

APPENDIX A. PROGRAM LISTINGS

BASIC listing for BAR program.

This listing is intended for use with a BASIC compiler (Turbo BASIC, QuickBasic, etc.). If a compiler is not used, several modifications are required for the program to operate correctly. In BAR.BAS, line 100, BARS1A.EXE and BARS2A.EXE should be changed to BARS1A.BAS and BARS2A.BAS. Also in BAR.BAS, line 490, "BARS2A" becomes "BASICA BARS2A.BAS," and in line 500, "BARS1A" becomes "BASICA BARS1A.BAS."

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10 *****BAR.BAS*****
20 *****WRITTEN BY GREGORY J. DEYE & MICHAEL G. GRESSEL*****
30 *****NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH*****
40 *****DIVISION OF PHYSICAL SCIENCES AND ENGINEERING*****
50 *****4676 COLUMBIA PARKWAY*****
60 *****CINCINNATI, OHIO 45226*****
70 *****
80 '
90 '
100 THIS PROGRAM REQUIRES 3 ADDITIONAL FILES: BARS1A.EXE, BARS2A.EXE,
110 '          AND PARMS.TXT
120 LIMITATIONS OF PROGRAM: DATA FILE CAN CONTAIN UP TO 3000 DATA POINTS
130 '
140 ' IF YOU ARE GENERATING TWO BARS
150 ' THE DATA FILE MUST HAVE 4 COLUMNS OF NUMBERS
160 '     COLUMN 1 - MINUTES
170 '     COLUMN 2 - SECONDS
180 '     COLUMN 3 - EXPOSURE VALUE #1
190 '     COLUMN 4 - EXPOSURE VALUE #2
200 '
210 ' IF YOU ARE GENERATING A SINGLE BAR
220 ' THE DATA FILE MUST HAVE 3 COLUMNS OF NUMBERS
230 '     COLUMN 1 - MINUTES
240 '     COLUMN 2 - SECONDS
250 '     COLUMN 3 - EXPOSURE VALUE
260 '
270 IF DATA FILE IS GENERATED IN LOTUS 1-2-3, MINUTES, SECOND AND EXPOUSRES
280 ' MUST BE IN SEPARATE COLUMNS. PRINT SPREADSHEET TO A FILE.
290 '
300 *****THIS PROGRAM REQUIRES AT LEAST A COLOR GRAPHICS ADAPTER (CGA)*****
310 '
320 IF THE VIDEO OVERLAY SYSTEM IS USED, COMPUTER MUST HAVE AN ENHANCED
330 GRAPHICS ADAPTER (EGA) AND OPERATE IN EGA 640x200 RESOLUTION MODE
340 '
350 ON ERROR GOTO 580
360 SCREEN 0: COLOR 10
370 CLS
380 PRINT "          VIDEO BAR GENERATOR": PRINT
390 PRINT : PRINT "          WRITTEN BY GREGORY DEYE AND MICHAEL GRESSEL"
400 PRINT "          NATIONAL INSTITUTE FOR OCCUPATIONAL SAFETY AND HEALTH"
410 PRINT "          4676 COLUMBIA PARKWAY, MAILSTOP R-5"
420 PRINT "          CINCINNATI, OHIO 45226"
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430 '
440 LOCATE 12, 7
450 COLOR 10
460 LOCATE 13, 7: PRINT "Enter Number of Bars to be Displayed (<1> or <2>)."

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BASIC listing for BARS1A program

