UNITED STATES DEPARTMENT OF THE INTERIOR

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PROGRAMS FOR THE AUTOMATIC PROCESSING AND INTERPRETATION OF SCHLUMBERGER SOUNDING CURVES IN QUICKBASIC 4.0

By

Adel A.R. Zohdy and Robert J. Bisdorf

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89-137A Manual, examples, and program listings (Paper Copy).

89-137B Disk with computer programs and test example.

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INTRODUCTION

This open file is composed of two parts: (a) The manual you are reading now (including examples and program listings which are given in the appendix), and (b) the disk with computer programs and test examples.

Two computer programs are presented. The first program (ATO.EXE) is based on a new method for the automatic interpretation of Schlumberger sounding curves obtained over horizontally stratified media (Zohdy, in press). The second program (PICKCONT.EXE) is a utility program that reads layering files created by ATO.EXE and automatically interpolates the depths at preselected resistivity contour values. The resulting list of depths and resistivities facilitates the construction of contoured geoelectric cross sections.

The programs were written in Microsoft QuickBASIC 4.0. Each program is composed of several modules. The complete listings of the source code for the various modules are given in appendices A and B.

DISCLAIMER

Although these computer programs have been tested extensively and every effort has been made to assure their accuracy and performance, no guarantees are expressed or implied. Furthermore, any use of trade names is for descriptive purposes only and does not constitute endorsement by the U. S. Geological Survey.

SYSTEM REQUIREMENTS

This version of the program is for IBM and compatible computers running under MS-DOS version 2.1 or higher. The computer must be equipped with an EGA (Enhanced Graphics Adaptor) or CGA (Color Graphics Adaptor) card and at least 256 K RAM (random access memory). A math co-processor chip is strongly recommended but is not required. If the proper graphics card is not available the program displays a message to that effect and then exits.

An Epson or compatible printer is required to dump graphics and obtain a hard copy.

DISK CONTENTS

The accompanying disk contains the following:

1) ATO.EXE is the executable form of the automatic interpretation program.

2) ATO.BAS is the main module of the automatic interpretation program written in QuickBASIC version 4.0. It requires two modules: ATOSUB.BAS, DRCT.BAS. (See appendix A for a complete

listing of ATO.BAS, ATOSUB.BAS, and DRCT.BAS).

3) ATOSUB.BAS is a module containing several sub-programs that are used with ATO.BAS.

4) DRCT.BAS is a second module containing several sub-programs that are used with ATO.BAS.

5) ATO.MAK is a make utility created by QuickBASIC 4.0 to call the modules ATO.BAS, ATOSUB.BAS and DRCT.BAS.

6) EGADUMPL.COM is a public domain (PD) program for dumping EGA graphics on an Epson (or compatible) printer.

7) PICKCONT.EXE is the executable form of the pick contour program.

8) PICKCONT.BAS is the main module of the pick contour program written in QuickBASIC 4.0. It requires the following modules: ATOSUB.BAS, CONTSUB.BAS, and DRCT.BAS. The first and third modules are the same as those used with ATO.BAS. (see appendix B for a complete listing of PICKCONT.BAS and CONTSUB.BAS).

9) CONTSUB.BAS is a module consisting of one subprogram that contains the preselected resistivity contour values.

10) PICKCONT.MAK is a make utility created by QuickBASIC 4.0 to call the modules: PICKCONT.BAS, ATOSUB.BAS, CONTSUB.BAS, and DRCT.BAS.

11) Directory named TEST. This directory contains example data files.

GETTING STARTED

Before running the automatic interpretation program, make a backup copy of the disk. If you do not have a hard disk then make sure that you have a formatted floppy disk on which to save files. If you wish to copy the executable program ATO.EXE to a hard disk, make sure to copy the PD program EGADUMPL.COM also.

To run the program, type: ATO and press <ENTER>. In this manual, and on screen displays, we use <ENTER> to indicate the <ENTER> or <RETURN> key, and we use <Esc> to indicate the Esc (or Escape) key.

The program is menu driven and most prompts require a single key stroke: Y, N, a letter, a number, <Esc>, or <ENTER>. Prompts requiring a single key stroke, begin with the word PRESS. Prompts requiring an entry followed by a carriage return, end with the word <ENTER>. Furthermore, almost every menu or prompt includes a way (press <Esc>) or choice (press an appropriate number) to get out of that particular menu or prompt. Pressing <Esc> will return you to the MAIN MENU or to a similar menu.

After the program is loaded into memory, a screen is displayed showing the program title, credits, the program version, and the message "Press any Key to Continue". After you press a key, the program will proceed and test the computer system for the presence of an EGA. If successful, the program will load the PD program "EGADUMPL.COM". If unsuccessful, the program will test the system for the

presence of CGA. If successful, it will load "GRAPHICS.COM" from DOS. If unsuccessful it will display an appropriate message and then exit.

NOTE: For the program to find the file "GRAPHICS.COM", the appropriate path should have been set up by the user in the AUTOEXEC.BAT file.

DISK DRIVE MENU

Under MS-DOS, disk drives are designated by the letters A and B (for floppy drives) or C (for hard drive). Hard disks may be partitioned by the user and designated by other letters.

The Disk Drive Menu is a single prompt that asks you to press the appropriate letter (A, B, C, etc.) for the disk drive that you wish to save data to or to retrieve data from. If you do not wish to save the sounding data, press <Esc>. NOTE: If you press <Esc> and you change your mind later, you cannot save the sounding data you entered without returning to the DISK DRIVE MENU, designating a drive, and reentering the data.

MAIN MENU

The Main Menu has four options:

1. ENTER new sounding from keyboard.
2. LOAD a sounding from disk.
3. RETURN to DISK MENU.
4. QUIT.

Press the appropriate number to proceed.

Whether you wish to ENTER or LOAD data, the next prompt will request the name of the Survey Area. Soundings are grouped by Survey Area.

Individual files for: field sounding data, digitized sounding data, and interpreted layering are automatically saved under a single directory. This directory is automatically created by the program. Its name is based on the name of the survey area, and it is always placed under the Root Directory.

SURVEY AREA

The name of the survey area can be more than one word, contain a space, and can be up to 25 characters long. For example: LONE MOUNTAIN, Tule Valley, Alamo road, etc., are all valid names. Regardless of how you type the name of the Survey Area, it is automatically capitalized.

In order to minimize the amount of typing required by the user, the name of the Survey Area is entered only once (after selecting ENTER or LOAD from the MAIN MENU). Furthermore, the name of the survey area is automatically used in the TITLE of the sounding, in the name of the DIRECTORY, and in the FILE NAME. The following paragraphs describe how this is done.

Survey Area and Sounding Title:

The complete name of the survey area (including spaces, apostrophes, hyphens, etc) is used as the first part of the

title of a sounding. The second part of the sounding title is the sounding number (which is provided by the user at a subsequent prompt).

Example: the TITLE of sounding number 5 obtained in the Lone Mountain area will be automatically generated and saved by the program as: LONE MOUNTAIN 5.

Survey Area and Name of Directory:

The program will capitalize all the letters in the name of the SURVEY AREA, delete the delimiters (spaces, apostrophes, hyphens, commas, etc) and use the first 8 characters as the name of a directory to save data to or to retrieve data from.

Example: the name of the directory for data obtained in the Lone Mountain survey area is LONEMOUN. If a directory with the name LONEMOUN does not exist under the root directory, you will be asked if you wish to create a new directory with that name.

Survey Area and File Name:

In MS-DOS, each file name can be up to 8 characters long plus 3 extension characters (for a total of 11 characters).

The first 4 characters in the file name are taken from the first four characters of the Survey Area. The next four characters in the file name are reserved for the sounding number (e.g. 125). A letter indicating that the sounding was smoothed (S), extended (X), or corrected (C) for the effect of a winding road (Zohdy and Bisdorf, 1982) may be used as

part of the sounding number in the file name (e.g. 125X). The three extension characters in a file name are automatically designated as FLD (for field), DGT (for digitized), or LYR (for layering).

Example: the FIELD data for sounding 5 obtained in the Survey Area named Lone Mountain will be saved in a sequential file named LONE5.FLD. This file will be listed in the LONEMOUN directory, which is listed under the Root Directory.

UNITS

The Schlumberger current-electrode spacings (AB/2) may be entered in feet or meters. Thus when the prompt:

"Electrode spacings: in Feet or Meters ? (F/M) "

is displayed, press F for feet or M for meters. If you enter the AB/2 spacings in feet, you will have the option later to convert them to meters and to display the sounding curve in the units you decided upon. The apparent resistivities are assumed to be in ohm-meters. The units for interpreted layer depths are the same as those used for the electrode spacings.

SOUNDING NUMBER

When prompted to enter a sounding number, enter only the appropriate number. You need not type the name of the survey area repeatedly for every sounding you wish to enter or load. As mentioned earlier, the program will combine the name of the SURVEY AREA and the sounding number to form the sounding title.

ENTERING SOUNDING DATA

Two methods are provided to enter sounding data. You may enter the data as obtained in the field (in AB/2 and apparent resistivity values), or you may enter a digitized sounding curve. In either method, the AB/2 units may be in feet or meters, the apparent resistivities are assumed to be in ohm-meters, the values of the potential electrode spacings (MN/2) are not required.

Standard Field Data:

For entering field data, enter all the AB/2 values first, all the apparent resistivities second, and then you may edit any errors using the provided edit submenu.

The AB/2 values must be entered in an ascending manner, one segment following another. Each segment is a set of AB/2 values used with a constant MN/2 value. The MN/2 values, which are assumed to be constant for each segment, are not entered (see example). When done entering all the AB/2 values, type 0 (zero) and press <ENTER>. Now you may enter the corresponding apparent resistivities.

The edit submenu allows you to Continue, Edit, Delete, Insert, Append, or Escape. You can not Continue unless the number of AB/2 equals the number of apparent resistivities.

Digitized Data:

You may wish to process the sounding curve and smooth it manually prior to entering it. If you do, you must shift the

various segments upward or downward to form a continuous sounding curve, then digitize the sounding curve at the rate of 6 points per logarithmic cycle.

To enter a digitized sounding, the program will prompt you to enter the smallest AB/2 value, and then all you have to do is to enter the digitized apparent resistivity values, as the program automatically increments the AB/2 values at the rate of 6 points per logarithmic cycle.

GRAPHIC DISPLAY

When the data for a given sounding are entered and you press C (to Continue) the sounding curve will be displayed on a 4 x 3 log-log graph with the message:

" CURVE LOOKS OK ? (Y/N/<Esc>)."

If you press N, the program returns to the edit screen. If you press Y, you will be asked:

" Save this Sounding ? (Y/N/<Esc>) "

if you press Y, then you will be asked if you wish to:

" Enter another sounding (Y/N/<Esc>) ? "

If you press Y, the program returns to SOUNDING NUMBER to enter another sounding. If you press N to either of the above two prompts, the program proceeds with processing the entered sounding data as follows.

If you entered the AB/2's in FEET you will be asked if you wish to convert them to METERS. Next you will be asked if you wish to:

" LIST field data and DUMP GRAPHICS ? (Y/N/<Esc>) "

If you press Y you will be prompted with a message to make sure that the printer is turned on, to adjust the paper and to press <ENTER> when ready. Figure 1 shows an example of a field curve named TEST 2. The AB/2 values were entered in feet and converted to meters. The listing of the field data, and the EGA screen dump were made on an Epson FX-185 dot matrix printer.

DATA PROCESSING

A field sounding curve is processed by shifting the various sounding segments, upward or downward, with respect to a fixed segment, to form a continuous sounding curve. The segments on the field curve are numbered from right to left. That is, the segment obtained with the largest MN spacing is segment 1. Segment 1 is the default fixed segment in the shift prompt.

The shifted curve is digitized (or sampled), from right to left, at the rate of 6 points per logarithmic cycle. The digitized curve is displayed with a prompt to save it. If the digitized curve is saved the file will automatically have the extension DGT.

OPTIONS

Three options are offered prior to the automatic interpretation of a sounding curve. These are:

* Fix DEPTH-SHIFT factor at (..., 0.7, 0.8, ...) ?
* Change Number of Layers per cycle from 6 to ...?
* Fix last layer resistivity at ?

It is not recommended to use any of these options before becoming familiar with the program.

* The DEPTH-SHIFT factor refers to the shifting of the digitized electrode spacings to determine depths (Zohdy, in press). This (horizontal) depth-shift factor should not be confused with the (vertical) shifting of the various segments, as discussed on the previous page. The program is written so that an optimum depth-shift factor, usually in the range between .35 and .5, is determined. A fixed depth-shift factor may be selected by the user to fix the depths or to help in using layer compression.

* Changing the number of layers per log cycle determines the amount of layer compression or expansion. The default value is 6. For values greater than 6 (6.5, 7, 8, etc) the number of layers per logarithmic cycles is increased, hence the layers are compressed. Conversely, the number of layers per log cycle may be made less than 6 (5.5, 5, etc) to expand the layer thicknesses. Layer compression/expansion may be used alone or in conjunction with fixing the depth-shift factor. For sounding curves with flat left branches,

compression may be applied with a depth-shift factor that is equal to or greater than unity to produce highly compressed layers.

* The resistivity of the last layer may be fixed by the user at any positive value.

NOTE: the use of any or all of the above options does not guarantee a successful fit. Experimentation with these options is useful in imposing some constraints and in generating generally unlikely models.

AUTOMATIC INTERPRETATION

The automatic interpretation is generally done in two sets of iterations (two passes). In the first set of iterations, the best fitting theoretical sounding curve is determined. If the least root mean square (between digitized and calculated apparent resistivities) is greater than 2 percent then this means that the digitized curve is noisy and therefore anomalous layers may have been created. To eliminate these anomalous layers, the best fitting theoretical curve is reinterpreted as if it is a smoothed version of the digitized curve. If the digitized curve, under interpretation, is an exceptionally smooth and complete curve and is fitted within 2 percent in the first pass, then a second set of iterations is not performed (Zohdy, in press).

The user is kept aware of what is going on with a display of the root mean square values. When the interpretation is completed, a plot of the digitized data, the calculated

sounding curve, and the corresponding layering is displayed. The following prompt is displayed at the top of the screen:

" SAVE LAYERING ? (Y/N/<Esc>)"

If you press Y the layering (depths and resistivities) is automatically saved in a file with the extension LYR.

The next prompt is:

" LIST RESULTS and DUMP GRAPHICS ? (Y/N/<Esc>) "

If you press Y then a prompt is displayed to urge you to make sure that the printer is turned on, to adjust the paper, and to press <ENTER> when ready. Figure 2 shows the results of interpreting sounding TEST 2. The table of depths and resistivities is followed by a screen dump of the graphics.

Following the graphics dump, or if the answer to the above prompt was N, a menu with six options (including Quit) is displayed. The items on this menu are self explanatory.

LOADING AN EXAMPLE

Several test examples, including the sounding named TEST 2, are given under the directory TEST. To run one of the test examples type TEST for the name of the Survey Area then select LOAD from the Main Menu. The TEST Directory contains few files. When prompted for the sounding number you wish to load, you may type FILE to find out what sounding numbers exist under the directory TEST (which represents the name of a survey area). If you type FILE, the program will load the files with extensions FLD and DGT and display them on the screen. You may use the cursor keys to highlight the file

names. Highlight the file name you want and then press <ENTER>, or highlight EXIT to exit without making a selection.

