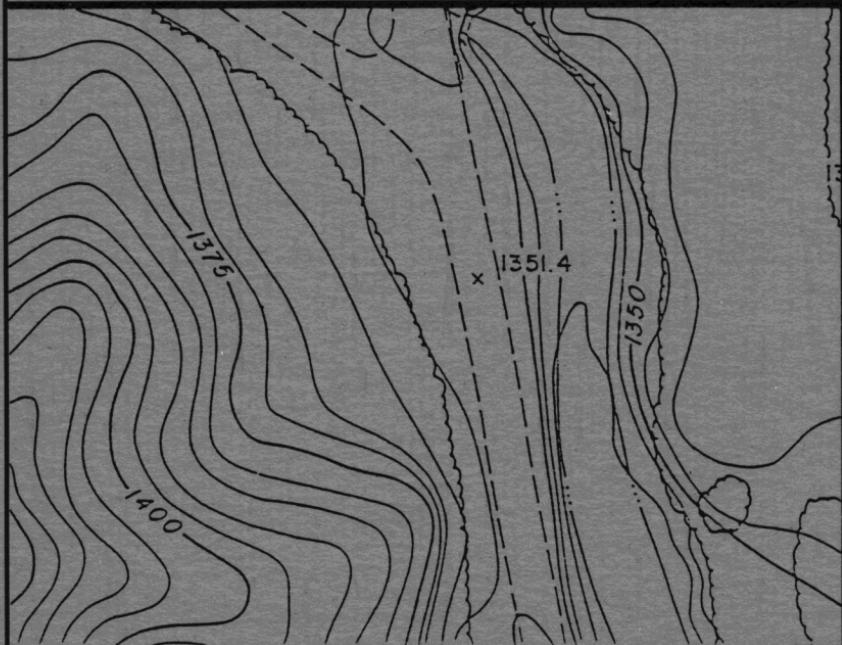


HP 42S Topography



D'Zign

TECHNICAL ASSISTANCE

The program material, instructions and procedures contained in this book assume that the user has a working knowledge of both surveying *and* the general operation of the HP-42S calculator.

Technical assistance is limited to verification of the results shown in the various examples used in this book.

If you have any questions or suggestions regarding this book, or other **D'Zign** publications, please feel free to call us. The number is (209) 297-8025, and someone is available to answer technical questions between the hours of **8:00 A.M. and Noon**, (Pacific Time Zone), **Monday through Thursday**.

Before calling for help, take a look through "*The Most Commonly Asked Questions*", on the inside of the back cover, and the comment about debugging on page 20.

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HP42S Topography

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The programs included in this booklet are designed to take full advantage of the power of the Hewlett-Packard HP42S calculator. Programming this calculator is really simple, but a bit confusing at first. We will try to walk you through some of the 'harder to find' steps as we proceed.

the operations index

To find a function for the first time, HP has provided an "Operations Index" on pages 310 through 335 of the instruction manual, which tells you exactly what keystrokes to use to type in the function you want.

Even better, this index gives you the page number that you can refer to if you want to know more about the function you are using. If, while typing in a program, you aren't sure how to input a particular function, simply refer to the Operations Index.

Another handy tool is the function catalog. When you stroke the shifted + key, a menu appears in the lower portion of the display. The leftmost key will take you into the function catalog, which contains ALL of the functions. Scroll up or down through the list until you come to the function you want, stroke the corresponding key, and the function is entered as a program step.

the programs

If this is your first try at programming the 42, we recommend that you read Chapter 8 of the manual before beginning.

The programs included in this booklet have been separated into accessible sub-programs to allow them to be used with other programs at a later date. For instance, if you are using the **HP42S Alignment & Offsets** booklet, you will find that a number of the subroutines you need for this program are already in the calculator.

A number of the subroutines will already have been input if you are using programs from the book, "**HP42S Surveying Solutions**". If a program or subroutine has the same NAME as one you already have (from any **D'Zign** publication) it is the same as the one in this book.

subroutines

Because of the way the calculator works, we will start by input of some subroutines.

Once the subroutine has been input, its name appears in the menu when you stroke **XEQ**, and all you have to do to add it as a step in the program you are typing in is stroke GTO or XEQ followed by keystroking the key corresponding to the subroutine to input the program step GTO XXX or XEQ XXX.

getting started

Begin by stroking the shift key, then the **XEQ** key. The display will show a menu which will be blank (if you haven't yet input any programs) except for **.END.** on the left. The keys just below each of the menu portions will correspond to the menu instruction above it. Stroke the key just below the **.END.** in the display.

001C 0-Byte Program
01 .END.

01LBL "YN"
02 "YES"
03 KEY 1 GTO 01
04 "NO"
05 KEY 2 GTO 02
06 MENU
07 STOP
08LBL 01
09 SF 10
10 GTO 03
11LBL 02
12 CF 10
13LBL 03
14 CLMENU
15 EXITALL
16 RTN

Next, go into **program mode** by stroking the shifted **R/S** key, and you should have a display similar to the one shown to the left. Begin typing in the program "YN" from the listing above.

quick tip

Program steps 03 and 05 use a function which stores the prompt to the menu, and at the same time assigns the key.

To access the function, stroke **PGM.FCN**

You'll receive a prompt, **KEY_**. Stroke the key number (we'll use 1 as the example), and you will get a prompt, **KEY 1 GTO__**.