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10 'BARS1A.BAS
20 CLEAR
30 KEY OFF
40 FILE2$ = " "
50 CLS
60 SCREEN 8
70 LOCATE 1, 30: COLOR 10: PRINT "VIDEO BAR GENERATOR"
80 LOCATE 21, 3: PRINT "PROMPTS AND MESSAGES"
90 LINE (0, 32)-(639, 89), 11, B
100 COLOR 10
110 LOCATE 6, 10: PRINT "MINIMUM READING"
120 LOCATE 8, 10: PRINT "MAXIMUM READING"
130 LOCATE 10, 7: PRINT "2--MAXIMUM TO BE DISPLAYED"
140 LINE (450, 32)-(450, 89), 11
150 LINE (80, 97)-(559, 149), 11, B
160 LINE (420, 97)-(420, 149), 11
170 LINE (0, 171)-(639, 189), 11, B
180 LOCATE 16, 14: COLOR 10: PRINT "3--MAXIMUM SCALE VALUE"
190 LOCATE 14, 14: PRINT " TIME OF FIRST MEASUREMENT"
200 LOCATE 18, 14: PRINT "4--TIME AND CONCENTRATION ON SCREEN?"
210 LOCATE 4, 7: COLOR 10: PRINT "1--": LOCATE 4, 10: COLOR 14: PRINT FILE$
220 MAXY = 300
230 DEFINT I-L: DEFSNG Y
240 ON ERROR GOTO 1480
250 DUMMY = 0
260 IMAX = 10
270 KOUNT = 0
280 LX2 = 319: LY1 = 199: DELX = 16: LX1 = LX2 - DELX: KSYPREV = LY1:
    KMIDX = INT((LX1 + LX2) / 2)
290 DIM KX(3000), Y(3000), KX2(3000)
300 GOSUB 380 'FILENAME
310 GOSUB 620 'MAX READING
320 SCALE=1:GOSUB 2140 'SCALE VALUE
330 GOSUB 680 'INTERVAL
340 GOSUB 730 'TIME AND CONCENTRATION
350 GOTO 780
360 '*****PROGRAM PARAMETER PROMPTS
370 '*****FILE NAME
380 LOCATE 23, 3: COLOR 14: INPUT "1--DATA FILE NAME (<ENTER> RETURNS DEFAULT): ", FILE2$
390 IF LEN(FILE2$) = 0 THEN FILE$ = FILE$ ELSE FILE$ = FILE2$
400 GOSUB 1870
410 CLOSE
420 LOCATE 23, 3: PRINT "READING FILE"
430 OPEN "1", #1, FILE$
440 WHILE NOT EOF(1)
450 INPUT #1, XREAD, X2READ, YREAD
460 IF NOT KFIRST THEN YMIN = YREAD: KFIRST = -1
470 KOUNT = KOUNT + 1
480 KX(KOUNT) = XREAD: Y(KOUNT) = YREAD: KX2(KOUNT) = X2READ
490 IF YREAD > YMAX THEN YMAX = YREAD: KOUNTMAX = KOUNT
500 IF YREAD < YMIN THEN YMIN = YREAD: KOUNTMIN = KOUNT
510 WEND
520 LOCATE 6, 64: COLOR 14: PRINT USING "####.##"; YMIN
530 LOCATE 8, 64: PRINT USING "####.##"; YMAX
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540 LOCATE 4, 10: PRINT FILE$
550 KXTIME$ = STR$(INT(KX2(1)))
560 IF LEN(KXTIME$) = 2 THEN KXTIME$ = "0" + RIGHT$(KXTIME$, 1) ELSE
      KXTIME$ = RIGHT$(KXTIME$, 2)
570 LOCATE 14, 59: PRINT KX(1); RIGHT$(KXTIME$, 2)
580 IF LEN(STR$(KX(1))) = 2 THEN LOCATE 14, 61 ELSE LOCATE 14, 62
590 PRINT ":"
600 RETURN
610 *****MAXIMUM READING DISPLAYED
620 LOCATE 23, 3: INPUT "2--ENTER THE MAXIMUM READING (DEFAULT=MAXIMUM) ", YMAX1
630 GOSUB 1870
640 IF YMAX1 = 0 THEN YMAX = YMAX ELSE YMAX = YMAX1
650 LOCATE 10, 64: COLOR 14: PRINT USING "####.##"; YMAX
660 RETURN
670 *****READING INTERVAL
680 INCSEC = KX2(2) - KX2(1)
690 IF INCSEC < 0 THEN INCSEC = KX2(3) - KX2(2)
700 KBEEP = 0
710 RETURN
720 *****TIME AND CONCENTRATION DISPLAY
730 LOCATE 23, 3: INPUT "4--TIME AND CONCENTRATION ON SCREEN? (DEFAULT=YES) ", AN$:
      IF LEFT$(AN$, 1) = "N" OR LEFT$(AN$, 1) = "n" THEN KPRINT = 0 ELSE KPRINT = -1
740 LOCATE 18, 60: IF KPRINT = -1 THEN PRINT "YES" ELSE PRINT "NO "
750 GOSUB 1870
760 RETURN
770 *****PARAMETER CHANGES
780 LOCATE 23, 3: COLOR 14: INPUT "ARE INPUTS CORRECT? (DEFAULT=YES) ", ACORR$
790 GOSUB 1870: IF ACORR$ = "N" OR ACORR$ = "n" THEN GOTO 810
800 GOTO 870
810 LOCATE 23, 3: INPUT "ENTER INPUT NUMBER TO CHANGE: ", CHANGES: GOSUB 1870
820 IF CHANGES = 1 THEN GOSUB 1900
830 IF CHANGES = 2 THEN GOSUB 620
840 IF CHANGES = 3 THEN GOSUB 2140
850 IF CHANGES = 4 THEN GOSUB 730
860 GOTO 780
870 CLS
880 LOCATE 15, 3: PRINT "WHEN VIDEO CLOCK READS "; KX(1); ":"; RIGHT$(KXTIME$,2)
890 LOCATE 16, 3: PRINT "PRESS S TO BEGIN OVERLAY. PRESS Q TO QUIT"
900 LBARDRAWN = 0: LAP = 0: KSYPREV = LY1
910 IK$ = INKEY$: IF IK$ <> "S" AND IK$ <> "s" THEN 910
920 SCREEN 7
930 PALETTE 8, 0
940 LOCATE , , 0
950 CLS
960 COLOR 4
970 '
980 *****PROGRAM EXECUTION
990 GOSUB 1190: DAYSECONDS = TOTALSECONDS: 'get seconds in day
1000 TIME$ = "00:00:00"
1010 KSECPREV = VAL(RIGHT$(TIME$, 2)): 'initilization of previous second
1020 I = 1: GOSUB 1260: 'starts out on first reading on key press
1030 WHILE I < KOUNT
1040 KSEC = VAL(RIGHT$(TIME$, 2)): 'seconds from clock
1050 LAP = ((KSEC - KSECPREV + 60) MOD 60): IF LAP < INCSEC THEN 1040:
1060 GOSUB 1260
1070 KSECPREV = KSEC MOD 60: 'set up new previous second equal to present

