	ammonia standardization curve
8	orthophosphate standardization curve
10	nitrite standardization curve
12	mean, S.D. and C.V. for NH3, Fe, N,
	or P
14	D.O. and/or B.O.D.

Listed below are the keys which may be used for the above programs.



## INSTRUCTIONS

NUMBER	<u>Program</u>
0	ALKALINITY
1	CALCIUM
2	TOTAL HARDNESS

- 1. Follow initialization procedure (if not done already).
- 2. NOTE: If an incorrect entry occurs, and CONTINUE has <u>not</u> been executed, push CLEAR X and enter correct value. If CONTINUE was executed and a mistake discovered, start anew by pushing END, then CONTINUE.

TOTAL HARDNESS

PUSH "SET FLAG"
IF STANDARD HAS
BEEN CALIBRATED
STANDARD
CALIBRATION

ENTER NORMALITY

Ø.Ø25ØØ\*

VOLUME OF

STANDARD USED (IN MLS)

10.00000\*

ENTER FOL (MLS)
OF TITRANT USED
ENTRY

1.00000

10.20000

ENTRY

2.00000

1**Ø.**25**Ø**ØØ

ENTRY

3.00000

11.00000

ENTRY

4.00000

NORMALITY

MEAN

Ø.Ø2385

S.D.

Ø.ØØ1Ø2

C.V.(%)

4.27483

Title of program.

For an initial run, push CONTINUE. If the standard has been calibrated, push SET FLAG, then CONTINUE and go to Step 3.

Information required to calibrate normality of the standard. Enter what is requested, then push CONTINUE. The numbers indicate what was entered.

Amount of titrant used per sample in calibrating the standard. Enter a value, then CONTINUE. Repeat until all data has been entered (minimum entry is 2). The first number is a counter and the second indicates what was entered.

When all data has been entered, push SET FLAG, then CONTINUE.

Statistics on the actual normality of your standard.

3. Once the standard has been calibrated, the following will be executed:

MLS OF SAMPLE=? 5Ø.ØØØØØ\* ENTER VOL (MLS) OF TITRANT USED ENTRY 1.00000 5.3ØØØØ ENTRY 2.00000 5.6ØØØØ ENTRY 3. ØØØØØ 5.5ØØØØ ENTRY 4.00000 TOTAL HARDNESS (MG/L AS CACO3) MEAN 26Ø.73132 S.D. 7.28549 C.V.(%) 2.79425

Enter the volume of your sample, then push CONTINUE. The number indicates what was entered.

Amount of titrant used per sample. Enter a value, then push CONTINUE. Repeat until all data has been entered (minimum entries is 2). The first number is a counter and the second indicates what was entered.

When all data has been entered, push SET FLAG, then CONTINUE.

Statistics for your desired program. Push PAPER to remove your copy.

- 4. If the same program is to be run again, push END, then CONTINUE.
- 5. If another program is desired, follow the procedure outlined in that section.
- 6. If no other program is to be run, turn off the computer and cassette memory.

## INSTRUCTION

NUMBER

3

PROGRAM

C.O.D.

- 1. Follow initialization procedure (if not done already).
- 2. NOTE: If an incorrect entry occurs, and CONTINUE has not been executed, push CLEAR X and enter correct value. If CONTINUE was executed and a mistake discovered, start anew by pushing END, then CONTINUE.

C.O.D. PUSH "SET FLAG" IF STANDARD HAS BEEN CALIBRATED NORMALITY=?  $\emptyset.25000*$ VOLUME OF STANDARD USED (IN MLS) 10.000000\* ENTER VOL (MLS) OF TITRANT USED ENTRY 1.00000 1Ø.1ØØØØ ENTRY 2.00000 10.00000 ENTRY 3.00000 10.20000 ENTRY 4.00000 NORMALITY MEAN  $\emptyset.24752$ S.D. Ø. ØØ245 C.V.(%)  $\emptyset.99010$ 

Title of program

For an initial run, push CONTINUE. If the standard has been calibrated, push SET FLAG, then CONTINUE and go to step 3.

Information required to calibrate normality of the standard. Enter what is requested, then push CONTINUE. The numbers indicate what was entered.

Amount of titrant used per sample in calibrating the standard. Enter a value, then CONTINUE. Repeat until all data has been entered (minimum entries is 2). The first number is a counter and the second indicates what was entered.

When all data has been entered, push SET FLAG, then CONTINUE.