If you know the sounding number you wish to load (for example sounding 2), then type 2 to load sounding TEST 2. The next prompt is:

"LOAD Field or Digitized sounding ? (F/D)"

Press the appropriate letter.

When a sounding is loaded and graphically displayed you will be prompted:

" Is this the sounding you want ? (Y/N) "

If you press N, you will go back to sounding number. If you press Y, you will be prompted:

" CURVE LOOKS OK ? (Y/N/<Esc>) "

If you press N, you get a chance to edit the sounding, re-save it, print it, etc. From here on, the program follows the same steps and prompts as if you entered a new sounding.

PICK CONTOUR

The program PICKCONT.EXE is a separate program that reads layering files created by ATO.EXE and automatically interpolates the depths at preselected resistivity values. The purpose is to facilitate the manual contouring of resistivity on geoelectric cross sections. The preselected resistivity contour values are: 1, 1.5, 2, 3, 4.5, 7, 10, 15, 20, 30, 45, 70, 100, 140, 200, 300, 450, ..., etc.

To run the PICKCONT.EXE program you must exit the program ATO.EXE and then type PICKCONT. The program will prompt you to select the drive to retrieve data from, then it will display the directories of the various survey areas so that you may select the one you wish by highlighting it. The next screen displays the file names that end with the extension LYR (layering files). Make sure the printer is turned on, select the file you want, and press <ENTER>. A list of the depths and corresponding, preselected, resistivity values is printed.

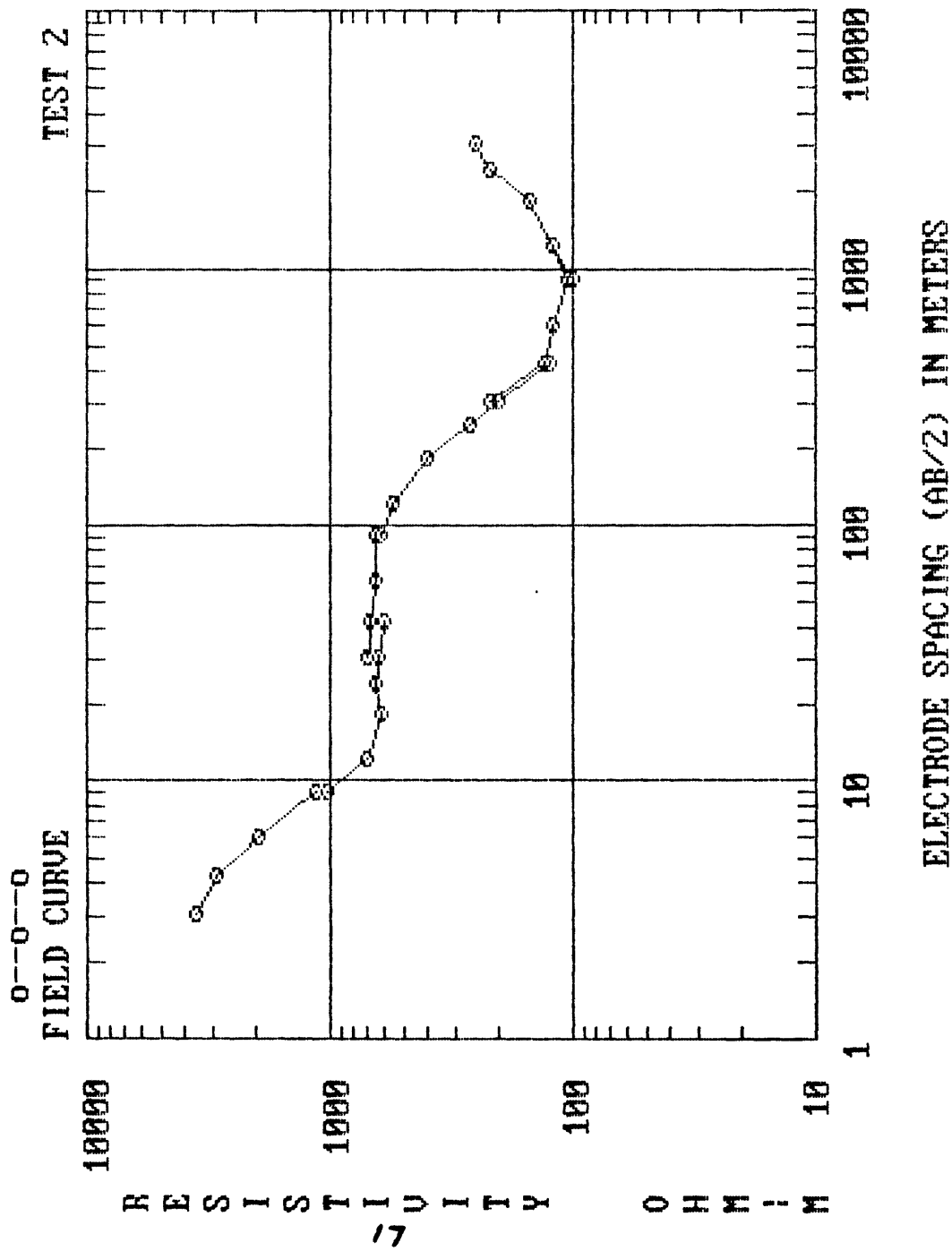
Lists of depths and preselected resistivities for soundings along a given cross section are very useful in the manual construction of geoelectric cross sections of contoured interpreted true resistivity. Table 1 shows the results of running PICKCONT for sounding TEST 2.

REFERENCES

Zohdy, A.A.R., (1989, in press), A new method for the automatic interpretation of Schlumberger and Wenner sounding curves: Geophysics, v. 54, No. 2, p ??.

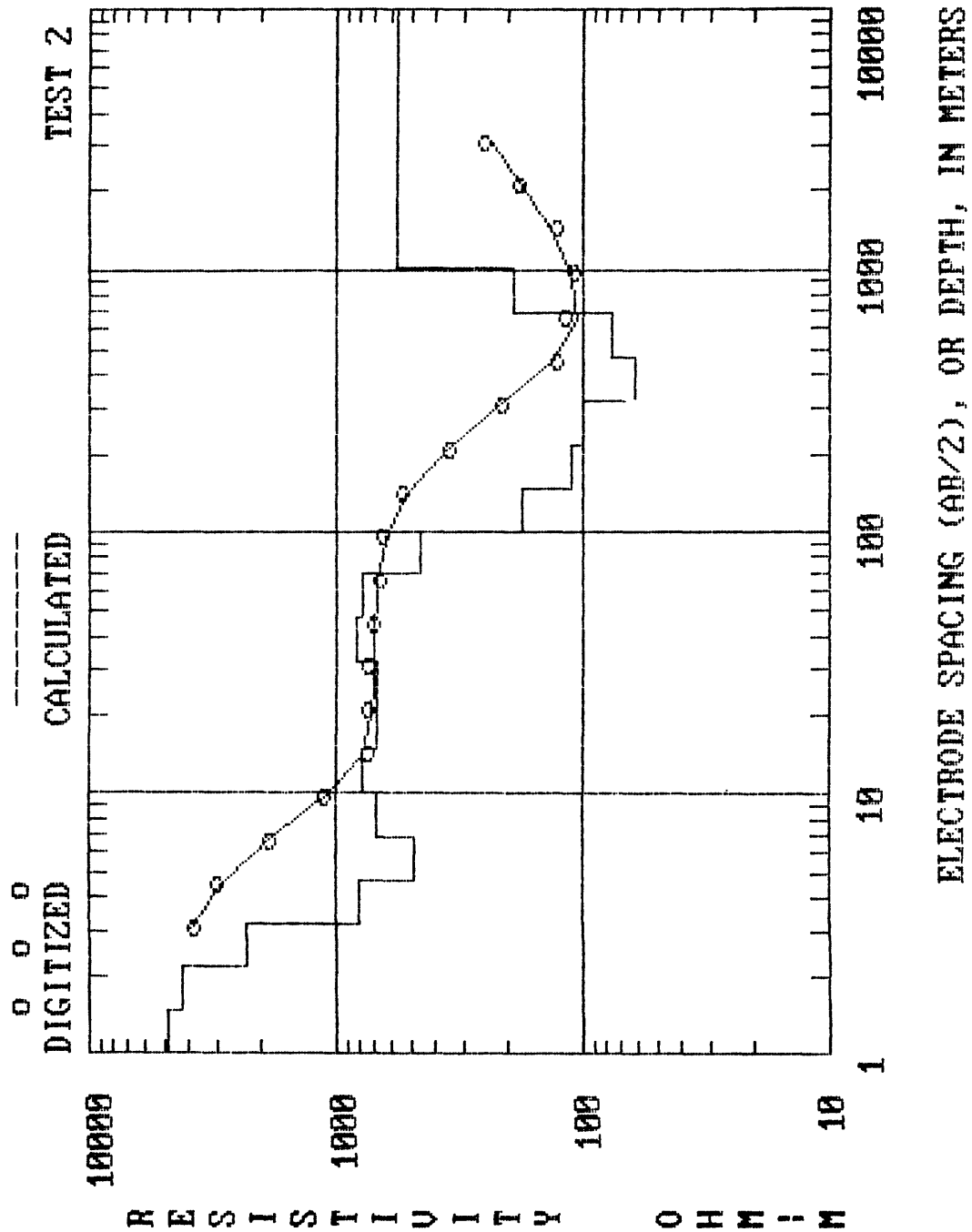
Zohdy, A.A.R., and Bisdorf, R.J., 1982, Schlumberger soundings in the Medicine Lake area, California: U.S. Geol. Survey Open-File Report, 82-887, 162 p.

AB/2, m (ft)	App. Res.	AB/2, m (ft)	App. Res.
3.05 (10.00)	3540.00	121.92 (400.00)	555.00
4.27 (14.00)	2940.00	182.88 (600.00)	400.00
6.10 (20.00)	1950.00	243.84 (800.00)	265.00
9.14 (30.00)	1130.00	304.80 (1000.00)	200.00
9.14 (30.00)	1030.00	426.72 (1400.00)	124.00
12.19 (40.00)	700.00	304.80 (1000.00)	220.00
18.29 (60.00)	620.00	426.72 (1400.00)	130.00
24.38 (80.00)	650.00	609.60 (2000.00)	120.00
30.48 (100.00)	630.00	914.40 (3000.00)	107.00
42.67 (140.00)	600.00	1219.20 (4000.00)	120.00
30.48 (100.00)	707.00	914.40 (3000.00)	98.80
42.67 (140.00)	690.00	1219.20 (4000.00)	121.00
60.96 (200.00)	645.00	1828.80 (6000.00)	149.00
91.44 (300.00)	640.00	2438.40 (8000.00)	218.00
91.44 (300.00)	620.00	3048.00 (10000.00)	252.00



TEST 2 (INTERPRETATION)

DEPTH, m	(ft)	RESIS.	DEPTH, m	(ft)	RESIS.
1.48	(4.86)	4805.14	46.84	(153.69)	822.80
2.17	(7.13)	4251.59	68.76	(225.58)	785.84
3.19	(10.47)	2312.34	100.92	(331.11)	450.01
4.68	(15.37)	798.04	148.13	(486.00)	178.96
6.88	(22.56)	479.53	217.43	(713.35)	112.85
10.09	(33.11)	691.31	319.14	(1047.06)	99.59
14.81	(48.60)	785.58	468.44	(1536.87)	61.52
21.74	(71.34)	678.26	687.57	(2255.81)	76.18
31.91	(104.71)	686.72	1009.22	(3311.08)	189.22
			99999.00	(99999.00)	564.41



TEST 2

DEPTH IN METERS	CONTOUR VALUE
1.5	4500.0
2.2	3000.0
2.8	2000.0
3.1	1500.0
3.6	1000.0
4.3	700.0
8.6	700.0
16.5	700.0
27.4	700.0
61.5	700.0
83.2	450.0
98.6	300.0
116.7	200.0
141.6	150.0
260.1	100.0
348.9	70.0
487.5	70.0
636.5	100.0
755.3	150.0
849.4	200.0
979.3	300.0
1129.2	450.0