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1080 IK$ = INKEY$: IF IK$ = "Q" OR IK$ = "q" THEN 1100
1090 WEND
1100 GOSUB 1190: RUNSECONDS = TOTALSECONDS: 'get seconds of duration of run
1110 DAYSECONDS = DAYSECONDS + RUNSECONDS: GOSUB 1220: 'restore system time
1120 COLOR 7
1130 CLS : SCREEN 8: LOCATE 12, 15
1140 INPUT "START AGAIN? ", AN$: AN$ = LEFT$(AN$, 1): IF AN$ = "Y" OR AN$ = "y" THEN GOTO 1150
ELSE SCREEN 0: END
1150 LOCATE 14, 15: INPUT "CHANGE PARAMENTERS? ", AN$: AN$ = LEFT$(AN$, 1): IF AN$ = "Y"
OR AN$ = "y" THEN GOTO 20 ELSE GOTO 870
1160 SCREEN 0
1170 END
1180 '*****GET TIME SUBROUTINE
1190 HOURS = VAL(MID$(TIME$, 1, 2)): MINUTES = VAL(MID$(TIME$, 4, 2)): SECONDS =
VAL(MID$(TIME$, 7, 2)): TOTALSECONDS = SECONDS + 60 * MINUTES + 3600 * HOURS
1200 RETURN
1210 '*****RESTORE SYSTEM TIME SUBROUTINE
1220 HOURS = INT(DAYSECONDS / 3600): MINUTES = INT((DAYSECONDS - HOURS * 3600) / 60):
SECONDS = INT(DAYSECONDS - HOURS * 3600 - MINUTES * 60)
1230 TIME$ = RIGHT$(STR$(HOURS + 100), 2) + ":" + RIGHT$(STR$(MINUTES + 100), 2) +
":" + RIGHT$(STR$(SECONDS + 100), 2)
1240 RETURN
1250 '*****DISPLAY TIME AND CONCENTRATION SUBROUTINE
1260 I = I + INT(LAP / INCSEC): 'number of readings to advance if too long
1270 IF KBECP THEN BEEP
1280 KSY = INT((LY1 - Y(I) / YMAX * LY1)): 'scales Y to maximum Y and screen size
1290 YREAD$ = LEFT$(STR$(Y(I)), 6): IF LEN(YREAD$) = 13 THEN YREAD$ = YREAD$
+ RIGHT$(YREAD$, 4)
1300 DUMMY$ = STR$(DUMMY)
1310 KX2$ = STR$(KX2(I))
1320 IF LEN(KX2$) = 2 THEN KX2$ = DUMMY$ + RIGHT$(KX2$, 1)
1330 COLOR 12, 7
1340 LINE (0, 0)-(295, 199), 8, BF
1350 LINE (296,99)-(301,100),4,BF
1360 LINE (296,2)-(301,3),4,BF
1370 LINE (296,50)-(301,51),4,BF
1380 LINE (296,150)-(301,151),4,BF
1390 COLOR 4
1400 IF SCPAR = -1 THEN LOCATE 1,34:PRINT USING "####";SCVAL
1410 IF SCPAR = -1 THEN LOCATE 13,34:PRINT USING "####";.5*SCVAL
1420 IF KPRINT THEN LOCATE 1, 10, 0: PRINT KX(I); ":"; KX2$: LOCATE 1, 20: PRINT USING "###.####";
(Y(I) * SCALE);
1430 GOSUB 1590
1440 KSYPREV = KSY
1450 RETURN
1460 END
1470 '*****ERROR HANDLING ROUTINES
1480 LOCATE 23, 3: COLOR 12: IF ERR = 53 AND ERL = 430 THEN INPUT "FILE NOT FOUND.
HIT ANY KEY.", IK$
1490 IF ERR = 75 AND ERL = 430 THEN INPUT "IMPROPER USE OF PATH NAME. HIT ANY KEY", IK$
1500 IF ERR = 76 AND ERL = 430 THEN INPUT "PATH DOES NOT EXIST. HIT ANY KEY", IK$
1510 IF ERR = 64 AND ERL = 430 THEN INPUT "BAD FILE NAME. HIT ANY KEY", IK$
1520 IF ERR = 62 AND ERL = 450 THEN INPUT "ERROR IN FILE STRUCTURE;POSSIBLY HAS
MISSING DATA. HIT ANY KEY", IK$
1530 IF ERR = 62 AND ERL = 450 THEN END