Statistics on the actual normality of your standard.

Once the computer has calibrated the standard, the following steps are executed:

MLS OF SAMPLE=?

20.00000

Enter the volume of your sample, then push CONTINUE. The number indicates the entry.

BLANK ENTER VOL (MLS) OF TITRANT USED ENTRY 1.00000 25.3ØØØØ ENTRY 2.00000 24.70000 ENTRY 3.00000 MEAN 25.00000 S.D. 0.42426 C.V.(%) 1.69706 SAMPLE ENTER VOL (MLS) OF TITRANT USED ENTRY 1.00000 22.ØØØØØ ENTRY 2.ØØØØØ 22.10000 ENTRY 3.00000 2**0.**8**000** ENTRY 4.00000 21.30000 ENTRY 5.00000 21.40000 ENTRY 6.00000 MEAN 21.52ØØØ S.D. 0.53572 C.V.(%) 2.48942 C.O.D. (MG/L) 344.55446

Amount of titrant used for the <u>blanks</u>. Enter a value, then CONTINUE. Repeat until all data has been entered (minimum entry = 2). The first number is a counter and the second is the entry.

When all data has been entered, push SET FLAG, then CONTINUE.

Statistics for your blank.

Amount of titrant used for the <u>samples</u>. Enter a value, then CONTINUE. Repeat until all data has been entered (minimum entry = 2). The first number is a counter and the second is the entry.

When all data has been entered, push SET FLAG, then CONTINUE.

Statistics for your sample.

C.O.D. of your sample. Push PAPER to remove your copy.

- 4. If the program is to be run again, push END, then CONTINUE.
- 5. If another program is desired, follow the procedure outlined in that section.
- 6. If no other program is to be run, turn off the computer and cassette memory.

## INSTRUCTIONS

NUMBER	Program	
4	Iron Standardization Curve	
6	Ammonia Standardization Curve	
8	Orthophospate Standardization Curve	
10	NITRITE STANDARDIZATION CURVE	

- 1. Follow the procedure for setting up your graph on the plotter.
- 2. Follow initialization procedure (if not already done).
- 3. Note: If an incorrect entry occurs, and CONTINUE has not been executed, push CLEAR X and enter correct value. If CONTINUE was executed and a mistake discovered, start anew by pushing END, then CONTINUE.

NITRI	TE	
MAX A	ABSORPTION=?	
	Ø.6ØØ	*
WAVEI	LENGTH=?	
0777	543.000	
CELL	LENGTH=? 1.000	ı
CELL	UNITS	
(1 =	IN. 2 CM)	)
X = ?	35.ØØØ*	ę į
Y = ?	33.000	
** 0	Ø.118*	k
X = ?	7Ø.ØØØ	
Y = ?		
77 0	Ø.26Ø*	*
X = ?	1Ø5.ØØØ	
Y = ?		
** 0	Ø.355;	ŧ
X=?	140.000	
Y = ?		ı
¥7. 0	Ø.51Ø*	۲
X = ?	•	1

Title of program.

Enter the largest value you want for the absorbance axis, then CONTINUE. The number indicates what was entered.

General information for your graph. Enter what is requested, then CONTINUE.

Coordinates to be entered for plotting your points:

X=Concentration

Y=Absorbance

At least 3 points are needed. Enter X, then CONTINUE. Enter Y, then CONTINUE. Arrange your data such that X is in <u>ascending</u> order.

