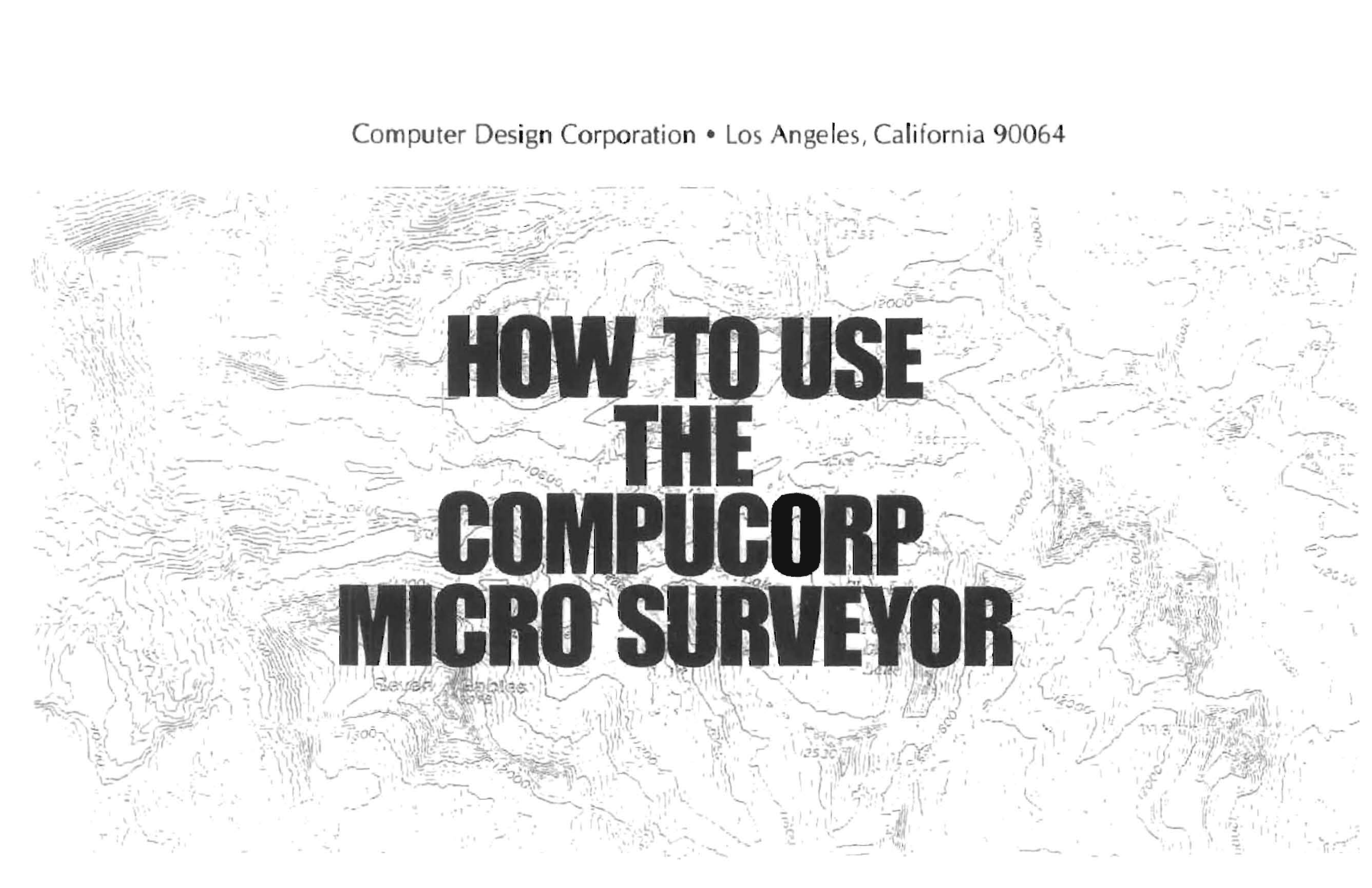


Computer Design Corporation • Los Angeles, California 90064

A detailed topographic map of a mountainous region, likely the Los Angeles area, serves as the background. The map features numerous contour lines indicating elevation, with labels such as 1000, 1200, 1500, 1700, 1800, 1900, 2000, 2100, 2200, 2300, 2400, 2500, 2600, 2700, 2800, 2900, 3000, 3100, 3200, 3300, 3400, 3500, 3600, 3700, 3800, 3900, 4000, 4100, 4200, 4300, 4400, 4500, 4600, 4700, 4800, 4900, 5000, 5100, 5200, 5300, 5400, 5500, 5600, 5700, 5800, 5900, 6000, 6100, 6200, 6300, 6400, 6500, 6600, 6700, 6800, 6900, 7000, 7100, 7200, 7300, 7400, 7500, 7600, 7700, 7800, 7900, 8000, 8100, 8200, 8300, 8400, 8500, 8600, 8700, 8800, 8900, 9000, 9100, 9200, 9300, 9400, 9500, 9600, 9700, 9800, 9900, and 10000. The map also shows various geographical features like rivers, roads, and buildings.

**HOW TO USE
THE
COMPCORP
MICRO SURVEYOR**

HOW TO USE
THE
COMPUCCORP
MICRO SURVEYOR

INTRODUCTION

The CompuCorp 354 Surveyor is an extraordinarily powerful and versatile instrument, created specifically to aid the land surveyor in his day-to-day calculations. Its size and portability make it practical for both field and office use. As with any instrument, practice makes perfect, and you will find that the longer you use it, the more powerful and useful to you it becomes.

To get the most out of your Surveyor, you should read this manual, following the examples with the Surveyor on and running. Our examples are carefully selected to illustrate the use of various features and capabilities, so study them carefully. Thereafter, use the manual as a quick reference guide to specific functions and operations.

TABLE OF CONTENTS

Starting	1	Traverse Example	42
Entering Numbers	2	Intersections	56
Making Corrections	3	I. Direction and Length Known	58
Entering Angles	4	II. Two Directions Known	62
Entering Bearings	6	III. Two Lengths Known	70
Traversing	7	IV. Relative Angle and One Length Known	73
Second Function	8	Arithmetic	78
Bearing-Distance Traversing	9	Averaging Angles	81
Bearing-Distance Traverse Example	10	Math Functions	82
Field Angles	15	Trig Functions	85
Traversing with Field Angles	17	Storage Registers	86
Elevation Angles	23	Rectangular \longleftrightarrow Polar	88
Point-to-Point Inversing	25	Programming	90
Inversing While Traversing	27	Batteries and Recharging	105
Side-Shots	28	Key Index	106
Curves in Traverse	35	Index	108


STARTING

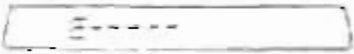
The ON/OFF switch is on the back. Next to it is a connector for the charger/adapter. Move the switch to the "ON" position.

NOTE: When the 354 is switched on, the display may contain almost any combination of numbers or characters while it goes through a clearing cycle. Wait for the display format $\square . \square \square \square$ to appear before pushing any of the keys. The clearing cycle lasts about three seconds.


If you are using the 354 with the adapter/charger, set the voltage switch on the bottom of the charger to the appropriate voltage. See page 105, Batteries and Recharging. Also, be sure that the RUN/LOAD switch in the upper right corner of the keyboard is in the RUN position.

ENTERING NUMBERS

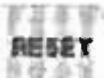
Keying in numbers is as simple as pressing the digit keys in sequence. Press the decimal point key when needed.  changes the sign of the number, from positive to negative, or negative to positive.




Notice that the number is displayed as you enter it. You can not enter more than 13 digits (12 if the first key is decimal point). If you put in too many digits the display goes into error and shows .

MAKING CORRECTIONS

Whenever you find you've made a mistake in an arithmetic operation,  clears the entire calculation so you can start over.

 clears the display, so that you can correct an entry error without losing the calculation you were doing.

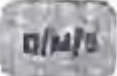

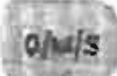
Although it's usually not necessary, it's a good idea to press  before starting a calculation, just to be sure there are no leftovers inside.

If you see  in the display (it stands for ERROR) that means you've done something mathematically illegal, or have produced a number outside the Surveyor's range (its capacity is $10^{-9.8}$ to $10^{9.8}$). Calculation is stopped. Press  or  to get going again.



The following cause error:


- Divide by zero
- $1/x$ of zero
- $\sqrt{\quad}$ of a negative number
- Arc sine of a number outside the range -1 to $+1$
- Asking for an impossible intersection
- Trying to calculate a number outside the Surveyor's range $10^{-9.8}$ to $10^{9.8}$
- a^x where a is negative and x is not an integer
- 0^{-x}
- Parentheses close before open
- More than two parentheses open without a close



ENTERING ANGLES


When entering angles, use the  key. Key in the degrees, press . The display changes to angle format. Now key in the minutes. Press  again and put in the seconds.



Enter 15°30'10"

Enter  

Press 

Enter  

Press 

Enter  

15.000

15 00 00

15 30 00

15 30 10

Note: change to angle display format

The 354 also is capable of handling decimal degrees, along with degrees and decimal minutes

For Example: 65.5°

Enter 6 5 . 5
 Press **D/M/S**

65.5 0
 65 30 00.0

$65^\circ 43.8'$

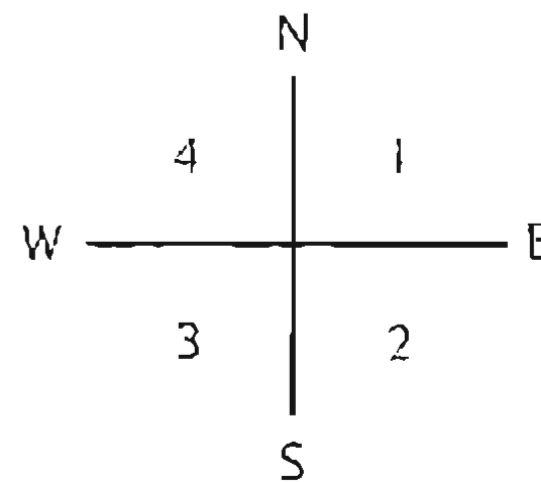
Enter 6 5
 Press **D/M/S**
 Enter 4 3 . 8
 Press **D/M/S**

65.000
 65 00 00
 65 43.8
 65 43 48.0

ENTERING BEARINGS

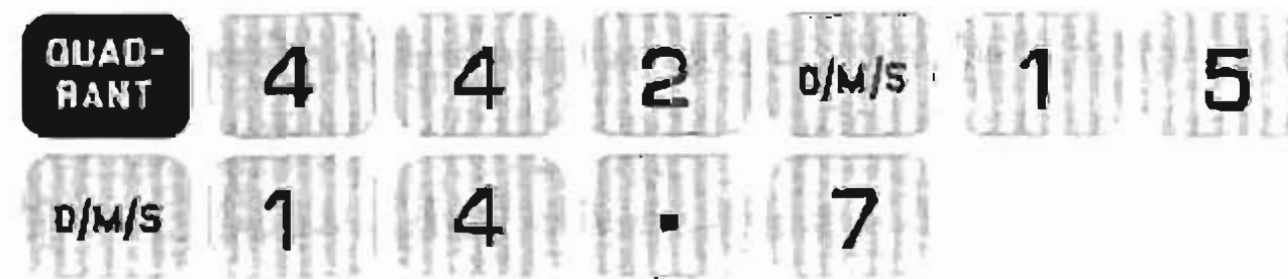
The first requirement in entering a bearing is to identify the direction. The 354 uses a numerical code for identifying the direction.

Bearing	Quadrant
NE	1
SE	2
SW	3
NW	4



To indicate direction, touch **QUAD-RANT**, followed by the appropriate quadrant number. Note the quadrant is displayed on the left. Then enter the degrees, touch **D/M/S**, enter minutes, **D/M/S** and then enter seconds.

To enter $N42^{\circ}15'14.7''W$, do this


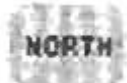




and see 4 42 15 14.7


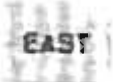


*NOTE: If you make an error in numerical entry and use the **CLEAR ENTRY** key, you must start over, re-entering the quadrant code and the angle.*

TRAVERSING


ENTERING STARTING COORDINATES:


The first step in traversing is to tell the 354 the values of the starting coordinates. To identify your starting north coordinate, simply enter it and touch  and , which stores the coordinate value in the north coordinate memory. Enter the starting east coordinate and touch  and .

DISPLAYING COORDINATES



If at any time, you want to know the coordinates of the point you are on, touch  and read the north coordinate, then touch  and read the east coordinate. As you are traversing, note that at the end of the entry of each course you may touch  and  to read the coordinates for the end point of that course.

SECOND FUNCTION

Many of the function keys on the Surveyor calculate two quantities when pressed (e.g., COS and SIN are on the same key). These keys always display one of the quantities, while the second is stored in the “Second Function” register. Pressing  causes exchange of the display with the Second Function register, so you can bring out the second function to work with.

NOTE: That this is an exchange—pressing  again will get the numbers back to their original places. The number in the Second Function register is not otherwise changed, until you do another two-function operation.

BEARING-DISTANCE TRAVERSING

The  and  keys are used to perform Bearing-Distance Traversing. As the legends indicate, they take a direction and a length, and convert it to a latitude and departure. They also compute and store the coordinates of the point at the end of the course.

