

# TRAVERSE, INVERSE and SIDESHOTS A POINT STORAGE CONVERSION for the HP-41CV/CX SURVEYING PAC

## 5. Keystroke

☐ RCL ☐ . ☐ 0 ☐ 8 ☐ 8

to go to step 88.

Delete steps 88 (DSE 13) through 77 (1.1), and then type in new steps as listed to the right.

70 XEQ 01  
71 RCL 03  
72 X<> 12  
73 STO 03  
74 GTO 02  
75 LBL 10  
76 SF 10

XEQ 01

☐ insert

6. ☐ RCL ☐ . ☐ 0 ☐ 7 ☐ 3

to go to step 73 (STO 03) and insert XEQ 01.

☐ RCL ☐ . ☐ 0 ☐ 0 ☐ 1 and

single step through the program to check it. A complete listing of the program steps is shown on the next page.

⑤ delete these steps  
insert these

73 STO 03  
74 GTO 02  
75 LBL 10  
76 SF 10  
77 1.1  
78 STO 13  
79 XROM "NE"  
80 STO 01  
81 RDN  
82 STO 00  
83 ISG 13  
84 XROM "NE"  
85 STO 05  
86 RDN  
87 STO 04  
88 DSE 13  
89 RTN  
90 LBL 00  
91 RCL 05  
92 RCL 01

ADV  
"BEG. PT. NO.?"  
PROMPT  
XEQ "POUT"  
STO 01  
RDN  
STO 00  
CF 10  
R↑  
XROM "NE"  
AVIEW  
"END PT. NO.?"  
PROMPT  
STO 16  
XEQ "POUT"  
STO 05  
RDN  
STO 04  
"SAVE AS?"  
PROMPT  
STO 15  
1.1  
STO 13  
SF 10

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**TRAVERSE, INVERSE and SIDESHOTS  
A POINT STORAGE CONVERSION  
for the HP-41CV/CX SURVEYING PAC**

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# Introduction

Someone once said, "Find a need, and fill it" .... That, in essence, is what these booklets are all about. To fill the need for software in the field.

Every new book we have published has prompted response that the user wishes that it had ALSO included a program for .... Or, "I only need the programs for spirals, I haven't tried the rest of them yet."

Most people will buy one of our books for a particular program that it contains, not because they need all of the programs in that particular book. Those comments prompted this series of "do it yourself" booklets. You only buy the ones you have a need for.

**This book** contains editing procedures for turning your HP Surveying Pac into a point storage system, and instructions for modifying the **TRAVERSE, INVERSE AND SIDESHOT** program of the Surveying Pac into a system that can store 100+ coordinate pairs in memory.

Coordinates may be recalled by point number after a traverse has been run, to do further calculations, and the results of those calculations are also stored.

You need a 41, a survey pac and a little time for editing the programs. Extended memory is NOT needed for point storage.

An added feature of the Traverse modification is an **AUTOMATIC COMPASS CORRECTION** subroutine.

This book has been published in two versions, one with and one without magnetic cards enclosed. If you have the version with the cards, you will still find the editing lists helpful, and you can further modify the programs to suit your particular needs.

## Utility Programs

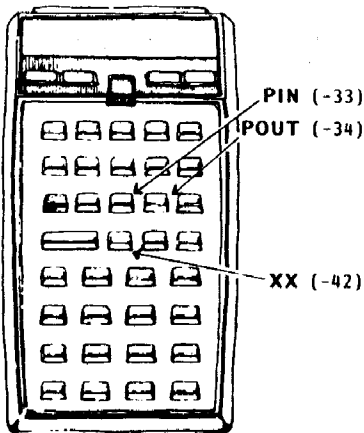
The Traverse, Inverse and Sideshots program contained in your HP Surveying Pac will respond in exactly the same way you are accustomed to, with all of the prompts and responses exactly as shown in the instruction manual you received with your module. At the same time, it will be storing the coordinate values for later use.

An automatic Compass Rule Adjustment program has been included in the modifications. When used, it replaces the original coordinate pairs with the adjusted pairs, and **automatically** outputs the adjusted bearings and distances of the courses.

The unadjusted data may be written to a data card, stored in extended memory or external memory before adjusting if you like.

There are three short UTILITY programs which must be in program memory as part of the operating system. Two are used for point number manipulation and one is used for automatically inverting between any stored coordinate pairs. A really fast layout routine with pre-stored coordinates.