In this case (step 03) answer 01 to complete the program step.

next subroutine

This one has 2 steps you'll want to review before you begin input:

02 Σ REG 00 To access this function, go to the "stat" menu (shifted divide key), and scroll down once. It's the second key from the right, and when you stroke it you will be prompted for the 00 to complete the program step.

05 CLΣ This one is the leftmost key when you bring up the menu by stroking .

To begin input, stroke the **shifted XEQ** key, then the key that corresponds to the menu listing "YN", the program just input.

Scroll upward once with the  key to put the pointer at step 00, and begin typing in the program steps shown to the right.

When you've finished stroke **EXIT** to leave program mode.

The step, **CF IND ST X**, (in the next group) is input through the **FLAGS** menu. To get to "IND", stroke the  key, then stroke it again to bring up the menu containing "ST X".

Go back into program mode (**R/S**). The program pointer should still be at step **08 RTN**. Type in the additional steps shown on the next page.

01 **LBL "CL"**
02 **Σ REG 00**
03 **CLΣ**
04 **Σ REG 11**
05 **CLΣ**
06 **0**
07 **STO 24**
08 **RTN**

09►LBL "FC0"	16►LBL 14	22 ►0.098
10 0.013	17 CF 19	23 GTO "FN0"
11►LBL "FN0"	18 CF 20	24►LBL 99
12 CF IND ST X	19 81.088	25 CLST
13 ISG ST X	20 GTO "FN0"	26 FS? 55
14 GTO "FN0"	21►LBL 89	27 SF 08
15 GTO IND ST X		

We're going to add one more step, 28 END. Input this step by stroking **XEO ENTER**, type in END, and then stroke **ENTER** again.

Input of the "END" step has separated this program from the program "YN". This general method of input will be used for almost all of the programs, starting at the 'top' of one program and then separating the two programs with an END as the last step of the new program. Using this method, we can put the programs in the menu where we want them.

cleaning house

Next, we want to do some editing that will make life easier later. Go to "YN", and then scroll upward to put the pointer at step 16, RTN. Type in a new label, "FILE".

Scroll up again to the RTN, delete it, and replace it with END the same way you just did after "FC0". This should leave the new label as the first step in the display, having separated this new label from the rest of the programming.

```

01►LBL "FILE"
02 CF 21
03 INPUT "
04 ASTO 28
05 "FILE NAME"
06 AVIEW
07 CLA
08 AON
09 STOP
10 AOFF
11 ASTO 26
12 ASHF
13 ASTO 27
14 CLA
15 CLX
16 ARCL 28
17 "DATE"
18 AVIEW
19 SF 21
20 STOP
21 STO 28
22 .END.

```

Finish typing in the program shown to the left (note that the .END. is already there, at the bottom).

Another new symbol that you'll be using a lot is the + symbol. It adds to what is already in the **alpha** register without overwriting it. To input the symbol, stroke **ENTER** to enter **alpha** mode, and then stroke **ENTER** again.

After you type in step 21, STO 28, if you scroll down one you should see the .END. as step 22. We will leave it there, in place of a regular END command; doing so will keep it out of the menu display from now on.

Another one to look at; the symbol, ↵, is "line feed".

First shot #?4" We use it to control the display. You
OMPT
ast Shot #?4" can input it by stroking
OMPT
↓



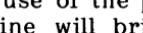
Go to "FILE", enter **program mode**, and then scroll upwards with the ▲ key until the pointer is at 21 STO 28. Now type in LBL "TOUT", scroll back up to 21 STO 28 and add an END. Stroke **EXIT** □ **XEQ TOUT** □ **R/S**, and then type in the rest of the program.

```
01LBL "TOUT"
02 XEQ "TO"
03 "First Shot #?4"
04 PROMPT
05 "Last Shot #?4"
06 PROMPT
07 1000
08 ÷
09 +
10 STO 13
11LBL a
12 SF 21
13 ADV
14 CLA
15 "Shot #"
16 FIX 00
17 CF 29
18 ARCL 13
19 SF 29
20 FIX 04
21 AVIEW
22 RCL 13
23 RCLX 01
24 RCL+ 02
25 STO 24
26 FS? 83
27 XEQ 05
28 FS? 86
29 XEQ 07
30 FS? 87
31 XEQ 06
32 ISG 13
33 GTO a
34 CLST
35 CLA
36 FIX 04
37 "END OF FILE"
38 ↵
39 ARCL 26
40 ARCL 27
41 ADV
42 AVIEW
43 RTN
44LBL 05
45 CLA
46 "H< = "
47 RCL IND 24

     48 XEQ "DMS"
     49 DSE 24
     50 STO ST X
     51 ↵ Z< =
     52 RCL IND 24
     53 XEQ "DMS"
     54 AVIEW
     55 FIX 02
     56 DSE 24
     57 STO ST X
     58 "S.D. = "
     59 ARCL IND 24
     60 ↵ ROD =
     61 DSE 24
     62 STO ST X
     63 ARCL IND 24
     64 AVIEW
     65 DSE 24
     66 STO ST X
     67 RTN
     68LBL 06
     69 ARCL IND 24
     70 DSE 24
     71 STO ST X
     72 ARCL IND 24
     73 DSE 24
     74 STO ST X
     75 ARCL IND 24
     76 ↵
     77 AVIEW
     78 RTN
     79LBL 07
     80 CLA
     81 FIX 04
     82 ADV
     83 FC? 20
     84 XEQ 01
     85 FS? 20
     86 XEQ 02
     87 AVIEW
     88 CLA
     89 DSE 24
     90 STO ST X
     91 FIX 02
     92 " EL = " 93 ARCL IND 24
     94 ↵ L
     95 AVIEW
     96 DSE 24
     97 STO ST X
     98 CLA
     99 RTN
    100LBL 01
    101 " N = "
    102 ARCL IND 24
    103 ↵ L
    104 DSE 24
    105 STO ST X
    106 ↵ E =
    107 ARCL IND 24
    108 RTN
    109LBL 02
    110 RCL IND 24
    111 CLA
    112 "Sta"
    113 XEQ "STA"
    114 DSE 24
    115 STO ST X
    116 RCL IND 24
    117 FIX 02
    118 RND
    119 X<0?
    120 SF 99
    121 FS? 99
    122 +/-"
    123 ↵ 40/5 =
    124 ARCL ST X
    125 FS? 99
    126 ↵ Left"
    127 FC?C 99
    128 ↵ Right"
    129 RTN
    130LBL 03
    131 CF 20
    132 SF 19
    133 RTN
    134LBL 04
    135 CF 19
    136 SF 20
```