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1540 IF ERR = 53 OR ERR = 75 OR ERR = 76 OR 64 THEN RESUME 380 ELSE PRINT "Error ":
      PRINT ERR: PRINT : PRINT "Error Level": PRINT ERL
1550 LOCATE 22, 1: PRINT "HIT ANY KEY"
1560 IK$ = INKEY$: IF IK$ = "" THEN GOTO 1560
1570 END
1580 *****BAR DRAW SUBROUTINE
1590 IF KSY < 0 AND NOT LBARDRAWN THEN GOSUB 1790
1600 IF KSY = KSYPREV THEN RETURN
1610 IF KSY > KSYPREV THEN GOSUB 1650
1620 IF KSY < KSYPREV THEN GOSUB 1720
1630 RETURN
1640 *****BAR CLEAR SUBROUTINE
1650 KY = KSYPREV
1660 WHILE KY < KSY
1670 LINE (LX1, KY)-(LX2, KY), 0
1680 KY = KY + 1
1690 WEND
1700 RETURN
1710 *****BAR FILL SUBROUTINE
1720 KY = KSYPREV
1730 WHILE KY > KSY
1740 LINE (LX1, KY)-(LX2, KY), 4
1750 KY = KY - 1
1760 WEND
1770 RETURN
1780 *****BAR LEVEL SUBROUTINE
1790 KY = LY1
1800 WHILE KY > 0
1810 LINE (LX1, KY)-(LX2, KY), 4
1820 KY = KY - 1
1830 WEND
1840 LBARDRAWN = -1
1850 RETURN
1860 *****PROMPT LINE CLEAR ROUTINE
1870 LINE (2, 174)-(630, 186), 0, 8F
1880 RETURN
1890 *****DATA FILE CHANGE ROUTINE
1900 LOCATE 23, 3
1910 SHELL "DEL PARMS.BAR"
1920 OPEN "O", 2, "PARMS.BAR"
1930 WRITE #2, FILE$, SCALE, KPRINT
1940 CLOSE
1950 CLEAR
1960 FILE$ = " ": FILE2$ = " "
1970 KEY OFF
1980 MAXY = 300
1990 DEFINT I-L: DEFSNG Y
2000 ON ERROR GOTO 1480
2010 DUMMY = 0: DUMMY$ = STR$(DUMMY)
2020 IMAX = 10
2030 KOUNT = 0
2040 LX2 = 319: LY1 = 199: DELX = 16: LX1 = LX2 - DELX: KSYPREV = LY1:
      KMIDX = INT((LX1 + LX2) / 2)
2050 CLOSE
2060 OPEN "I", 3, "PARMS.BAR"
2070 INPUT #3, FILE$, SCALE, KPRINT

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```
2080 GOSUB 380
2090 LOCATE 10, 64: PRINT "      "
2100 GOSUB 620
2110 GOSUB 680
2120 GOTO 780
2130 '*****SCALE VALUE
2140 LOCATE 23,3: INPUT "3-SCALE ON SCREEN? (DEFAULT =NO) ",AN$:IF LEFT$(AN$,1)="y"
    OR LEFT$(AN$,1)="Y" THEN SCPAR=-1 ELSE SCPAR=0
2150 IF SCPAR= 0 THEN LOCATE 16,60:PRINT "NONE":RETURN
2160 GOSUB 1870
2170 LOCATE 23,3: INPUT "3-INPUT FULL SCALE VALUE. ",SCVAL
2180 GOSUB 1870
2190 LOCATE 16,60: PRINT USING "###";SCVAL
2200 RETURN
```

BASIC listing for BARS2A program

```

10 'BARS2A.BAS
20 FILE$ = " "
30 FILE2$ = " "
40 CLS
50 SCREEN 8
60 LOCATE 1, 30: COLOR 10: PRINT "VIDEO BAR GENERATOR"
70 LOCATE 21, 3: PRINT "PROMPTS AND MESSAGES"
80 LINE (0, 32)-(639, 102), 11, B
90 COLOR 10
100 LOCATE 6, 10: PRINT "MINIMUM READING"
110 LOCATE 8, 10: PRINT "MAXIMUM READING"
120 LOCATE 10, 7: PRINT "4-MAXIMUM TO BE DISPLAYED"
130 LOCATE 3, 48: COLOR 10: PRINT "BAR 1"
140 LOCATE 3, 65: COLOR 10: PRINT "BAR 2"
150 LINE (500, 32)-(500, 102), 11
160 LINE (361, 32)-(361, 102), 11
170 LINE (80, 111)-(559, 150), 11, B
180 LINE (420, 111)-(420, 150), 11
190 LINE (0, 171)-(639, 189), 11, B
200 LOCATE 16, 14: COLOR 10: PRINT " TIME OF FIRST MEASUREMENT"
210 LOCATE 12, 7: COLOR 10: PRINT "5-MAXIMUM SCALE VALUE"
220 LOCATE 18, 14: PRINT "6-TIME AND CONCENTRATION ON SCREEN?"
230 LOCATE 4, 48: COLOR 10: PRINT "2-"
240 LOCATE 4, 65: COLOR 10: PRINT "3-"
250 LOCATE 4, 7: COLOR 10: PRINT "1-": LOCATE 4, 10: COLOR 14: PRINT FILE$
260 KEY OFF
270 MAXY = 300
280 DEFINT I-L: DEFSNG Y
290 ON ERROR GOTO 1930
300 DUMMY = 0: DUMMY$ = STR$(DUMMY)
310 IMAX = 10
320 KOUNT = 0: Y2MIN = 1000: Y1MIN = 1000: Y1MAX = 0: Y2MAX = 0
330 LBARDRAWN1 = 0: LBARDRAWN2 = 0
340 CLOSE
350 LX11 = 0: LY1 = 199: DELX = 16: LX12 = LX11 + DELX: 'parameters for bar size and location
360 KSY1PREV = LY1
370 LX22 = 319: LY2 = 199: DELX = 16: LX21 = LX22 - DELX
380 KSY2PREV = LY2
390 GOSUB 490'
400 GOSUB 790
410 GOSUB 840
420 GOSUB 890
430 SCALE=1: GOSUB 2900
440 GOSUB 1000
450 GOSUB 1040
460 GOTO 1090
470 '*****PROGRAM PARAMETER PROMPTS
480 '*****FILE NAME
490 LOCATE 23, 3: COLOR 14: INPUT "1-DATA FILE NAME (<ENTER> RETURNS DEFAULT): ", FILE2$
500 GOSUB 2580
510 LOCATE 4, 10: PRINT " "
520 IF LEN(FILE2$) = 0 THEN FILE$ = FILE$ ELSE FILE$ = FILE2$
530 LOCATE 23, 3: PRINT "READING FILE ....."
540 GOSUB 2580

```