"Point IN" (PIN) allows direct storage of point-numbered coordinates. "Point OUT" (POUT) will recall any coordinate pair whose point number is in the x-register when executed.



For convenience, assign these utility programs to the keyboard. They are assigned to the **shifted** functions of the button, as shown to the left.

These programs may be keyed in at any time, and should be left in program memory when ANY of the other routines are being used. The program for radial inverting is called "XX".

Let's begin by typing in the utility programs. Before beginning, execute a **GTO** and enter **program mode** by using the following keystrokes:

 **RCL** **\*** **\*** **PRGM**

Your display should show **00 REG** and a number, **NNN**. This last number is the number of program registers left in memory. For this program you will need 21 registers available. Type in the program steps shown in the listing below.\*

01*LBL "XX"	22*LBL "POUT"	44 *
02 XROM "IN"	23 STO 13	45 19
03 XEQ "C"	24*LBL "OUT"	46 +
04 CF 10	25 RCL 13	47 X<>Y
05 XEQ "POUT"	26 2	48 STO IND Y
06 XROM "NE"	27 *	49 RDN
07 RVIEW	28 19	50 1
08 ADV	29 +	51 -
09 STO 08	30 ENTER↑	52 X<>Y
10 RDN	31 ENTER↑	53 STO IND Y
11 STO 07	32 1	54 RTN
12*LBL 03	33 -	55*LBL "C"
13 CF 01	34 RCL IND X	56 .019
14 "T0?"	35 RCL IND Z	57 0
15 PROMPT	36 RTN	58*LBL 11
16 XEQ "POUT"	37*LBL "PIN"	59 STO IND Y
17 DSE 13	38 SF 10	60 ISG Y
18 STO X	39 STO 13	61 GTO 11
19 XROM "INVERSE"	40 XROM "NE"	62 RDN
20 GTO 03	41*LBL "IN"	63 RDN
21 RTN	42 RCL 13	64 RTN
	43 2	65 END

The steps, XROM "NE" and XROM "INVERSE", are put in as XEQ "NE" and XEQ "INVERSE". The calculator will change the XEQ to XROM for you. For instance, the keystrokes for input of program step 06 are

**XEQ** **ALPHA** **N** **E** **ALPHA**

Any portion of a program step which is included in quotation marks (" ") indicates that it is **alpha** input, and must be input with the calculator in **alpha mode**.

\*If your edition of this book includes program cards, see Appendix A.

## User instructions

The only program steps which might give you trouble are the "indirect" store and recall instructions. An example of the input for these is program step 34, which is input by keystroking




RCL   6

The only other one that may be misleading is step 49, RDN, this is the printout for "rolldown", and is shown on the keyboard as **R+**. The **+** symbol at each label is inserted by the calculator, and you don't need to input it.

Next, let's assign these programs to the keyboard so that we can try them out. Keystroke

 XEQ ALPHA **X** **X** ALPHA  CHS  
 XEQ ALPHA **P** **I** **N** ALPHA  STO  
 XEQ ALPHA **P** **O** **U** **T** ALPHA  RCL

Size your calculator to **040**, and we'll input some coordinates by point number, using "**PIN**" (assigned to the shifted **CHS** key, #-42). The keystroke instructions are as follows:

- 1                    Input the point number, and stroke  
 **STO**
- 2    **NX=?**                    Input the north coordinate for the point, and stroke  
 **R/S**
- 3    **EX=?**                    Input the east coordinate for the point, and stroke  
 **R/S**

That's all there is to it! Continue in the same manner until all of your coordinates have been stored. We'll do some keystroke examples on the next page, inputting a few coordinate pairs to practice with.

"XX" uses both of the shorter programs as sub-routines, and taps the Surveying Pac to do the inverting between the points. In the keystroke procedures which follow, it is assumed that "XX" has already been assigned to key #-41, the shifted CHS key. Just follow these simple steps:

1 Put the calculator into **USER** mode, (normal form is FIX 4, and in Degree Mode)

2 Input the beginning point number, and stroke



output: Nx=XXXXX.xxxx

3 If a printer is attached the output is automatic. If no printer is present keystroke



output: Ex=XXXXX.xxxx

**R/S** if no printer

TO?