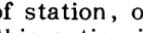
If you scroll down with ▼ you'll see that "TOUT" now has the permanent .END..

Continuing with input, the program shown to the right is a subroutine that lets you decide what type of data will be stored. This is another that may be put in on top of "YN", and it has an END to separate it when you are finished with the input.

During use of the program, this subroutine will bring up a menu bar, , as one of the prompts, allowing you to select which kinds of data you want to store.

Stroke the key beneath each of the types you want, and then stroke **R/S** to continue. This program automatically allocates the correct number of registers to hold data for each shot.

Selecting all three (raw, finished and descriptor) will use ten storage registers for each shot. The raw data stored will be the horizontal and vertical angles, the slope distance and the rod reading.

Finished data can either be as 3-dimensional coordinates or in the form of station, offset and elevation. This option is offered by this subroutine also, using the menu .

Select any (or all) of the options by stroking the keys associated with the menu selections you want and then stroke **R/S** to continue with the program.

Don't forget to proof-read as you go.

```
01▶LBL "TY"
02 CLA
03 CF 20
04 " TYPE"
05 ASTO 07
06 CLMENU
07 "COORD"
08 KEY 1 GTO 03
09 "S-0/S"
10 KEY 3 GTO 02
11 MENU
12 "SELECT TOPO"
13 ASTO 08
14 ARCL 07
15 CF 21
16 PROMPT
17▶LBL 02
18 SF 20
19▶LBL 03
20 CLMENU
21 CLA
22 "RAW"
23 KEY 1 GTO 01
24 "FIN'D"
25 KEY 3 GTO 00
26 "DESC."
27 KEY 5 GTO 05
28 MENU
29 CLA
30 ARCL 08
31 " DATA"
32 ARCL 07
33 AVIEW
34 STOP
35▶LBL 00
36 SF 86
37 2
38 GTO 04
39▶LBL 01
40 SF 83
41 1
42 GTO 04
43▶LBL 05
44 SF 87
45 4
46▶LBL 04
47 STO+ 24
48 CLX
49 AVIEW
50 STOP
51 RCL 24
52 5
53 X<>Y
54 X=Y?
55 85
56 STO 25
57 STO 24
58 SF 21
59 SF IND 24
60 CLST
61 CLMENU
62 END
```

Topography (the program) is, as you can see, a combination of shorter programs and subroutines. By keeping each program as short as possible (using separated subroutines) the 'parent' program runs faster.

01 DLBL "STA"
02 CF 29
03 FIX 00
04 STO 21
05 1E2
06 ÷
07 ENTER
08 IP
09 ARCL ST X
10 -
11 ← "+"
12 FIX 03
13 1E2
14 X
15 10
16 X>Y?
17 ← "0"
18 ARCL ST Y
19 RCL 21
20 SF 29
21 FIX 04
22 RTN

You may also add programs of your own that use these same subroutines to do a specific task just by having your program execute an already existing program. This is one that you may want to use as a subroutine for your own programs, later.

"STA" changes the number in the x-register into the form we use for stationing. It can go in right on top of "FILE".

Should you decide to use "STA" for a different program, notice that it does not have an AVIEW at the end, nor does it clear the **alpha** register before execution. Those two functions need to be added to your parent program when you use this subroutine.

We haven't added an END to the program either, because we'll be adding more to it later.

Steps 05 and 13 are input using the **E** key on the keyboard. It isn't necessary to input the 1, just stroke **E**, followed by the number (in this case, 2). Nothing will happen until you stroke the key for the next program step, usually **x** or **±**.

The next program changes the number in the x-register to the "°'" form for output of angles. It doesn't have an AVIEW either, but the clearing of the **alpha** register is optional. If you want it cleared, use the program step SF 19 before executing "DMS" as part of your program. Flag 19 is cleared by the subroutine if it is set.