The sequence to follow in calculating a course, given its bearing and distance is:

Enter the Bearing Angle (Direction)

Press 


Enter the Distance (length)


Press 

See: Latitude of Course

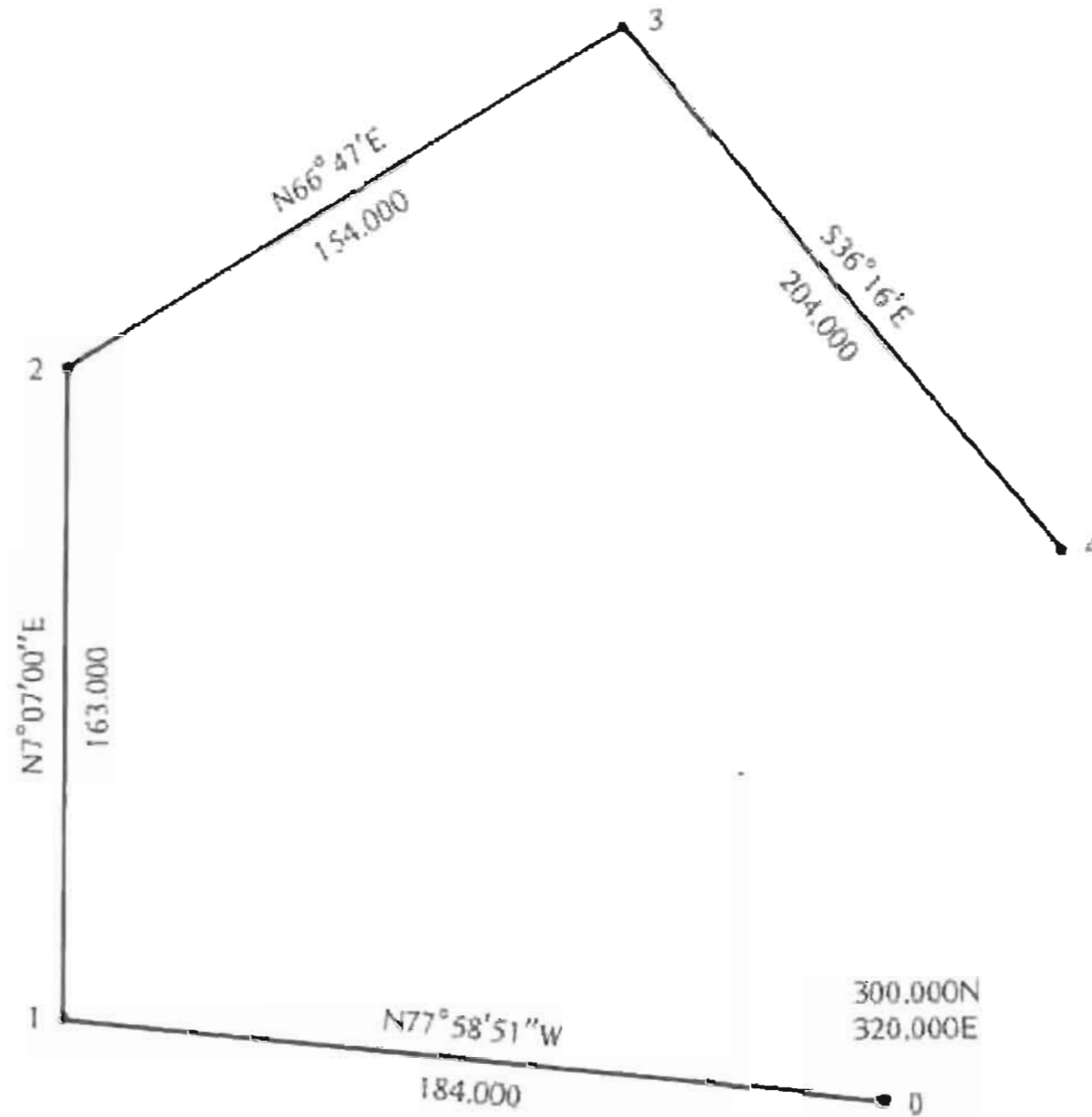
Press 

See: Departure of Course

Press:  see North coordinate at end of course.

Press:  see East coordinate at end of course.

BEARING-DISTANCE TRAVERSE EXAMPLE



Entering Starting Coordinates

3	0	0	ST _n	NORTH
3	2	0	ST _n	EAST

300.000
320.000

Enter Data for Course 0-1

QUAD-RANT 4
 7 7 D/M/S 5 8 D/M/S
 5 1 D N
 1 8 4 FOR-
 WARD
 2ND
 FUNC
 NORTH
 EAST

4 7 25 5
 33.315 latitude
 12.355 departure
 325.315 North
 coordinate
 12.355 East
 coordinate

Bearing Distance Traversing Example

Enter Data for Course 1-2

The bearing and distances for course 1-2 is $N7^{\circ}7'E$, 163 feet.



1 7 07 00

161.744

latitude

20.194

departure

500.060

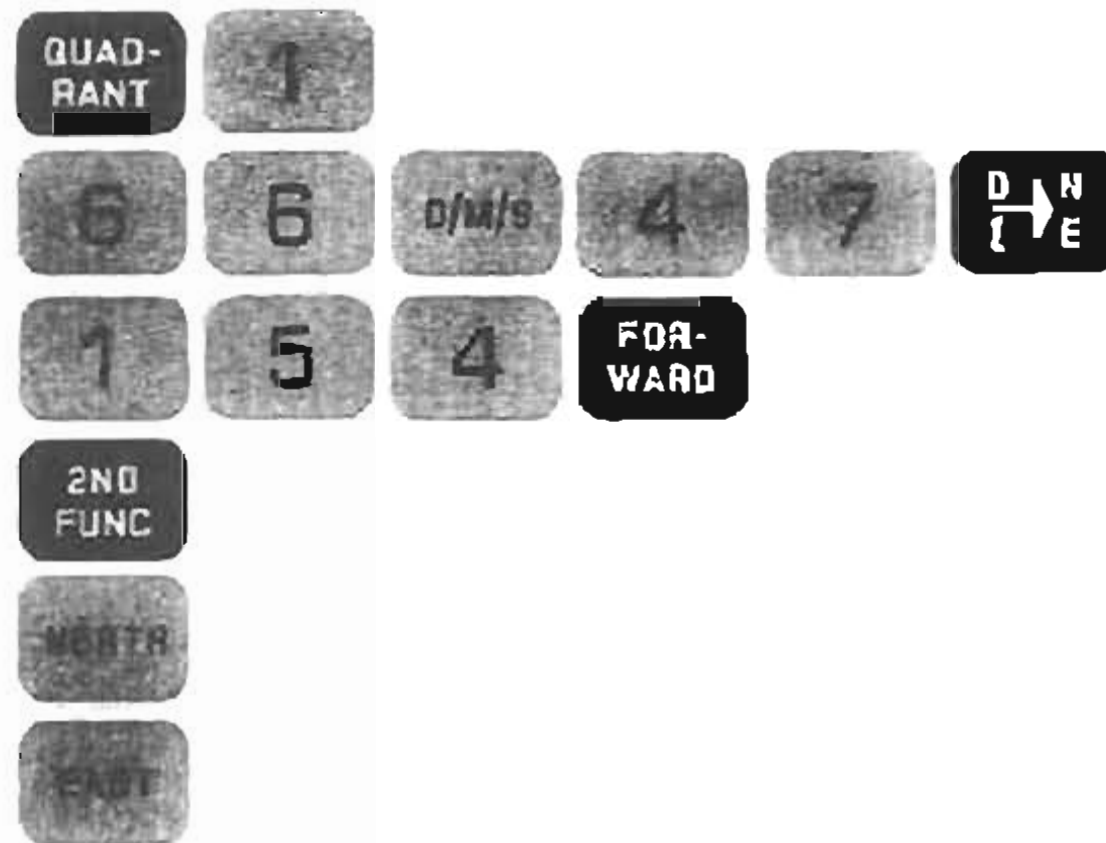
North coordinate

160.227

East coordinate

Now proceed to course 2-3

The Bearing and Distance is N66°47'E, 154 feet.



00.000	
00.000	latitude
000.000	departure
000.000	North coordinate
000.000	East coordinate

FIELD ANGLES

The 354 is capable of handling entry of Field Angles. For the time being, we'll be using only horizontal angles, although vertical angles may also be used.

*NOTE: The **FIELD ANGLE** key. It is above the **DIMS** key, and works very much like the **QUADRANT** key. The difference is that the numerical code you enter describes a particular kind of Field Angle, rather than a Quadrant.*

The four horizontal Field Angles and their numerical codes are:

Right deflection angle—Code 1



Angles turned to the left (counter clockwise)—Code 2



Angles turned to the right (clockwise) — Code 3



Left deflection angle — Code 4



Field Angles

Suppose you traverse from Point 1 to Point 2. You then Back-Sight to Point 1 and turn an angle to the left of $137^{\circ}45'$. The key sequence for Entry of the angle is:

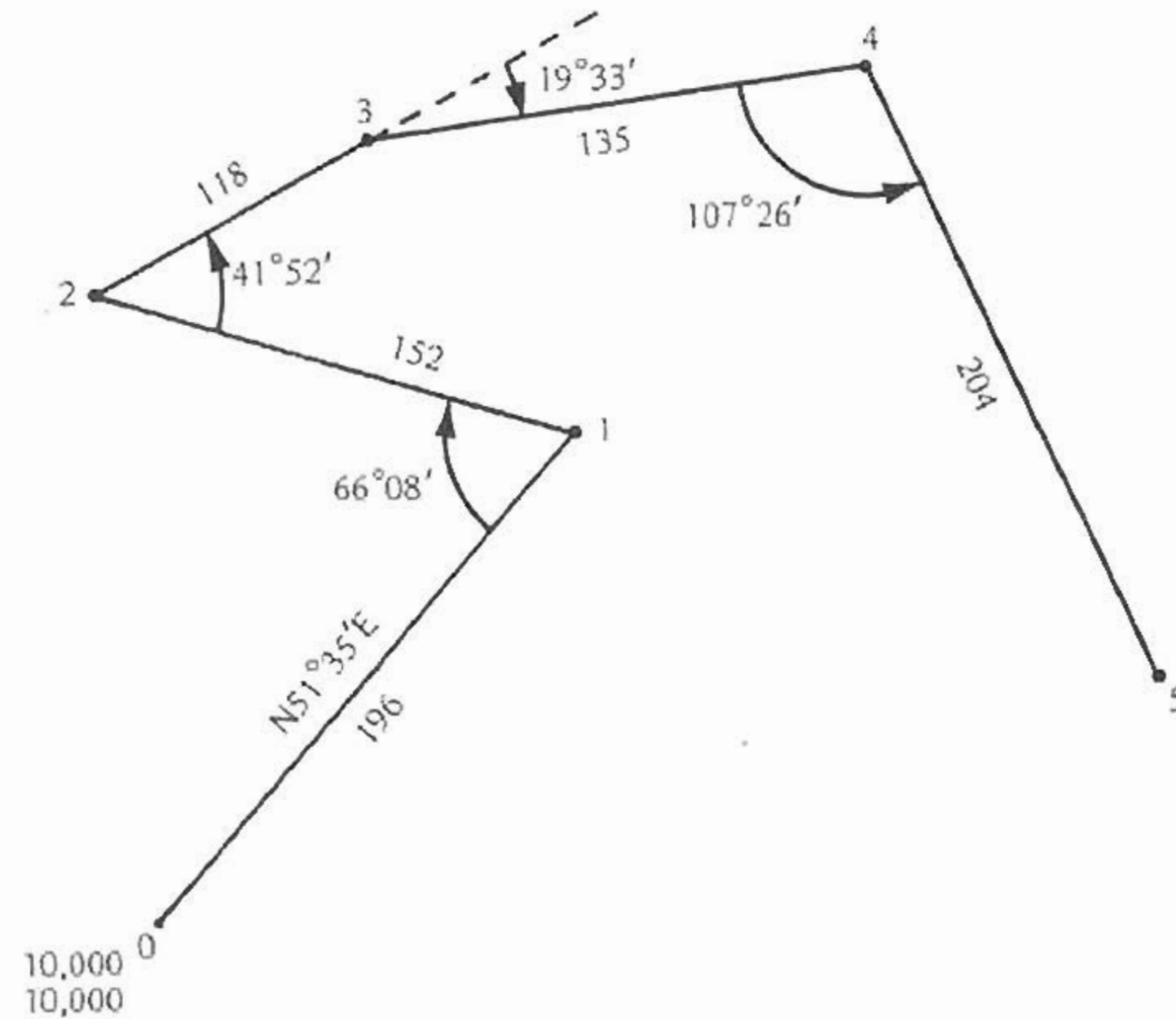


If you set-up on Point 1 and deflect your transit to the left $56^{\circ}38'$, the key sequence is:



**NOTE: The Field Angle numerical code appears in the left side of the display. The same basic key sequence holds true for the two other horizontal Field Angles.*