4 Input the point number of the point you are inverting to, and stroke



output: AZ=DDD.mmss\*

5 Stroke



output: HD=XXX.xxxx

6\*\* Stroke\*\*



output: Ny=XXXXX.xxxx

7\*\* Stroke\*\*



output: Ey=XXXXX.xxxx

\*Bearing output will be shown instead of azimuth when FLAG 00 is set.

\*\*These last two steps are automatic with the printer attached. If no printer is present, continue stroking **R/S** until the prompt TO? appears.



## Keystroke Examples

Continue calculating RADIAL ties by inputting the next point number each time the **TO?** prompt appears, and stroking

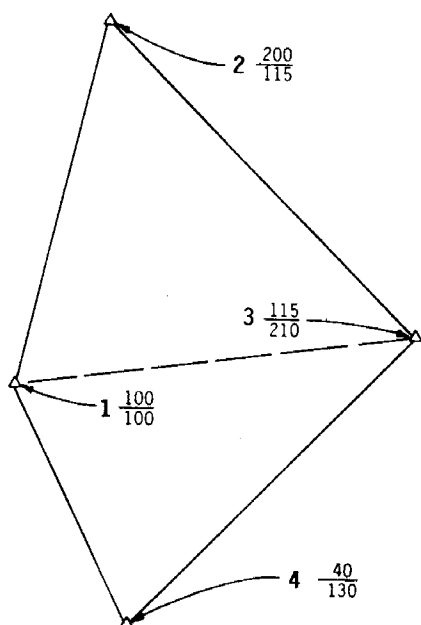
**R/S**

You may also use this routine to do an **inverse traverse** between pre-stored points. The program will "move up" to the new point when **FLAG 01** is set.

**For INVERSE TRAVERSE:** Each time the **TO?** prompt appears, input the next point number and stroke

**7** **0** **1** before stroking **R/S**

For examples of how this program group works, first we'll input the point numbers from the illustration below, using "PIN".



keystroke:

**1**  **STO**

prompt: **N1=?**

keystrokes:

**1** **0** **0** **R/S**

prompt: **E1=?**

keystrokes:

**1** **0** **0** **R/S**

keystrokes:

**2**  **STO**

prompt: **N2=?**

keystrokes:

**2** **0** **0** **R/S**

prompt: **E2=?**

keystrokes:

**1** **1** **5** **R/S**

keystrokes:

**3** **[ ]** **STO**

prompt: N3=?

keystrokes:

**1** **1** **5** **R/S**

prompt: E3=?

keystrokes:

**2** **1** **0** **R/S**

keystrokes:

**4** **[ ]** **STO**

prompt: N4=?

keystrokes:

**4** **0** **R/S**

prompt: E4=?

keystrokes:

**1** **3** **0** **R/S**

We now have all of the points in storage. We'll use these points for the next two examples, starting with an example of **radial** inversing.

Using point #1 as the "setup" point, we may calculate radial ties to each of the other points (FLAG 01 is clear) as follows:

keystrokes:

**1** **[ ]** **CHS**

output:

N1=100.0000  
E1=100.0000

\*

prompt: T0?

keystrokes:

**2** **R/S**

output:

AZ=8.3151  
HD=101.1187

N2=200.0000  
E2=115.0000

\*

prompt: T0?

keystrokes:

**3** **R/S**

output:

AZ=82.1405  
HD=111.0180

\*

prompt: T0?

keystrokes:

**4** **R/S**

output:

AZ=153.2606  
HD=67.0020

N4=40.0000  
E4=130.0000

\*

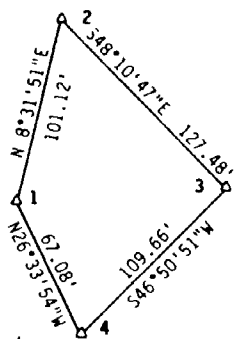
prompt: T0?

\*An additional **R/S** will be needed if used without printer

## Keystroke Examples

We'll use the same stored coordinates to do a keystroke example of an **INVERSE TRAVERSE**, using "XX". The only difference between this example and the last is that we set FLAG 01 each time, prior to entering the point number.

We will also set FLAG 00 before we start, to have **bearing** output instead of azimuth.



keystrokes:

☐ 1 ☐ CHS

output:

N1=100.0000  
E1=100.0000

\* prompt: TO?

keystrokes:

☐ 7 0 0 0  
☐ 7 0 1 2 R/S

output:

N 8.3151 E  
HD=101.1187

N2=200.0000  
E2=115.0000

\* prompt: TO?

keystrokes:

☐ 7 0 1 3 R/S

output:

S 48.1047 E  
HD=127.4755

N3=115.0000  
E3=210.0000

\* prompt: TO?