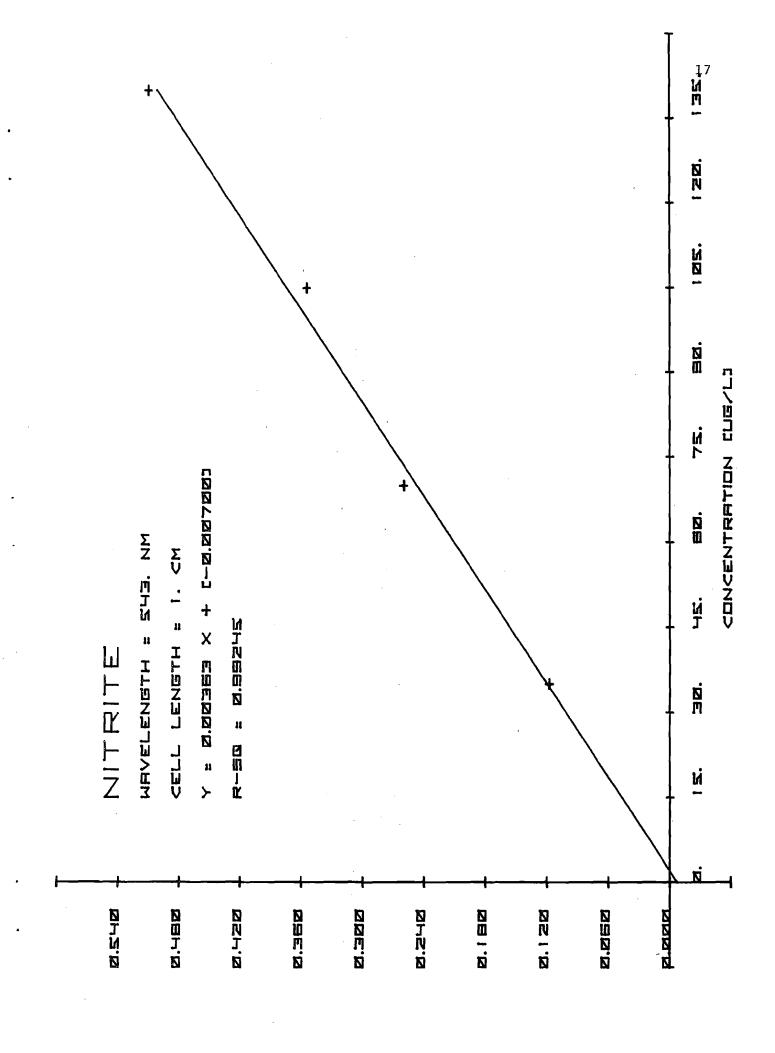
When all points have been plotted, push SET FLAG, then CONTINUE. The best straight line will be drawn and an equation, with  $R^2$ , written on your graph. (See page 17.)

4. The following will illustrate how concentrations can be found if you know absorbance.

}	•	١
EQUATION	ON	h
Y = ?		
]	Ø.152ØØ*	
X=	43.78442	U
Y = ?	43.70444	1
•••	Ø.3ØØØØ*	1
X=		1
Ì	84.53973	П
Y = ?		
1 77	Ø.523ØØ*	ļ
X=	145.94807	L
Y = ?	143.34097	ľ
' '		1

Enter the absorbance (i.e., Y) of your sample, then CONTINUE. The X represents concentrations in  $mg/\ell$ .

- 5. Push the HOLD button (it should stay up). Remove your graph.
- 6. If this, or any other program is to be run again, follow the procedure for that section.
- 7. If no other program is to be run, turn off the computer, cassette memory, and plotter board. Be sure the plastic lid is on the tip of the pen.



## INSTRUCTIONS

Number

PROGRAM

12

Mean, S.D., and C.V. for  $NH_3$ , Fe, N, or P

- 1. Follow initialization procedure (if not already done).
- 2. NOTE: If an incorrect entry occurs, and CONTINUE has not been executed, push CLEAR X and enter correct value. If CONTINUE was executed and a mistake discovered, start anew by pushing END, then CONTINUE.

MEAN, S.D., AND C.V. FOR AMMONIA IRON, NITRITE OR ORTHOPHOSPHATE ENTER ABSORBANCE ENTRY 1.00000 Ø.14ØØØ ENTRY 2.ØØØØØ Ø.145ØØ ENTRY 3.00000 0.14500 ENTRY 4.00000 Ø.143ØØ ENTRY 5.ØØØØØ Ø.149ØØ ENTRY 6.ØØØØØ Ø.133ØØ ENTRY 7.ØØØØØ MEAN Ø.1425Ø S.D. 0.00550 C.V.(%) 3.86284 ENTER VALUE IF GRAPHING STANDARD CURVE 4 = FE6 = NH38 = Pprocedure. 10 = N

Title of program

Absorbance readings of your sample. Enter a value then CONTINUE. Repeat until all data has been entered (minimum entries is 2). The first number is a counter and the second indicates what was entered.

When all data has been entered, push SET FLAG, then CONTINUE.

Statistics on the absorbance of your samples.

Option to allow the user to go to a standard curve without having to go to the initialization

If the program is to be run again, push END, then CONTINUE.

- 4. If another program is desired, follow the procedure outlined in that section.
- 5. If no other program is to be run, turn off the computer and cassette memory.

## INSTRUCTIONS

Number

PROGRAM

14

D.O. AND/OR B.O.D.