LAST DEPTH = 1222.7

APPENDIX A

```
'************************** This is main module ATO.BAS **********************

DECLARE SUB CHKGRAPH (E!, GR$)
DECLARE SUB GRAPHSET (GR$)
DECLARE SUB PRTSCR ()
DECLARE SUB UPSORT (A$(), NZ)
DECLARE SUB FILESLCT (nam$, fl$(), NZ)
DECLARE SUB DIRECT (A$(), NZ, p$, kZ)
DECLARE SUB LVES (A!(), B!(), NZ, t$, U$, kZ)
DECLARE SUB CLR5L ()
DECLARE SUB CLRLNE (iZ)
DECLARE SUB PRSSANYKY ()
DECLARE FUNCTION PrssNmbrZ (NZ)
DECLARE SUB SETCOORD (AX!(), AY!(), X!(), y!(), NZ)
DECLARE SUB ONEILL (Xk!(), NkZ)
DECLARE SUB SETSCRN ()
DECLARE SUB Logplt (AX!(), AY!())
DECLARE FUNCTION CAPNWT$ ()
DECLARE SUB CNTR (YT!, A$)
DECLARE SUB HIGHL (A$)
DECLARE FUNCTION ALGT! (X!)
DECLARE FUNCTION DROUND! (tx1!, ty1!)
DECLARE SUB Kernel (LZ, X!(), t!(), R!(), V!(), NZ)
DECLARE SUB Conves (Vv!(), Ves!(), NradZ, Xk!(), NkZ)
DECLARE SUB Spline1 (MZ, H!, X!(), y!(), A!(), B!(), C!(), t!, D!(), p!(), S!())
DECLARE SUB Cubic1 (MZ, X!(), y!(), A!(), B!(), C!(), Delx!, xx!(), Yy!(), kZ)
DECLARE SUB Pltbox (AX!(), AY!())
DECLARE SUB RMS1 (RhoDig!(), Ves!(), RMS!, LayersZ)
DECLARE SUB Shft (ab!(), ob!(), NPTSZ, absh!(), obsh!(), nshZ, IsgmntZ)
        DEFINT I-N
        CONST FALSE = 0, true = NOT FALSE, con1 = .3048, Xratio = 1.467799267588
        ON ERROR GOTO ChkError
        DIM AB2(45), PsOb(45), ABX(45), PSY(45), AX(5), AY(5), FILENAME$(300)
        DIM AbDig(45), RhoDig(45), RhoDig1(45), Rho(45), Thick(45), depth(45)
        DIM Ves(45), Rhof(45), Thickf(45), Depthf(45), Vesf(45)
        DIM Xamda(65), Vv(65), Xk(20), Pso(45), absh(45), obsh(45), A(45)
        DIM B(45), C(45), D(2), S(45), p(45), Ps(45), It(65), Ss(65)
        DIM F1$(300), F2$(150)
        ONEILL Xk(), Nk
        SETSCRN
        WIDTH 80
        LOCATE , , 0
        Es$ = CHR$(27)

        CNTR 6, " SCHLUMBERGER SOUNDING DATA PROCESSING AND INTERPRETATION PROGRAM "
        CNTR 10, " By "
        CNTR 12, "   Adel  A.R.  Zohdy   "
        CNTR 14, "   Robert J. Bisdorf   "
        CNTR 16, "   U.S. GEOLOGICAL SURVEY, DENVER, CO.   "
        CNTR 20, " 1989 "
        CNTR 22, " Version 1.8"
        PRSSANYKY
        CRVPLT = true
        CHKGRAPH E, GR$
        CRVPLT = FALSE
        SETSCRN
```

```
        IF GR$ = "N" THEN
                CLS
                BEEP
                CNTR 10, " SORRY, GRAPHICS NOT AVAILABLE ... "
                CNTR 12, " CAN'T USE THIS PROGRAM !. "
                PRSSANYKY
                CLS
                SYSTEM
        END IF

        CLS
        CNTR 10, " PLEASE WAIT ..... "
        A$ = " LOADING " + GR$ + "GA GRAPHICS PRINTER DRIVER. "
        CNTR 12, A$
        IF GR$ = "E" THEN SHELL "EGADUMPL"
        IF GR$ = "C" THEN SHELL "GRAPHICS"

DrvMnu:
        SETSCRN
        CNTR 23, " * If you DO NOT wish to save or retrieve press <Esc>. "
        CNTR 7, " DISK-DRIVE MENU "
        LOCATE 10, 20: PRINT " Please type letter of DISK DRIVE "
        LOCATE 12, 21
        HIGHL " (A, B, C, etc.) "
        LOCATE 14, 20, 1
        PRINT " to SAVE or RETRIEVE DATA from: ";
        A$ = CAPNWT$
        IF A$ = CHR$(13) THEN BEEP: GOTO DrvMnu
        IF A$ = Es$ THEN DD$ = "": GOTO MainMnu
        DD$ = A$
        LOCATE 14, 52: PRINT DD$; : DD$ = DD$ + ":"
        LOCATE 16, 20: PRINT " Please wait ...          ";
        chkdrive$ = "CHKDRIVE"
        OPEN DD$ + chkdrive$ FOR INPUT AS #1
        CLOSE #1
        chkdrive$ = ""

MainMnu:
        SETSCRN
        LodF = 0
        Edt = 0
        Mnu$ = "ENTRY"
        ABUnit$ = ""
        LOCATE , , 0
        CNTR 7, " MAIN MENU "
        LOCATE 10, 26
        PRINT "1. "; : HIGHL " ENTER "
        PRINT " SOUNDING FROM KEYBOARD."
        LOCATE 12, 26
        PRINT "2. "; : HIGHL " LOAD "
        PRINT " SOUNDING FROM DATA DISK."
        LOCATE 14, 26
        PRINT "3. "; : HIGHL " RETURN "
        PRINT " TO DISK-DRIVE MENU."
        LOCATE 16, 26
        PRINT "4. "; : HIGHL " QUIT. "
```

```
        k = PrssNmbr(4)
ON k GOTO SrvyArea, LodFile, DrvMnu, Kwit

SrvyArea:
        IF DD$ = "" THEN GOTO ABUnit
        Dir$ = ""
        CLS
        file = FALSE
        LOCATE 10, 16: PRINT "Type name of "; : HIGHL " SURVEY AREA "
        PRINT " <ENTER>: "
        LOCATE 13, 16: PRINT "* If NO NAME press <ENTER>."
        LOCATE 14, 16: PRINT "* You may use SPACES in name of survey area."
        LOCATE 15, 16: PRINT "* Automatic Assignments:"
        LOCATE 16, 16: PRINT "  Sounding Title = Survey Area + Sounding Number."
        LOCATE 17, 16: PRINT "  Directory name = First 8 Letters of Survey Name."
        LOCATE 10, 52
        LINE INPUT "", SurveyNm$
        IF SurveyNm$ = "" THEN GOTO ABUnit
        SurveyNm$ = UCASE$(SurveyNm$)
        A$ = SurveyNm$
        GOSUB CapNTrim
        IF A$ = "" THEN BEEP: GOTO SrvyArea

chkdir:
        Dir$ = LEFT$(A$, 8)
        LOCATE 10, 52: PRINT Dir$; "                    "
        LOCATE 22, 16: PRINT "Please wait, checking directory ..."
        IF LEN(Dir$) = 4 AND Dir$ = "FILE" THEN
                BEEP
                LOCATE 22, 16
                PRINT "Can't use the name FILE for Survey area !!         "
                PRSSANYKY
                GOTO SrvyArea
        END IF
        chkdir$ = "dir"
        CHDIR DD$ + "\" + Dir$
        IF chkdir$ <> "" THEN GOTO ABUnit
        BEEP
        LOCATE 22, 16
        PRINT "Above directory not found, wish to create a new one ? (Y/N)"
        GOSUB YsNo
        IF A$ = "Y" THEN
                MKDIR DD$ + "\" + Dir$
                GOTO ABUnit
        END IF
        GOTO SrvyArea

ABUnit:
        CLS
        ABunits$ = ""
        CNTR 12, " Electrode spacings: in Feet or Meters ? (F/M) "
        A$ = CAPNWT$
        IF A$ <> "F" AND A$ <> "M" THEN BEEP: GOTO ABUnit
        PRINT A$
        IF A$ = "F" THEN ABUnit$ = "FEET"
        IF A$ = "M" THEN ABUnit$ = "METERS"
```

```
VesNmbr:
        SETSCRN
        IF convert$ = "Y" THEN
                convert$ = "N"
                ABUnit$ = "FEET"
                FOR i = 1 TO NAB2
                        AB2(i) = AB2(i) / con1
                NEXT i
        END IF
        CNTR 8, " ENTER SOUNDING ... "
        LOCATE 12, 16: PRINT " Type Sounding ";
        HIGHL " NUMBER ": PRINT " <ENTER>: "
        LOCATE 14, 16: PRINT " (4 Digits and/or Characters max)"
        LOCATE 16, 16: PRINT " * If no number type 0 <ENTER>. "
        LOCATE 18, 16: PRINT " * To return to MAIN MENU press <ENTER>."
        LOCATE 12, 48: LINE INPUT " ", VesNum$
        IF VesNum$ = "" THEN GOTO MainMnu
        IF VesNum$ = "0" THEN VesNum$ = "": GOTO DataEntryMnu
        A$ = VesNum$
        GOSUB CapNTrim
        VesNum$ = A$
        LOCATE 14, 23
        PRINT VesNum$; "            "
        TITLE$ = SurveyNm$ + " " + VesNum$

DataEntryMnu:
        SETSCRN
        CNTR 4, " DATA ENTRY MENU "
        VesTyp$ = ""
        LOCATE 11, 15
        PRINT "1. Enter AB/2 and "; : HIGHL " FIELD "
        PRINT " APPARENT RESISTIVITIES."
        LOCATE 13, 15
        PRINT "2. Enter SMALLEST AB/2 and "; : HIGHL " DIGITIZED "
        PRINT " APPARENT RESISTIVITIES."
        LOCATE 15, 15
        PRINT "3. Return to "; : HIGHL " MAIN MENU. "
        k = PrssNmbr(3)
        IF k = 3 THEN GOTO MainMnu
        IF k = 1 THEN
                VesTyp$ = "FLD"
                IF Dir$ = "" THEN GOTO InptFld
        ELSE
                VesTyp$ = "DGT"
                IF Dir$ = "" THEN GOTO InptDgt
        END IF
        FILENAME$ = LEFT$(Dir$, 4) + LEFT$(VesNum$, 4) + "." + VesTyp$
        LOCATE 23, 16: PRINT "Please wait ..."
        CLOSE
        ChkFil = 1
        OPEN DD$ + "\" + Dir$ + "\" + FILENAME$ FOR INPUT AS #1
        CLOSE #1
        IF ChkFil THEN
                BEEP
                CLS
```

```
                LOCATE 10, 12
                PRINT "File for: "
                LOCATE 12, 12
                HIGHL " " + Dir$ + " " + VesNum$ + " (" + VesTyp$ + ") already Exists! "
                LOCATE 14, 12
                PRINT "Do you wish to replace it ? (Y/N/<Esc>)"
                GOSUB YsNo
                IF A$ = Es$ THEN GOTO MainMnu
                IF A$ = "N" THEN GOTO VesNmbr
        END IF
        IF VesTyp$ = "DGT" THEN GOTO InptDgt

InptFld:
        COLOR 7, 1: CLS
        LOCATE 21, 22: COLOR 0, 7
        PRINT " ENTER ALL DATA NOW ..... EDIT LATER! "
        LOCATE 22, 22
        PRINT " Type AB/2 values   &   press   <ENTER>. "
        LOCATE 23, 22
        PRINT " When done, type  0 &   press   <ENTER>. "
        LOCATE 25, 22
        PRINT " TO  RETURN  TO  MENU  TYPE  -1 <ENTER>. "; : COLOR 7, 1
        xx = 5: y = 4: X = 6: i = 1

AB2Hdr1:
        LOCATE 2, xx - 2
        PRINT "#"
        LOCATE 2, xx
        HIGHL " AB/2 "

AB2Nmbr:
        LOCATE y, X - 4: PRINT i
        LOCATE y, X: INPUT "", ab$
        IF ab$ = "" AND AB2(i) <> 0 THEN ab$ = STR$(AB2(i))
        LOCATE y, X: HIGHL ab$
        AB2(i) = VAL(ab$)
        IF AB2(i) < 0 THEN AB2(i) = 0: GOTO DataEntryMnu
        IF ab$ = "0" AND i = 1 THEN BEEP: GOTO AB2Nmbr
        IF ab$ = "0" THEN GOTO DonAB
        IF ab$ <> "" AND AB2(i) <> 0 AND AB2(i) <> -1 THEN
                LOCATE y, X
                PRINT "     "
                LOCATE y, X
                HIGHL STR$(AB2(i))
        END IF
        IF AB2(i) = 0 THEN
                BEEP
                LOCATE y, X
                PRINT "     "
                GOTO AB2Nmbr
        END IF
        i = i + 1
        IF y = 18 THEN
                y = 4
                xx = xx + 24
                X = X + 24
```

```
        ELSE
                y = y + 1
        END IF
        GOTO AB2Nabr

DonAB:
        CLR5L
        NAB2 = i - 1
        xx = 15
        y = 4
        X = 16
        i = 1

RoFldPrapt:
        LOCATE 21, 22: COLOR 0, 7
        PRINT " ENTER ALL DATA NOW ..... EDIT LATER! "
        LOCATE 22, 22
        PRINT " Type  APP. RESISTIVITY & press <ENTER>. "
        LOCATE 23, 22
        PRINT " When  done  type   0   & press <ENTER>. "
        COLOR 7, 1
25 LOCATE 2, xx - 2
        PRINT "# "
        LOCATE 2, xx
        HIGHL " APP.RHO "

InptRo:
        LOCATE y, X - 4: PRINT i
        LOCATE y, X: INPUT "", Ps$
        IF Ps$ = "" AND PsOb(i) <> 0 THEN Ps$ = STR$(PsOb(i))
        LOCATE y, X: HIGHL Ps$
        PsOb(i) = VAL(Ps$)
        IF PsOb(i) < 0 THEN
                PsOb(i) = 0
                GOTO DataEntryMnu
        END IF
        IF Ps$ = "0" AND i = 1 THEN
                BEEP
                GOTO InptRo
        END IF
        IF Ps$ = "0" THEN
                NAPR = i - 1
                GOTO ChkNabr
        END IF
        IF Ps$ <> "" AND PsOb(i) <> 0 AND PsOb(i) <> -1 THEN
                LOCATE y, X
                PRINT "      "
                LOCATE y, X
                HIGHL STR$(PsOb(i))
        END IF
        IF PsOb(i) = 0 THEN BEEP: GOTO InptRo
        i = i + 1
        IF y = 18 THEN
                y = 4
                xx = xx + 24
                X = X + 24
```

```
            GOTO 25
        END IF
        y = y + 1
        GOTO InptRo

ChkNmbr:
         IF NAB2 <> NAPR THEN GOSUB NtEql
         GOSUB Dsply
         GOTO EdtPrmpt

InptDgt:
        VesTyp$ = "DGT"
        CLS
        LOCATE 12, 12
        PRINT " PLEASE TYPE SMALLEST DIGITIZED AB/2 <ENTER> "
        LOCATE 16, 20
        HIGHL " TO RETURN TO MENU PRESS <ENTER> "

ABMIN:
        LOCATE 12, 60
        INPUT "", ABMIN$
        IF ABMIN$ = "" THEN GOTO DataEntryMnu
        IF VAL(ABMIN$) = 0 THEN BEEP: GOTO ABMIN
        AbDig(1) = VAL(ABMIN$)
        COLOR 7, 4: CLS
        LOCATE 21, 16: COLOR 0, 7
        PRINT " ENTER ALL DATA NOW ..... EDIT LATER! "
        LOCATE 22, 16
        PRINT " INPUT DIGITIZED APP. RESISTIVITIES & PRESS <ENTER> "
        LOCATE 23, 16
        PRINT " WHEN  DONE,  TYPE  0  AND  PRESS ..... <ENTER> "
        LOCATE 25, 16
        PRINT " TO  RETURN  TO  MENU  TYPE  -1  AND PRESS  <ENTER> ";
        COLOR 7, 4
        xx = 5: y = 4: X = 6: i = 1

DgtHdr:
        LOCATE 2, xx - 2: PRINT "#"
        LOCATE 2, xx
        COLOR 0, 7: PRINT " AB/2 ": COLOR 7, 4
        GOSUB PrtAbDgt
        xx = xx + 10: y = 4: X = X + 10
        LOCATE 2, xx - 2: PRINT "# "
        LOCATE 2, xx
        COLOR 0, 7: PRINT " APP.RHO ": COLOR 7, 4

InptRoDgt:
        LOCATE y, X - 4: PRINT i
        LOCATE y, X: INPUT "", RhoDig$
        IF RhoDig$ = "" AND RhoDig(i) > 0 THEN RhoDig$ = STR$(RhoDig(i))
        LOCATE y, X
        COLOR 0, 7: PRINT RhoDig$: COLOR 7, 4
        RhoDig(i) = VAL(RhoDig$)
        IF RhoDig(i) < 0 THEN RhoDig(i) = 0: GOTO DataEntryMnu
        IF RhoDig$ = "0" AND i = 1 THEN BEEP: GOTO InptRoDgt
        IF RhoDig$ = "0" THEN NAPR = i - 1: GOTO DnRhoDig