\*An additional R/S will be needed if used without printer

keystrokes:

☐ 7 0 1 4 R/S

output:

S 46.5051 W  
HD=109.6586

N4=40.0000  
E4=130.0000

\* prompt: TO?

keystrokes:

☐ 7 0 1 1 R/S

output:

N 26.3354 W  
HD=67.0820

N1=100.0000  
E1=100.0000

\* prompt: TO?

To use "POUT", simply input the point number, and stroke ☐ RCL. This recalls the point's coordinates to the x and y registers. The Easting will be displayed, and you may verify that the northing is in the y-register by stroking either X=Y or R<sub>1</sub>.

The time has come to modify our Surveying Pac traverse program. Do a **GTO** and shift into **program mode** for a minute, stroking **PRGM**. Check to insure that you have enough available registers (you will need at least 80), then stroke **PRGM** again.

We want to copy the program "TRAV" from the Surveying Pac, and this is done by stroking

**XEQ ALPHA C O P Y ALPHA**

at the prompt:

**ALPHA T R A V ALPHA**

Next, go to program step 001 by stroking

**RCL . 0 0 1**

The display should say **001 LBL TRAV**. Stroke **USER** so that you are not in **user mode** (the shifted "STO" function is assigned to "PIN" right now) and type in

**STO ALPHA T R A ALPHA SST ←**

This has renamed the program "TRA", and deleted the old name. The revisions to the existing program will be done from the bottom, working upward through the program steps, so that we can keep our program step numbers easy to find. Now, follow these steps in the order shown:

1. Stroke

**RCL . 2 7 5**

to go to program step 275. Use

the **←** key to delete steps 275

thru 268, and type in **EEX**

to have RTN at step 268.

2. Go to step 208 by stroking

**RCL . 2 0 8**

delete  
replace with  
268 RTN

267 RTN  
268 STOP

269 LBL "ACRES"  
270 RCL 04  
271 ABS  
272 RCL 05  
273 +  
274 43560  
275 /

276 LBL 05  
277 =0EQ=

① delete these steps

# Editing the Surveying Pac

170 RCL 03

191 +

192 XEQ 05

193 RDN

194 RCL 13

195 ENTER↑

196 CF 01

197 CLA

198 "f CORR"

199 ASTO 13

200 SF 10

201 XROM "WE"

202 "CLOSURE"

203 R↑

204 STO 13

205 RDN

206 AVIEW

207 XEQ a

208 SF 01

209 STOP

② delete these steps

then replace them  
with these

193 "CLSR PT?"

194 PROMPT

195 SF 10

196 STO 18

197 XEQ "PIN"

198 XEQ "OUT"

199 DSE 13

200 ADV

201 CF 01

202 XEQ a

203 SF 01

204 RCL 13

③ delete

replace with

168 XROM "INVERSE"

3. Go to step 181 and delete program steps 181 thru 168. Type in XEQ "INVERSE"; backstep, and add these steps

166 RCL 01

167 LBL a

168 LBL "INVERSE"

169 RCL 08

170 -

171 RCL 03

172 -

173 X<>Y

174 RCL 07

175 -

176 RCL 02

177 -

178 XEQ 08

179 RCL 10

180 RCL 01

181 XEQ 04

182 RTN

183 RCL F

168 1

169 ST- 13

170 RDN

4. Go to program step number 157 (RTN) and delete all of the program steps thru step 102 (RCL 00), backstep and delete step number 100 (LBL "TS").

Singlestep once (the display should now show 100 LBL D) and type in these steps:

```
101 XROM "TS"
102 XEQ "IN"
103 RTN
```

④ delete these steps

```
98 X<Y
99 X<Y
100 LBL "TS"
101 LBL D
102 RCL 00
103 X<Y
104 FS? 01
105 GTO 04
106 RCL 10
107 X<Y
    LBL 04
    01
151 150
152 FS?C 04
153 SF 01
154 XROM "NE"
155 AVIEW
156 ADV
157 RTN
158 LBL 10
159 "L="
```

⑤ insert these steps

```
43 "PT. NO.?"
44 PROMPT
45 1
46 -
47 STO 13
```

here

```
48 XIN
49 LBL J
42 CF 01
43 "SS"
44 RTN
```

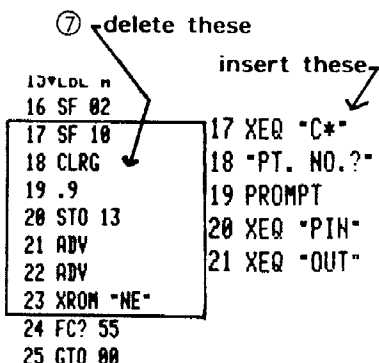
5. Go to step number 042 (CF 01). We want to insert the steps shown to the left between steps 42 and 43 ("SS").