```

550 DIM KX(2000), Y1(2000), KX2(2000), Y2(2000)
560 OPEN "I", #1, FILE$
570 WHILE NOT EOF(1)
580 INPUT #1, XREAD, X2READ, Y1READ, Y2READ
590 IF NOT KFIRST THEN Y1MIN = Y1READ: Y2MIN = Y2READ: KFIRST = -1: ' start minimum Y off
      with first reading
600 KOUNT = KOUNT + 1
610 KX(KOUNT) = XREAD: KX2(KOUNT) = X2READ: Y1(KOUNT) = Y1READ: Y2(KOUNT) = Y2READ
620 IF Y1READ > Y1MAX THEN Y1MAX = Y1READ: KOUNTMAX1 = KOUNT: 'find maximum Y1 and
      time for Y1
630 IF Y1READ < Y1MIN THEN Y1MIN = Y1READ: KOUNTMIN1 = KOUNT
640 IF Y2READ > Y2MAX THEN Y2MAX = Y2READ: KOUNTMAX2 = KOUNT
650 IF Y2READ < Y2MIN THEN Y2MIN = Y2READ: KOUNTMIN2 = KOUNT
660 WEND
670 LOCATE 6, 48: COLOR 14: PRINT USING "####.##"; Y1MIN
680 LOCATE 8, 48: PRINT USING "####.##"; Y1MAX
690 LOCATE 6, 65: PRINT USING "####.##"; Y2MIN
700 LOCATE 8, 65: PRINT USING "####.##"; Y2MAX
710 LOCATE 4, 10: PRINT FILE$
720 KXTIME$ = STR$(INT(KX2(1)))
730 IF LEN(KXTIME$) = 2 THEN KXTIME$ = "0" + RIGHT$(KXTIME$, 1) ELSE KXTIME$ =
      RIGHT$(KXTIME$, 2)
740 LOCATE 16, 59: PRINT KX(1); RIGHT$(KXTIME$, 2)
750 IF LEN(STR$(KX(1))) = 2 THEN LOCATE 16, 61 ELSE LOCATE 16, 62
760 PRINT ":"
770 RETURN
780 '*****DATA SET 1 NAME
790 LOCATE 23, 3: INPUT "2--ENTER FIRST DATA SET NAME: ", NAME1$
800 GOSUB 2580
810 LOCATE 4, 51: PRINT NAME1$
820 RETURN
830 '*****DATA SET 2 NAME
840 LOCATE 23, 3: INPUT "3--ENTER SECOND DATA SET NAME: ", NAME2$
850 GOSUB 2580
860 LOCATE 4, 68: PRINT NAME2$
870 RETURN
880 '*****MAXIMUM READING
890 LOCATE 23, 3: COLOR 14: INPUT "4--ENTER THE MAXIMUM READING FOR FIRST
      SET (DEFAULT=MAXIMUM) ", YINMAX
900 IF YINMAX <> 0 THEN Y1MAX = YINMAX
910 LOCATE 10, 48: COLOR 14: PRINT USING "####.##"; Y1MAX
920 GOSUB 2580
930 '*****MAXIMUM READING 2
940 LOCATE 23, 3: INPUT "4--ENTER THE MAXIMUM READING FOR SECOND SET (DEFAULT =
      MAXIMUM) ", YINMAX
950 IF YINMAX <> 0 THEN Y2MAX = YINMAX
960 LOCATE 10, 65: PRINT USING "####.##"; Y2MAX
970 GOSUB 2580
980 RETURN '
990 '*****DETERMINE INTERVAL
1000 INCSEC = KX2(2) - KX2(1):
1010 IF INCSEC < 0 THEN INCSEC = KX2(3) - KX2(2)
1020 RETURN
1030 '*****TIME AND CONCENTRATION DISPLAY
1040 LOCATE 23, 3: INPUT "6--TIME AND CONCENTRATION ON SCREEN? (DEFAULT=YES) ", AN$:
      IF LEFT$(AN$, 1) = "n" OR LEFT$(AN$, 1) = "N" THEN KPRINT = 0 ELSE KPRINT = -1