TRAVERSING WITH FIELD ANGLES



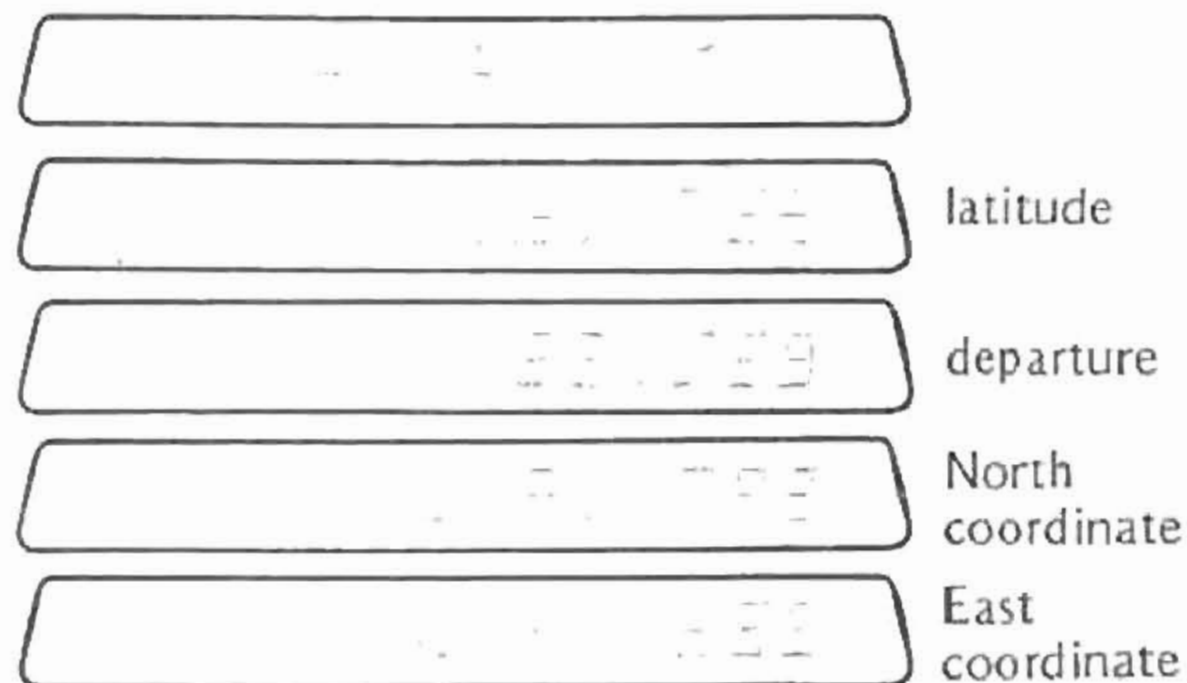
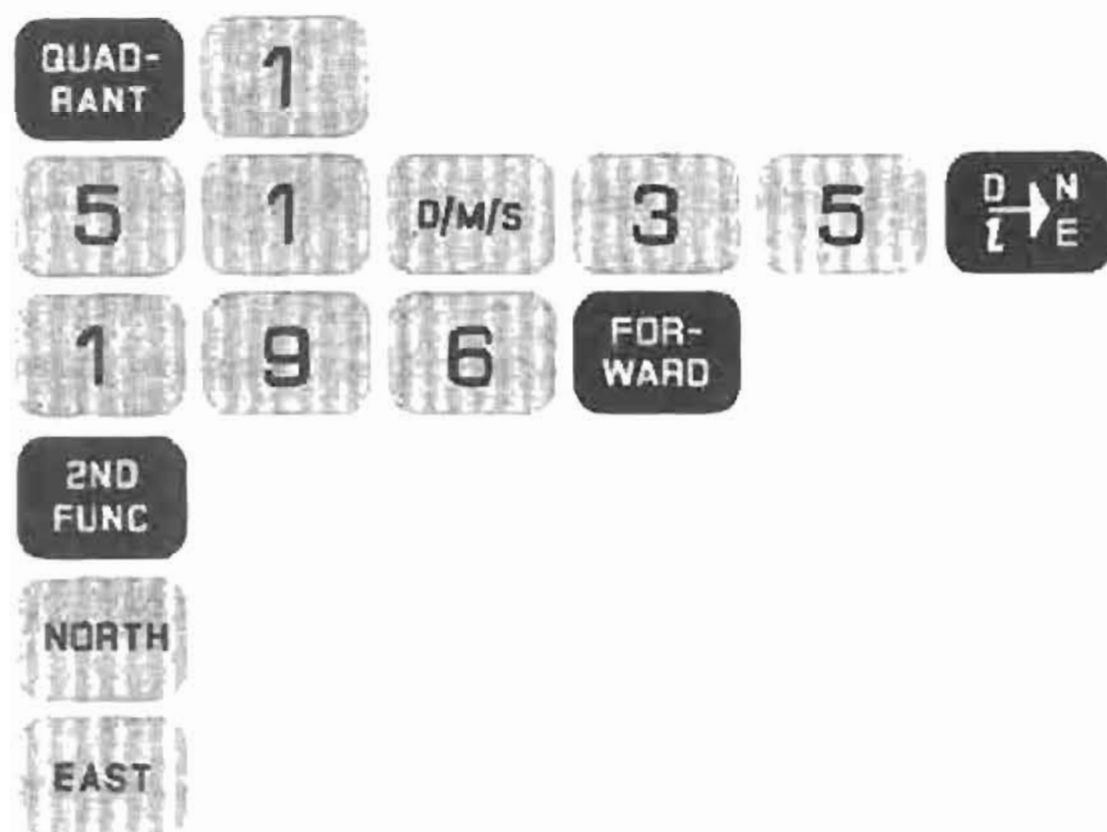
Enter the starting codes:

1	0	0	0	0	ST _n	NORTH	10662.500
1	0	0	0	0	ST _n	EAST	10662.500

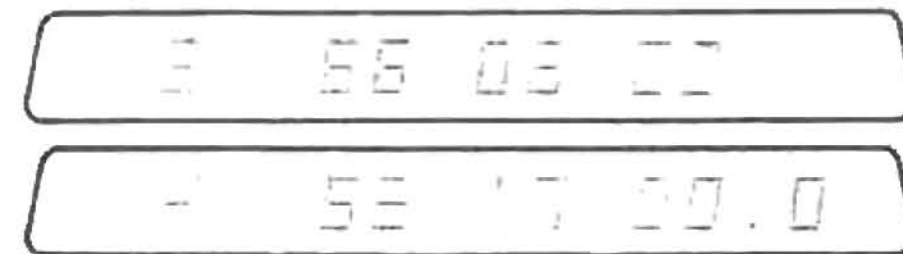
Traversing with Field Angles

NOTE: When traversing using Field Angles, all directions are based upon the previous course. For that reason, the initial course MUST be either a Bearing or an Azimuth.

Course 1 should be entered as follows:

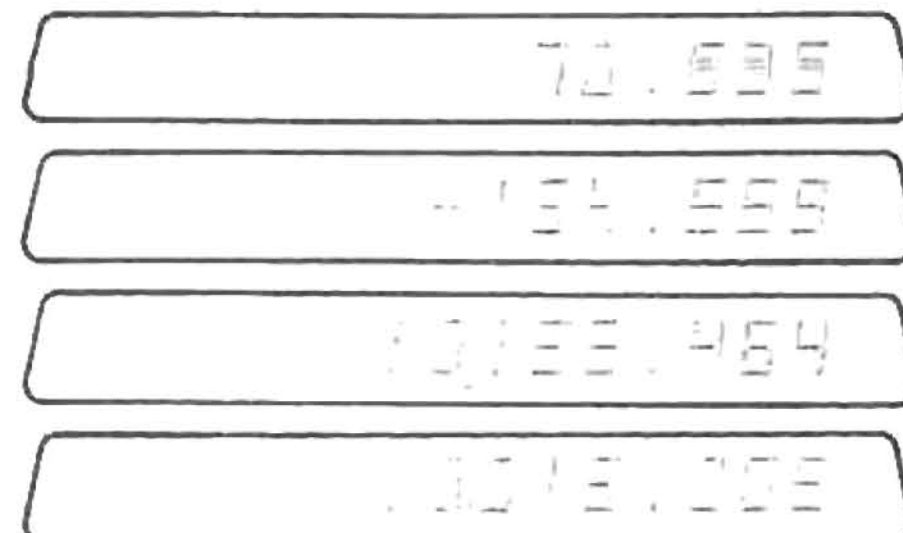


The direction of Course 1-2 is measured as a clockwise angle $66^{\circ}08'$ turned from a back-sight to point 0. The distance is 152 feet. The key sequence for calculation and description of this course is:



field angle
resultant bearing*

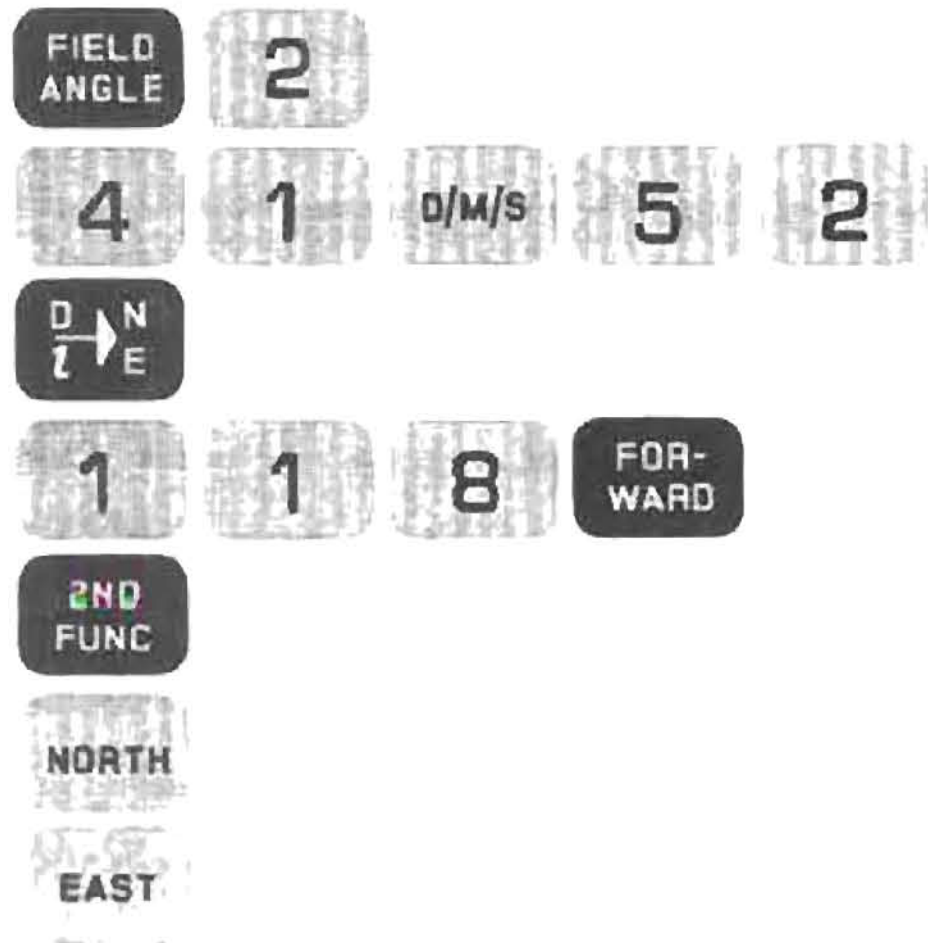
*NOTE: The 354 calculates and displays the resultant bearing of the course when  is pressed.



latitude
departure
North coordinate
East coordinate

Traversing with Field Angles

Course 2-3 also involves a back sight, with an angle of $41^{\circ}52'$, turned to the left, for a distance of 118 feet.