6. If you Single Step ahead as a check, the next step should now read 48 "SS". Step 49 should be AVIEW, and step 50 should be RTN.

## Editing the Surveying Pac

7. Backstep to step 023 (XROM "NE"), delete all of the program steps thru step 17 (SF 10).

Type in the new steps shown to the right.



8. Go to step 010 (LBL 12) and delete it. ~~10\*LBL 12~~

Go to the end of the program. As a check, this should be program step 207 END. If it isn't, recheck the steps so far, and correct any errors.

Backstep to program step 206 and type in the following program steps:

207 RTN	222 ADV
208*LBL "INV"	223 RTN
209 RCL 08	224*LBL "CO"
210 -	225 0
211 X<>Y	226 STO 11
212 RCL 07	227 STO 14
213 -	228 STO 15
214 R-P	229 "BEG. PT."
215 "HD="	230 PROMPT
216 ARCL X	231 XEQ "POUT"
217 AVIEW	232 XROM "NE"
218 X<>Y	233 AVIEW
219 HMS	234 ADV
220 XROM "BRG"	235 1
221 AVIEW	236 ST+ 13

237 RCL 10  
 238 RCL 01  
 239 CHS  
 240 P-R  
 241 RCL 06  
 242 /  
 243 CHS  
 244 STO 16  
 245 X<>Y  
 246 RCL 06  
 247 /  
 248 CHS  
 249 STO 05  
 250\*LBL 02  
 251 RCL 13  
 252 RCL 18  
 253 X=Y?  
 254 GTO 01  
 255 XEQ "OUT"  
 256 STO 01  
 257 STO 15  
 258 X<>Y  
 259 STO 00  
 260 STO 14  
 261 X<>Y  
 262 RCL 08  
 263 -  
 264 X<>Y  
 265 RCL 07  
 266 -  
 267 R-P  
 268 ST+ 11  
 269 RCL 11  
 270 RCL 16  
 271 \*

272 ST+ 14  
 273 RCL 11  
 274 RCL 05  
 275 \*  
 276 ST+ 15  
 277 RCL 14  
 278 RCL 15  
 279 XEQ "IN"  
 280 RCL 13  
 281 1  
 282 -  
 283 XEQ "POUT"  
 284 STO 08  
 285 X<>Y  
 286 STO 07  
 287 1  
 288 ST+ 13  
 289 XEQ "OUT"  
 290 XEQ "INV"  
 291 RCL 00  
 292 STO 07  
 293 RCL 01  
 294 STO 08  
 295 XEQ "OUT"  
 296 XROM "NE"  
 297 AVIEW  
 298 ISG 13  
 299 ADV  
 300 ADV  
 301 GTO 02  
 302 RTN  
 303\*LBL 01  
 304 STOP  
 305 RTN  
 306 END

Go to "XX". Go to step 065 (END), and delete it. Now all of the programs are combined, and may be used with each other from the keyboard.



## Traversing

Before you try out your new program, you need to re-size the calculator to establish enough storage registers for your coordinates.

With an otherwise empty calculator memory (only "TRA" and the utilities in program memory) you can store 100 coordinate pairs. The storage registers begin at register 20 and two are needed for each coordinate pair.

One easy way to check storage capacity is to size the calculator to 020, pack with a **GTO 00**, and stroke **PRGM**. The number of registers left, divided by two, is the number of points you may store.

**Resize the calculator to the number of registers shown after packing, divided by two, +18.**

The program steps are exactly the same as shown on pages 10 through 28 of the HP Surveying Pac instruction manual, with two exceptions. The first of these is an added prompt following the **DSP BRG?** and **DSP L/D?** prompts. The added prompt is "PT. NO.?"