```

```
        IF RhoDig$ <> "" AND RhoDig(i) <> 0 AND RhoDig(i) <> -1 THEN
                LOCATE y, X
                PRINT "      "
                LOCATE y, X
                COLOR 0, 7: PRINT RhoDig(i): COLOR 7, 4
        END IF
        IF RhoDig(i) = 0 THEN BEEP: GOTO InptRoDgt
        y = y + 1
        i = i + 1
        AbDig(i) = AbDig(i - 1) * Xratio
        IF y = 19 THEN
                y = 4
                IF i = 16 THEN
                        xx = 30
                        X = 30
                ELSEIF i = 31 THEN
                        xx = 60
                        X = 60
                END IF
                GOTO DgtHdr
        ELSEIF y < 19 AND i < 16 THEN
                xx = 5
                X = 6
        ELSEIF y < 19 AND i > 16 AND i < 31 THEN
                xx = 30
                X = 30
        ELSEIF y < 19 AND i > 31 THEN
                xx = 60
                X = 60
        END IF
                GOSUB PrtAbDgt
                xx = xx + 10
                X = X + 10
                GOTO InptRoDgt

DnRhoDig:
        NAB2 = NAPR
        FOR i = 1 TO NAPR
                AB2(i) = AbDig(i)
                PsOb(i) = RhoDig(i)
        NEXT i
        GOSUB Dsply

EdtPrmpt:
        Edt = -1
         CLR5L
         LOCATE 21, 11
         PRINT "Press: "; : HIGHL " C ": PRINT " to Continue, ";
         HIGHL " E ": PRINT " to Edit,   ";
         HIGHL " D ": PRINT " to Delete, "
         LOCATE 23, 18
         HIGHL " I ": PRINT " to Insert,   ";
         HIGHL " A ": PRINT " to Append, ";
         HIGHL " <Esc> ": PRINT " to Main Menu. "

WhrTo:
```

```
        A$ = CAPNWT$
        IF A$ = "E" THEN B$ = " EDIT ": GOTO EdtDel
        IF A$ = "D" THEN B$ = " DELETE ": GOTO EdtDel
        IF A$ = "I" THEN B$ = " INSERT ": GOTO Insrt
        IF A$ = "A" THEN GOTO Apnd
        IF A$ = Es$ THEN GOTO MainMnu
        IF A$ = "C" THEN
                IF NAB2 <> NAPR THEN
                        GOSUB NtEql
                        GOTO EdtPrmpt
                ELSEIF VesTyp$ = "DGT" THEN
                        FOR i = 1 TO NAB2
                                AbDig(i) = AB2(i)
                                RhoDig(i) = PsOb(i)
                        NEXT i
                END IF
                IF NAB2 = NAPR THEN GOTO Plt
        END IF
        BEEP
        GOTO WhrTo

EdtDel:
        C$ = " TYPE ENTRY NUMBER TO ": A$ = C$ + B$
        CLR5L
        LOCATE 21, 18
        COLOR 3, 1: PRINT C$;
        HIGHL B$
        COLOR 3, 1: PRINT " <ENTER> ": COLOR 7, 1
        LOCATE 22, 18
        COLOR 7, 1: PRINT " If NO CHANGE ..... press <ENTER>"
        LOCATE 21, 18 + LEN(A$) + 12
        COLOR 3, 1: INPUT "", N$: COLOR 7, 1
        IF N$ = "" THEN
                GOSUB Dsply
                GOTO EdtPrmpt
        END IF
        IF ASC(N$) < 49 OR ASC(N$) > 57 THEN BEEP: GOTO EdtDel
        N = VAL(N$)
        IF N = 0 THEN
                BEEP
                GOTO EdtDel
        END IF
        IF N > Q THEN
                GOSUB WrngNmbr
                GOSUB Dsply
                GOTO EdtDel
        END IF
        IF B$ <> " EDIT " THEN GOTO Del
        IF N > NAB2 THEN 1440
        y = 3 + N
        IF N <= 15 THEN LOCATE y, 7
        IF N > 15 AND N <= 30 THEN LOCATE y - 15, 33
        IF N > 30 AND N <= 45 THEN LOCATE y - 30, 59
        AK = AB2(N)
        COLOR 0, 7: INPUT "", ab$
        IF ab$ = "" THEN AB2(N) = AK ELSE AB2(N) = VAL(ab$)
```

```
        IF AB2(N) <= 0 THEN BEEP: AB2(N) = AK
        GOSUB Dsply
        GOTO EdtDel

1440    y = 3 + N - NAB2
        IF N <= 15 + NAB2 THEN LOCATE y, 19: GOTO 1480
        IF N <= 30 + NAB2 THEN LOCATE y - 15, 44: GOTO 1480
        IF N <= 45 + NAB2 THEN LOCATE y - 30, 69: GOTO 1480

1480    AKK = PsOb(N - NAB2)
        COLOR 0, 7
        INPUT "", Ps$
        IF Ps$ = "" THEN PsOb(N - NAB2) = AKK: GOTO 1500
        PsOb(N - NAB2) = VAL(Ps$)
        IF PsOb(N - NAB2) <= 0 THEN BEEP: PsOb(N - NAB2) = AKK

1500    GOSUB Dsply
        GOTO EdtDel

Del:
        IF B$ <> " DELETE " THEN GOTO Insrt
        IF N > NAB2 THEN GOTO DelRo

DelAB2:
        FOR i = N TO NAB2
                AB2(i) = AB2(i + 1)
        NEXT i
        NAB2 = NAB2 - 1
        GOSUB Dsply
        GOTO EdtDel

DelRo:
        IF N > Q THEN
                GOSUB WrngNmbr
                GOSUB Dsply
        END IF
        FOR i = N TO Q
                PsOb(i - NAB2) = PsOb(i - NAB2 + 1)
        NEXT i
        NAPR = NAPR - 1
        GOSUB Dsply
        GOTO EdtDel

Insrt:
        CLR5L
        LOCATE 21, 6
                COLOR 3, 1: PRINT "Type entry number "; : COLOR 1, 3
                PRINT " ABOVE WHICH ";
                COLOR 3, 1: PRINT " you wish to ";
                COLOR 0, 7: PRINT B$; : COLOR 3, 1
                PRINT " & press <ENTER>  "
        LOCATE 22, 22
                COLOR 7, 1: PRINT "IF NO CHANGE ..... press <ENTER>  "
        LOCATE 21, 75
                INPUT "", N$
        N = VAL(N$)
```

```
        IF N$ = "" THEN GOTO EdtPrmpt
        IF ASC(N$) < 49 OR ASC(N$) > 57 THEN BEEP: GOTO Insrt
        IF N = 0 THEN BEEP: GOTO Insrt
        IF N > NAB2 THEN GOTO InsrtRo

InsrtAB:
        LOCATE 23, 1: PRINT STRING$(79, " ")
        LOCATE 23, 21
        HIGHL " TYPE VALUE OF AB/2 TO BE INSERTED "
        PRINT "    ";
        INPUT "", N$
        IF N$ = "" THEN GOTO EdtPrmpt
        IF ASC(N$) < 49 OR ASC(N$) > 57 THEN BEEP: GOTO InsrtAB
        AM = VAL(N$)
        IF AM = 0 THEN BEEP: GOTO InsrtAB
        NAB2 = NAB2 + 1
        FOR i = NAB2 TO N + 1 STEP -1
                AB2(i) = AB2(i - 1)
        NEXT i
        AB2(N) = AM
        GOSUB Dsply
        GOTO Insrt

InsrtRo:
        IF N > Q THEN
                GOSUB WrngNmbr
                GOSUB Dsply
                GOTO Insrt
        END IF
        LOCATE 23, 1: PRINT STRING$(79, " ")
        LOCATE 23, 22
                HIGHL " TYPE VALUE OF APP.RHO TO BE INSERTED "
        PRINT " ";
        INPUT "", N$
        IF N$ = "" THEN GOTO EdtPrmpt
        IF ASC(N$) < 49 OR ASC(N$) > 57 THEN BEEP: GOTO InsrtRo
        AM = VAL(N$)
        IF AM = 0 THEN BEEP: GOTO InsrtRo
        NAPR = NAPR + 1: Q = Q + 1
        FOR i = Q TO N + 1 STEP -1
                PsOb(i - NAB2) = PsOb(i - NAB2 - 1)
        NEXT i
        PsOb(N - NAB2) = AM
        GOSUB Dsply
        GOTO Insrt

WrngNmbr:
        BEEP
        CLR5L
        CNTR 24, " THERE IS NO SUCH NUMBER!. "
        PRSSANYKY
        CLR5L
        RETURN

Apnd:
        CLR5L
```

```
        LOCATE 21, 8
        PRINT " Press ";
        HIGHL "  A  ": PRINT " to append ";
        HIGHL " AB/2 ": PRINT " , or press ";
        HIGHL "  R  ": PRINT " to append ";
        HIGHL " APP.RHO "
        LOCATE 23, 22
        PRINT " If NO CHANGE  ......  Press <ENTER> "
        A$ = CAPNWT$
        IF A$ = CHR$(13) THEN GOTO EdtPrmpt
        IF A$ = "A" THEN GOTO ApndAB
        IF A$ = "R" THEN GOTO ApndRo
        BEEP: GOTO Apnd

ApndAB:
        CLR5L
        LOCATE 23, 22
        PRINT " If NO CHANGE  ......  Press <ENTER> "
        LOCATE 22, 18
        HIGHL "Type  VALUE OF AB/2  to be added <ENTER>"
        INPUT "  ", N$
        IF N$ = "" THEN GOTO EdtPrmpt
        IF ASC(N$) < 49 OR ASC(N$) > 57 THEN BEEP: GOTO ApndAB
        AN = VAL(N$)
        IF AN <= 0 THEN BEEP: GOTO ApndAB
        NAB2 = NAB2 + 1
        AB2(NAB2) = AN
        GOSUB Dsply
        GOTO Apnd

ApndRo:
        CLR5L
        LOCATE 23, 22
        PRINT " If NO CHANGE  ......  Press <ENTER> "
        LOCATE 22, 18
        HIGHL " Type  VALUE OF APP.RHO  to be added <ENTER>"
        INPUT "  ", N$
        IF N$ = "" THEN GOTO EdtPrmpt
        IF ASC(N$) < 49 OR ASC(N$) > 57 THEN BEEP: GOTO ApndRo
        AN = VAL(N$)
        NAPR = NAPR + 1
        PsOb(NAPR) = AN
        GOSUB Dsply
        GOTO Apnd

Plt:
        GOSUB FldPlt

CrvOk:
        CLRLNE 1
        LOCATE 1, 24
                PRINT " CURVE LOOKS OK ? (Y/N/<Esc>) "
        GOSUB YsNo
                IF A$ = Es$ THEN GOTO MainMnu
        IF A$ = "N" THEN
                SETSCRN
```

```
                GOSUB Dsply
                GOTO EdtPrmpt
        END IF
        IF DD$ = "" OR Dir$ = "" THEN GOTO FtToM
        CLRLNE 1
        IF Edt = -1 THEN
                LOCATE 1, 20
                PRINT "Save this Sounding ? (Y/N/<Esc>)"
                GOSUB YsNo
                IF A$ = Es$ THEN GOTO MainMnu
                IF A$ = "N" THEN GOTO FtToM
                GOSUB SaveIt
        END IF
        IF LodF <> -1 THEN
                CLRLNE 1
                LOCATE 1, 15
                PRINT "ENTER another sounding ? (Y/N/<Esc>)"
                GOSUB YsNo
                IF A$ = Es$ THEN GOTO MainMnu
                IF A$ = "Y" THEN GOTO VesNmbr ELSE GOTO FtToM
        END IF

FtToM:
        convert$ = ""
        CLRLNE 1
        LOCATE 1, 15
        IF ABUnit$ = "METERS" THEN
                GOSUB Lbl2
                GOTO DmpGrfx
        END IF
        IF ABUnit$ = "FEET" THEN
                CLRLNE 1
                LOCATE 1, 15
                PRINT " CONVERT AB/2 from FEET to METERS ? (Y/N/<Esc>)"
                GOSUB YsNo
                IF A$ = Es$ THEN GOTO MainMnu
                IF A$ = "N" THEN
                        convert$ = "N"
                        GOSUB FldPlt
                        GOTO DmpGrfx
                END IF
                convert$ = "Y"
                ABUnit$ = "METERS"
                IF VesTyp$ = "DGT" THEN
                        FOR i = 1 TO NAB2
                                AbDig(i) = AbDig(i) * con1
                                AB2(i) = AbDig(i)
                        NEXT i
                ELSE
                        FOR i = 1 TO NAB2
                                AB2(i) = AB2(i) * con1
                        NEXT i
                END IF
                GOSUB FldPlt
                GOTO DmpGrfx
        END IF
```

```
        BEEP
        GOTO FtToM

DmpGrfx:
        CLRLNE 1
        LOCATE 1, 10
        PRINT "LIST field data & DUMP GRAPHICS on printer ? (Y/N/<Esc>) "
        GOSUB YsNo
        IF A$ = Es$ THEN GOTO MainMnu
        IF A$ = "Y" THEN
                GOSUB PrntrRdy
                nspc = 14
                IF convert$ = "Y" THEN nspc = 4
                IF VesTyp$ = "FLD" THEN
                        LPRINT : LPRINT SPC(nspc); TITLE$; "  (FIELD DATA)": LPRINT
                ELSE
                        LPRINT : LPRINT SPC(nspc); TITLE$; "  (DIGITIZED DATA)": LPRINT
                END IF
                XNu = INT(NAB2 / 2)
                XNm = NAB2 / 2
                IF convert$ = "N" OR convert$ = "" THEN
                        form1$ = "            #####.##      #####.##     #####.##    #####.##"
                        form2$ = "                                       #####.##    #####.##"
                        form$ = "               AB/2       App. Res.       AB/2     App. Res."
                        LPRINT form$
                        LPRINT
                        FOR i = 1 TO XNu
                                LPRINT USING form1$; AB2(i), PsOb(i), AB2(i + XNu), PsOb(i + XNu)
                        NEXT i
                        IF XNm > XNu THEN LPRINT USING form2$; AB2(NAB2), PsOb(NAB2)
                ELSE
                        form3$ = "   #####.## (#####.##)     #####.##     #####.## (#####.##)  #####.##"
                        form4$ = "                                       #####.## (#####.##)  #####.##"
                        form$ = "      AB/2, m (  ft  )     App. Res.       AB/2, m (  ft  )   App. Res."
                        LPRINT form$: LPRINT
                        FOR i = 1 TO XNu
                                LPRINT USING form3$; AB2(i), AB2(i) / con1, PsOb(i), AB2(i + XNu); AB2(i + XNu) / con1,
PsOb(i + XNu )
                        NEXT i
                        IF XNm > XNu THEN LPRINT USING form4$; AB2(NAB2); AB2(NAB2) / con1; PsOb(NAB2)
                END IF
                GOSUB DmpGrfxMsg
        END IF
        IF VesTyp$ = "FLD" THEN GOSUB ShftNDig
        GOTO Ato

LodFile:
        SETSCRN
        IF DD$ = "" THEN
                BEEP
                CLS
                LOCATE 10, 10
                PRINT " You did not select a Drive to load data from !!!"
                PRSSANYKY
                GOTO DrvMnu
        END IF
```

```
        file = FALSE
        CNTR 8, " LOAD FILE ... "
        LOCATE 12, 16: PRINT "Type name of ";
        HIGHL " SURVEY AREA ": PRINT " <ENTER>: "
        LOCATE 15, 16: PRINT "* You may use SPACES in name of survey area."
        LOCATE 17, 16: PRINT "* To return to MAIN MENU press <ENTER>"