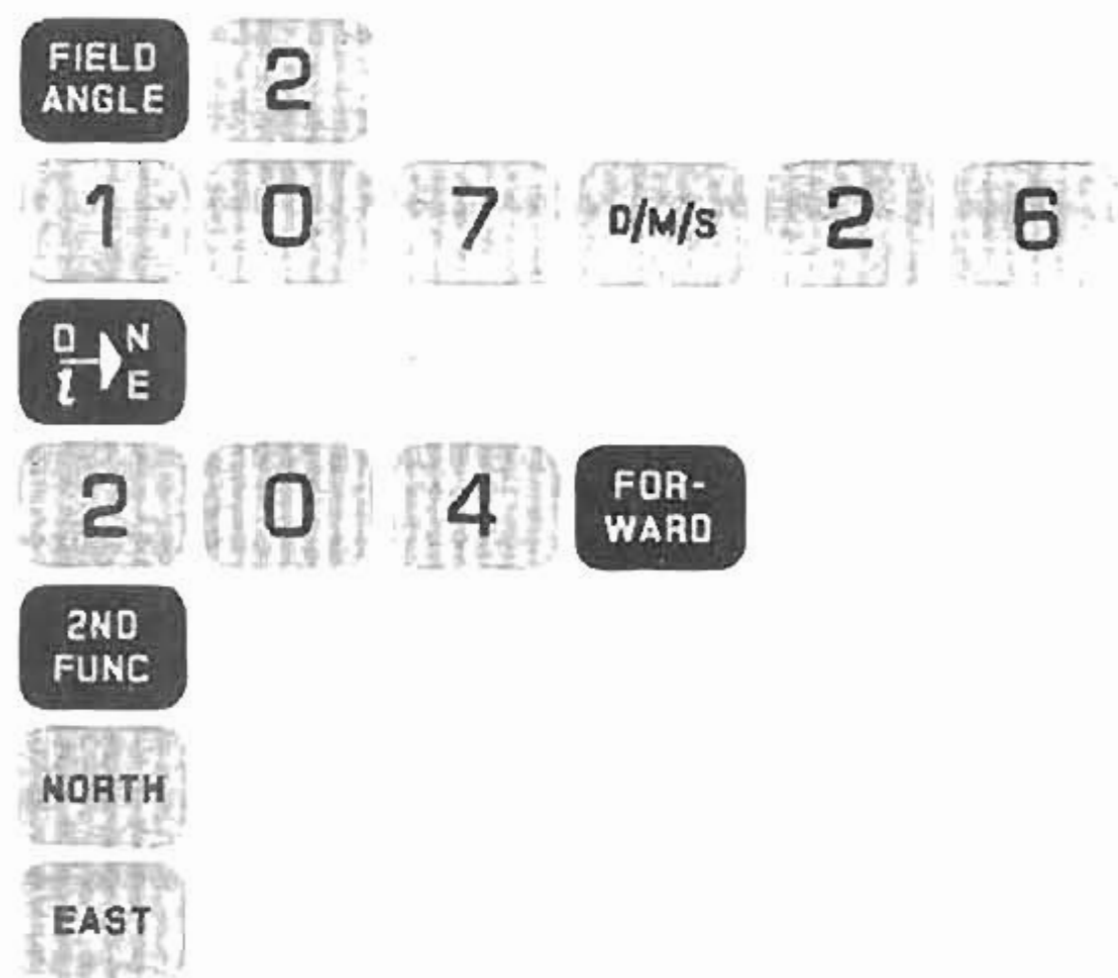


2 41 52 00	field angle
1 75 51 00.0	resultant bearing
28.846	latitude
114.419	departure
10,221.331	North coordinate
10,133.428	East coordinate

The Field Angle at Point 3 is a Right Deflection Angle of $19^{\circ}33'$, with a distance of 135 feet.

FIELD ANGLE	1					1 19 33 00	field angle
1	9	D/M/S	3	3		2 84 35 30.0	resultant bearing
$\begin{matrix} D \\ \downarrow \\ E \end{matrix}$						-12.704	latitude
1	3	5	FORWARD			134.400	departure
2ND FUNC						10208.525	North coordinate
NORTH						10267.829	East coordinate
EAST							

The final course in this open traverse is defined by a back-sight with an angle-left $107^{\circ}26'$, for a distance of 204 feet.



107.44	field angle
S 32.00.0	resultant bearing
-199.917	latitude
42.530	departure
10009.109	North coordinate
10310.359	East coordinate

A QUICK REVIEW

Entering **FIELD ANGLES** is almost identical to entering Bearings. The only difference is that you use the **FIELD ANGLE** key instead of the

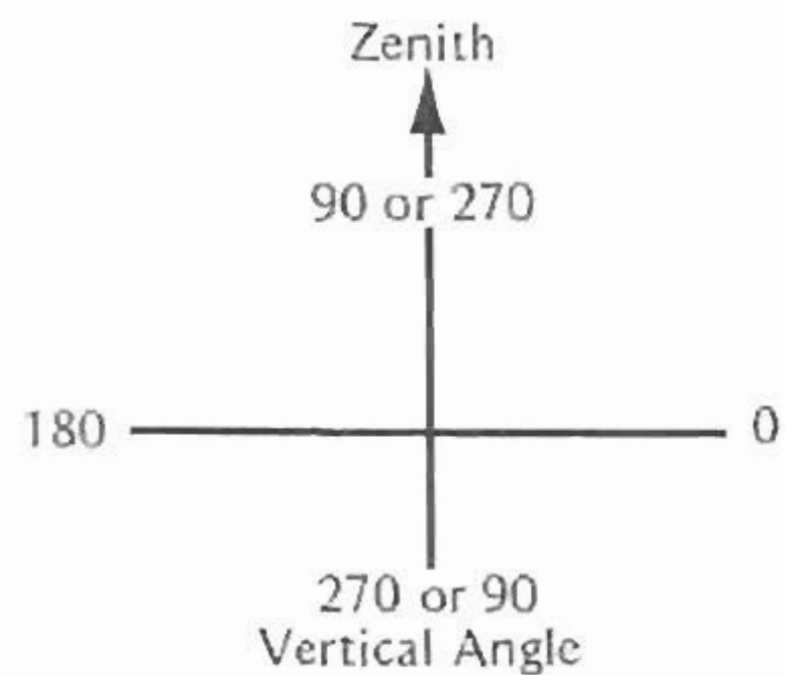
QUAD-RANT key, and the numerical code you enter indicates a type of **FIELD ANGLE**, rather than a Quadrant Code.

Traversing with **FIELD ANGLES** is similar to traversing with Bearings. The only difference here is that after entering the **FIELD ANGLE** and touching **Q/N**, the resultant Bearing is calculated and displayed. The key sequences are the same.

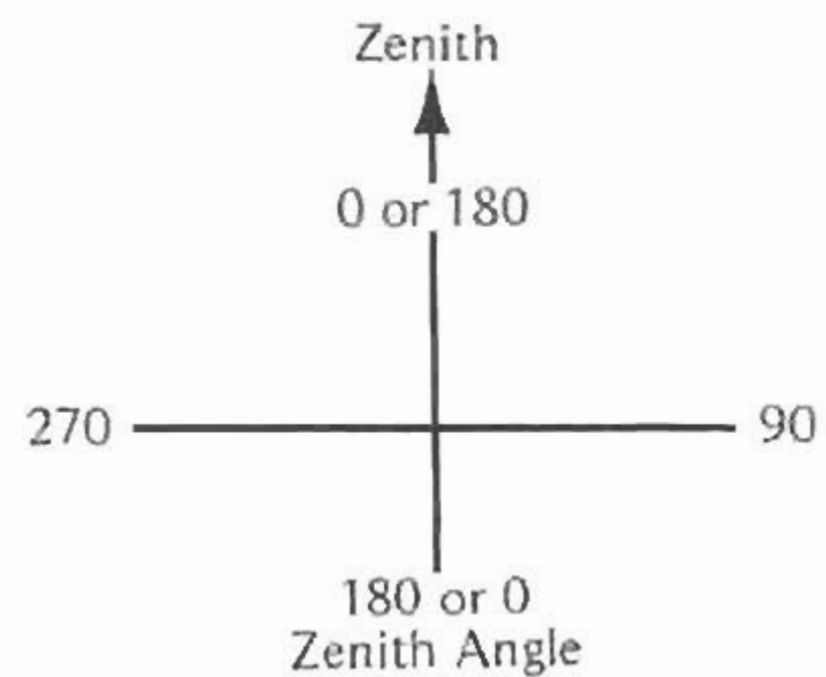
ELEVATION ANGLES

The **FIELD ANGLE** key is also used to enter elevation angles, for both transits and theodolites.

FIELD ANGLE—Code 7



FIELD ANGLE—Code 8



Elevation Angles

A simple example is a course N29°56'W, for a distance of 345 feet, with a vertical angle of 3°36' above the horizontal.

	QUAD-RANT	4									
	2	9	D/M/S	5	6	D	N	E		4 29 56 00	bearing
	3	4	5	(DO NOT TOUCH FORWARD)						345.000	slope distance
	FIELD ANGLE	7	3	D/M/S	3	6				7 3 36 00	vertical angle
NOW	FORWARD									298.389	latitude
	2ND FUNC									-171.812	departure

Since no starting coordinates were entered, pressing **NORTH** and **EAST** will result in the display of completely meaningless values.

The key sequence for course calculation when using vertical angles is:

- Identify course direction, **D**
- Enter Course length, **FIELD ANGLE**
- Enter Elevation Angle, **FORWARD**


POINT TO POINT INVERSING

If you know the NORTH and EAST coordinate value of Points 1 and 2, and you want to find the Bearing or Azimuth from 1 to 2 and the distance between them, follow this key sequence:

Enter North coordinate of Point 1  

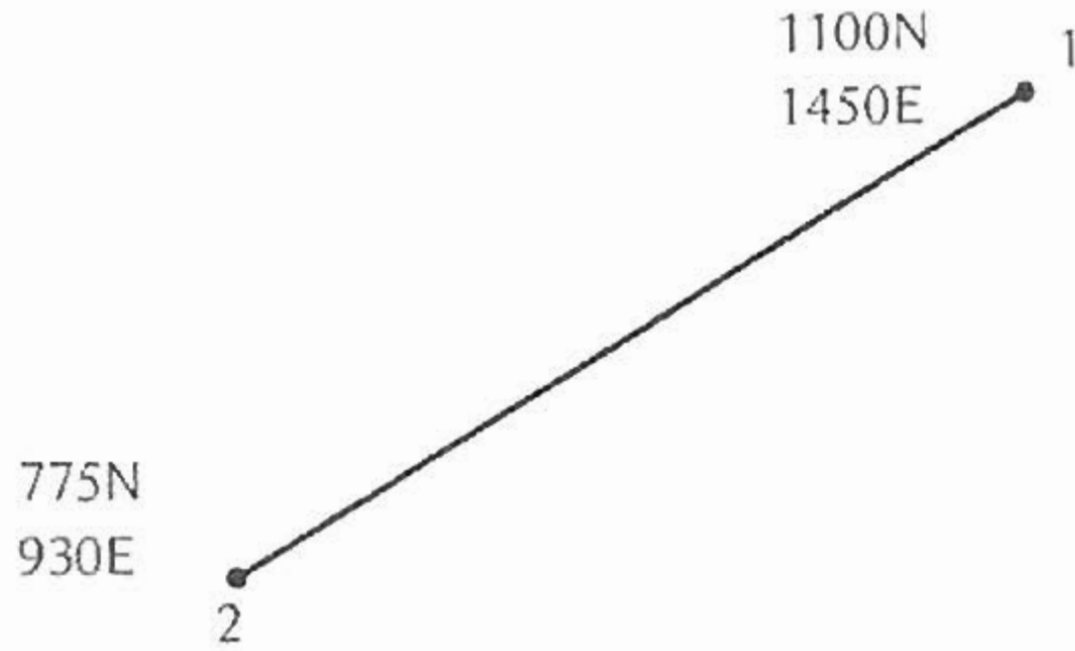
Enter East coordinate of Point 1  

Enter North coordinate of Point 2 

Enter East coordinate of Point 2 

Point to Point Inversing

Example



1 1 0 0 **ST_n** **NORTH**

1 4 5 0 **ST_n** **EAST**

7 7 5 **N → E**

9 3 0 **IN-VERSE**

2ND FUNC

BRC
AZ

N₁

E₁






N₂

bearing

azimuth

distance

INVERSING WHILE TRAVERSING

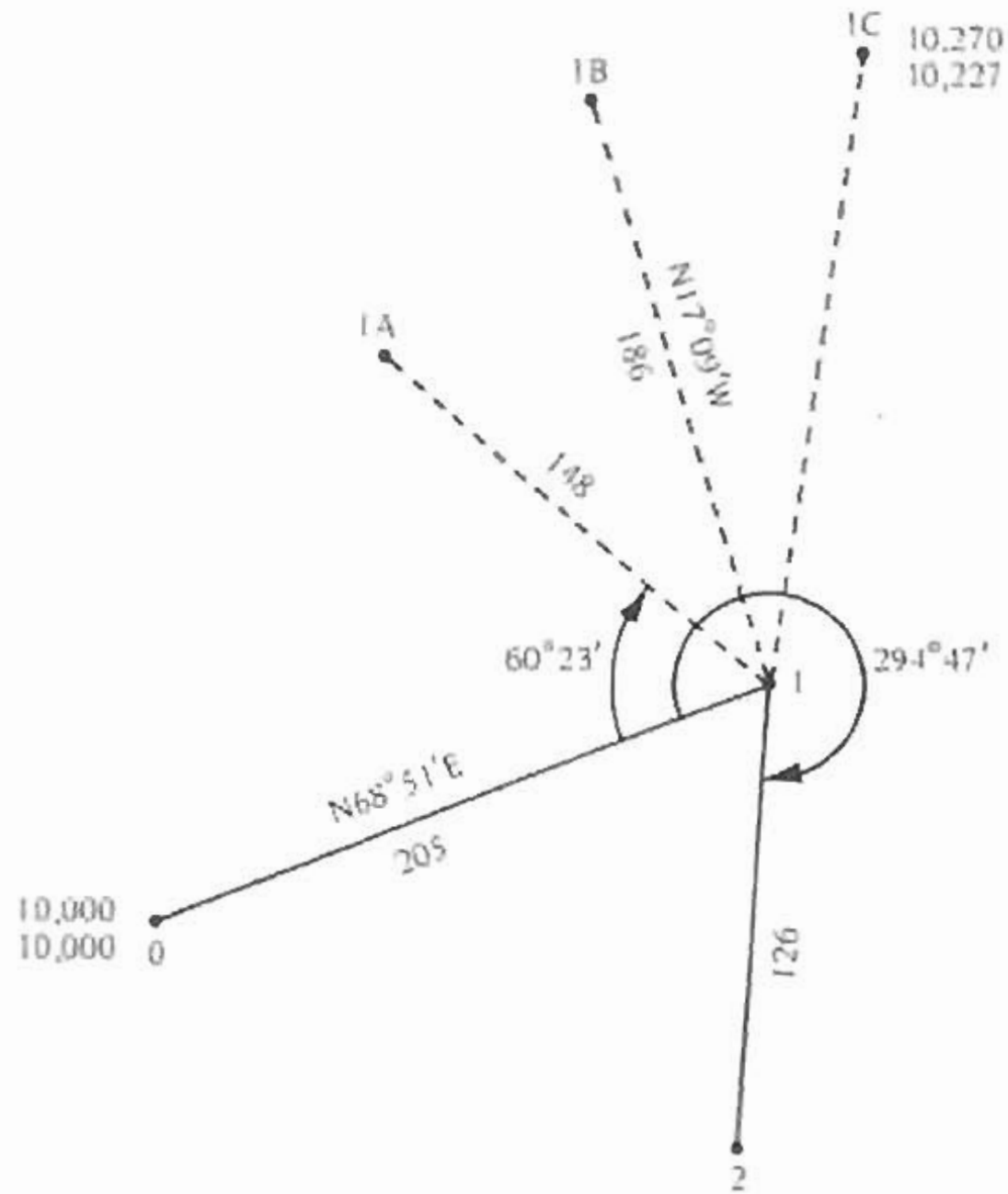
If you want to inverse while traversing, i.e., to a control survey marker or to force closure, enter the North coordinate of the next point, press  , then enter the East coordinate and press  . The direction is displayed, either as an Azimuth or bearing, depending on the setting of the BEARING/AZIMUTH switch. Touch  to display the length of the course. If you touch  , you see the North coordinate of the new point. Touching  displays its East coordinate.