This one contains an END, so it can go above any of the programs . . . why not just stick it on top of "YN"?

```
00 ( 79-Byte Prgm )
01►LBL "DMS"
02 FS?C 19
03 CLA
04 ENTER
05 STO 19
06 IP
07 CF 29
08 FIX 00
09 ARCL ST X
10 F"**"
11 -
12 100
13 X
14 ABS
15 STO 18
16 IP
17 XEQ 01
18 ARCL ST X
19 F"**"
20 RCL 18
21 FP
22 100
23 X
24 FIX 02
25 RND
26 FIX 01
27 XEQ 01
28 ARCL ST X
29 F"**"
30 CLX
31 FIX 04
32 SF 29
33 RCL 19
34 RTN
35►LBL 01
36 10
37 X<>Y
38 XXY?
39 F"0"
40 END
```

You can go right to the top of "DMS" to input this next one. Scroll up to 00 and begin input. The END will separate them when you've finished.

```
00 ( 133-Byte Prgm )
01►LBL "T0"
02 CF 62
03 SF IND 25
04 "FILE:"
05 ARCL 26
06 ARCL 27
07 XEQ 00
08 F"4"
09 F"DATE:"
10 XEQ 01
11 XEQ 02
12 AVIEW
13►LBL "T00"
14 FS? 01
15 4
16 FS? 02
17 3
18 FS? 03
19 7
20 FS? 04
21 3
22 FS? 85
23 7
24 FS? 06
25 6
26 FS? 07
27 10
28 STO 01
29 RTN
30►LBL 00
31 ALENG
32 6
33 -
34►LBL 02
35 X=0?
36 F" Not Given"
37 RTN
38►LBL 01
39 RCL 28
40 X=0?
41 RTN
42 F" "
43 AIP
44 F"/"
45 FP
46 100
47 X
48 AIP
49 F"/"
50 FP
51 100
52 X
53 AIP
54 END
```

On page 8 you input the program, "STA", and we said we'd be adding some more to it. Now is the time, and here are four short programs that go onto the bottom of "STA".

```
23LBL "REP"
24CLA
25ARCL "A"
26ARCL "B"
27ARCL "C"
28RTN
29LBL "TIN"
30ASTO "A"
31ASTO IND 24
32ASHF
33DSE 24
34STO ST X
35ASTO "B"
36ASTO IND 24
37ASHF
38DSE 24
39STO ST X
40ASTO "C"
41ASTO IND 24
42DSE 24
43STO ST X
44CLA
45RTN
46LBL "MAN"
47SF 92
48CLA
49RON
50STOP
51AOFF
52CF 22
53XEQ "STOR"
54RTN
55LBL "STOR"
56ASTO "A"
57ASHF
58ASTO "B"
59ASHF
60ASTO "C"
61ASHF
62END
```

Go to "STA" and enter **program** mode. Scroll up to put the pointer at step 22 RTN and begin typing in the programs shown to the left.

"REP" is the subroutine that lets you repeat the last label if the descriptor of the current shot is the same as the last one. This can be handy for taking a series of shots like "top of bank", because the whole descriptor is input with just the one keystroke, .

"TIN" is short for Topo IN . . it's the routine that stores the descriptor into the proper registers to allow retrieval under the proper shot number. It also stores a copy into variables A, B and C to allow the use of the repeat routine.

MAN is the subroutine for manual input of a descriptor, or the 'prefix' of a descriptor (the rest of the descriptor is added by menu keystroke). The 'automatic' menu can be as simple or as elaborate as you want to make it, and is described in detail later in this book.

The next group of subroutines handles the curves, when you are working with Station/Offset. Shots taken within the curve area are reduced to **radial** shots.

The subroutines also adjust the instrument or backsight information when either or both of them are within the curved portion of the alignment. The shots are not just output as station/offset along a straight baseline, but actually can be plotted relative to a 'real' alignment that includes a circular (horizontal) curve.

These subroutines can also go right on top of "YN".

```

00 { 302-Byte Prgm }
01 LBL "CU"
02 STO "0"
03 R↓
04 STO "S"
05 FS? 96
06 GTO 01
07 SF 95
08 "B.C. Station? "
09 PROMPT
10 STO 09
11 "Delta? "
12 PROMPT
13 X??
14 SF 05
15 ABS
16 ↑HR
17 STO 12
18 ↑RAD
19 "Radius? "
20 PROMPT
21 STO 10
22 X
23 RCL+ 09
24 STO 23
25 RCL 12
26 ↑HMS
27 FS? 05
28 +/--
29 CF 21
30 "Delta = "
31 XEQ "DMS"
32 "Radius = "
33 RCL 10
34 LBL
35 AVIEW
36 SF 21
37 RCL 12
38 2
39 ÷
40 TAN
41 RCLX 10
42 ENTER
43 RCL+ 09
44 X??
45 ENTER
46 ENTER

        47 RCL 12
        48 SIN
        49 X
        50 FS? 05
        51 +/--
        52 STO 06
        53 R↓
        54 RCL 12
        55 COS
        56 X
        57 +
        58 STO 05
        59 SF 96
        60 GTO 01
        61 LBL "CU1"
        62 X<>Y
        63 RCL 23
        64 X<Y?
        65 GTO "CU3"
        66 R↓
        67 RCL 09
        68 X<Y?
        69 GTO "CU2"
        70 R↓
        71 X<>Y
        72 GTO "CUR"
        73 LBL "CU2"
        74 -
        75 X<>Y
        76 FS? 05
        77 +/--
        78 RCL+ 10
        79 ↑POL
        80 +/--
        81 RCL+ 10
        82 X<>Y
        83 ↑RAD
        84 RCLX 10
        85 RCL+ 09
        86 X<>Y
        87 GTO "CUR"
        88 LBL "CU3"
        89 R↓
        90 RCL- 05
        91 STO 30
        92 R↓

        93 RCL- 06
        94 STO 31
        95 RCL+ 30
        96 ATAN
        97 FS? 05
        98 +/--
        99 STO 32
        100 COS
        101 RCL 30
        102 X<>Y
        103 -
        104 STO 33
        105 RCL 32
        106 RCL- 12
        107 STO 34
        108 SIN
        109 X
        110 FS? 05
        111 +/--
        112 RCL 33
        113 RCL 34
        114 COS
        115 X
        116 RCL+ 23
        117 X<>Y
        118 GTO "CUR"
        119 LBL 01
        120 RCL "S"
        121 RCL- 09
        122 RCL+ 10
        123 ↑DEG
        124 STO 19
        125 RCL 18
        126 RCL- 0*
        127 STO 18
        128 X<>Y
        129 SIN
        130 X
        131 RCL+ 09
        132 RCL 10
        133 RCL 18
        134 RCL 19
        135 COS
        136 X
        137 -
        138 END