        LOCATE 12, 52
        LINE INPUT "", SurveyNm$
        IF SurveyNm$ = "" THEN GOTO MainMnu
        SurveyNm$ = UCASE$(SurveyNm$)
        A$ = SurveyNm$
        GOSUB CapNTrim
        IF A$ = "" THEN BEEP: GOTO LodFile
        Dir$ = LEFT$(A$, 8)
        LOCATE 12, 52: PRINT Dir$; "                    "
        LOCATE 20, 16: PRINT "Please wait, checking directory ..."
        IF LEN(Dir$) = 4 AND Dir$ = "FILE" THEN
                BEEP
                LOCATE 20, 16
                PRINT "Can't use the name FILE for Survey area !!        "
                PRSSANYKY
                GOTO LodFile
        END IF
        chkdir$ = "LOD"
        CHDIR "\"
        MKDIR DD$ + "\" + Dir$
        IF chkdir$ = "LOD" THEN
                BEEP
                LOCATE 20, 16
                PRINT "Above directory not found !!                "
                RMDIR DD$ + Dir$
                PRSSANYKY
                GOTO LodFile
        END IF

LodVes:
        SETSCRN
        IF DD$ = "" OR Dir$ = "" THEN
                BEEP
                CLS
                LOCATE 10, 10
                PRINT " Can't LOAD, you did not select a Drive and/or a Directory !!"
                PRSSANYKY
                GOTO MainMnu
        END IF

Lod1:
        CNTR 8, " LOAD FILE ..... "
        LOCATE 15, 16: PRINT "* To see file names type FILE."
        LOCATE 16, 16: PRINT "* To return to MAIN MENU press <ENTER>."
        LOCATE 12, 16: PRINT " Type Sounding ";
        HIGHL " NUMBER ": PRINT " <ENTER>: ";
        LINE INPUT A$
        IF A$ = "" THEN GOTO MainMnu
        GOSUB CapNTrim
        VesNum$ = A$
```

```
        IF LEFT$(VesNum$, 4) = "FILE" THEN
                CLS
                CNTR 12, " LOADING DISK DIRECTORY: .... PLEASE WAIT. "
                IF file THEN GOTO file1
                F$ = DD$ + "\" + Dir$ + "\*.FLD"
                DIRECT F1$(), N1, F$, 1
                UPSORT F1$(), N1
                F$ = DD$ + "\" + Dir$ + "\*.DGT"
                DIRECT F2$(), N2, F$, 1
                UPSORT F2$(), N2
                FOR i = N1 + 1 TO N1 + N2
                        F1$(i) = F2$(i - N1)
                NEXT i
                NF = N1 + N2 + 1
                F1$(NF) = "EXIT"
                file = true

file1:
        CNTR 1, " SELECT A FILE OR SELECT EXIT TO RETURN "
                FILESLCT FILENAME$, F1$(), NF
                IF FILENAME$ = "EXIT" THEN GOTO LodFile
                VesTyp$ = RIGHT$(FILENAME$, 3)
                ist = LEN(Dir$)
                IF ist > 4 THEN ist = 4
                VesNum$ = MID$(FILENAME$, ist + 1, LEN(FILENAME$) - ist - 4)
                GOTO Lod4
        END IF

Lod2:
        LOCATE 20, 10: PRINT STRING$(60, " "): LOCATE 20, 10
        PRINT " Type of sounding:  FIELD or DIGITIZED ? (F/D/<Esc>) ";
        A$ = CAPNWT$
        IF A$ = Es$ THEN GOTO MainMnu
        IF A$ = "F" THEN VesTyp$ = "FLD": GOTO Lod3
        IF A$ = "D" THEN VesTyp$ = "DGT": GOTO Lod3
        BEEP
        GOTO Lod2

Lod3:
        FILENAME$ = LEFT$(Dir$, 4) + LEFT$(VesNum$, 4) + "." + VesTyp$

Lod4:
        OPEN DD$ + "\" + Dir$ + "\" + FILENAME$ FOR INPUT AS #1
        IF VesTyp$ = "FLD" THEN
                LVES AB2(), PsDb(), NAB2, TITLE$, ABUnit$, 1
        ELSE
                LVES AbDig(), RhoDig(), NAB2, TITLE$, ABUnit$, 1
                FOR i = 1 TO NAB2
                        AB2(i) = AbDig(i)
                        PsDb(i) = RhoDig(i)
                NEXT i
        END IF
        NAPR = NAB2
        CLOSE #1
        LodF = -1
        Edt = 0
```

```
        GOSUB FldPlt
        CLRLNE 1
        LOCATE 1, 15
        PRINT " Is this the sounding you want ? (Y/N)"
        GOSUB YsNo
        IF A$ = Es$ OR A$ = "N" THEN GOTO LodVes
        GOTO CrvOk


Ato:
        SETSCRN
        Replough = 0
        Ft = 2                      'First FITTING TOLERANCE
        Layers = NAB2
        Nrad = 20 + Layers          'Nrad = # of Kernel Function Spacings
        IF VesTyp$ = "DGT" THEN
                Radmin = AbDig(1)
                FOR i = 1 TO Layers
                        RhoDig1(i) = RhoDig(i)
                NEXT i
                GOTO KrnlSpcing
        END IF
        FOR i = 1 TO Layers
                RhoDig1(i) = RhoDig(i)
        NEXT i

KrnlSpcing:
        Xmin = Radmin / Xratio ^ 14 / 1.1396'Xmin=Smallest KERNEL FUNCTION SPACING
        Xamda(1) = Xmin
        FOR i = 2 TO Nrad           ' COMPUTE KERNEL FUNCTION SPACINGS (XAMDA)
                Xamda(i) = Xratio * Xamda(i - 1)
        NEXT i

Options:
        Compress = 6        ' NUMBER OF LAYERS PER CYCLE
        Shift = 0           ' DEPTH-SHIFT factor
        Iterate = 1         ' NUMBER OF ITERATIONS
        Max = 60            ' MAX NUMBER OF ITERATIONS
        FixRhoN = 0
        CLS
        CNTR 6, " OPTIONS "
        LOCATE 10, 10
        PRINT "Do You wish to use any of the following options ? (Y/N)"
        LOCATE 12, 10
        PRINT "* Fix DEPTH-SHIFT factor at (...,0.7, 0.8, ...)  ? "
        LOCATE 14, 10
        PRINT "* Change Number of Layers/Cycle from 6 to (5.5, 6.5, etc.)"
        LOCATE 16, 10
        PRINT "* Fix Last Layer Resistivity at .......? "
        GOSUB YsNo
        IF A$ = Es$ THEN GOTO MainMnu
        IF A$ = "Y" THEN
                LOCATE 20, 10
                COLOR 7, 0
                PRINT " IF NO CHANGE press <ENTER>, ELSE type REQUIRED VALUE. "
                COLOR 7, 1
```

```
            LOCATE 12, 67
            LINE INPUT A$
            IF A$ <> "" THEN Shift = VAL(A$)
            LOCATE 14, 72
            LINE INPUT A$
            IF A$ <> "" THEN Compress = VAL(A$)
            LOCATE 16, 60
            LINE INPUT A$
            IF A$ <> "" THEN FixRhoN = VAL(A$)
        END IF

DoAto:
        CLS
        CNTR 3, " AUTOMATIC INTERPRETATION WORKING "
        LOCATE 5, 1

Init:
        Squish = 10 ^ (1 / Compress) ' MULTIPLIER FOR GENERATING COMPRESSED DEPTHS
        RMSmin = 99999999   ' RMSmin= SMALLEST RMS PERCENT
        FOR j = 1 TO Layers
            Rho(j) = RhoDig(j)
        NEXT j
        IF Shift = 0 THEN
            Shift = .6
            FOR j = 1 TO 10
                Shift = Shift * .9
                GOSUB LCompress
                GOSUB LVES
                IF RMS < RMSmin THEN
                    ShiftMin = Shift
                    RMSmin = RMS
                    PRINT USING "Shift = ###.###  RMS% = ###.###"; ShiftMin, RMSmin
                ELSE
                    EXIT FOR
                END IF
            NEXT j
        Shift = ShiftMin
        END IF
        GOSUB LCompress    'COMPUTE SHIFTED AND COMPRESSED DEPTHS AND THICKNESSES
        GOSUB LVES         'COMPUTE KERNEL & VES & COMPARE Ves TO RhoDig
        GOSUB SaveLyrNVes
        RMSmin = RMS

FlipFlop:
        FOR i = 1 TO Layers
            Rho(i) = RhoDig(i) / Ves(i) * Rho(i)
        NEXT i
        GOSUB LVES                              'COMPUTE AND COMPARE
        PRINT USING " RMS% = ###.###"; RMS
        IF RMS > RMSmin THEN GOTO Replough     'FLIP FAILS TO IMPROVE
        GOSUB SaveLyrNVes
        IF (RMSmin / RMS - 1) * 100 < 5 THEN GOTO Replough
        RMSmin = RMS
        IF RMSmin < Ft OR Iterate > Max THEN GOTO Graphics
        Iterate = Iterate + 1
        GOTO FlipFlop          ' FLIP-FLOP SOME MORE
```

```
Replough:
        IF Replough = 1 THEN GOTO Graphics
        CLS
        CNTR 3, " INTERPRETING SMOOTHED CURVE ..... "
        LOCATE 5, 1
        FOR i = 1 TO Layers
                RhoDig(i) = Vesf(i)
        NEXT i
        Replough = 1
        Ft = 1
        GOTO Init

'-------------------------------------------------------------------------
LCompress:
        depth(1) = AbDig(1) * Shift
        Thick(1) = depth(1)
        FOR i = 2 TO Layers
                depth(i) = AbDig(i) * Shift
                depth(i) = depth(i - 1) * Squish
                Thick(i) = depth(i) - depth(i - 1)
        NEXT i
        depth(Layers) = 99999
RETURN

'-------------------------------------------------------------------------
LVES:
        IF FixRhoN <> 0 THEN Rho(Layers) = FixRhoN
        CALL Kernel(Layers, Xamda(), Thick(), Rho(), Vv(), Nrad)
        CALL Conves(Vv(), Ves(), Nrad, Xk(), Nk)
        CALL RMS1(RhoDig(), Ves(), RMS, Layers)
RETURN

'-------------------------------------------------------------------------
SaveLyrNVes:
        FOR i = 1 TO Layers
                 Vesf(i) = Ves(i)
                 Rhof(i) = Rho(i)
                 Depthf(i) = depth(i)
                 Thickf(i) = Thick(i)
        NEXT i
RETURN

'-------------------------------------------------------------------------
Graphics:
        GOSUB IntrPlt
        IF Dir$ = "" THEN GOTO Listen
        CLRLNE 1
        LOCATE 1, 10
        PRINT " SAVE LAYERING ? (Y/N/<Esc>) "
        GOSUB YsNo
        IF A$ = Es$ THEN GOTO MainMnu
        IF A$ = "Y" THEN
                CLRLNE 1
                LOCATE 1, 20
                PRINT "SAVING ......."
```

```
                FILENAME$ = LEFT$(FILENAME$, INSTR(FILENAME$, ".")) + "LYR"
                OPEN DD$ + "\" + Dir$ + "\" + FILENAME$ FOR OUTPUT AS #2
                PRINT #2, TITLE$
                PRINT #2, ABUnit$
                PRINT #2, Layers
                FOR i = 1 TO Layers
                        PRINT #2, Depthf(i), Rhof(i)
                NEXT i
                CLOSE #2
                CLRLNE 1
                LOCATE 1, 1
                        PRINT TITLE$; " saved as: ";
                        PRINT " "; FILENAME$; " "; " Press Any Key to Continue"
                        WHILE INKEY$ = "": WEND
        END IF
Listen:
        CLRLNE 1
        LOCATE 1, 10
        PRINT " LIST RESULTS & DUMP GRAPHICS on printer ? (Y/N/<Esc>) "
        GOSUB YsNo
        IF A$ = Es$ OR A$ = "N" THEN GOTO Whatnow
        GOSUB PrntrRdy
        nspc = 14
        IF convert$ = "Y" THEN nspc = 6
        LPRINT : LPRINT SPC(nspc); TITLE$; "  (INTERPRETATION)": LPRINT
        XNu = INT(Layers / 2)
        XNm = Layers / 2
                IF convert$ = "N" OR convert$ = "" THEN
                        form5$ = "            #####.##      #####.##     #####.##     #####.##"
                        form6$ = "                                       #####.##     #####.##"
                        LPRINT "              DEPTH         RESIS.       DEPTH        RESIS."
                        LPRINT
                        FOR i = 1 TO XNu
                                LPRINT USING form5$; Depthf(i), Rhof(i), Depthf(i + XNu), Rhof(i + XNu) NEXT i
                        IF XNm > XNu THEN LPRINT USING form6$; Depthf(Layers), Rhof(Layers)
                ELSE
                        formm$ = "      DEPTH, m (   ft   )      RESIS.   DEPTH, m (   ft   )     RESIS."
                        form7$ = "      #####.## (#####.##)    #####.##   #####.## (#####.##)   #####.##"
                        form8$ = "                                        #####.## (#####.##)   #####.##"
                        LPRINT formm$: LPRINT
                        FOR i = 1 TO XNu
                                LPRINT USING form7$; Depthf(i), Depthf(i) / con1, Rhof(i), Depthf(i + XNu); Depthf(i + XNu
/ con1, Rhof(i + XNu)
                        NEXT i
                        IF XNm > XNu THEN LPRINT USING form8$; Depthf(Layers); Depthf(Layers); Rhof(Layers)
                END IF
        GOSUB DmpGrfxMsg

Whatnow:
                VesTyp$ = "DGT"
                NAPR = NAB2
                Replough = 0
                FOR i = 1 TO NAB2
                        RhoDig(i) = RhoDig1(i)
                        AB2(i) = AbDig(i)
                        PsOb(i) = RhoDig1(i)
```

```
            NEXT i
            SETSCRN
            LOCATE 6, 12
            PRINT "Do you wish to: "
            LOCATE 8, 12
            PRINT "1. "; : HIGHL " ENTER "
            PRINT " sounding from the ";
            HIGHL " SAME AREA. "
            LOCATE 10, 12
            PRINT "2. "; : HIGHL " LOAD "
            PRINT " sounding from the ";
            HIGHL " SAME AREA. "
            LOCATE 12, 12
            PRINT "3. "; : HIGHL " DISPLAY "
            PRINT " digitized sounding to edit & reinterpret. "
            LOCATE 14, 12
            PRINT "4. "; : HIGHL " REINTERPRET "
            PRINT " same sounding using "; : HIGHL " DIFFERENT OPTIONS. "
            LOCATE 16, 12
            PRINT "5. "; : HIGHL " RETURN TO MAIN MENU. "
            LOCATE 18, 12
            PRINT "6. "; : HIGHL " QUIT. "
            k = PrssNmbr(6)
            ON k GOTO ABUnit, LodVes, Plt, Options, MainMnu, Kwit

'-------------------------------------------------------------------------
ChVsNmbr:
        IF Edt = 0 THEN RETURN
        CLRLNE 1
        LOCATE 1, 10: PRINT "Modify sounding number = "; VesNum$; " ? (Y/N/<Esc>)"
        GOSUB YsNo
        IF A$ = Es$ THEN GOTO MainMnu
        IF A$ = "Y" THEN
                CLRLNE 1
                LOCATE 1, 10
                LINE INPUT "Enter NEW sounding number (4 char. max) ", A$
                GOSUB CapNTrim
                IF A$ = "" THEN BEEP: GOTO ChVsNmbr
                VesNum$ = LEFT$(A$, 4)
                FOR i = LEN(TITLE$) TO 1 STEP -1
                        IF MID$(TITLE$, i, 1) = " " THEN
                                TITLE$ = LEFT$(TITLE$, i) + VesNum$
                                i = 1
                        END IF
                NEXT i
                FILENAME$ = LEFT$(Dir$, 4) + VesNum$ + "." + VesTyp$
        END IF
RETURN

'-------------------------------------------------------------
SaveIt:
        IF DD$ = "" OR Dir$ = "" THEN
                CLRLNE 1
                BEEP
                LOCATE 1, 10
                PRINT " Can't Save! Drive or Directory not specified."
```

```
            RETURN
        END IF
        GOSUB ChVsNmbr
        CLRLNE 1
        LOCATE 1, 10: PRINT " SAVING ....."
        OPEN DD$ + "\" + Dir$ + "\" + FILENAME$ FOR OUTPUT AS #1
        PRINT #1, TITLE$
        PRINT #1, ABUnit$
        FOR i = 1 TO NAB2
            PRINT #1, AB2(i), PsOb(i)
        NEXT i
        CLOSE #1
        CLRLNE 1
        LOCATE 1, 1
            PRINT TITLE$; " saved as: ";
            PRINT " "; FILENAME$; " "; " Press Any Key to Continue"
            WHILE INKEY$ = "": WEND
RETURN

'-------------------------------------------------------------------------
FldPlt:
        CRVPLT = true
        GRAPHSET GR$
        SETCOORD AX(), AY(), AB2(), PsOb(), NAB2
        CALL Logplt(AX(), AY())
        ABX(1) = ALGT(AB2(1)): PSY(1) = ALGT(PsOb(1))

PltCrv:
        FOR i = 2 TO NAB2
            IF AB2(i - 1) < AB2(i) THEN
                ABX(i) = ALGT(AB2(i))
                PSY(i) = ALGT(PsOb(i))
                LINE (ABX(i - 1), PSY(i - 1))-(ABX(i), PSY(i))
            ELSEIF AB2(i - 1) >= AB2(i) THEN
                ABX(i) = ALGT(AB2(i))
                PSY(i) = ALGT(PsOb(i))
            END IF
        NEXT i
        GOSUB PltCrcl
        LOCATE 2, 28
        PRINT "o--o--o"
        LOCATE 3, 26
        IF VesTyp$ = "DGT" THEN PRINT "DIGITIZED CURVE" ELSE PRINT "FIELD CURVE"
        GOSUB Lbl
        CRVPLT = FALSE
RETURN

'-------------------------------------------------------------------------
Wtr:    A$ = INKEY$: IF A$ = "" THEN GOTO Wtr
        RETURN

'-------------------------------------------------------------------------
CapNTrim:
        A$ = UCASE$(A$)
        TEST$ = ""          'remove delimiters
        FOR i = 1 TO LEN(A$)
```

```
            ZZ = ASC(MID$(A$, i, 1))
            IF (ZZ >= 48 AND ZZ <= 57) OR (ZZ >= 65 AND ZZ <= 90) THEN TEST$ = TEST$ + CHR$(ZZ)
        NEXT i
         A$ = TEST$
RETURN

'---------------------------------------------------------------------
YsNo:
        A$ = CAPNWT$
        IF A$ = "Y" OR A$ = "N" OR A$ = Es$ THEN RETURN
        BEEP
        GOTO YsNo

'---------------------------------------------------------------------
NtEql:
        BEEP
        CLR5L
        CNTR 24, " Number of AB/2 is NOT EQUAL to number of APP.RHO!! "
        PRSSANYKY
        CLR5L
        RETURN

'---------------------------------------------------------------------
PrntrRdy:
        CLRLNE 1
        LOCATE 1, 5: PRINT "Make sure printer is on, Adjust Paper, press <ENTER> when ready"
        WHILE INKEY$ <> CHR$(13): WEND
RETURN

'---------------------------------------------------------------------
DmpGrfxMsg:
        CLRLNE 1
        PRTSCR
RETURN

'---------------------------------------------------------------------
IntrPlt:
        Intrp = 1
        GRAPHSET GR$
        SETCOORD AX(), AY(), AbDig(), Vesf(), Layers
        CALL Logplt(AX(), AY())
        ABX(1) = ALGT(AbDig(1)): PSY(1) = ALGT(Vesf(1))
        FOR i = 2 TO Layers
            ABX(i) = ALGT(AbDig(i))
            PSY(i) = ALGT(Vesf(i))
            LINE (ABX(i - 1), PSY(i - 1))-(ABX(i), PSY(i))
        NEXT i
        RAD = .03
        FOR i = 1 TO Layers
            CIRCLE (ABX(i), ALGT(RhoDig1(i))), RAD
        NEXT i
        LINE (ALGT(Depthf(1) / 10), ALGT(Rhof(1)))-(ALGT(Depthf(1)), ALGT(Rhof(1)))
        FOR i = 2 TO Layers
            LINE -(ALGT(Depthf(i - 1)), ALGT(Rhof(i)))
            LINE -(ALGT(Depthf(i)), ALGT(Rhof(i)))
        NEXT i
```

```
        LOCATE 2, 28
        PRINT "o  o  o", " ---------"
        LOCATE 3, 26
        PRINT "DIGITIZED", "CALCULATED"
        GOSUB Lbl
        Intrp = 0
RETURN

'-------------------------------------------------------------------------
PltCrcl:
        RAD = .03
        FOR i = 1 TO NAB2
                CIRCLE (ABX(i), PSY(i)), RAD
        NEXT i
RETURN

'-------------------------------------------------------------------------
Lbl:
        LOCATE 3, (79 - LEN(TITLE$)): PRINT TITLE$
        LOCATE 4, 24 - LEN(STR$(AY(4))): PRINT AY(4)
        LOCATE 10, 24 - LEN(STR$(AY(3))): PRINT AY(3)
        LOCATE 16, 24 - LEN(STR$(AY(2))): PRINT AY(2)
        LOCATE 22, 24 - LEN(STR$(AY(1))): PRINT AY(1)
        LOCATE 23, 24: PRINT AX(1)
        LOCATE 23, 37: PRINT AX(2)
        LOCATE 23, 50: PRINT AX(3)
        LOCATE 23, 63: PRINT AX(4)
        LOCATE 23, (78 - INT(ALGT(AX(5)))): PRINT AX(5);

Lbl2:
        LOCATE 3, (79 - LEN(TITLE$)): PRINT TITLE$       ' modified title
        LOCATE 25, 35: PRINT "ELECTRODE SPACING (AB/2)";
        IF Intrp = 1 THEN PRINT ", OR DEPTH,";
        PRINT " IN " + ABUnit$;
        LOCATE 5, 17: PRINT "R"
        LOCATE 6, 17: PRINT "E"
        LOCATE 7, 17: PRINT "S"
        LOCATE 8, 17: PRINT "I"
        LOCATE 9, 17: PRINT "S"
        LOCATE 10, 17: PRINT "T"
        LOCATE 11, 17: PRINT "I"
        LOCATE 12, 17: PRINT "V"
        LOCATE 13, 17: PRINT "I"
        LOCATE 14, 17: PRINT "T"
        LOCATE 15, 17: PRINT "Y"
        LOCATE 18, 17: PRINT "O"
        LOCATE 19, 17: PRINT "H"
        LOCATE 20, 17: PRINT "M"
        LOCATE 21, 17: PRINT "!"
        LOCATE 22, 17: PRINT "M"
RETURN

'-------------------------------------------------------------------------
Dsply:
        SETSCRN
        xx = 5: y = 4: X = 6: i = 1: Q = 1
```

```
DsplABHdr:
        LOCATE 2, xx - 2: PRINT "#"
        LOCATE 2, xx: HIGHL " AB/2 "

DsplABNmbr:
        LOCATE y, X - 4: COLOR 3, 1: PRINT Q;
        LOCATE y, X: HIGHL STR$(AB2(i))
        Q = Q + 1
        IF i = NAB2 THEN
                y = 4
                xx = 18
                X = 18
                i = 1
                GOTO DsplRoHdr
        END IF
        i = i + 1
        IF y = 18 THEN
                y = 4
                xx = xx + 26
                X = X + 26
        ELSE
                y = y + 1
        END IF
        GOTO DsplABNmbr

DsplRoHdr:
                LOCATE 2, xx - 2: PRINT "#"
                LOCATE 2, xx
                HIGHL " APP.RHO "

DsplRoNmbr:
                LOCATE y, X - 4
                COLOR 3, 1: PRINT Q
                LOCATE y, X
                HIGHL STR$(PsOb(i))
        IF i = NAPR THEN RETURN
        i = i + 1
        Q = Q + 1
        IF y = 18 THEN
                y = 4
                xx = xx + 25
                X = X + 25
        ELSE
        y = y + 1
        END IF
        GOTO DsplRoNmbr

'-------------------------------------------------------------------------
Kwit:
        CLS
        LOCATE 12, 20
        PRINT "Are you sure you want to QUIT ? (Y/N/<Esc>)"
        GOSUB YsNo
        IF A$ = Es$ OR A$ = "N" THEN GOTO MainMnu
        IF A$ = "Y" THEN CLS : SYSTEM
```

```
'-------------------------------------------------------------------------
ChkError:
        IF ERR = 5 AND CRVPLT THEN
                E = true
                RESUME NEXT
        END IF
        IF ERR = 11 THEN
                BEEP
                SETSCRN
                LOCATE 16, 21: PRINT " Division by Zero !"
                PRSSANYKY
                RESUME MainMnu
        END IF
        IF ERR = 25 THEN
                BEEP
                SETSCRN
                LOCATE 10, 10
                PRINT " PRINTER trouble! ....."
                PRSSANYKY
                RESUME MainMnu
        END IF
        IF ERR = 57 THEN
                CLS
                BEEP
                LOCATE 16, 21
                PRINT "Unformatted disk in selected drive!"
                PRSSANYKY
                RESUME DrvMnu
        END IF
        IF ERR = 64 THEN BEEP: RESUME LodFile
        IF ERR = 68 AND chkdrive$ = "CHKDRIVE" THEN
                BEEP
                LOCATE 16, 21
                PRINT "Drive ("; DD$; ") not found"
                CLOSE #1
                PRSSANYKY
                RESUME DrvMnu
        END IF
        IF ERR = 75 AND chkdir$ = "dir" OR ERR = 76 AND chkdir$ = "dir" THEN 'dir exists
                chkdir$ = ""
                RESUME NEXT
        END IF
        IF ERR = 75 AND chkdir$ = "LOD" OR ERR = 76 AND chkdir$ = "LOD" THEN 'dir exists
                chkdir$ = ""
                RESUME LodYes
        END IF
        IF ERR = 70 THEN
                CLS
                BEEP
                LOCATE 10, 20
                PRINT " DISK WRITE PROTECTED ?"
                PRSSANYKY
                RESUME MainMnu
        END IF
        IF ERR = 71 THEN
```

```
                BEEP
                LOCATE 16, 21
                PRINT "Drive ("; DD$; ") NOT READY, Door Open or No Disk in Drive!"
                CLOSE #1
                PRSSANYKY
                RESUME DrvMnu
        END IF
        IF ERR = 53 AND chkdrive$ = "CHKDRIVE" THEN RESUME NEXT
        IF ERR = 53 AND ChkFil = 1 THEN ChkFil = 0: RESUME NEXT
        IF ERR = 53 THEN
                BEEP
                CLS
                LOCATE 10, 16: PRINT "File NOT FOUND ...."
                PRSSANYKY
                RESUME LodVes
        END IF
        SETSCRN
        PRINT "Can't do what you want. Error number = "; ERR, ERL
        PRSSANYKY
        RESUME MainMnu

'-------------------------------------------------------------------------
PrtAbDgt:
        LOCATE y, X - 4: PRINT i
        LOCATE y, X: PRINT AbDig(i)
        RETURN

'-------------------------------------------------------------------------
ShftNDig:
          CLRLNE 1
          Isgmnt = 1
          LOCATE 1, 1
          LINE INPUT "Which segment remains fixed (Default is 1) ? <ENTER> ", Isegmnt$
          Isegmnt = VAL(Isegmnt$)
          IF Isegmnt$ = "" THEN Isegmnt = 1
          IF Isegmnt = 0 OR LEN(Isegmnt$) > 1 THEN BEEP: GOTO ShftNDig
          NPTS = NAB2
          CALL Shft(AB2(), PsDb(), NPTS, absh(), obsh(), nsh, Isegmnt)
        FOR i = 1 TO nsh
                absh(i) = ALGT(absh(i))
                obsh(i) = ALGT(obsh(i))
        NEXT i
        temp = 0
        CALL Spline1(nsh, temp, absh(), obsh(), A(), B(), C(), temp, D(), p(), S())
        Delx = 1 / 6
        CALL Cubic1(nsh, absh(), obsh(), A(), B(), C(), Delx, AbDig(), Ps(), NAB2)
        FOR i = 1 TO NAB2
                AbDig(i) = 10 ^ AbDig(i)
                RhoDig(i) = 10 ^ Ps(i)
        NEXT i
        Radmin = AbDig(1)
        Layers = NPTS
        FOR i = 1 TO NAB2 - 1
LINE (ALGT(AbDig(i)), ALGT(RhoDig(i)))-(ALGT(AbDig(i + 1)), ALGT(RhoDig(i + 1)))
        NEXT i
        IF DD$ = "" OR Dir$ = "" THEN
```

```
                CLRLNE 1
                LOCATE 1, 1: PRINT " Press any key to continue ..."
                WHILE INKEY$ = "": WEND
                RETURN
        END IF
        CLRLNE 1
        LOCATE 1, 10: PRINT "Save DIGITIZED  curve ? (Y/N/<Esc>"
        GOSUB YsNo
        IF A$ = Es$ THEN GOTO MainMnu
        IF A$ = "Y" THEN
                GOSUB ChVsNmbr
                FILENAME$ = LEFT$(FILENAME$, INSTR(FILENAME$, ".")) + "DGT"
                CLRLNE 1
                LOCATE 1, 10: PRINT " SAVING ..... "
                OPEN DD$ + "\" + Dir$ + "\" + FILENAME$ FOR OUTPUT AS #1
                PRINT #1, TITLE$
                PRINT #1, ABUnit$
                FOR i = 1 TO NAB2
                        PRINT #1, AbDig(i), RhoDig(i)
                NEXT i
                CLOSE #1
                CLRLNE 1
                LOCATE 1, 1
                PRINT TITLE$ + " saved as: " + " " + FILENAME$ + " " + " Press Any Key To Continue"
                WHILE INKEY$ = "": WEND
        END IF
RETURN

SUB CHKGRAPH (E, GR$) STATIC
        E = FALSE
        SCREEN 9
        IF NOT E THEN GR$ = "E": EXIT SUB
        E = FALSE
        SCREEN 10
        IF NOT E THEN GR$ = "M": EXIT SUB
        E = FALSE
        SCREEN 2