SIDE SHOTS

To do side-shots from a point in the traverse use the  and  keys with  instead of  or . This way North and East coordinates are not updated.

You can do any number of side-shots from a point. The side-shot can be described either with the direction and length of the leg, the field angle from the previous leg with a length, or by the coordinates of the end of the side-shot. When the length is used, it can be the horizontal length or slope length and elevation angle.

Example



Enter and store starting coordinates:

1	0	0	0	0	ST _n	NORTH	10,000.000
1	0	0	0	0	ST _n	EAST	10,000.000

Calculate Course 0-1

QUAD-RANT 1
6 8 0/M/S 5 1 D N
2 0 5 FOR- WARD
2ND FUNC
NORTH
EAST

113.11

bearing

73.555

latitude

1.3111

departure

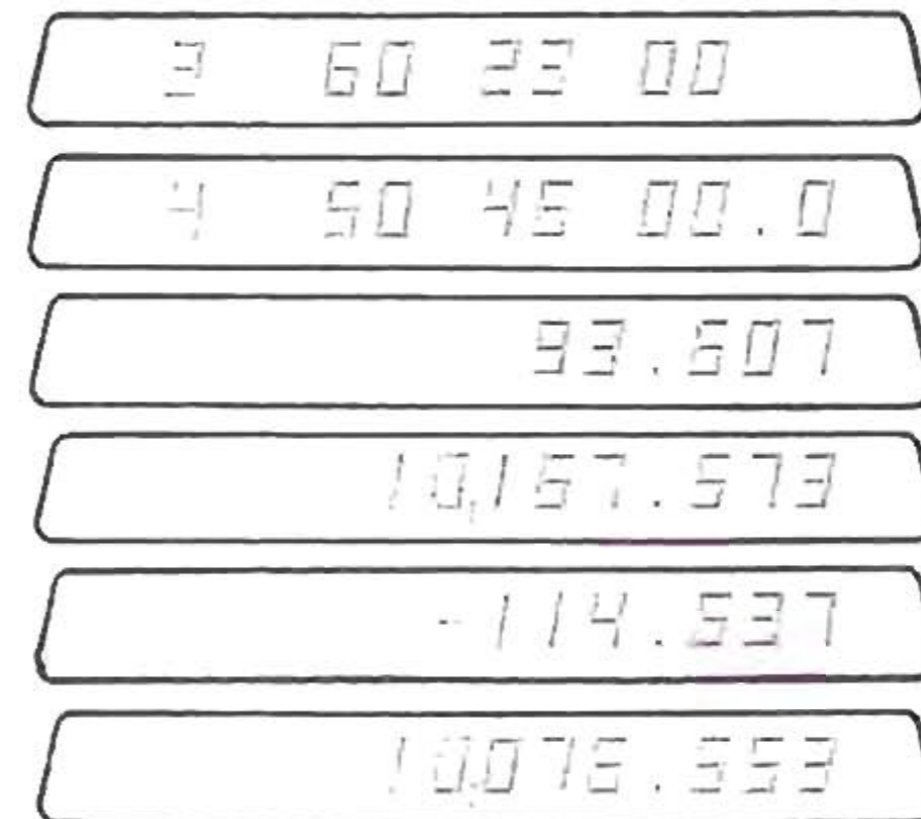
1073.555

North coordinate

10.5111

East coordinate

A side-shot is taken from Point 1, using a backsight with an angle to the right of $60^{\circ}23'$, for a distance of 148 feet.



latitude

North
coordinate

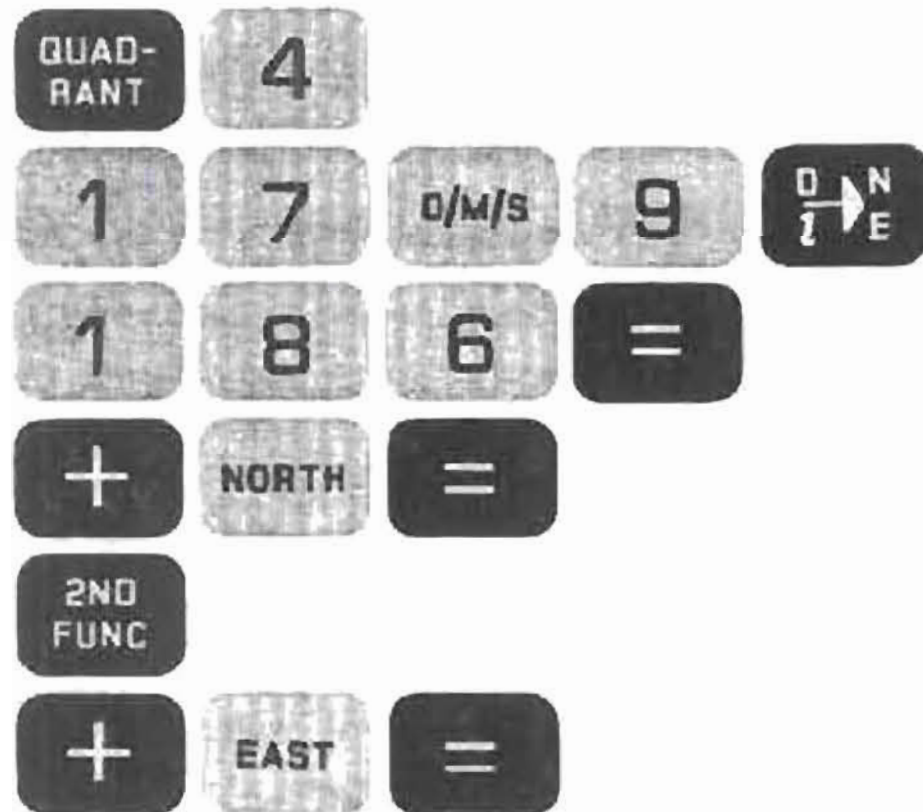
departure

East
coordinate

*NOTE: That touching **NORTH** and **EAST** displays the coordinate of Point 1. Touching **=** rather than **FORWARD** signals the 354 not to update the coordinate memories.*

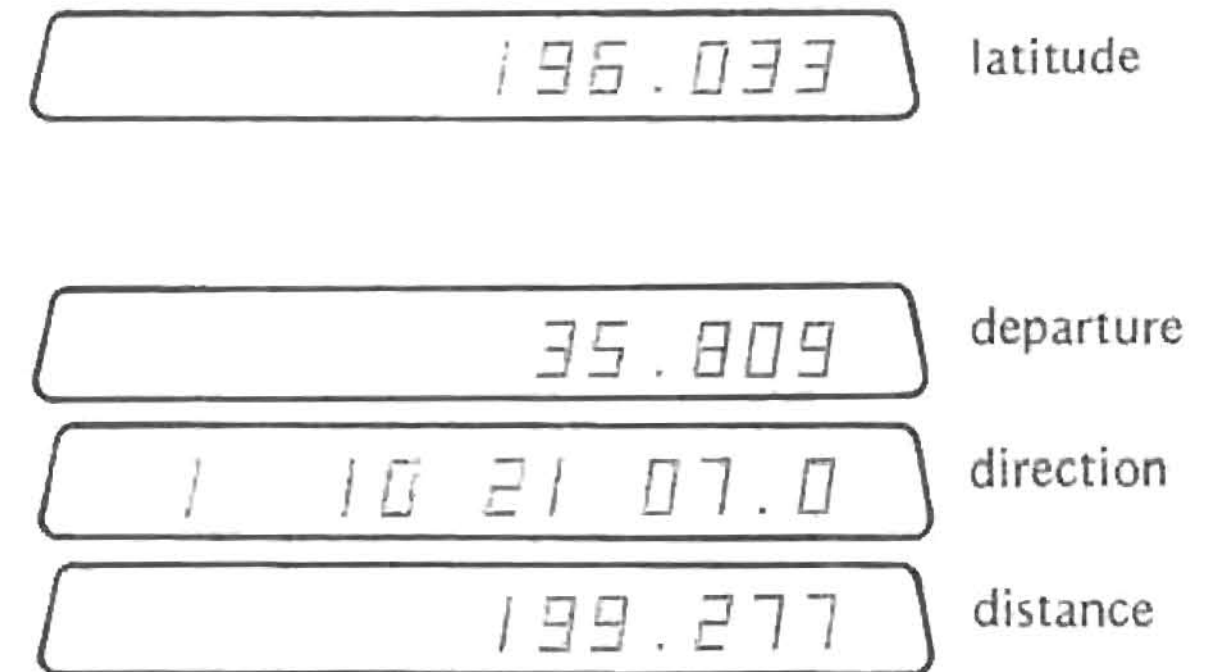
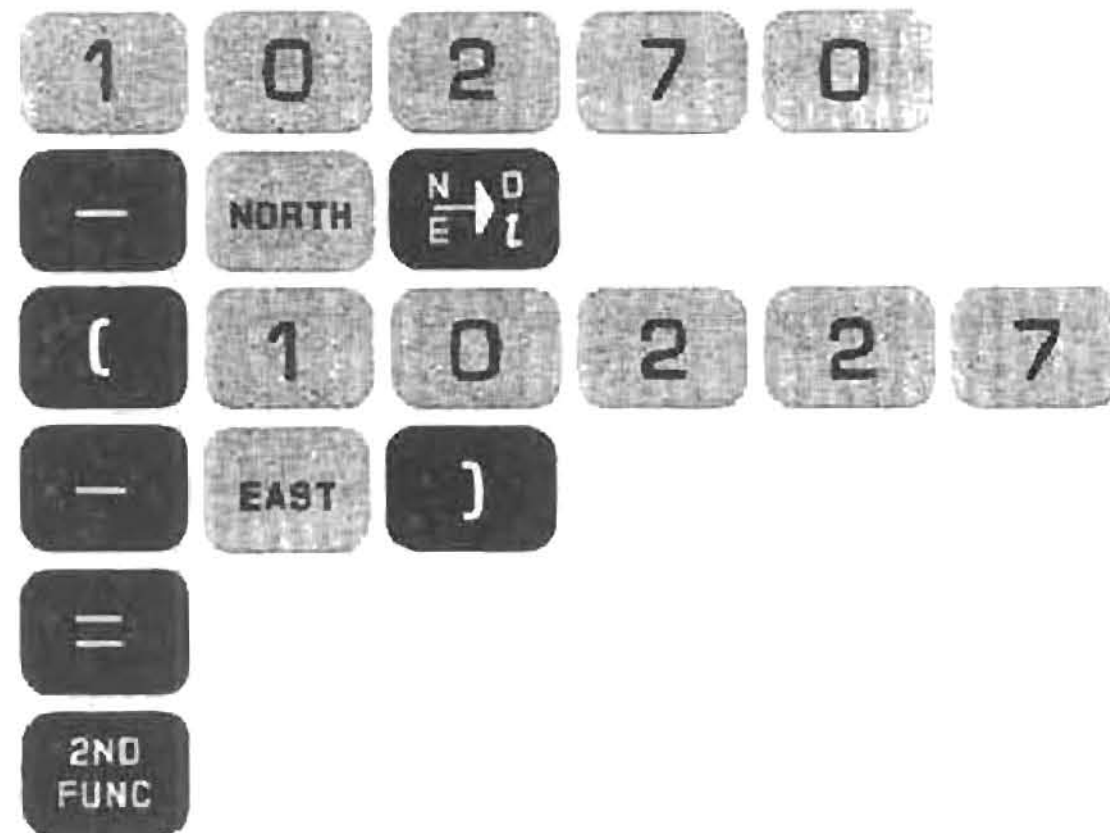
Side-Shots

A second side-shot from Point 1 has a Bearing Angle of $N17^{\circ}09'W$ and a distance of 186 feet.