```

After you've proof-read that set of routines, let's start with input of the main program, "**TOPO**". First, go to "**TOUT**", enter **program** mode, and then scroll upward to put the pointer at step 127, SF 20. Insert the step, LBL "**TOPO**", scroll up again, and add an END.

The new program now has the permanent end, and you can begin to type in the rest of the program. Take your time with the input, and proof-read sections of it as you go.

The portion of the program shown on pages 12 and 13 is not the whole program, but, for now, do this much of it.

NOTE: Steps 61 and 70 refer to a global label with the name " ". This label has 3 blank spaces for a name, and will be input as step 129.

61	GTO "	121	FIX 04
62	CF 21	122	CLA
63	"Curve in Topo "	123	CLMENU
64	L"Area?"	124	RTN
65	AVIEW	125	LBL 06
66	SF 21	126	SEQ "MAN"
67	SEQ "YN"	127	CF 22
68	F3? 10	128	GTO E
69	SEQ "CU"	129	LBL "
70	GTO "	130	FC?C 09
71	RTN	131	ISG 13
72	LBL 05	132	STO ST X
73	CF 21	133	RCL 13
74	"ON CURVE?"	134	RCLX 01
75	AVIEW	135	RCL+ 02
76	SEQ "YN"	136	STO 24
77	FS? 10	137	SEQ 07
78	SEQ "CU"	138	INPUT SHOT #
79	RTN	139	SEQ 09
80	LBL 50	140	"H <"
81	SEQ 07	141	KEY 1 GTO 01
82	"LABEL SHOT #"	142	"Z <"
83	KEY 2 GTO 02	143	KEY 2 GTO 02
84	SEQ 09	144	"S.D."
85	"LABEL"	145	KEY 3 GTO 03
86	KEY 1 GTO 01	146	"ROD"
87	"REPT"	147	KEY 4 GTO 04
88	KEY 3 GTO 03	148	MENU
89	"ADD"	149	STOP
90	KEY 4 GTO 04	150	LBL 01
91	"O/S"	151	FS? 83
92	KEY 5 GTO 05	152	SEQ 08
93	"MAN"	153	HR
94	KEY 6 GTO 06	154	RCL+ 00
95	MENU	155	STO 16
96	STOP	156	CLX
97	LBL 01	157	STOP
98	GTO E	158	LBL 02
99	LBL 03	159	FS? 83
100	SEQ "REP"	160	SEQ 08
101	SEQ "TIN"	161	HR
102	GTO	162	STO 17
103	LBL 04	163	STOP
104	STO 29	164	LBL 03
105	SF 90	165	STO 14
106	RTN	166	FS? 83
107	LBL 05	167	SEQ 08
108	STO 29	168	FIX 02
109	SF 91	169	RCL 15
110	RTN	170	CF 21
111	LBL 07	171	Rod =
112	CF 29	172	ARCL ST X
113	FIX 00	173	L"Y"
114	CF 21	174	AVIEW
115	RTN	175	SF 21
116	LBL 09	176	STOP
117	ARCL 13	177	LBL 04
118	AVIEW	178	STO 15
119	SF 21	179	FS? 83
120	SF 29	180	SEQ 08

Continue with the input of the additional steps below, and we'll take a breather to look at what we have so far.

The first part of the program uses subroutines to clear 'old' data and flag settings, then calls the subroutines "FILE", "TY" and "TOO". "FILE" prompts for data that will later label your output with the file name and date.

"TY" calls up the menus for selection (see page 7) of type of data to be stored. "TOO" sets the proper flags (based on your responses to the prompts so far) to have the input/output configuration stored as part of the file.

The prompts for setup information come next, the first of these being Height of Inst?. This prompt wants the actual **elevation** at the center of the scope, not the 'plus rod' from the point you are over. The prompt, Inst. **R?**, expects input of 2 pieces of data (either northing, **ENTER**, easting or station **ENTER**, offset). The same applies to the prompt for the backsight information.

If you are working in station/offset form, the additional prompt to determine if the points are on a curve will also appear, requiring a **yes** or **no** answer. If either or both of the points are on a curve, prompts for curve data input will appear.

If neither the instrument nor backsight station were on a curve a prompt to determine whether or not there is a curve in the topo area will appear.