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1050 LOCATE 18, 60: IF KPRINT = -1 THEN PRINT "YES" ELSE PRINT "NO "
1060 GOSUB 2580
1070 RETURN
1080 *****INPUT CORRECTION
1090 LOCATE 23, 3: COLOR 14: INPUT "ARE INPUTS CORRECT? (DEFAULT=YES) ", ACORR$
1100 GOSUB 2580: IF ACORR$ = "n" OR ACORR$ = "N" THEN GOTO 1120
1110 GOTO 1270
1120 LOCATE 23, 3: INPUT "ENTER INPUT NUMBER TO CHANGE: ", CHANGES: GOSUB 2580
1130 IF CHANGES = 1 THEN GOTO 2610
1140 LOCATE 10, 48: IF CHANGES = 4 THEN PRINT " "
1150 LOCATE 10, 65: IF CHANGES = 4 THEN PRINT " "
1160 LOCATE 4, 51: IF CHANGES = 2 THEN PRINT " "
1170 IF CHANGES = 2 THEN GOSUB 790
1180 LOCATE 4, 68: IF CHANGES = 3 THEN PRINT " "
1190 IF CHANGES = 3 THEN GOSUB 840
1200 IF CHANGES = 4 THEN GOSUB 890
1210 LOCATE 16, 60: IF CHANGES = 5 THEN PRINT " "
1220 IF CHANGES = 5 THEN GOSUB 2900
1230 LOCATE 18, 60: IF CHANGES = 6 THEN PRINT " "
1240 IF CHANGES = 6 THEN GOSUB 1040
1250 GOTO 1090
1260 *****START PROGRAM*****
1270 CLS
1280 LOCATE 15, 3: PRINT "WHEN VIDEO CLOCK READS "; KX(1); ":"; RIGHT$(KXTIME$,2)
1290 LOCATE 16, 3: PRINT "PRESS S TO BEGIN OVERLAY. PRESS Q TO QUIT"
1300 LBARDRAWN = 0: LAP = 0: KSYPREV = LY1
1310 LX11 = 0: LY1 = 199: DELX = 16: LX12 = LX11 + DELX
1320 KSY1PREV = LY1
1330 LX22 = 319: LY2 = 199: DELX = 16: LX21 = LX22 - DELX
1340 KSY2PREV = LY2
1350 IK$ = INKEY$: IF IK$ <> "S" AND IK$ <> "s" THEN 1350
1360 LOCATE , , 0
1370 CLS
1380 SCREEN 7
1390 PALETTE 8, 0
1400 GOSUB 2410
1410 COLOR 12
1420 '
1430 *****PROGRAM EXECUTION
1440 GOSUB 1640: DAYSECONDS = TOTALSECONDS: 'get seconds in day
1450 TIME$ = "00:00:00"
1460 KSECPREV = VAL(RIGHT$(TIME$, 2)): 'initialization of previous second
1470 I = 1: GOSUB 1710: 'starts out on first reading on key press
1480 WHILE I < KOUNT
1490 KSEC = VAL(RIGHT$(TIME$, 2)): 'seconds from clock
1500 LAP = ((KSEC - KSECPREV + 60) MOD 60): IF LAP < INCSEC THEN 1490: 'return until clock
    ticks INCSEC seconds
1510 GOSUB 1710: ' update bar on screen and, if needed, print values on screen
1520 KSECPREV = KSEC MOD 60: 'set up new previous second equal to present
1530 IK$ = INKEY$: IF IK$ = "Q" OR IK$ = "q" THEN 1550
1540 WEND
1550 GOSUB 1640: RUNSECONDS = TOTALSECONDS: 'get seconds of duration of run
1560 DAYSECONDS = DAYSECONDS + RUNSECONDS: GOSUB 1670: 'restore system time
1570 COLOR 7
1580 SCREEN 8: CLS : LOCATE 10, 15, 0

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1590 INPUT "START AGAIN? ", AN$: AN$ = LEFT$(AN$, 1): IF AN$ = "Y" OR AN$ = "y" THEN GOTO
    1600 ELSE SCREEN 9: END
1600 LOCATE 12, 15: INPUT "CHANGE PARAMETERS? ", AN$: AN$ = LEFT$(AN$, 1): IF AN$ = "Y" OR
    AN$ = "y" THEN GOTO 10 ELSE GOTO 1270
1610 SCREEN 0
1620 END
1630 '*****GET TIME SUBROUTINE
1640 HOURS = VAL(MID$(TIME$, 1, 2)): MINUTES = VAL(MID$(TIME$, 4, 2)): SECONDS =
    VAL(MID$(TIME$, 7, 2)): TOTALSECONDS = SECONDS + 60 * MINUTES + 3600 * HOURS
1650 RETURN
1660 '*****RESTORE SYSTEM TIME SUBROUTINE
1670 HOURS = INT(DAYSECONDS / 3600): MINUTES = INT((DAYSECONDS - HOURS * 3600) / 60):
    SECONDS = INT(DAYSECONDS - HOURS * 3600 - MINUTES * 60)
1680 TIME$ = RIGHT$(STR$(HOURS + 100), 2) + ":" + RIGHT$(STR$(MINUTES + 100), 2) +
    ":" + RIGHT$(STR$(SECONDS + 100), 2)
1690 RETURN
1700 '*****DISPLAY TIME AND CONCENTRATION SUBROUTINE
1710 I = I + INT(LAP / INCSEC): 'number of readings to advance if waiting too long in other routines
1720 '
1730 KSY1 = INT(LY1 - Y1(I) / Y1MAX * LY1): 'scales Y1 to maximum Y1 and screen size
1740 KSY2 = INT(LY1 - Y2(I) / Y2MAX * LY1): 'scales Y2 to same maximum Y1 and screen siz
1750 IF KSY1 < 0 THEN KSY1 = 0: 'prevents delay in updating bar if too high
1760 IF KSY2 < 0 THEN KSY2 = 0
1770 IF KSY1 > 199 THEN KSY1 = 199
1780 IF KSY2 > 199 THEN KSY2 = 199
1790 Y1READ$ = LEFT$(STR$(Y1(I)), 6): IF LEN(Y1READ$) = 13 THEN Y1READ$ = Y1READ$ +
    RIGHT$(Y1READ$, 4): 'format for screen display
1800 Y2READ$ = LEFT$(STR$(Y2(I)), 6): IF LEN(Y2READ$) = 13 THEN Y2READ$ = Y2READ$ +
    RIGHT$(Y2READ$, 4): 'format for screen display
1810 KX2$ = STR$(KX2(I))
1820 IF LEN(KX2$) = 2 THEN KX2$ = DUMMY$ + RIGHT$(KX2$, 1)
1830 COLOR 4
1840 SCALE=1:IF KPRINT THEN LOCATE 1, 17, 0: PRINT KX(I); ":"; KX2$;
1850 IF KPRINT THEN LOCATE 1, 10: PRINT USING "###.##"; (Y1(I) * SCALE);
1860 IF KPRINT THEN LOCATE 1, 25: PRINT USING "###.##"; (Y2(I) * SCALE);
1870 GOSUB 2060: 'update bar
1880 KSY1PREV = KSY1: 'new previous line number for bar
1890 KSY2PREV = KSY2
1900 RETURN
1910 END
1920 '*****ERROR HANDLING ROUTINES
1930 LOCATE 23, 3: COLOR 12: IF ERR = 53 AND ERL = 560 THEN INPUT "FILE NOT FOUND.
    HIT ANY KEY.", IK$
1940 IF ERR = 75 AND ERL = 560 THEN INPUT "IMPORPER USE OF PATH NAME. HIT ANY KEY.", IK$
1950 IF ERR = 76 AND ERL = 560 THEN INPUT "PATH DOES NOT EXIST. HIT ANY KEY.", IK$
1960 IF ERR = 64 AND ERL = 560 THEN INPUT "BAD FILE NAME. HIT ANY KEY.", IK$
1970 IF ERR = 62 AND ERL = 580 THEN PRINT "ERROR IN FILE STRUCTURE; POSSIBLY HAS MISSING
    DATA. HIT ANY KEY."
1980 IF ERR = 5 AND ERL = 1380 THEN PRINT "WRONG GRAPHICS ADAPTER HAS BEEN CHOSEN.
    RERUN SETUP."
1990 IF ERR = 5 AND ERL = 1380 THEN GOTO 2020
2000 IF ERR = 62 AND ERL = 580 THEN END
2010 IF ERR = 53 OR ERR = 75 OR ERR = 76 OR ERR = 64 THEN RESUME 490 ELSE PRINT "Error ":
    PRINT ERR: PRINT : PRINT "Error Level": PRINT ERL
2020 LOCATE 22, 1, 0: PRINT "HIT ANY KEY";
2030 IK$ = INKEY$: IF IK$ = "" THEN 2030