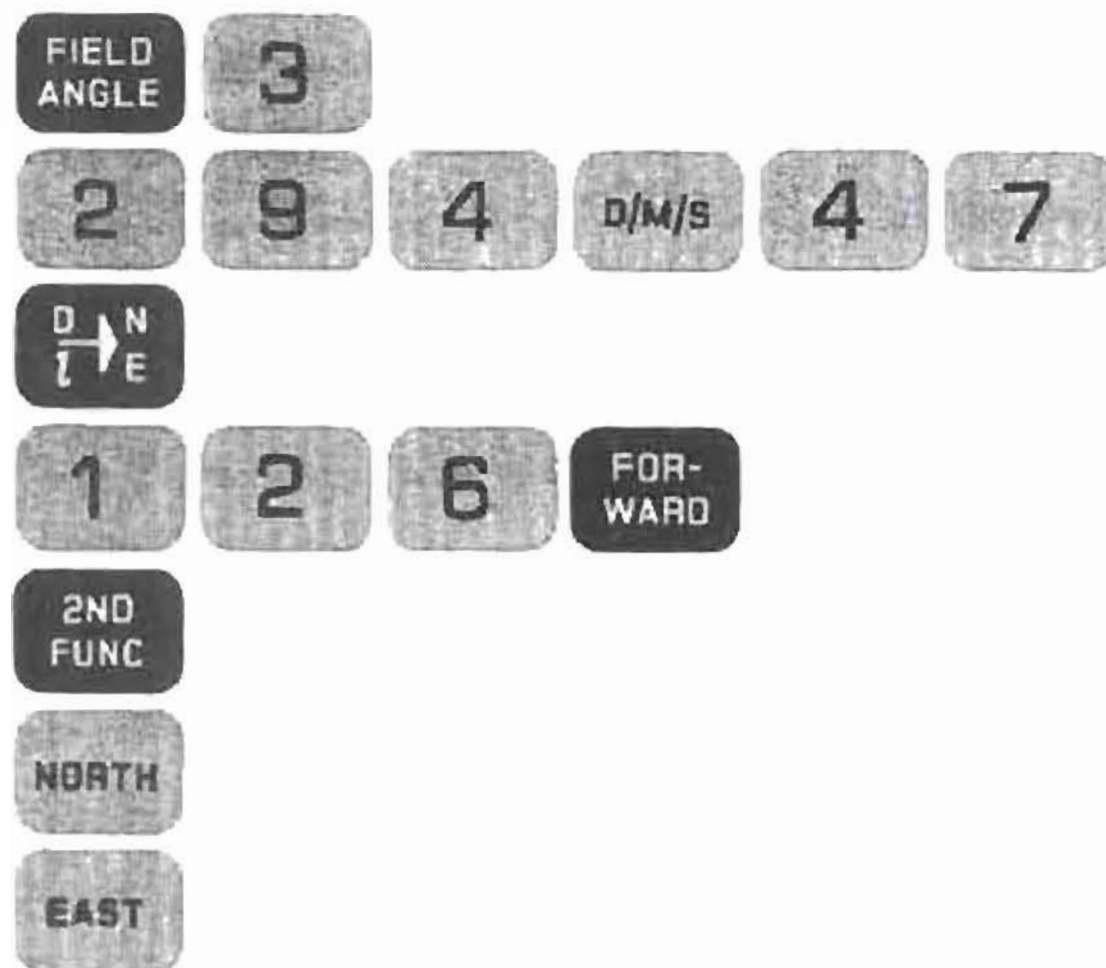


4 17 09 00	field angle
177.729	latitude
10,251.695	North coordinate
-54.646	departure
10,136.344	East coordinate

The final side-shot is an inverse. To do this side-shot, the latitude and departure must be calculated and entered.



To continue the traverse to Point 2, an angle to the right of $294^{\circ}47'$ was measured, with a distance of 126 feet.




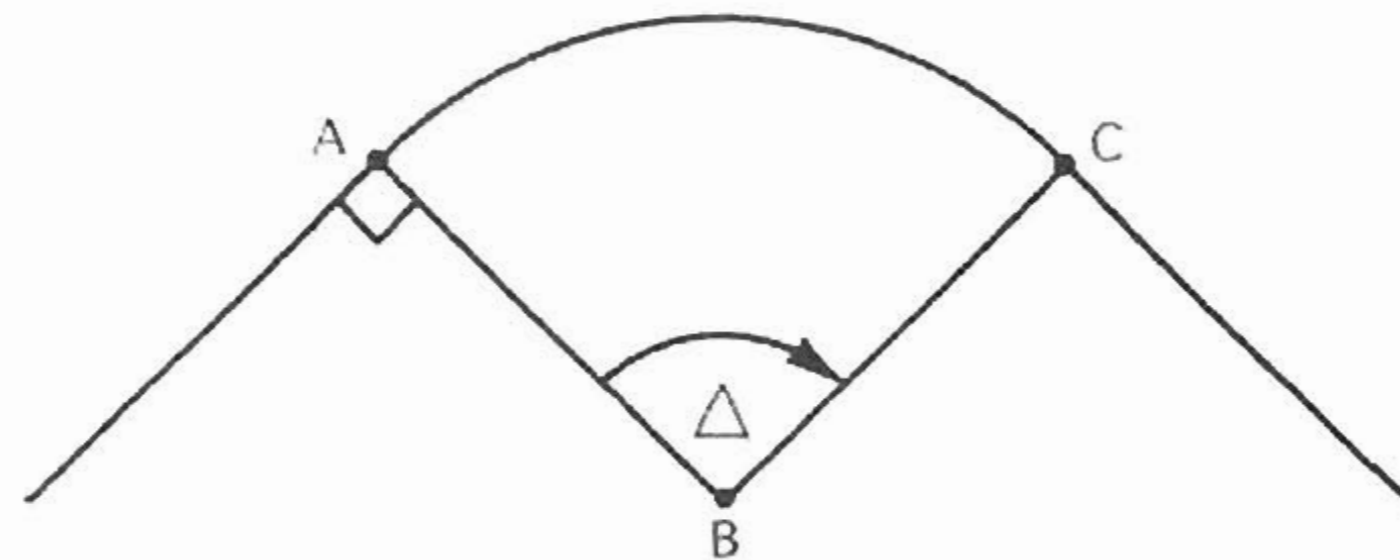
3 294 47 00	field angle
3 3 36 00.0	resultant bearing
-125.746	latitude
-7.984	departure
9,946.213	North coordinate
10,183.206	East coordinate

CURVES IN TRAVERSE

The 354 has a key,  , for entering circular curves into a traverse.

The procedure is:

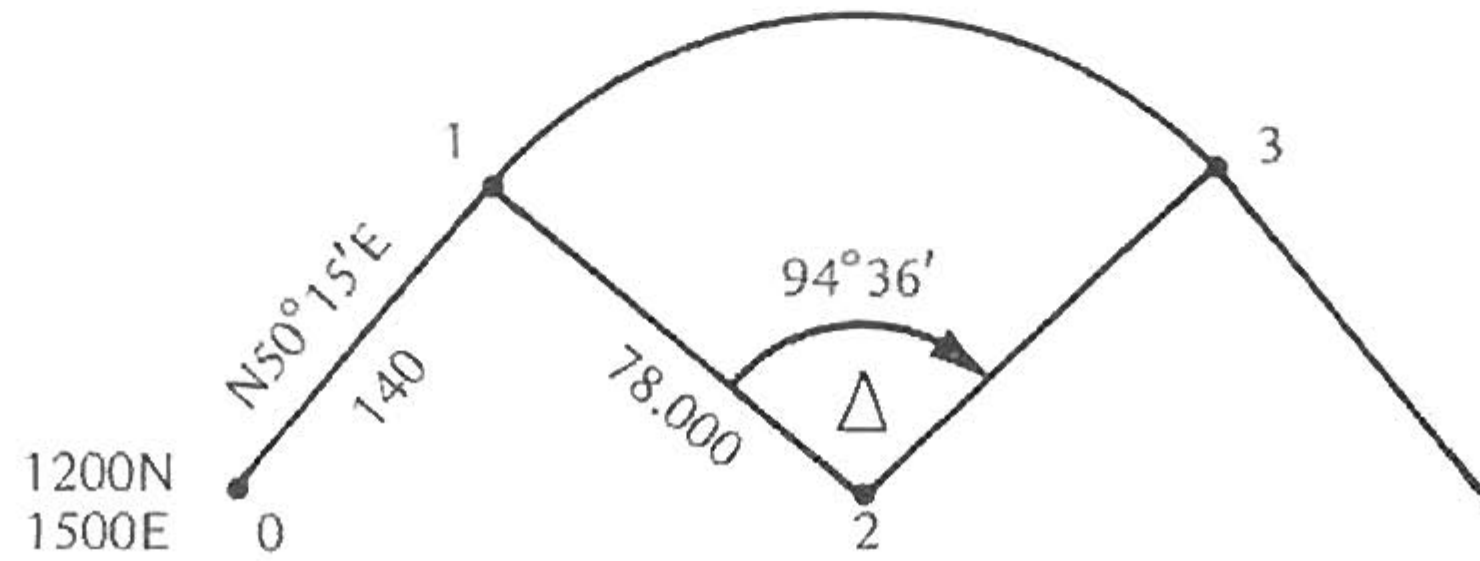
- Traverse to the center of the curve. (Point B). For tangent curves, this is a 90° deflection angle from the previous course.
- Input the central angle (Δ) and press 



The first thing displayed is the bearing of course B-C. Pressing  displays the length of B-C. Pressing the  and  keys will display the coordinates of Point C.

Curves in Traverse

For Example:



1 2 0 0 ST_n NORTH
 1 5 0 0 ST_n EAST
 QUAD-RANT 1
 5 0 D/M/S 1 5 $\frac{D}{L} \rightarrow \frac{N}{E}$
 1 4 0 FORWARD
 2ND FUNC
 NORTH
 EAST

1,200.000

1,500.000

1 50 15 00

89.521

latitude

107.637

departure

1,289.521

North coordinate

1,607.637

East coordinate

Curves in Traverse

Now, traverse to the center of the curve (point 2)



<input type="text"/>	field angle
<input type="text"/>	bearing (1-2)
<input type="text"/>	latitude
<input type="text"/>	departure
<input type="text"/>	North coordinate
<input type="text"/>	East coordinate

Now enter the central angle:



34 33 00

central angle

34 31 30.0

bearing (2-3)

73.000

distance

1274.457

North coordinate

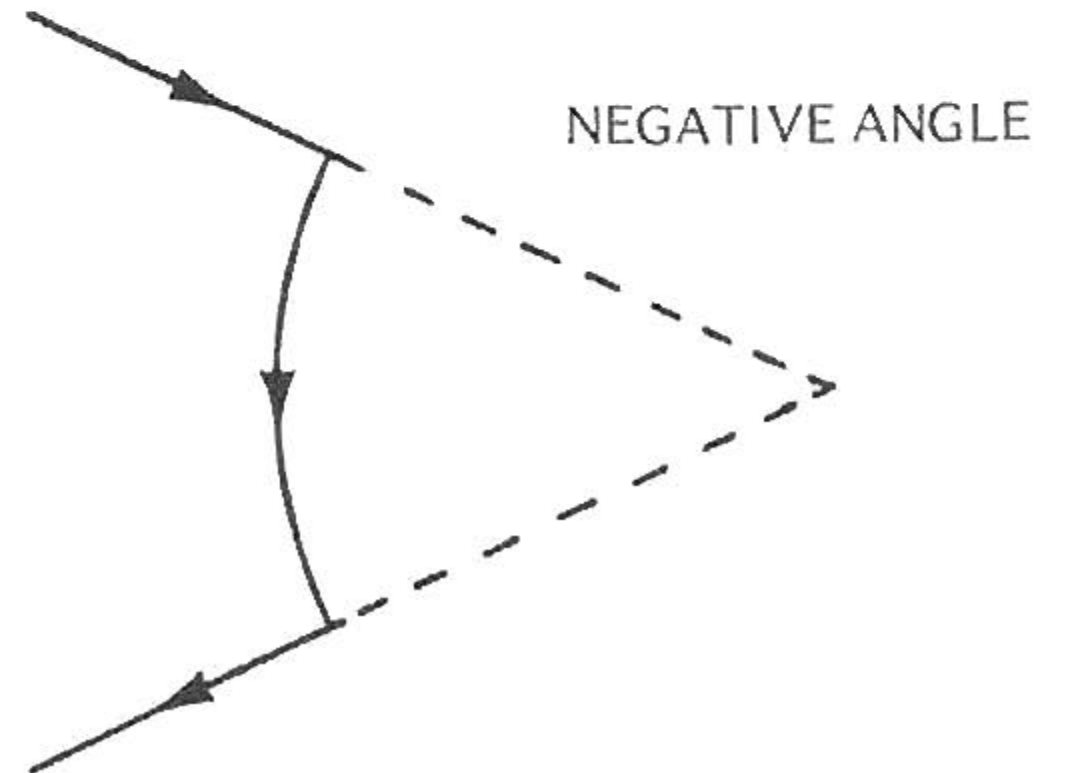
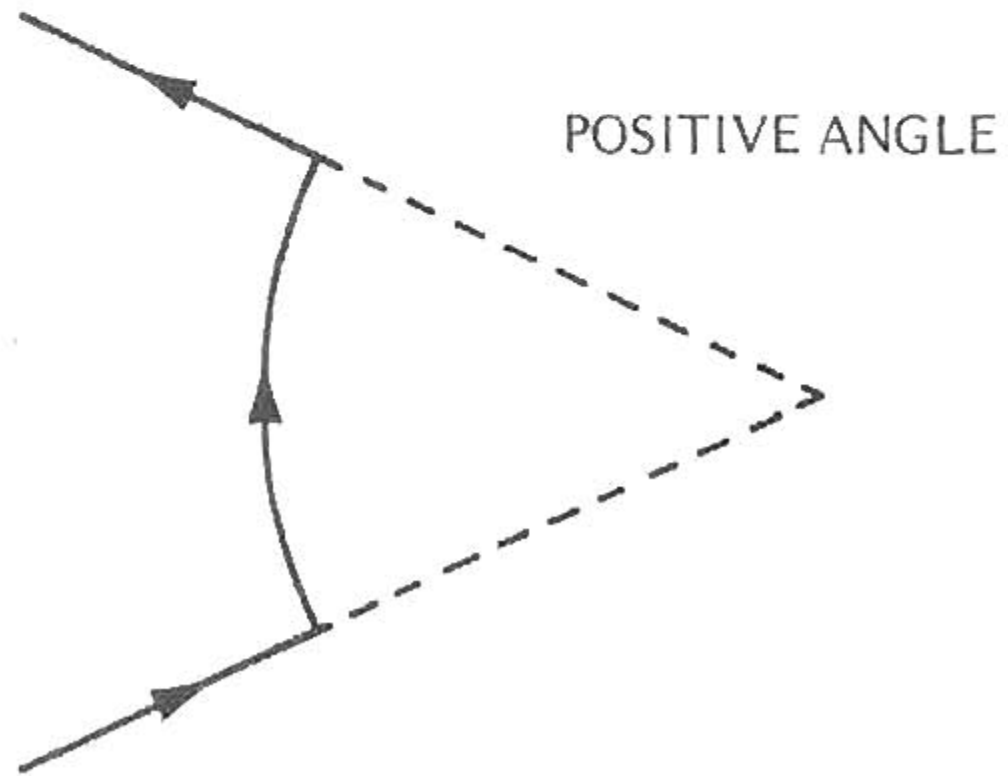
1721.290