This prompt is added for insurance against overwriting any coordinates you may already have in storage. The second difference is in the closure routine, **LBL E**, and we'll do a short example traverse before we look at that. Otherwise, you won't notice any real difference (it runs a little faster), but it's storing the coordinates as it calculates them.

Begin with **XEQ ALPHA T R A ALPHA** and we'll work the little traverse shown below.

prompt: **DSP BRG?**

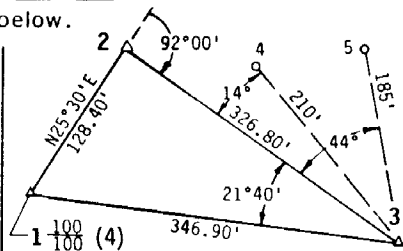
keystrokes:

**Y R/S**

prompt: **DSP L/D?**

keystrokes:

**N R/S**



prompt: PT. NO.?

keystrokes:

**1** **R/S**

prompt: N1=?

keystrokes:

**1** **0** **0** **R/S**

prompt: E1=?

keystrokes:

**1** **0** **0** **R/S**

output:

N1=100.0000

E1=100.0000 \*

keystrokes:

**2** **5** **.** **3** **B**

prompt: QD=?

keystrokes:

**1** **R/S**

output:

N 25.3000 E

keystrokes:

**1** **2** **8** **.** **4** **D**

output:

HD=128.4000

N2=215.8920

E2=155.2776 \*

keystrokes:

**9** **2** **[ ]** **C**

output:

S 62.3000 E

keystrokes:

**3** **2** **6** **.** **8** **D**

output:

HD=326.8000

N3=64.9925

E3=445.1528 \*

keystrokes:

**2** **1** **.** **4** **CHS** **C**

output:

N 84.1000 W

keystrokes:

**3** **4** **6** **.** **9** **D**

output:

HD=346.9000

N4=100.2497

E4=100.0491 \*

Now for the closure:

Again the added prompt  
for point number. Input  
the next highest number.

keystrokes:

**E**

output:

ΣHD=802.1000

AREA=20,923.8192

prompt: CLSR PT?

keystrokes:

**5** **R/S**

prompt: N5=?

keystrokes:

**1** **0** **0** **R/S**

prompt: E5=?

keystrokes:

**1** **0** **0** **R/S**

output:

S 11.0727 W

HD=0.2545

N4=100.0000

E4=100.0000

\*An additional **R/S** will be  
needed if used without printer

## Compass Correction

There are actually two differences in the closure routine, compared to the Surveying Pac. The first was the added prompt for a closure point number, and the second is that the closure isn't labeled. The closing to one point number higher than the actual point is the same in the Surveying Pac. There, the number is generated by the program.

If you leave these coordinates in storage and begin another traverse, or want to do some sideshots, you can begin with point number 5, since it is a duplicate point of number one. You could also re-use point number 4, after the traverse has been adjusted, since it will then be equal to point number 1.

**A couple of words of caution:** Most of the routines in the Surveying Pac begin with a sequence which includes CLRG, the command to clear the registers. If you have to use a HP routine, it is a good idea to protect your points by storing them.

At this point, if you want to use the built-in compass correction routine, the procedure is:

stroke **XEQ** **ALPHA** **C** **O** **ALPHA**

prompt: **BEG PT?**

keystrokes:

**1** **R/S**

**output:** the output is shown to the right, and is automatic. The program will calculate the adjusted coordinates from storage, inverting each course before output of the coordinates.

N1=100.0000  
E1=100.0000

HD=128.3605  
N 25.3016 E

The procedure which we recommend for traversing with this program is

N2=215.8520  
E2=155.2698

1. Run the raw traverse through the program, ignoring sideshots.

HD=326.8292  
S 62.2857 E

2. Adjust the coordinates (the adjusted coordinates are stored in place of the original ones).

N3=64.8508  
E3=445.1249

3. Rerun the traverse, using the adjusted information, and do the sideshots as you go.

HD=346.9102  
N 84.1105 W

N4=100.0000  
E4=100.0000

That last isn't as difficult as it sounds, because we can inverse traverse by point number. To do the sideshots, execute "TRA" and answer the first few prompts, through the input of the starting coordinates. Recall the second point (#2 in the example) by executing "POUT", and inverse to it.