- 1. Follow initialization procedure (if not already done.)
- 2. NOTE: If an incorrect entry occurs, and CONTINUE has <u>not</u> been executed, push CLEAR X and enter correct value. If CONTINUE was executed and a mistake discovered, start anew by pushing END, then CONTINUE.

DO AND/OR BOD DO ONLY? (1=YES 2 = NO) 1.000000\* PUSH "SET FLAG" IF STANDARD HAS BEEN CALIBRATED STANDARD CALIBRATION ENTER NORMALITY Ø.Ø25ØØ\* MLS OF STANDARD 20.000000\* ENTER VOL (MLS) OF TITRANT USED ENTRY 1.00000 20.20000 ENTRY 2.00000 20.20000 ENTRY 3.00000 2Ø.2ØØØØ ENTRY 4.00000 NORMALITY MEAN 0.02475 S.D. Ø.ØØØØØ

C.V.(%)

Ø.ØØØØØ

Title of program

Choose between D.O. or B.O.D. The number indicates what choice was made.

For an initial run, push CONTINUE. If the standard has been calibrated, push SET FLAG, then CONTINUE and go to D.O. or B.O.D. instructions.

Information required to calibrate normality of the standard. Enter what is required, then push CONTINUE. The numbers indicate what was entered.

Amounts of titrant used per sample in calibrating the standard. Enter a value then CONTINUE. Repeat until all data has been entered (minimum entry is 2). The first number is a counter and the second indicates what was entered.

When all data has been entered, push SET FLAG, then CONTINUE.

Statistics on the actual normality of your standard.

#### D.O. Instructions

1 ML OF . Ø25 N NA2S203 EQUALS 0.99010MG OF 02/L AS DO D.O. SAMPLE 1.00000 ENTER VOL (MLS) OF TITRANT USED 1.00000 3.00000 ENTRY 2.00000 2.9ØØØØ ENTRY 3.00000 3.10000 ENTRY 4.ØØØØØ MEAN 2.97Ø3Ø S.D. Ø. Ø99Ø1 C.V.(%) 3.33333 SAMPLE 2.ØØØØØ ENTER VOL (MLS) OF TITRANT USED ENTRY 1.00000 0.70000ENTRY 2.00000 8.5ØØØØ ENTRY 3.00000 8.40000 ENTRY 4.00000 MEAN 8.44884 S.D.  $\emptyset.15124$ C.V. (%) 1.79007

Equivalance of  $Na_2S_2O_3$  to milligrams/liter of  $O_2$ .

Identifies what sample is being analyzed for D.O.

Amount of titrant used. Enter a value, then CONTINUE. Repeat until all data has been entered (minimum entry is 2). The first number is a counter and the second is the entry.

When all data has been entered, push SET FLAG, then CONTINUE.

Statistics of D.O. for your sample. The mean and S.D. are final D.O. values (in mg/ $\ell$  of  $0_2$ ).

Identifies the next sample being analyzed.

Amount of titrant used. Enter a value, then CONTINUE. Repeat until all data has been entered (minimum entry is 2). The first number is a counter and the second is the entry.

When all data has been entered, push SET FLAG, then CONTINUE.

Statistics of D.O. for your sample. The mean and S.D. are final D.O. values (in  $mg/\ell$  of  $O_2$ ).

3. Continue in a similar manner until all your samples have been analyzed for 0.0.

#### B.O.D. Instructions

B.O.D.

SET FLAG WHEN SAMPLE CALCULA-TIONS ARE COM-PLETED

DO SAMPLE

1.00000
ENTER VOL (MLS)
OF TITRANT USED

1.00000 7.51000

ENTRY

ENTRY

2.00000

7.61ØØØ

ENTRY

3.00000

7.51ØØØ

**ENTRY** 

4.00000

MEAN

7,46865

S.D.

Ø.Ø5716

C.V. (%)

Ø.76538

DO SAMPLE

2.ØØØØØ

Title of program

If D.O. samples are to be calculated push  ${\tt CONTINUE}$ 

Titrant entries to calculate the D.O. of your sample. Enter value, then CONTINUE (a minimum of 2 entries is required). The first number is a counter and the second represents what was entered

When all data has been entered, push SET FLAG, then CONTINUE

Statistics of D.O. for your sample. The mean and S.D. are final D.O. values (in mg/ $\ell$  of O $_2$ ).