East coordinate

Curves in Traverse

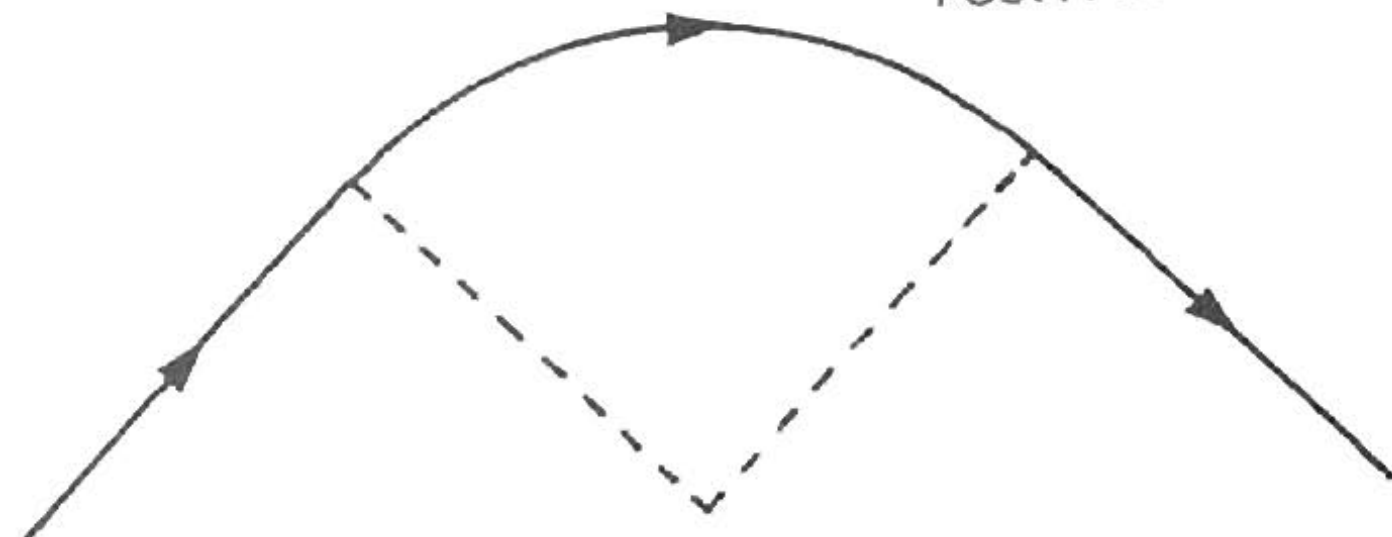
Follow a rule of thumb to determine whether the central angle is positive or negative. As you move along the arc from the present point (P.C.) to the next point on the traverse (P.T.), if the direction is clockwise, the central angle is positive. If the direction is counter-clockwise, the central angle is negative.

Excluded Areas

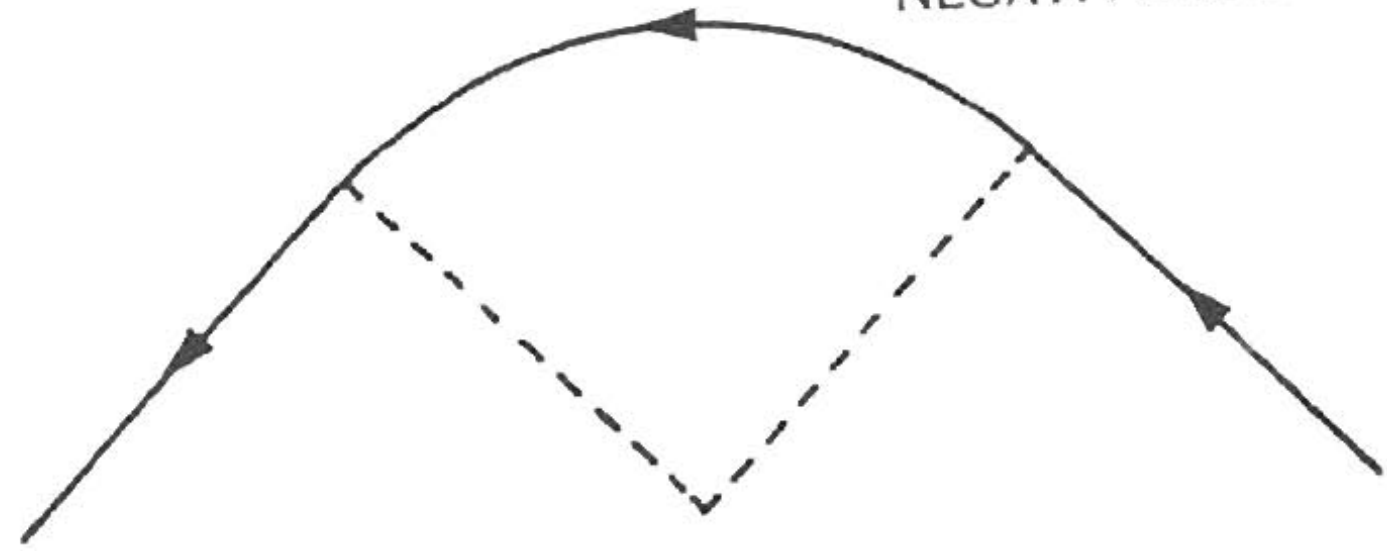


Included Areas

POSITIVE ANGLE



NEGATIVE ANGLE



EXAMPLE

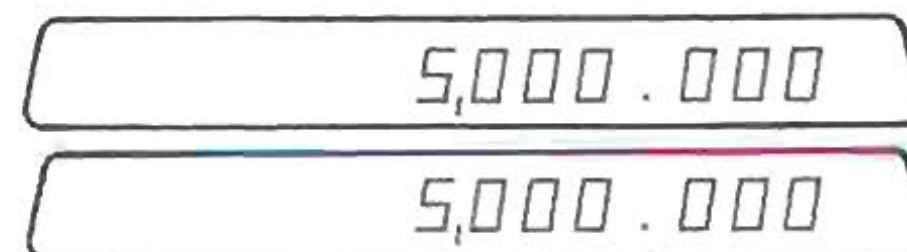
The purpose of this example is to calculate a traverse using as many of the keys as possible. It is not meant to be representative of a typical field problem.

The Surveyor has the capability to calculate both the Perimeter and the Area. This is done in two separate memories. If you are interested in knowing Perimeter and/or Area, you must first make sure these memories have no numbers in them.

To clear them:

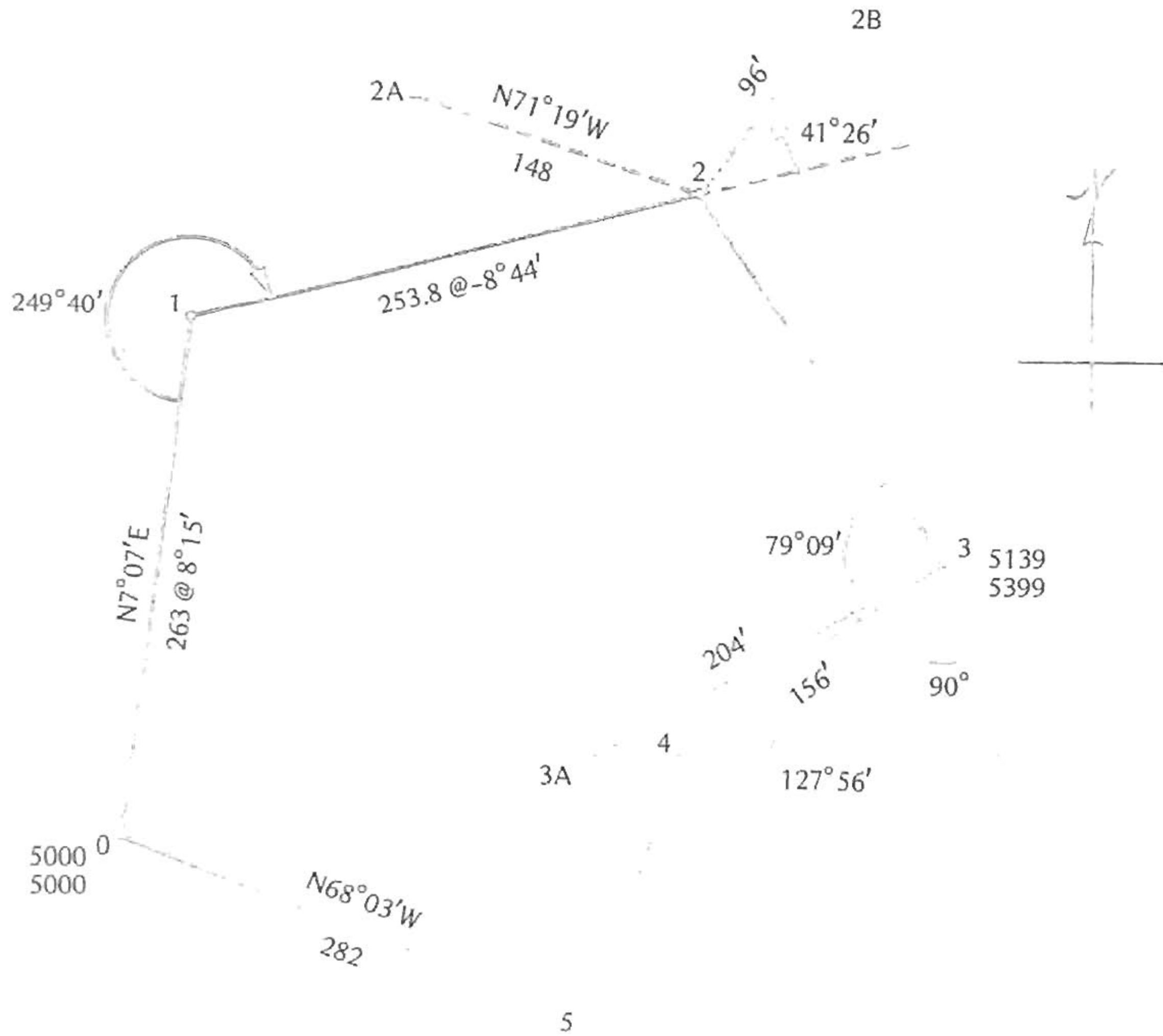


Enter starting coordinates:



Set BEARING/AZIMUTH switch to BEARING





Description _____

Survey Date _____

Compucorp[®]
SURVEY WORK SHEET



Crew Chief _____

Sheet Prepared by _____

Date Prepared _____


Course	Field Angle	Bearing	Slope Distance	Vertical Angle	Horizontal Component	Δ Elevation	Latitude	Departure	North	East
Starting Coordinates									5000 000	5000 000
0-1		N - 7 07 00 - E	263 000	8°15						
1-2	Right 249°40'	- -	253 800	-8°44						
2-2A		N -71 19 00 - W	148 000							
2-2B	L.D. 41°26'	- -	96 000							
2-3		- -							5139 000	5399 000
3-3A	Left 79°09'	- -	204 000							
3-4	RD 90°	- -	156 000							
4-5	Δ127°56'	- -								
5-0		N -88 03 00 - W	282 000							
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								
-		- -								

Traverse Example

Course	Field Angle	Bearing	Slope Distance	Vertical Angle	Horizontal Component	Δ Elevation	Latitude	Departure	North	East
Starting Coordinates									5000 000	5000 000
0-1		N 7 07 00 - E	263,000	8°15						

Describe course 0-1:

QUAD-RANT 1

7 D/M/S 7 

2 6 3

FIELD ANGLE 7 8 D/M/S 1 5

FOR-WARD

2ND FUNC

NORTH

EAST

bearing

distance

vertical angle

latitude

departure

North coordinate

East coordinate

Course	Field Angle	Bearing	Slope Distance	Vertical Angle	Horizontal Component	Δ Elevation	Latitude	Departure	North	East
Starting Coordinates									5000 000	5000 000
0-1		N - 7 07 00 - E	263,000	8°15			260,270	59,240		
1-2	Right 249°40'	-	253,800	-8°44						

Course 1-2 has a back-sight with an angle right of 249°40', for a distance of 253.8 feet with a vertical angle of 8°44' below horizontal.