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2040 END
2050 *****BAR DRAW SUBROUTINE
2060 IF KSY1 < 0 AND NOT LBARDRAWN1 THEN GOSUB 2350: LBARDRAWN1 = -1: ' for drawing
      first bar if off screen
2070 CLOR = 2
2080 IF KSY2 < 0 AND NOT LBARDRAWN2 THEN GOSUB 2350: LBARDRAWN2 = -1
2090 CLOR = 4
2100 'IF KSY=KSYPREV THEN RETURN
2110 IF KSY1 > KSY1PREV THEN KSY = KSY1: KSYPREV = KSY1PREV: LXSTART = LX11: LXEND = LX12:
      GOSUB 2210
2120 CLOR = 2
2130 IF KSY2 > KSY2PREV THEN KSY = KSY2: KSYPREV = KSY2PREV: LXSTART = LX21: LXEND = LX22:
      GOSUB 2210
2140 CLOR = 4
2150 IF KSY1 < KSY1PREV THEN KSY = KSY1: KSYPREV = KSY1PREV: LXSTART = LX11: LXEND = LX12:
      GOSUB 2280
2160 CLOR = 2
2170 IF KSY2 < KSY2PREV THEN KSY = KSY2: KSYPREV = KSY2PREV: LXSTART = LX21: LXEND = LX22:
      GOSUB 2280
2180 CLOR = 4
2190 RETURN
2200 *****BAR CLEAR SUBROUTINE
2210 KY = KSYPREV
2220 WHILE KY < KSY
2230 LINE (LXSTART, KY)-(LXEND, KY), 0
2240 KY = KY + 1
2250 WEND
2260 RETURN
2270 *****BAR FILL SUBROUTINE
2280 KY = KSYPREV
2290 WHILE KY > KSY
2300 LINE (LXSTART, KY)-(LXEND, KY), CLOR
2310 KY = KY - 1
2320 WEND
2330 RETURN
2340 *****BAR LEVEL SUBROUTINE
2350 KY = LY1
2360 WHILE KY > 0
2370 LINE (LXSTART, KY)-(LXEND, KY), CLOR
2380 KY = KY - 1
2390 WEND
2400 RETURN
2410 COLOR 3, 7
2420 LINE (24, 8)-(295, 199), 8, BF
2430 LOCO = 38 - (LEN(NAME2$))
2440 LOCATE 24, 4:COLOR 4
2450 PRINT NAME1$: LOCATE 23, LOCO: COLOR 2:PRINT NAME2$
2460 LINE (24, 184)-(295, 199), 8, BF
2470 LINE (296,99)-(301,100),2,BF:LINE (18,99)-(23,100),4,BF
2480 LINE (296,2)-(301,3),2,BF:LINE (18,2)-(23,3),4,BF
2490 LINE (296,50)-(301,51),2,BF:LINE (18,50)-(23,51),4,BF
2500 LINE (296,150)-(301,151),2,BF:LINE (18,150)-(23,151),4,BF
2510 IF SCPAR = -1 THEN COLOR 2:LOCATE 1,34:PRINT USING "####";SCVAL2
2520 IF SCPAR = -1 THEN LOCATE 13,34:PRINT USING "####";.5*SCVAL2
2530 IF SCPAR = -1 THEN COLOR 4:LOCATE 1,4:PRINT USING "####";SCVAL1
2540 IF SCPAR = -1 THEN LOCATE 13,4:PRINT USING "####";.5*SCVAL1