If all samples have been calculated for D.O. then push SET FLAG, and CONTINUE. Otherwise, push CONTINUE.

DECIMAL FRACTION OF SAMPLE=?

Ø.Ø5ØØØ

BLANK 1=?

7.75ØØØ\*

BLANK 2=?

7.10000\*

D.0.1 = ?

7.47000\*

D.O.2 = ?

6.49ØØØ\*

MG BOD/L EQUALS 6.60000

DECIMAL FRACTION

OF SAMPLE=?

Enter the fraction of your sample used, then CONTINUE. The number represents what was entered.

Enter the initial blank D.O. value, then CONTINUE.

Enter the second blank D.O. value, then CONTINUE.

Enter the initial sample D.O. value, then CONTINUE.

Enter the second D.O. value, then CONTINUE.

The BOD for that particular day being analyzed.

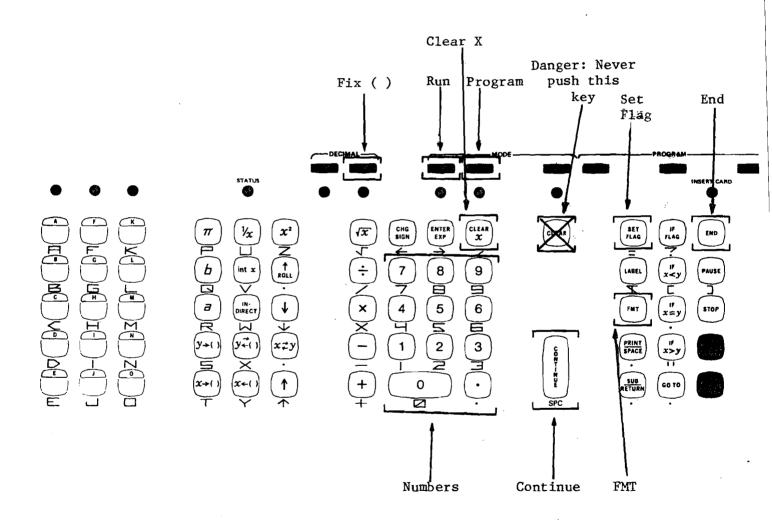
Repeat the above until all days have been completed.

- 4. Push PAPER to remove your copy.
- 5. If this, or another, program is to be run again, follow the procedure outlined in that section.
- 6. If no other program is to be run, turn off the computer and cassette tape drive.

## INSTRUCTIONS

Number 16 Program
Graphing (includes linear regressions)

Listed below are the keys which may be used for this section.



1. Follow initialization procedure (if not already done).

INITIALIZATION

ENTER PROGRAM NUMBER

Enter 16, then CONTINUE.

PUSH FIX(), THEN ENTER THE NUMBER OF DIGITS YOU WANT AFTER THE DECIMAL POINT FOR THE AXIS

FINALLY, PUSH CONTINUE

16.

This allows you to select the number of digits after the decimal point desired if it is decided to allow the computer to draw and label each axis.

Program number chosen.

- 2. NOTE: If an incorrect entry occurs, and CONTINUE has <u>not</u> been executed, push CLEAR X and enter correct value. If CONTINUE was executed and a mistake discovered, start anew by pushing END then CONTINUE.
- 3. Follow Plotter Instructions

GRAPHING

X - MAX = ?

15Ø.

X-MIN = ?

ø.

Y - MAX = ?

150.

Y-MIN = ?

Ø.

ARE YOU PLOTTING ON GRAPH PAPER? (Ø=NO 1=YES)

Title of program.

Maximum and minimum cordinates of your graph. Choose numbers which will include your values to be plotted adequately.

If 0 is entered, a graph will be drawn with the ordinates and abscissa each divided into ten equal parts. After the graph is developed, follow the linear regression or non-linear regression instructions.

#### Linear Regression Instructions

YES)
· IES)
s.øøø
5.000*
5.ØØØ
5.000*
0.000
5.ØØØ*

Enter 1, then CONTINUE.

Once the linear regression option has been selected, enter the coordinates as requested, then CONTINUE. These points will be plotted on your graph.

When all data has been entered, push SET FLAG, then CONTINUE. On your graph, the best straight line will be drawn along with the equation and  $R^2$  value written. (See the graph on page 32.)

LINEAR REG. WAS EXECUTED

GENERAL EQUATION IS Y = MX + B

DO YOU WANT TO ENTER X AND SOLVE FOR Y? (Ø=NO, 1=YES)

Y = ?