This allows for the curved portion to be included in the calculations even if the instrument and backsight were both on a tangent.

```
181 PLBL D
182 RCL 17
183 COS
184 ACOS
185 ENTER
186 SIN
187 RCLX 14
188 FS?C 90
189 RCL+ 29
190 STO 20
191 R+
192 COS
193 RCLX 14
194 RCL+ 11
195 RCL- 15
196 STO 22
197 RCL 16
198 RCL 20
199 FS?C 91
200 XEQ 05
201 +REC
202 RCL+ 07
203 X>>Y
204 RCL+ 08
205 FS? 95
206 GTO "CU1"
207 LBL "CUR"
208 RCL 22
209 R+
210 R+
211 STO IND 24
212 DSE 24
213 STO ST X
214 R+
215 STO IND 24
216 DSE 24
217 STO ST X
218 R+
219 STO IND 24
220 DSE 24
221 STO ST X
222 SF 00
223 GTO 50
224 PLBL 05
225 RCL 29
226 X>>Y
227 ÷
228 ATAN
229 +
230 RCL 20
231 RTN
232 LBL 08
233 STO IND 24
234 DSE 24
235 STO ST X
236 RTN
```

the menu system

After the input of the rod height, the first of the menus appears, with the prompt to label the shot:

LABEL **TREE** **BLDG** **TYPE** **CALC**

This is as good a place as any to stop and discuss how the menus can be used to best advantage.

ADD is a key that allows you to 'add' or subtract from a shot in those cases where the shot could not be taken directly on the item being shot.

If, for instance, you take a shot to a 14" diameter power pole with the rod held at the face of the pole, you can input .6 and stroke this key to make the shot equivalent to a shot at the **center** of the pole.

MOVE lets you handle a problem quite often encountered when the shot is to a tree. You won't be able to see the rod through the branches, so the rodperson holds it to one side . . . let's say 6' to the left. Input **6** **✓** and use this key to adjust the shot to the **center** of the tree.

INPUT can be used to manually label a shot, or to input a prefix. The calculator is automatically put into alpha mode for input, a descriptor may be typed in, and stroking **R/S** will bring up a menu **TREE** **BLDG** **TYPE** **CALC** **ROAD**.

If the descriptor was complete, stroke **R/S** again, to complete the shot. If not completely labeled, the portion input so far will be a prefix to the rest of the descriptor.

TYPE brings up the same menu as above, without first going through **INPUT**. The first two, TREE and BLDG, add the word to the existing descriptor to complete it.

The remainder of the menu selections will bring up additional menu choices, containing **types**, then add to the descriptor after the next selection.

LAST is a timesaver if the description of the current shot is the same as the last shot. Just stroke this key and the label from the last shot is copied onto the current shot.

When you are adding the descriptor to your shot you can use the keys in combination. For instance, you can use **BB** to bring up the **alpha mode** and type in 6', stroke **R/S ESEL**. **ESEL** brings up a new menu, with options*

BARB WW BOARD PICKT STON GATE

for selection of the next part of the descriptor.

Let's say that you select "BOARD" . . . when the shots have been downloaded later, the descriptor will be printed out as "6' board fence", and the output shot will look like the one to the right.

Shot #4

Sta. 11+74.533
0/S = 3.00 Right
EL = 99.22

6' Board Fence

If you think of the menu key that just adds a word (TREE, BLDG) as **type A**, and the menu key (FENC, WALL) which adds a description and then adds a word, as being **type B**, you can see how the system can not only be customized, but also expanded, to suit your needs.

The **type B** routines add a suffix after the descriptive. There is also a **type C** (STRET, ROAD), which does not add the actual word, "street" or "road" to the descriptor, but brings up a new menu for selection.

In the programming that follows we have used "Centerline", "Top of Curb" and "Flowline" as selections. There is also an "Edge of" (LBL 30) which appends either "Pavement" or "Dirt Road", depending on the settings of flags 93 and 94.

If you study the program steps on page 16, following the paths of one of each type, you will see how to design your own descriptor system. The first descriptor menu is LBL E, and we have begun a second menu (LBL e), by assigning keys 7 and 8 to **GTO e**.

This menu only has one entry, UTLY, as an example. You can add any others which may occur to you as you use the program.

* The user may vary the menu items to suit his/her own needs. The menus shown in the text are as currently programmed on page 16.