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2550 RETURN
2560 RETURN
2570 '*****PROMPT CLEAR ROUTINE
2580 LINE (2, 174)-(630, 186), 0, BF
2590 RETURN
2600 '*****DATA FILE CHANGE ROUTINE
2610 LOCATE 23, 3
2620 SHELL "DEL PARM.S.BAR"
2630 OPEN "O", 2, "PARMS.BAR"
2640 WRITE #2, FILE$, NAME1$, NAME2$, SCALE, KPRINT
2650 CLOSE
2660 CLEAR
2670 FILE$ = " ": FILE2$ = " "
2680 KEY OFF
2690 MAXY = 300
2700 DEFINT I-L: DEFSNG Y
2710 ON ERROR GOTO 1930
2720 DUMMY = 0: DUMMY$ = STR$(DUMMY)
2730 IMAX = 10
2740 KOUNT = 0: Y2MIN = 1000: Y1MIN = 1000: Y1MAX = 0: Y2MAX = 0
2750 LBARDRAWN1 = 0: LBARDRAWN2 = 0
2760 CLOSE
2770 LX11 = 0: LY1 = 199: DELX = 16: LX12 = LX11 + DELX: 'parameters for bar size and location
2780 KSY1PREV = LY1
2790 LX22 = 319: LY2 = 199: DELX = 16: LX21 = LX22 - DELX
2800 KSY2PREV = LY2
2810 OPEN "I", 3, "PARMS.BAR"
2820 INPUT #3, FILE$, NAME1$, NAME2$, SCALE, KPRINT
2830 GOSUB 490
2840 LOCATE 10, 48: PRINT "   "
2850 LOCATE 10, 65: PRINT "   "
2860 GOSUB 890
2870 GOSUB 1000
2880 GOTO 1090
2890 '*****SCALE VALUE
2900 LOCATE 23,3: INPUT "5--SCALE ON SCREEN? (DEFAULT=NO) ",AN$:IF LEFT$(AN$,1)="Y" OR
    AN$="y" THEN SCPAR=-1 ELSE SCPAR=0
2910 IF SCPAR=0 THEN LOCATE 12,51:PRINT "NONE":LOCATE 12,68:PRINT "NONE":RETURN
2920 GOSUB 2580
2930 LOCATE 23,3: INPUT "5--INPUT DATA SET 1 FULL SCALE VALUE. ",SCVAL1
2940 GOSUB 2580
2950 LOCATE 23,3: INPUT "5--INPUT DATA SET 2 FULL SCALE VALUE. ",SCVAL2
2960 LOCATE 12,51:PRINT USING "####"; SCVAL1:LOCATE 12,68:PRINT USING "####";SCVAL2
2970 RETURN

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APPENDIX B. BAR PROGRAM OPERATING INSTRUCTIONS

To run the bar program, change to the drive and directory where the program is located, then type "BAR" at the DOS prompt. A screen appears listing three choices of operation: display one bar, display two bars, or quit. To display one bar, type "1" then "ENTER"; for two bars type "2" then "ENTER"; to quit, type "Q" then "ENTER." If "1" or "2" was entered, a new screen appears prompting for data inputs. The first prompt is for the data file name. Enter this name including drive, directory, and file extension. For example, "C:\DATADIR\DATAFILE.PRN" would call for the data file named "DATAFILE.PRN," located on the C: drive in the directory named "DATADIR." The program reads the data file into memory, determines the interval between the readings, the maximum and minimum readings, as well as the time of the first reading. If two bars are to be displayed, the maximum and minimum readings are determined for both data sets. Next, if two bars are to be displayed, the program asks for names for the two data sets. When the program is displaying the data, the names will appear at the bottom of the screen next to its associated bar. For displaying both one bar and two bars, the next prompt is for the maximum reading to be displayed. The default is for the maximum reading in the data set. This prompt allows the user to ignore the readings that exceed a certain value. Any reading exceeding this value will be displayed as a full size bar. For the two bar display, the maximum reading value must be set for both data sets. After specifying the maximum reading, the next prompt is for a scaling factor. This input allows the user to multiply the readings by a value, such as a calibration factor. The default value is 1.00. The final input prompt is for displaying the time and concentration at the top of the screen. The default is to show this display. When finished entering the inputs, the program asks if the inputs are all correct. If not, the user is given the opportunity to make changes. When all inputs are correct, the user is prompted to press "S" to immediately begin displaying the bar(s). Pressing "Q" at any time while displaying the data, will halt the program before it displays the final reading in the data set. After displaying all of the data or after pressing "Q" to stop the display, a prompt will ask if the data should be displayed again. Answering "No" will take the program back to the main menu screen (where the program asks the number of bars to be displayed). If "Yes" is answered at the prompt, a second prompt will appear asking if changes should be made to the input parameters. Answering "Yes" to this prompt will allow changes to be made to the inputs. Answering "No" will result in the prompt to press "S" to start the display.