90.00000\*

Χ=

67.94723

Y = ?

33.500000\*

X =

23.61995

Y = ?

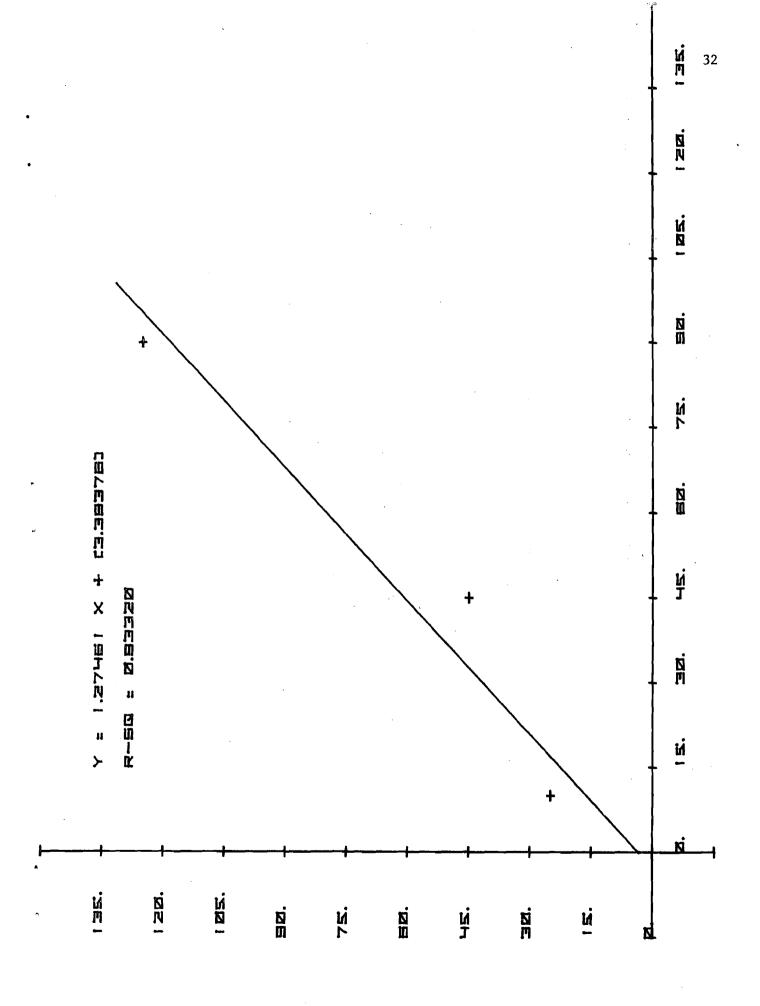
This allows you to use the linear regression equation developed to solve for the dependent variable (i.e. Y) or independent variable (i.e. X). Enter 0 or 1, then CONTINUE.

Example of solving for the independent variable (i.e. X) when Y is known. Enter value of Y, then CONTINUE (Repeat as often as desired).

X=?	· <u>-</u>
<b>3</b> 7	150.00000*
Y=	194.58528
X=?	
Y=	72.60000*
	95.93047
X = ?	· · · · · · · · · · · · · · · · · · ·

Example of solving for the dependent variable (i.e. Y) when X is known. Enter value of X, then CONTINUE (Repeat as often as desired).

- 4. Remove graph from plotter.
- 5. To run this or any other program, follow the procedure of that section.
- 6. If no other program is to be run, turn off the computer, cassette memory and plotter board (the ON button should be up).
- 7. Be sure the plastic lid is on the tip of the ink pen.



### Non Linear Regression Instructions

GRAPHING Title of program. X-MAX = ?200. X-MIN = ?Ø. Maximum and minimum coordinates of your graph. See, the linear regression instructions. Y-MAX = ?15Ø. Y-MIN = ?ARE YOU PLOTTING ON GRAPH PAPER? See the linear regression instructions  $(\emptyset = NO$ 1 = YES) Enter 0, then CONTINUE. LINEAR REG?