        IF NOT E THEN GR$ = "C": EXIT SUB
        GR$ = "N"
END SUB

SUB GRAPHSET (GR$) STATIC
IF GR$ = "C" THEN
        CLS
        SCREEN 2
        VIEW (200, 45)-(630, 170)
ELSE
        CLS
        IF GR$ = "E" THEN SCREEN 9:                     ELSE SCREEN 10
        VIEW (200, 45)-(630, 300)
END IF
END SUB

SUB UPSORT (A$(), N) STATIC
                        k = 2: M = N - 1
SORT1:   IF M < INT(N / 2) THEN EXIT SUB
```

```
                    IF A$(k - 1) > A$(M + 1) THEN SWAP A$(k - 1), A$(M + 1)
                    FOR i = k TO M
                            IF A$(i) > A$(M + 1) THEN
                                    SWAP A$(i), A$(M + 1)
                            ELSEIF A$(i) < A$(k - 1) THEN
                                    SWAP A$(i), A$(k - 1)
                            END IF
                    NEXT i
                    k = k + 1
                    M = M - 1
                    GOTO SORT1
END SUB



' ***************** ATOSUB.BAS MODULE ******************

DECLARE SUB HIGHL (A$)
DECLARE FUNCTION LOGAV! (A!, B!)
DECLARE SUB CLRLNE (I%)
DECLARE SUB CNTR (YT!, A$)
DECLARE FUNCTION PrssNmbr% (N%)
DECLARE FUNCTION CAPNWT$ ()
DECLARE FUNCTION ALGT! (X!)
DECLARE FUNCTION DROUND! (tx1!, ty1!)

DEFINT I-N
FUNCTION ALGT (X) STATIC
   ALGT = LOG(X) / LOG(10)
END FUNCTION

FUNCTION CAPNWT$ STATIC
Cap:
   A$ = INKEY$: IF A$ = "" THEN GOTO Cap
   IF A$ = CHR$(27) THEN GOTO cdone
   IF A$ = CHR$(13) THEN GOTO cdone
   A$ = UCASE$(A$)
   IF A$ < "A" OR A$ > "Z" THEN BEEP: GOTO Cap
cdone: CAPNWT$ = A$
END FUNCTION

SUB CLR5L STATIC
    COLOR 7, 1
    CLRLNE 21
    CLRLNE 22
    CLRLNE 23
    CLRLNE 24
    CLRLNE 25
END SUB

SUB CLRLNE (I) STATIC
LOCATE I, 1: PRINT STRING$(79, " ");
END SUB

SUB CNTR (YT, A$) STATIC
    XT = (80 - LEN(A$)) / 2
```

```
    LOCATE YT, XT: HIGHL A$
END SUB

SUB Conves (Vv(), Ves(), Nrad, Xk(), Nc) STATIC
   M = 0
   L = 1
   L1 = Nc
Cnvlv:
   Vs = 0
   FOR J = L TO L1
      Vs = Vs + Vv(J) * Xk(J - M)
   NEXT J
   Ves(L) = Vs
   L = L + 1
   L1 = L1 + 1
   M = M + 1
   IF L1 <= Nrad GOTO Cnvlv
END SUB

SUB Cubic1 (M, X(), Y(), A(), B(), C(), Delx, xx(), Yy(), K) STATIC
   Xmax = X(M)
   Xmin = X(1)
   K = INT(DROUND((Xmax - Xmin) / Delx, 5)) + 1
   IF K < 1 THEN GOTO L9
   I = M
   xx(K) = Xmax
   Yy(K) = Y(M)
   FOR L = 1 TO K - 1
      J = K - L
      xx(J) = Xmax - (K - J) * Delx
L7:
      IF DROUND(xx(J), 5) >= DROUND(X(I - 1), 5) THEN GOTO L8
      I = I - 1
      GOTO L7
L8:
      Z = xx(J) - X(I - 1)
      Yy(J) = Y(I - 1) + ((C(I - 1) * Z + B(I - 1)) * Z + A(I - 1)) * Z
   NEXT L
   EXIT SUB
L9:
   PRINT "ERROR IN CUBIC1"

END SUB

SUB DELAY (B) STATIC
A = TIMER
WHILE TIMER - A < B: WEND
END SUB

FUNCTION DROUND (tx1, ty1) STATIC
DROUND = INT(.5 + (tx1 * (10 ^ ty1))) / (10 ^ ty1)
END FUNCTION

SUB HIGHL (A$) STATIC
COLOR 0, 7
PRINT A$;
```

```
COLOR 7, 1
END SUB

SUB Kernel (L, X(), t(), R(), V(), N) STATIC
   FOR J = 1 TO N
       B = 1
       A = -2 / X(J)
       FOR I = L TO 2 STEP -1
          C = B * R(I)
          D = A * t(I - 1)
          IF D < -10 THEN B = 1: GOTO nxt
          Q = (R(I - 1) - C) / (R(I - 1) + C) * EXP(D)
          B = (1 - Q) / (1 + Q)
nxt:     NEXT I
       V(J) = B * R(1)
   NEXT J
END SUB

DEFSNG I-N
FUNCTION LOGAV (A, B) STATIC
LOGAV = 10 ^ ((ALGT(A) + ALGT(B)) / 2)
END FUNCTION

SUB Logplt (AX(), AY()) STATIC
 x0 = ALGT(AX(1)): xm = ALGT(AX(5))
 y0 = ALGT(AY(1)): ym = ALGT(AY(4))
 WINDOW (x0, y0)-(xm, ym)
 t = .065
FOR I = 1 TO 5
   X = x0 + I - 1
   x1 = 10 ^ X
   LINE (X, y0)-(X, ym)
   FOR J = 2 TO 9
   x2 = ALGT(x1 * J)
   LINE (x2, y0)-(x2, y0 + t)
   LINE (x2, ym - t)-(x2, ym)
   NEXT J
NEXT I
t = .05
FOR I = 1 TO 4
   Y = y0 + I - 1
   y1 = 10 ^ Y
   LINE (x0, Y)-(xm, Y)
   FOR J = 2 TO 9
      y2 = ALGT(y1 * J)
      LINE (x0, y2)-(x0 + t, y2)
      LINE (xm - t, y2)-(xm, y2)
   NEXT J
NEXT I
END SUB

DEFINT I-N
SUB LVES (A(), B(), N, t$, U$, K) STATIC
   INPUT #1, t$
   INPUT #1, U$
      FOR I = 1 TO 45
```

```
        IF EOF(K) THEN EXIT FOR
        INPUT #K, A(I), B(I)
      NEXT I
      N = I - 1
   CLOSE #1
END SUB

SUB ONEILL (Xk(), N) STATIC
   Xk(1) = -.000318
   Xk(2) = .002072
   Xk(3) = -.004978
   Xk(4) = .01125
   Xk(5) = -.02521
   Xk(6) = .05812
   Xk(7) = -.1436
   Xk(8) = .393
   Xk(9) = -1.1324
   Xk(10) = 2.7044
   Xk(11) = -3.4507
   Xk(12) = .4248
   Xk(13) = 1.1817
   Xk(14) = .6194
   Xk(15) = .2374
   Xk(16) = .08688
   Xk(17) = .0235
   Xk(18) = .01284
   Xk(19) = -.001198
   Xk(20) = .003042
   N = 20
END SUB

DEFSNG I-N
SUB PRSSANYKY
   LOCATE 25, 1: PRINT STRING$(78, " ");
   CNTR 25, " Press Any Key to Continue "
   WHILE INKEY$ = "": WEND
END SUB

DEFINT I-N
FUNCTION PrssNabr% (N) STATIC
Prss:
    LOCATE 25, 26
    COLOR 0, 7: PRINT " Please Press Appropriate Number "; : COLOR 7, 1
    A$ = INKEY$
    WHILE A$ = "": A$ = INKEY$: WEND
    K = VAL(A$)
    IF K < 1 OR K > N THEN BEEP: GOTO Prss
   PrssNabr% = K
END FUNCTION

SUB RMS1 (RhoDig(), Ves(), RMS, Layers) STATIC
   RMS = 0
   FOR I = 1 TO Layers
   RMS = ((RhoDig(I) - Ves(I)) / RhoDig(I)) ^ 2 + RMS
   NEXT I
   RMS = (RMS / Layers) ^ .5 * 100
```

```
END SUB

SUB SETCOORD (AX(), AY(), X(), Y(), N) STATIC
   AX(1) = 10 ^ INT(ALGT(X(1)))
   FOR I = 2 TO 5
      AX(I) = AX(I - 1) * 10
   NEXT I
   IF AX(4) > X(N) THEN
      FOR I = 1 TO 5
         AX(I) = AX(I) / 10
      NEXT I
   END IF
   RhoMin = Y(1)
   RhoMax = Y(1)
   FOR I = 1 TO N
      IF Y(I) < RhoMin THEN RhoMin = Y(I)
      IF Y(I) > RhoMax THEN RhoMax = Y(I)
   NEXT I
   AVRHO = EXP((LOG(RhoMin) + LOG(RhoMax)) / 2)
   AY(1) = 10 ^ INT(ALGT(AVRHO)) / 10
   FOR I = 2 TO 4
      AY(I) = AY(I - 1) * 10
   NEXT I
END SUB

SUB SETSCRN STATIC
   SCREEN 0
   COLOR 7, 1
   CLS
END SUB

SUB Shft (ab(), ob(), npts, absh(), obsh(), nsh, iseg) STATIC
   DIM sgant(15)
   J = 1
   I = 1
   absh(1) = ab(1)
   obsh(1) = ob(1)
   nsgant = 1
   amult = 1
   sgant(1) = 1
   s1 = ab(1)
lshift1:
   I = I + 1
   IF I > npts THEN GOTO doneshift
   IF ab(I) > s1 THEN
      J = J + 1
      absh(J) = ab(I)
      obsh(J) = ob(I) * amult
      s1 = ab(I)
   ELSEIF ab(I) = s1 THEN
      amult = obsh(J) / ob(I)
      nsgant = nsgant + 1
      sgant(nsgant) = amult
   ELSE
   END IF
   GOTO lshift1
```

```
doneshift:
   nsh = J
   IF iseg >= nsgmnt OR iseg < 1 THEN EXIT SUB
   I = nsgmnt - iseg + 1
   amult = sgmnt(I)
   FOR J = 1 TO nsh
      obsh(J) = obsh(J) / amult
   NEXT J
END SUB

SUB Spline1 (M, H, X(), Y(), A(), B(), C(), t, D(), P(), S()) STATIC
   IF (t < 0) OR (t > 1) OR (H < 0) OR (M < 3) THEN GOTO L999
   N = M - 1
   IF t >= 0 THEN GOTO L20
   Ne = N - 1
   IF H = 0 THEN GOTO L11
L1:
   Hh = 3 / H
   FOR I = 1 TO Ne
      B(I) = 4
      A(I) = 1
      C(I) = 1
      P(I) = Hh * (Y(I + 2) - Y(I))
   NEXT I
   P(1) = P(1) - D(1)
   P(Ne) = P(Ne) - D(2)
L3:
   C(1) = C(1) / B(1)
   P(1) = P(1) / B(1)
   FOR I = 2 TO Ne
      Mul = 1 / (B(I) - A(I) * C(I - 1))
      C(I) = Mul * C(I)
      P(I) = Mul * (P(I) - A(I) * P(I - 1))
   NEXT I
   A(Ne + t) = P(Ne)
   I = Ne - 1
L5:
   A(I + t) = P(I) - C(I) * A(I + t + 1)
   I = I - 1
   IF I >= 1 THEN GOTO L5
   IF t = 0 THEN GOTO L6
   A(1) = D(1)
   A(M) = D(2)
L6:
   IF H = 0 THEN GOTO L14
   Hh = 1 / H
   FOR I = 1 TO N
      Mul = Hh * (Y(I + 1) - Y(I))
      B(I) = Hh * (3 * Mul - (A(I + 1) + 2 * A(I)))
      C(I) = Hh * Hh * (-2 * Mul + A(I + 1) + A(I))
   NEXT I
   GOTO Rtn
L11:
   FOR I = 1 TO N
      S(I + 1) = X(I + 1) - X(I)
   NEXT I
```

```
   FOR I = 1 TO Ne
      B(I) = 2 * (S(I + 1) + S(I + 2))
      C(I) = S(I + 1)
      A(I) = S(I + 2)
      P(I) = 3 * (S(I + 1) ^ 2 * (Y(I + 2) - Y(I + 1)) + S(I + 2) ^ 2 * (Y(I + 1) - Y(I))) / (S(I + 1) * S(I + 2))
   NEXT I
   P(1) = P(1) - S(3) * D(1)
   P(Ne) = P(Ne) - S(N) * D(2)
   GOTO L3
L14:
   FOR I = 1 TO N
      Hh = 1 / S(I + 1)
      Mul = (Y(I + 1) - Y(I)) * Hh ^ 2
      B(I) = 3 * Mul - (A(I + 1) + 2 * A(I)) * Hh
      C(I) = -2 * Mul * Hh + (A(I + 1) + A(I)) * Hh ^ 2
   NEXT I
   GOTO Rtn
L20:
   Ne = N + 1
   IF H = 0 THEN GOTO L31
   Hh = 3 / H
   FOR I = 2 TO N
      P(I) = Hh * (Y(I + 1) - Y(I - 1))
      B(I) = 4
      C(I) = 1
      A(I) = 1
   NEXT I
   B(1) = 2
   B(Ne) = 2
   C(Ne) = 1
   A(Ne) = 1
   P(1) = Hh * (Y(2) - Y(1)) - .5 * H * D(1)
   P(Ne) = Hh * (Y(M) - Y(N)) + .5 * H * D(2)
   GOTO L3
L31:
   FOR I = 1 TO N
      S(I + 1) = X(I + 1) - X(I)
   NEXT I
   N1 = N - 1
   FOR I = 1 TO N1
      B(I + 1) = 2 * (S(I + 1) + S(I + 2))
      C(I + 1) = S(I + 1)
      A(I + 1) = S(I + 2)
      P(I + 1) = 3 * (S(I + 1) ^ 2 * (Y(I + 2) - Y(I + 1)) + S(I + 2) ^ 2 * (Y(I + 1) - Y(I))) / (S(I + 1) * S(I + 2))
   NEXT I
   B(1) = 2
   B(Ne) = 2
   C(1) = 1
   C(Ne) = 1
   A(Ne) = 1
   P(1) = 3 * (Y(2) - Y(1)) / S(2) - .5 * S(2) * D(1)
   P(Ne) = 3 * (Y(M) - Y(N)) / S(M) + .5 * S(M) * D(2)
   GOTO L3
L999: PRINT "ERROR IN SPLIN1"

Rtn: END SUB
```

```
' *************** This is DRCT.BAS module ******************

DECLARE SUB CNTR (YT!, A$)
DECLARE SUB HIGHL (A$)
DECLARE FUNCTION trim$ (A$)
DECLARE SUB LCATE (i%, iof%, m%)
TYPE regtype
     AX    AS INTEGER
     bx    AS INTEGER
     cx    AS INTEGER
     dx    AS INTEGER
     bp    AS INTEGER
     si    AS INTEGER
     di    AS INTEGER
     flags AS INTEGER
END TYPE
DECLARE SUB interrupt (intnum AS INTEGER, INREG AS regtype, outreg AS regtype)

DEFINT I-N
SUB DIRECT (A$(), n, p$, k) STATIC
DIM INREG AS regtype, outreg AS regtype, f AS STRING * 128
i = 0
INREG.dx = VARPTR(f)
INREG.AX = &H1A00
CALL interrupt(&H21, INREG, outreg)
INREG.AX = &H4E00
p1$ = p$ + CHR$(0)
INREG.dx = SADD(p1$)
INREG.cx = &H255
CALL interrupt(&H21, INREG, outreg)
lupe:
IF outreg.AX AND &H18 THEN GOTO done
   file$ = f$
   at$ = MID$(file$, 22, 1)
   m = ASC(at$)
   f$ = LEFT$(f$, 30) + "                "
   IF k <> 1 AND m <> 16 THEN GOTO c1
      i = i + 1
      A$(i) = trim$(MID$(file$, 31, 13))
c1:   INREG.AX = &H4F00
      CALL interrupt(&H21, INREG, outreg)
GOTO lupe
done:
   n = i
END SUB

SUB FILESLCT (nam$, f1$(), nf) STATIC
nmax = 126
IF nf = 0 THEN
   PRINT " no files exist"
   nam$ = ""
   EXIT SUB
ELSE
   n = nf
   IF n > nmax THEN n = nmax
END IF
```

```
a = 1 + INT(n / 6): nof = 2: j = 1: k = 1
IF a > 21 THEN a = 21
ist = 1
iend = n
GOSUB lst
lupp: A$ = INKEY$
   WHILE A$ = "": A$ = INKEY$: WEND
    L = LEN(A$): b = ASC(RIGHT$(A$, 1))
   IF L = 2 AND b = 72 GOTO up
   IF L = 2 AND b = 80 GOTO dwn
   IF L = 2 AND b = 75 GOTO lft
   IF L = 2 AND b = 77 GOTO rgt
   IF L = 2 AND b = 71 GOTO hme
   IF L = 2 AND b = 79 GOTO enn
   IF L = 2 AND b = 73 GOTO pup
   IF L = 2 AND b = 81 GOTO pdn
   IF b <> 13 GOTO lupp
nam$ = fl$(ist + i - 1): EXIT SUB
GOTO lupp
up:   LCATE i, nof, a: PRINT fl$(ist + i - 1): i = i - 1: IF i < 1 THEN i = n
      LCATE i, nof, a: HIGHL fl$(ist + i - 1): GOTO lupp
dwn:  LCATE i, nof, a: PRINT fl$(ist + i - 1): i = i + 1: IF i > n THEN i = 1
      LCATE i, nof, a: HIGHL fl$(ist + i - 1): GOTO lupp
lft:  LCATE i, nof, a: PRINT fl$(ist + i - 1): i = i - a: IF i < 1 THEN i = 1
      LCATE i, nof, a: HIGHL fl$(ist + i - 1): GOTO lupp
rgt:  LCATE i, nof, a: PRINT fl$(ist + i - 1): i = i + a: IF i > n THEN i = n
      LCATE i, nof, a: HIGHL fl$(ist + i - 1): GOTO lupp
hme:  LCATE i, nof, a: PRINT fl$(ist + i - 1): i = 1
      LCATE i, nof, a: HIGHL fl$(ist + i - 1): GOTO lupp
enn:  LCATE i, nof, a: PRINT fl$(ist + i - 1): i = n
      LCATE i, nof, a: HIGHL fl$(ist + i - 1): GOTO lupp
pdn:  IF iend = nf THEN GOTO lupp
      ist = ist + nmax
      iend = ist + nmax - 1
      IF iend > nf THEN iend = nf
      n = iend - ist + 1
      a = 1 + INT(n / 6)
      IF a > 21 THEN a = 21
      GOSUB lst
      GOTO lupp
pup:  IF ist = 1 THEN GOTO lupp
      ist = ist - nmax: IF ist < 1 THEN ist = 1
      iend = ist + nmax - 1
      IF iend > nf THEN iend = nf
      n = iend - ist + 1
      a = 1 + INT(n / 6)
      IF a > 21 THEN a = 21
      GOSUB lst
      GOTO lupp
lst:  CLS
      CNTR 1, " SELECT A FILE OR SELECT EXIT TO RETURN "
      FOR i = ist TO iend
         LCATE i - ist + 1, nof, a
         PRINT fl$(i);
      NEXT i
      i = 1
```

```
      LCATE i, nof, m: HIGHL fl$(ist)
      RETURN
END SUB

SUB LCATE (i, iof, m) STATIC
   n = INT((i - 1) / m)
   j = n * 13 + 1
   k = iof + i - n * m
   LOCATE k, j
END SUB

DEFSNG I-N
SUB PRTSCR STATIC
DIM INREG AS regtype, outreg AS regtype
INREG.AX = &H500
CALL interrupt(&H5, INREG, outreg)
END SUB

FUNCTION trim$ (A$) STATIC
capn:
   A$ = UCASE$(A$)
   T$ = ""'remove spaces
   FOR i = 1 TO LEN(A$)
      j = ASC(MID$(A$, i, 1))
      IF j >= 45 AND j <= 57 OR j >= 65 AND j <= 90 THEN T$ = T$ + CHR$(j)
   NEXT i
   trim$ = T$
END FUNCTION
```