237 LBL E
 238 FC? 92
 239 CLA
 240 CLMENU
 241 "TREE"
 242 KEY 1 GTO 21
 243 "BLDG."
 244 KEY 2 GTO 22
 245 "STRET"
 246 KEY 3 GTO 23
 247 "FENC"
 248 KEY 4 GTO 24
 249 "WALL"
 250 KEY 5 GTO 25
 251 "ROAD"
 252 KEY 6 GTO 26
 253 KEY 7 GTO e
 254 KEY 8 GTO e
 255 FC? 92
 256 CLA
 257 MENU
 258 STOP
 259 FC? 22
 260 XEQ "REP"
 261 FC? 22
 262 GTO "
 263 LBL e
 264 CLMENU
 265 "UTLY"
 266 KEY 1 GTO 31
 267 KEY 7 GTO E
 268 KEY 8 GTO E
 269 MENU
 270 STOP
 271 RTN
 272 LBL 21
 273 FS?C 92
 274 XEQ 02
 275 L" TREE "
 276 GTO 01
 277 LBL 22
 278 FS?C 92
 279 XEQ 02
 280 L" BLDG"
 281 GTO 01
 282 LBL 23
 283 CLA
 284 CLMENU
 285 "CTR"
 286 KEY 1 GTO 27
 287 "T.C."
 288 KEY 2 GTO 28
 289 "F.L."
 290 KEY 3 GTO 29
 291 "E.P."
 292 KEY 4 GTO 30
 293 FS? 93
 294 XEQ 03
 295 MENU
 296 STOP
 297 LBL 27
 298 CLA
 299 "Centerline"
 300 GTO 01
 301 LBL 28
 302 CLA
 303 "Top of Curb"
 304 GTO 01
 305 LBL 29
 306 CLA
 307 "Flowline"
 308 GTO 01
 309 LBL 30
 310 CLA
 311 "Edge of "
 312 FC? 93
 313 L" Pavement"
 314 FS?C 94
 315 L" Drift "
 316 FS?C 93
 317 L" Road"
 318 GTO 01
 319 RTN
 320 LBL 24
 321 CLA
 322 CLMENU
 323 "BARB"
 324 KEY 1 GTO 34
 325 "WM"
 326 KEY 2 GTO 35
 327 "BOARD"
 328 KEY 3 GTO 36
 329 "PICKT"
 330 KEY 4 GTO 37
 331 "STON"
 332 KEY 5 GTO 38
 333 "GATE"
 334 KEY 6 GTO 39
 335 CLA
 336 FS?C 92
 337 XEQ 02
 338 MENU
 339 STOP
 340 LBL 34
 341 L" Barb Wire"
 342 GTO 04
 343 LBL 35
 344 L" W. W."
 345 GTO 04
 346 LBL 36
 347 L" Board"
 348 GTO 04
 349 LBL 37
 350 L" Picket"
 351 GTO 04
 352 LBL 38
 353 L" Stone"
 354 GTO 04
 355 LBL 39
 356 L" GATE"
 357 GTO 01
 358 LBL 04
 359 L" Fence"
 360 GTO 01
 361 LBL 25
 362 CLA
 363 CLMENU
 364 "FRAME"
 365 KEY 1 GTO 41
 366 "STUCO"
 367 KEY 2 GTO 42
 368 "CMU"
 369 KEY 3 GTO 43
 370 "CONC"
 371 KEY 4 GTO 44
 372 "ROCK"
 373 KEY 5 GTO 45
 374 "GATE"
 375 KEY 6 GTO 39
 376 CLA
 377 FS?C 92
 378 XEQ 02
 379 MENU
 380 STOP
 381 LBL 41
 382 L" Frame"
 383 GTO 05
 384 LBL 42
 385 L" Stucco"
 386 GTO 05
 387 LBL 43
 388 L" CMU"
 389 GTO 05
 390 LBL 44
 391 L" Conc"
 392 GTO 05
 393 LBL 45
 394 L" Rock"
 395 LBL 05
 396 L" Wall"
 397 GTO 01
 398 LBL 26
 399 SF 93
 400 GTO 23
 401 LBL 03
 402 "DIRT"
 403 KEY 5 GTO 32
 404 "PAV'D"
 405 KEY 6 GTO 33
 406 RTN
 407 LBL 01
 408 XEQ "TIN"
 409 GTO 02
 410 LBL 02
 411 CLA
 412 ARCL "A"
 413 ARCL "B"
 414 ARCL "C"
 415 RTN
 416 LBL 32
 417 SF 94
 418 RTN
 419 LBL 33
 420 CF 93
 421 END

the labeling sequence

To better understand how the system does the writing for you, lets look at what happens in the program when we want to label a shot "6' Board Fence", a type B case.

First, stroke **DEHN** to enter the alpha mode. Stroke **6** **▼** **BLDG** **▼** **STRET** **▼** **WALL** **▼** and then **WS**. This brings up the item menu in Label E.

```
237►LBL E
238 FC? 92
239 CLA
240 CLMENU
241 "TREE"
242 KEY 1 GTO 21
243 "BLDG"
244 KEY 2 GTO 22
245 "STRET"
246 KEY 3 GTO 23
247 "FENC"
248 KEY 4 GTO 24
249 "WALL"
250 KEY 5 GTO 25
251 "ROAD"
252 KEY 6 GTO 26
253 KEY 7 GTO e
254 KEY 8 GTO e
255 FC? 92
256 CLA
257 MENU
258 STOP
  FC? 22
```

TREE BLDG STRET WALL ROAD

Each of the keys is assigned to a specific label, so when you stroke **DEHN**, key 4 acts as the branch, and sends you to Label 24. Since this is a type B, Label 24 brings up another menu.

```
320►LBL 24
321 CLA
322 CLMENU
323 "BARB"
324 KEY 1 GTO 34
325 "WALL"
326 KEY 2 GTO 35
327 "BOARD"
328 KEY 3 GTO 36
329 "PICKT"
330 KEY 4 GTO 37
331 "STON"
332 KEY 5 GTO 38
333 "GATE"
334 KEY 6 GTO 39
335 CLA
336 F5FC 92
337 XEQ 02
338 MENU
339 STOP
```

This menu acts as a prompt for 'what kind' of fence. When you select **Board**, key 3 sends you to Label 36, which appends the word "Board" to what is already in the alpha register, and then sends you to Label 04.

```
345 GLU 87
346►LBL 36
347 F "Board"
348 GTO 04
349 BRI 37
```

Label 04 appends the word "Fence" to the alpha register, then sends you to Label 01 to finish the process of storing the descriptor.

```
355 GLU 81
356►LBL 04
357 F "Fence"
358 GTO 01
359 BRI 35
360 GTO 01
361 BRI 37
371 K11
372►LBL 01
373 XEQ "TIN"
374 GTO 02
375 BRI 02
```

If you will look again at Label E on page 17, notice that steps 253 and 254 assign Label e to keys 7 and 8. These are the 'scroll' keys, **▼** and **▲**.

```
263►LBL e
264 CLMENU
265 "UTLY"
266 KEY 1 GTO 31
267 KEY 7 GTO E
268 KEY 8 GTO E
269 MENU
270 STOP
271 RTN
```

Label e, in turn assigns these two keys back to Label E. This is how you set up a second menu. In this case we only have one key assigned, and it goes to **UTLY**, for utilities, in Label 31.