- 8. NOTE: As the program is written, each point will be marked with a "+" This may be altered by the following steps:
  - 1) push GO TO 0462
  - 2) push PRGM
  - 3) push:
    - a) FMT
    - b) 1
    - c) FMT
    - d) any number or symbol desired
    - e) FMT
  - 4) push RUN
  - 5) push 0.1, then FMT 11
  - 6) push END, then CONTINUE

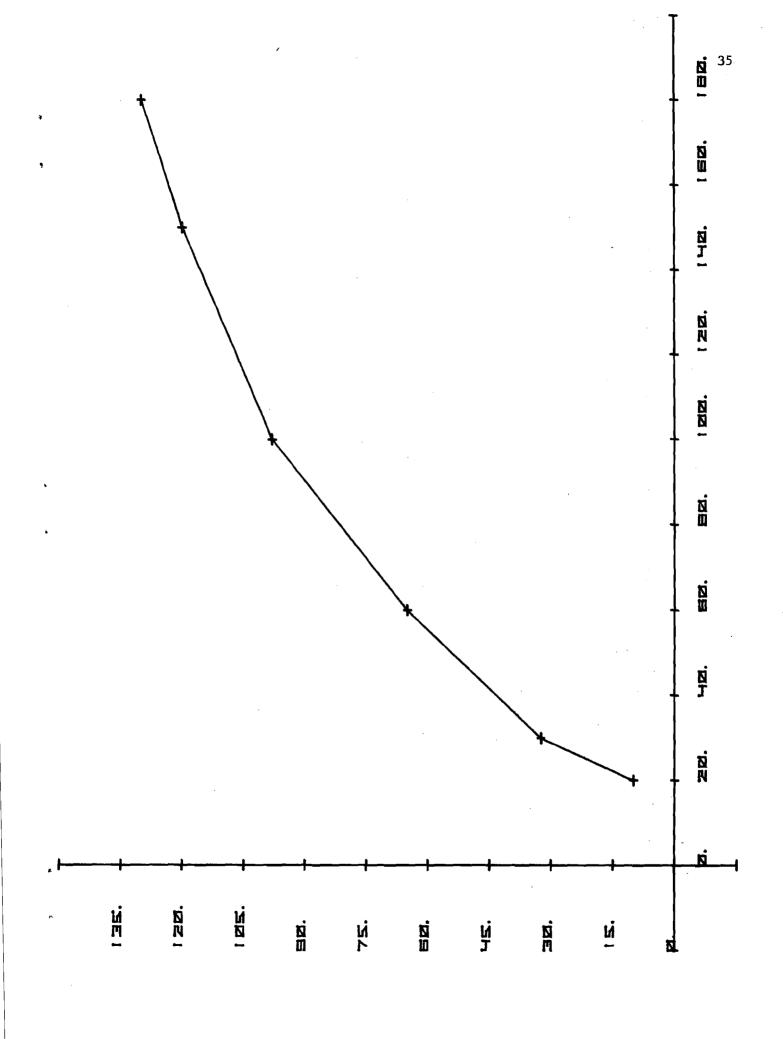
This must be executed  $\underline{\text{before}}$  a decision on connection points is made. This allows more than one curve to be put on a single graph.

	DOTYMA	1
	POINTS?	1 }
(Ø=NO,	T=AE2)	Ľ
X = ?		1
	2 <b>Ø.ØØ</b> Ø	
Y = ?		( [
	10.000*	
X = ?		<b>∤</b> ∦
	3Ø.ØØØ	
Y = ?		
	32.500*	1
X = ?		11
	60.000	11
Y = ?	0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1,	1
- •	65.000*	
X = ?	03.000	$\mathcal{I}$
	100.000	1/
Y = ?	TAA.AAA	Į į
1-:	98.000*	
v – 9	90.000	11
X = ?	4 444	11
	150.000	1
Y = ?		1
	120.000*	
X = ?		
	180.000	1
Y = ?		1
	130.000*	1 /
X = ?		14

This allows the option of connection each point with a straight line. Enter your choice, then CONTINUE

Enter your value for X, then CONTINUE. Enter your value for Y, then CONTINUE. Repeat the above until all data has been plotted.

- 9. If another curve is to be plotted on the same graph, go to step 8.
- 10. Remove your graph (see plotting instructions).
- 11. If no other program is to be run, turn off the computer, cassette memory and plotter board (the ON button should be up).
- 12. If this, or any other program is to be run, the initialization procedure for that section must be followed.



### **BIBLIOGRAPHY**

- Cowan, Pete and Don Porcella (eds.) 1975. Water Quality Analysis Laboratory Procedures Syllabus. 94 pages.
- Hewlett-Packard Company. 1971. Hewlett-Packard 9810A Calculator Operating and Programming Manual. 151 pages.