APPENDIX B

```
' ********** This is main module PICKCONT.BAS **********

DECLARE SUB UPSORT (A$(), NZ)
DECLARE SUB ReadLYR (KZ, D!(), R!(), NZ, T$, u$)
DECLARE SUB LLYR (D!(), R!(), NZ, T$, u$)
DECLARE SUB CNTRES (D!(), R!(), LayersZ, DP!(), RS!(), MZ)
DECLARE SUB SLCTSOUND (D$, p$, S$(), MZ, N$, KZ)
DECLARE SUB FILESLCT (NAM$, fl$(), NZ)
DECLARE SUB DIRECT (A$(), NZ, p$, KZ)
DECLARE SUB PRSSANYKY ()
DECLARE SUB CLRLNE (iZ)
DECLARE SUB SETSCRN ()
DECLARE SUB CNTR (YT!, A$)
DECLARE SUB HIGHL (A$)
DECLARE SUB SETCNT (c!(), ncZ)
DECLARE SUB SETPATH (D$, p$, ierrZ)
DECLARE FUNCTION ALGT! (A!)
DECLARE FUNCTION LOGAV! (A!, B!)
DECLARE FUNCTION CAPNWT$ ()
DECLARE FUNCTION trim$ (A$)
DEFINT I-N
CONST FALSE = 0, TRUE = NOT FALSE, ndim = 40
DIM depth(ndim), resist(ndim), CONT(35), DP(100), RS(100)
DIM CNT(100), DPC(100), FILES$(200)
ON ERROR GOTO Errorproc
SETSCRN
SETCNT CONT(), ncnt
M1:   SETPATH Dd$, dir$, ierr
      IFRST = TRUE
M2:   SLCTSOUND Dd$, dir$, FILES$(), NF, NAM$, IFRST
      IFRST = FALSE
      IF NAM$ = "DONE" THEN
         SETSCRN
         END
      END IF
      IF NAM$ = "CHANGE DRIVE" THEN GOTO M1
      inn = FREEFILE
      OPEN Dd$ + ":\" + dir$ + "\" + NAM$ FOR INPUT AS inn
      ReadLYR inn, depth(), resist(), Layers, T$, unit$
      CNTRES depth(), resist(), Layers, DP(), RS(), M
      L = 0: i = 1: j = 1
M3:   IF i >= M THEN GOTO a6
      SLP = (ALGT(RS(i + 1)) - ALGT(RS(i))) / (ALGT(DP(i + 1)) - ALGT(DP(i)))
      IF SLP > 0 THEN
M4:      IF CONT(j) > RS(i + 1) THEN
            i = i + 1
            GOTO M3
         ELSEIF CONT(j) > RS(i) AND CONT(j) <= RS(i + 1) THEN
            L = L + 1
            CNT(L) = CONT(j)
            DPC(L) = 10! ^ (ALGT(DP(i)) + (ALGT(CONT(j)) - ALGT(RS(i))) / SLP)
         END IF
            j = j + 1
            IF j > ncnt THEN
               j = ncnt
               i = i + 1
```

```
            GOTO M3
         ELSE
            GOTO M4
         END IF
      ELSE
a4a:   IF i = 1 THEN j = ncnt
M5:      IF CONT(j) < RS(i + 1) THEN
            i = i + 1
            GOTO M3
         ELSEIF CONT(j) < RS(i) AND CONT(j) >= RS(i + 1) THEN
            L = L + 1
            CNT(L) = CONT(j)
            DPC(L) = 10! ^ (ALGT(DP(j)) + (ALGT(CONT(j)) - ALGT(RS(i))) / SLP)
         END IF
            j = j - 1
            IF j < 1 THEN
               j = 1
               i = i + 1
               GOTO M3
            ELSE
               GOTO M5
            END IF
      END IF
a6:   SETSCRN
      LPRINT : LPRINT : LPRINT "    " + T$
      LPRINT : LPRINT "    DEPTH IN    CONTOUR"
      LPRINT "     " + unit$ + "      VALUE": LPRINT
      F$ = "   #####.#     #####.#"
      G$ = "   LAST DEPTH = #####.#"
      FOR i = 1 TO L
         LPRINT USING F$; DPC(i), CNT(i)
      NEXT i
      LPRINT : LPRINT USING G$; DP(M)
      GOTO M2
END

Errorproc:
   ierr = TRUE
   LOCATE 1, 70
   HIGHL STR$(ERR)
   SELECT CASE ERR
   CASE 71
         BEEP
         CNTR 16, "    DRIVE " + Dd$ + " not ready or door open    "
e1:      CNTR 17, "press R to retry or S to select another drive"
         K = INSTR("RS", UCASE$(INPUT$(1)))
         ON K + 1 GOTO e1, e2, e3
e2:      CLRLNE 16
         CLRLNE 17
         RESUME
e3:      RESUME M1
   CASE 76
         ierr = ERR
         RESUME NEXT
   CASE ELSE
         PRINT "ERROR NUMBER "; ERR
```

```
        END
END SELECT
RESUME

SUB CNTRES (D(), R(), N, DP(), RS(), M) STATIC
   j = 1
   DP(j) = 10! ^ (ALGT(D(1)) - .5 * (ALGT(D(2)) - ALGT(D(1))))
   RS(j) = R(1)
   FOR i = 1 TO N - 1
      j = j + 1
      DP(j) = D(i)
      RS(j) = LOGAV(R(i), R(i + 1))
      j = j + 1
      DP(j) = LOGAV(D(i), D(i + 1))
      RS(j) = R(i + 1)
   NEXT i
   M = j
   DP(M) = 10! ^ (ALGT(D(N - 1)) + .5 * (ALGT(D(N - 1)) - ALGT(D(N - 2))))
END SUB

SUB LLYR (D(), R(), N, T$, u$) STATIC
SETSCRN
LOCATE 5, 5: HIGHL T$: PRINT "     UNIT= " + u$
PRINT
PRINT "  DEPTH       RESISTIVITY": PRINT
FOR i = 1 TO N
   PRINT D(i), R(i)
NEXT i
PRSSANYKY
END SUB

SUB ReadLYR (K, D(), R(), N, T$, u$) STATIC
INPUT #K, T$
INPUT #K, u$
INPUT #K, N
FOR i = 1 TO N
   INPUT #K, D(i), R(i)
NEXT i
CLOSE #K
END SUB

SUB SETPATH (D$, dr$, ierr) STATIC
DIM dir$(ndim)
set1: SETSCRN
      LOCATE 10, 10
      PRINT "type letter of DISK DRIVE "; : HIGHL " (A,B,C...etc) ": PRINT " ";
      D$ = CAPNWT$
      PRINT D$
      CHDIR D$ + ":\"
      IF ierr > 0 THEN
         BEEP
         CNTR 15, "DRIVE " + D$ + " not found"
         PRSSANYKY
         ierr = TRUE
         GOTO set1
      END IF
```

```
set2: SETSCRN
      CNTR 1, "  SELECT THE DATA SUB-DIRECTORY  "
      p$ = D$ + ":\*.*"
      DIRECT dir$(), ndir, p$, 0
      ndir = ndir + 1
      dir$(ndir) = "CHANGE DRIVE"
      FILESLCT dr$, dir$(), ndir
      IF dr$ = "CHANGE DRIVE" THEN GOTO set1
      dr$ = trim$(dr$)
END SUB

SUB SLCTSOUND (D$, p$, S$(), NS, N$, K) STATIC
   IF NOT K THEN GOTO sl1
   A$ = D$ + ":\" + RTRIM$(p$) + "\*.lyr"
   DIRECT S$(), NS, A$, 1
   UPSORT S$(), NS
   NS = NS + 1
   S$(NS) = "CHANGE DRIVE"
   NS = NS + 1
   S$(NS) = "DONE"
sl1: SETSCRN
   CNTR 1, "  SELECT A SOUNDING  "
   FILESLCT N$, S$(), NS
END SUB

SUB UPSORT (A$(), N) STATIC
        K = 2: M = N - 1
SORT1:  IF M < INT(N / 2) THEN EXIT SUB
        IF A$(K - 1) > A$(M + 1) THEN SWAP A$(K - 1), A$(M + 1)
        FOR i = K TO M
           IF A$(i) > A$(M + 1) THEN
              SWAP A$(i), A$(M + 1)
           ELSEIF A$(i) < A$(K - 1) THEN
              SWAP A$(i), A$(K - 1)
           END IF
        NEXT i
        K = K + 1
        M = M - 1
        GOTO SORT1
END SUB
```

```
' ********** This is module CONTSUB.BAS **********

DECLARE SUB PRSSANYKY ()
DECLARE SUB SETSCRN ()
DECLARE SUB CNTR (YT!, A$)
DECLARE SUB HIGHL (A$)
DECLARE FUNCTION CAPNWT$ ()
DEFINT I-N

SUB SETCNT (c(), nc) STATIC
c(1) = 1!
c(2) = 1.5
c(3) = 2!
c(4) = 3!
c(5) = 4.5
c(6) = 7!
c(7) = 10!
c(8) = 15!
c(9) = 20!
c(10) = 30!
c(11) = 45!
c(12) = 70!
c(13) = 100!
c(14) = 150!
c(15) = 200!
c(16) = 300!
c(17) = 450!
c(18) = 700!
c(19) = 1000!
c(20) = 1500!
c(21) = 2000!
c(22) = 3000!
c(23) = 4500!
c(24) = 7000!
nc = 24
END SUB
```