.... output: N1=100.0000  
E1=100.0000

keystrokes:

pause **2** **[ ]** **RCL**

**[ ]** **A**

output: N 25.3016 E  
HD=128.3605

N2=215.8520  
E2=155.2698

Repeat the process, and  
inverse to point 3

keystrokes:

pause **3** **[ ]** **RCL**

**[ ]** **A**

output: S 62.2857 E  
HD=326.8292

N3=64.8508  
E3=445.1249

keystroke: **J**

prompt: PT. NO.?

keystrokes:

**4** **R/S**

output: SS

keystrokes:

**1** **4** **C**

output:

N 48.2857 W

keystrokes:

**2** **1** **0** **D**

output:

HD=210.0000

N4=204.0489

E4=287.8866 \*

keystroke: **J**

prompt: PT. NO.?

keystrokes:

**5** **R/S**

output:

SS

keystrokes:

**4** **4** **C**

output:

N 18.2857 W

keystrokes:

**1** **8** **5** **D**

output:

HD=185.0000

N5=240.3885

E5=386.4769

keystroke: **I**

output:

TRAV

Resume inverting to the  
next point (in this case  
point number 1).

\*An additional **R/S** will be  
needed if used without printer

## Appendix A

The storage registers of any point may be found as follows:

**north coordinate**

$$18 + 2(PT\#)$$

**east coordinate**

$$19 + 2(PT\#)$$

To store data onto a magnetic card, place **20.eee** (where eee is the three-digit number of the highest register) and execute WDTAX.

If your edition of this book includes the program cards, the program is carried on tracks 1 and 2 of cards A, B and C, and on track 1 of card D.

N1	R19=	0.0000
E1	R20=	100.0000
N2	R21=	100.0000
E2	R22=	215.8520
N3	R23=	155.2698
E3	R24=	64.8508
N4	R25=	445.1249
E4	R26=	204.0489
N5	R27=	287.8866
E5	R28=	240.3085
	R29=	386.4769
	R30=	0.0000
	R31=	0.0000

To help with the "proof reading" chores after editing, a complete program listing of the final form of the program is included below.

01*LBL "XX"	25 RCL 13	09N	73 CF 00	97 SF 01
02 XROM "IN"	26 2	1	74 "DSP L/D"	98 CF 02
03 XEQ "C"	27 *	51 -	75 XROM "YN"	99 "TRAV"
04 CF 10	28 19	52 X<>Y	76 FS? 10	100 AVIEW
05 XEQ "POUT"	29 +	53 STO IND Y	77 SF 03	101 RTN
06 XROM "NE"	30 ENTER↑	54 RTN	78*LBL A	102*LBL J
07 AVIEW	31 ENTER↑	55*LBL "C"	79 SF 02	103 CF 01
08 ADV	32 1	56 .019	80 XEQ "C"	104 "PT. NO.?"
09 STO 08	33 -	57 0	81 "PT. NO.?"	105 PROMPT
10 RDN	34 RCL IND X	58*LBL 11	82 PROMPT	106 1
11 STO 07	35 RCL IND Z	59 STO IND Y	83 XEQ "PIN"	107 -
12*LBL 03	36 RTN	60 ISC Y	84 XEQ "OUT"	108 STO 13
13 CF 01	37*LBL "PIN"	61 GTO 11	85 FC? 55	109 "SS"
14 "TO?"	38 SF 10	62 RDN	86 GTO 00	110 AVIEW
15 PROMPT	39 STO 13	63 RDN	87 CF 10	111 RTN
16 XEQ "POUT"	40 XROM "NE"	64 RTN	88 XROM "NE"	112*LBL H
17 DSE 13	41*LBL "IN"	65*LBL "TRA"	89 AVIEW	113 SF 05
18 STO X	42 RCL 13	66 XROM "IN"	90 ADV	114*LBL C
19 XROM "INVERSE"	43 2	67 CF 05	91*LBL 00	115 PI
20 GTO 03	44 *	68 SF 01	92 STO 08	116 R-D
21 RTN	45 19	69 SF 00	93 RDN	117 HMS+
22*LBL "POUT"	46 +	70 "DSP BRC"	94 STO 07	118 FS?C 05
23 STO 13	47 X<>Y	71 XROM "YN"	95 STOP	119 GTO b
24*LBL "OUT"	48 STO IND Y	72 FC? 10	96*LBL I	120*LBL c