Additional items may be added to the menu, or **UTLY** can call up an additional menu of just utility items. As an example, the short program below may be substituted for the original Label e, to handle a lot of the work.

The first menu types in a prefix, the second a suffix, allowing you to spell out "Tele. Pole", "Water Valve", "Storm Manhole", etc.

```
►LBL e
CF 22
FC? 92
CLA
CLMENU
"ELEC"
KEY 1 GTO 51
"TELE"
KEY 2 GTO 52
"CATV"
KEY 3 GTO 53
"STOM"
KEY 4 GTO 54
"SAN"
KEY 5 GTO 55
"HZ 0"
KEY 6 GTO 56
KEY 7 GTO 57
KEY 8 GTO 57
FC? 92
CLA
MENU
STOP
FC? 22
GTO 58
►LBL 51
" Elec."
GTO 57
►LBL 52

        " Tele."
        GTO 57
        ►LBL 53
        " CATV"
        GTO 57
        ►LBL 54
        " Storm"
        GTO 57
        ►LBL 55
        " San."
        GTO 57
        ►LBL 56
        " Water"
        ►LBL 57
        " STOA"
        XEQ "STOA"
        CLA
        CF 22
        CLMENU
        " POLE"
        KEY 1 GTO 61
        " MH"
        KEY 2 GTO 62
        " BOX"
        KEY 3 GTO 63
        " VALVE"
        KEY 4 GTO 64
        " INLET"
        KEY 5 GTO 65

        " HYD"
        KEY 6 GTO 66
        MENU
        XEQ "REP"
        STOP
        FC? 22
        GTO 58
        ►LBL 61
        " AA"
        ►LBL 62
        " Pole"
        GTO 58
        ►LBL 63
        " Manhole"
        GTO 58
        ►LBL 64
        " Box"
        GTO 58
        ►LBL 65
        " Valve"
        GTO 58
        ►LBL 66
        " Inlet"
        GTO 58
        ►LBL 67
        " Hydrant"
        XEQ "TIN"
        GTO 58
```

With these examples, you should be able to write menus that best suit your own needs.

the output

There is an illustration, on page 15, that shows the output of a typical shot. That example is of a station/offset topo which stored the finished data and the descriptor.

```
Shot #4
H<= 9°05'25.0"
Z<= 30°03'00.0"
S.D.= 101.28
ROD= 0.00
N = 4,898.7590
E = 4,997.1893
EL = 92.66
16" OAK TREE
```

The example to the left is of a shot in coordinate topo, and in this case the raw data was also stored. Storing the raw data, finished data and descriptor requires 10 registers, while just storing the finished data and descriptor only requires 6.

The number of shots that may be stored is, of course, directly proportional to the amount of memory you have left after you have the program and menus in their final form. You can check available memory by sizing the calculator to **0035**, and then checking the amount of bytes left (MEM, through CATALOG). Dividing this number by 9, and then adding 35 to it should tell you about what size will work, in terms of registers.

You can again check the number of bytes through MEM, and if you forget what size you are set to, RCL REGS will bring up a matrix as an answer. The first number in the matrix is your current size.

more on prompts

Most of the prompts were described as we wrote the subroutines which call them up, but here are a few additional comments:

1. The prompts for file name and date may be answered with **R/S** if you don't need them. The output will show "not given" when the file is output.
2. The date should be input as month, decimal point, day, last two digits of the year.
3. If you are working in **coordinate mode**, answer the prompt, "curve in topo area?" NO.

4. If you are working in station/offset mode, a curve to the left is input with a negative delta. Stroke **✓** before **R/S** if the curve is to the left.
5. Data **must** be output before additional use of the calculator, to protect the calculator's "environment". There are a number of flag settings and code numbers in storage that tell the output program what to do. Disturbing these settings will prevent output (most likely, "alpha data invalid" when a wrong register is recalled).

debugging assistance

We have always tried to give as much assistance as possible to our users by telephone, but with this program it is not too practical. If you experience difficulty in getting the program to work, send us a note explaining what the program is doing wrong, a print-out of the program and subroutines, and a self-addressed, stamped envelope.

We will try to proof-read the program for you and make suggestions by return mail.

Software by D'Zign
P.O. Box 430 • Tollhouse, CA 93667

The Most Commonly Asked Questions

The following questions and answers were compiled from the calls and letters we've received in the past 4+ years that we've been publishing solution books for the HP42S calculator, and are included here in the event that your question is one of them.

Q: *How do you type in the END?*

A: There are a number of ways . . . one easy way is to stroke **XEQ** **ENTER** and type it in, using the alpha keys. Because you stroked **XEQ** first, the calculator will recognize that this is not an alpha input, and substitute the actual function when you stroke **ENTER** again. You may input *any* function by this method.

You may also take advantage of the built-in *function catalog*, stroke **0** **+** (catalog), and then the **FCN** menu key. You may scroll up or down with the **▲** or **▼** keys, and *all* of the calculator's functions are in there. When you reach the one you want, just stroke the key under the menu item.

Q: *How do you type in the indirect calls, such as step 12 in the first program on page 5?*

A: The indirect calls are made by stroking **0**. In the case of the call above, first stroke **0** **6** (flags), then **CF**, to bring up the prompt **CF__**, then stroke **0**. Some of the indirect calls give a secondary prompt, requiring another **0**.

Q: *How do I type in a ARCL command?*

A: Enter **alpha mode** before stroking **RCL** or **STO**.

D'Zign

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