121 RCL 00	171 "L="	221 STO 11	271 RTN	321 STO 15
122 HMS	172 ARCL X	222 SIGM	272*LBL "INV"	322 X<>Y
123 HMS+	173 AVIEW	223 X<>Y	273 RCL 08	323 STO 00
124 GTO b	174 "D="	224 CHS	274 -	324 STO 14
125*LBL B	175 ARCL Y	225 LASTX	275 X<>Y	325 X<>Y
126 SF 10	176 AVIEW	226 X+2	276 RCL 07	326 RCL 08
127 XROM "A1"	177 ADV	227 *	277 -	327 -
128 HMS	178 RTN	228 2	278 R-P	328 X<>Y
129*LBL b	179*LBL a	229 /	279 "HD="	329 RCL 07
130 HR	180 1	230 *	280 ARCL X	330 -
131 1	181 ST- 13	231 ST+ 05	281 AVIEW	331 R-P
132 P-R	182 RDN	232 "SEG="	282 X<>Y	332 ST+ 11
133*LBL 08	183 XROM "INVERSE"	233 ARCL X	283 HMS	333 RCL 11
134 CF 10	184 RTN	234 AVIEW	284 XROM "BRG"	334 RCL 16
135 R-P	185*LBL E	235 RCL 14	285 AVIEW	335 *
136 STO 01	186 SF 04	236 RCL 11	286 ADV	336 ST+ 14
137 X<>Y	187 "END="	237 *	287 RTN	337 RCL 11
138 X<>0?	188 ARCL 06	238 ABS	288*LBL "CO"	338 RCL 05
139 GTO 07	189 AVIEW	239 ST+ 06	289 0	339 *
140 360	190 RCL 04	240 "L="	290 STO 11	340 ST+ 15
141 +	191 ABS	241 ARCL X	291 STO 14	341 RCL 14
142*LBL 07	192 RCL 05	242 AVIEW	292 STO 15	342 RCL 15
143 FS?C 02	193 +	243 RCL 12	293 "BEG. PT."	343 XEQ "IN"
144 STO 00	194 XEQ 05	244 2	294 PROMPT	344 RCL 13
145 FS? 01	195 "CLSR PT?"	245 /	295 XEQ "POUT"	345 1
146 STO 00	196 PROMPT	246 TAN	296 XROM "NE"	346 -
147 STO 10	197 SF 10	247 RCL 11	297 AVIEW	347 XEQ "POUT"
148 FC? 00	198 STO 10	248 *	298 ADV	348 STO 08
149 GTO 09	199 XEQ "PIN"	249 ABS	299 1	349 X<>Y
150 XROM "B1"	200 XEQ "OUT"	250 "T="	300 ST+ 13	350 STO 07
151 AVIEW	201 DSE 13	251 ARCL X	301 RCL 10	351 1
152 RTN	202 ADV	252 AVIEW	302 RCL 01	352 ST+ 13
153*LBL 09	203 CF 01	253 RCL 12	303 CHS	353 XEQ "OUT"
154 HMS	204 XEQ a	254 2	304 P-R	354 XEQ "INV"
155 XROM "A0"	205 SF 01	255 /	305 RCL 06	355 RCL 00
156 AVIEW	206 RCL 13	256 SIN	306 /	356 STO 07
157 RTN	207 STOP	257 RCL 11	307 CHS	357 RCL 01
158*LBL d	208*LBL e	258 *	308 STO 16	358 STO 08
159 "A=?"	209 SF 10	259 2	309 X<>Y	359 XEQ "OUT"
160 PROMPT	210 XROM "DL"	260 *	310 RCL 06	360 XROM "NE"
161 HR	211 CF 10	261 ABS	311 /	361 AVIEW
162 X<>Y	212 HR	262 ST- 06	312 CHS	362 ISG 13
163 P-R	213 STO 12	263 "C="	313 STO 05	363 ADV
164 X<=Y?	214 SIN	264 ARCL X	314*LBL 02	364 ADV
165 X<>Y	215 LASTX	265 AVIEW	315 RCL 13	365 GTO 02
166*LBL D	216 D-R	266 RTN	316 RCL 18	366 RTN
167 XROM "TS"	217 STO 14	267*LBL 05	317 X=Y?	367*LBL 01
168 XEQ "IN"	218 -	268 "AREA="	318 GTO 01	368 STOP
169 RTN	219 "R=?"	269 ARCL X	319 XEQ "OUT"	369 RTN
170*LBL 10	220 PROMPT	270 AVIEW	320 STO 01	370 END

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