FIELD ANGLE

3

2

4

9

D/M/S

4

0

3 4 9 . 4 0

field angle

D
N
E

1

7

0

7

0

1 7 0 7 0 0

resultant bearing

2

5

3

.

8

2 5 3 . 8

length

FIELD ANGLE

7

CHG SIGN

8

D/M/S

4

4

7 - 8 4 4

vertical angle

FORWARD

2 6 0 2 7 0

latitude

2ND FUNC

5 9 2 4 0

departure

NORTH

5 0 0 0 0 0

North coordinate

EAST

5 0 0 0 0 0

East coordinate

Traverse Example

Now calculate the horizontal component and change in elevation of courses 1 and 2:

Horizontal component = slope distance x cosine vertical angle

Change in elevation = slope distance x sine vertical angle

The image shows a calculator keypad simulation with the following sequence of operations and results:

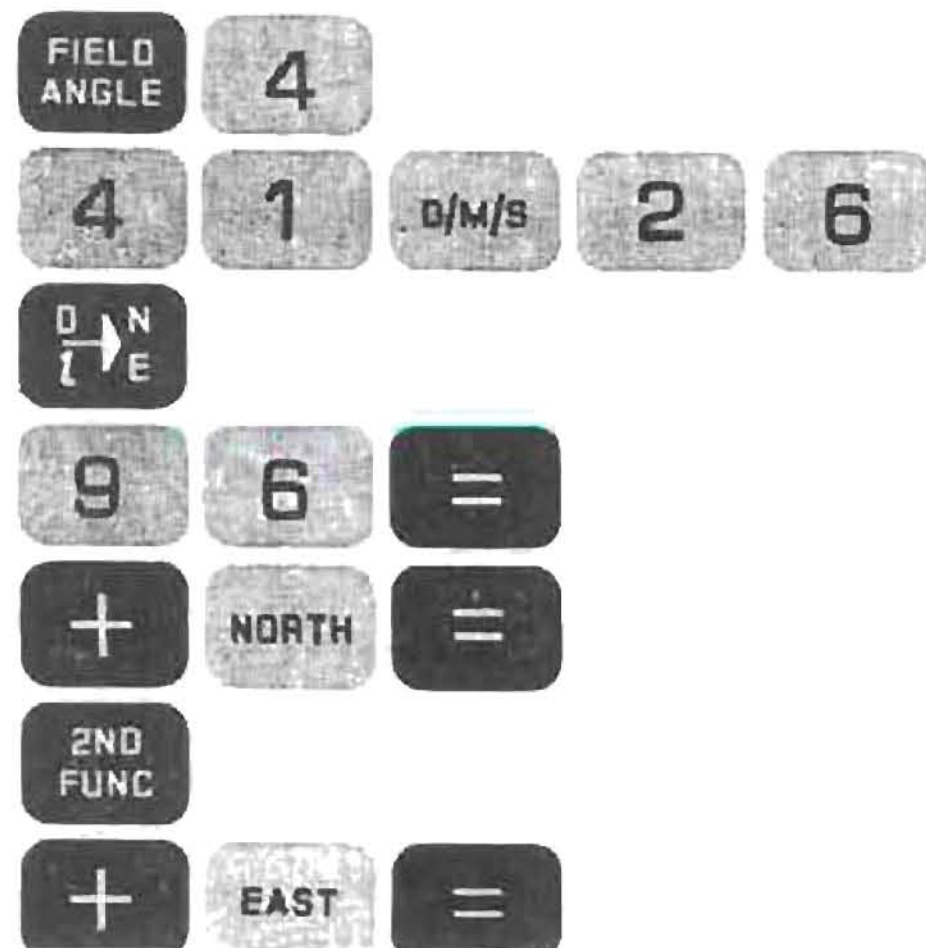
- Row 1: 2, 6, 3, ×
- Row 2: 8, D/M/S, 1, 5, COS/SIN, =
- Row 3: 2ND FUNC, =
- Row 4: 2, 5, 3, ., 8, ×
- Row 5: CHG SIGN, 8, D/M/S, 4, 4, COS/SIN, =
- Row 6: 2ND FUNC, =

The results are displayed in rounded rectangular boxes:

- 260.278 horizontal component
- 37.738 change in elevation
- 250.857 horizontal component
- 38.535 change in elevation

The second side-shot from Point 2 is a left-deflection angle of $41^{\circ}26'$, for a distance of 96 feet.

To Calculate:



resultant bearing



latitude



North coordinate



departure



East coordinate

2-3	-	-							5139,000	5399,000
3-3A	Left 79°09'	-	-	204,000						

A side shot from Point 3, is taken, with an angle to the left of 79°09', for a distance of 204 feet:

FIELD ANGLE 2
 7 9 D/M/S 9
 D → N
 2 0 4 =
 + NORTH =
 2ND FUNC
 + EAST =

field angle
 resultant bearing
 latitude
 North coordinate
 departure

Traverse Example

Course	Field Angle	Bearing	Slope Distance	Vertical Angle	Horizontal Component	Δ Elevation	Latitude	Departure	North	East
Starting Coordinates									5000 000	5000 000
0-1		N - 7 07 00 - E	263,000	8°15			258,273	32,245	5258,273	5032,245
1-2	Right 249°40'	N - 76 47 00.0 - E	253,800	-8°44			57,354	244,212	5315,627	5276,458
2-2A		N - 71 19 00 - W	148,000				47,409	-140,200	5363,037	5136,257
2-2B	L.D. 41°26'	N - 35 21 00 - E	96,000				78,300	55,542	5393,928	5332,001
2-3		S - 34 45 08.2 - E	214,973						5139,000	5399,000
3-3A	Left 79°09'	S - 66 05 51.8 - W	204,000						5056,343	5212,495
3-4	RD 90°	- -	156,000							
4-5	Δ 127°56'	- -								

The next calculation encountered is a circular curve. We first traverse to the center:

FIELD ANGLE 1 9 0
 D N
 E
 1 5 6 FORWARD
 2ND FUNC
 NORTH
 EAST

1 90 00 00 right deflection angle
 3 55 14 51.8 resultant bearing
 -88.924 latitude
 -128.173 departure
 5,050.075 North coordinate of point 4
 5,270.826 East coordinate of point 4

Now, enter the central angle. (Positive in this case)



127 56 00	central angle
3 3 10 51.8	bearing of course 5
156.000	length
4,894.315	North coordinate
5,262.169	East coordinate

Traverse Example

Course	Field Angle	Bearing	Slope Distance	Vertical Angle	Horizontal Component	Δ Elevation	Latitude	Departure	North	East
Starting Coordinates									5000,000	5000,000
0-1		N - 7 07 00 - E	263,000	8°15						
1-2	Right 249°40'	N - 70 00 00 - E	253,800	-8°44						
2-2A		N - 71 19 00 - W	148,000							
2-2B	L.D. 41°28'	N - 70 00 00 - E	96,000							
2-3		N - 71 19 00 - W							5139,000	5399,000
3-3A	Left 79°09'	N - 60 00 00 - E	204,000							
3-4	RD 90°	N - 60 00 00 - E	156,000							
4-5	Δ 127°56'	N - 68 03 00 - W								
5-0		N - 68 03 00 - W	282,000							

The final course has a Bearing of N68°03'W and a distance of 282 feet.

QUAD-RANT

4

6

8

D/M/S

3

D → N
↓ → E

2ND FUNC

2

8

2

FORWARD

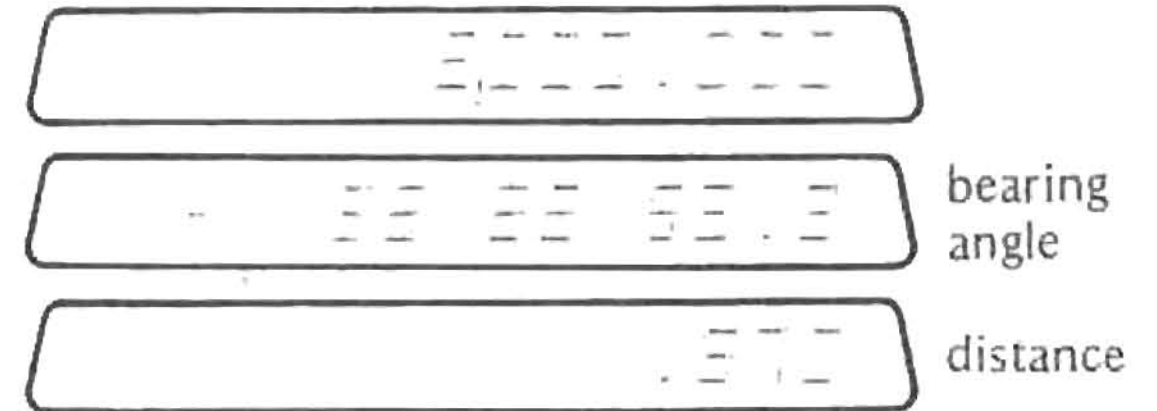
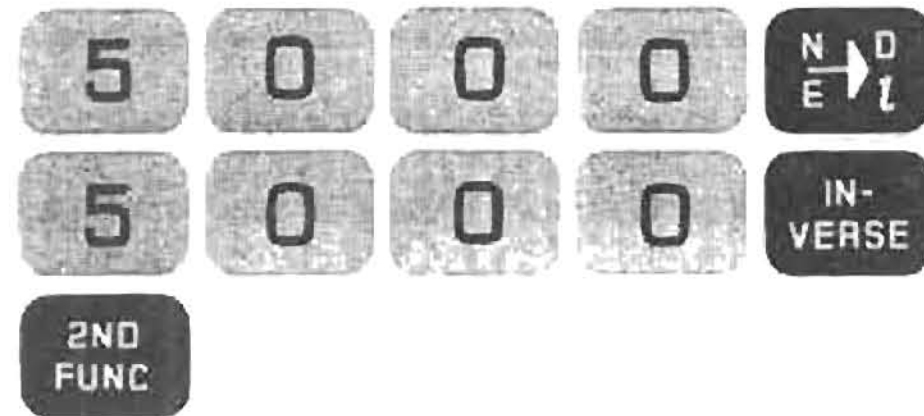
latitude

departure

North

East

The traverse does not close. To check how far off it is, force the closure by inversing.

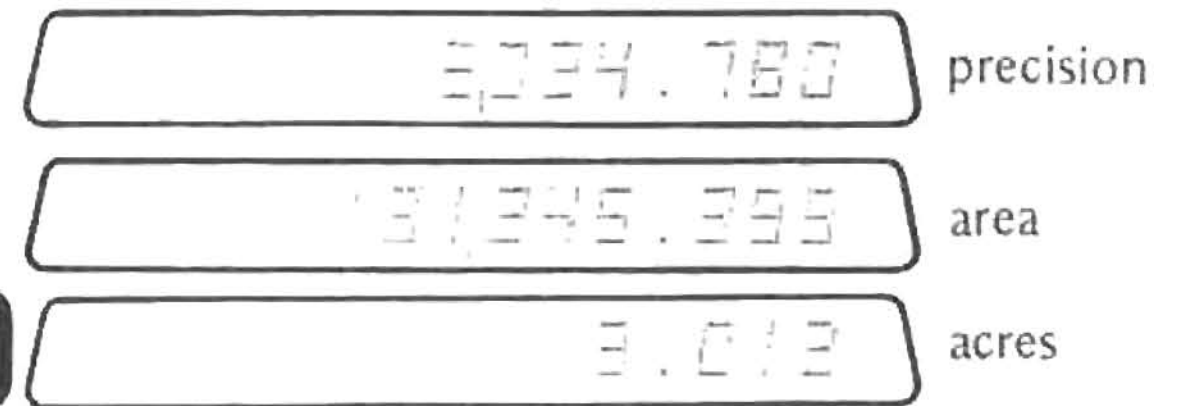


To calculate the precision of the traverse

Press



To display the area,

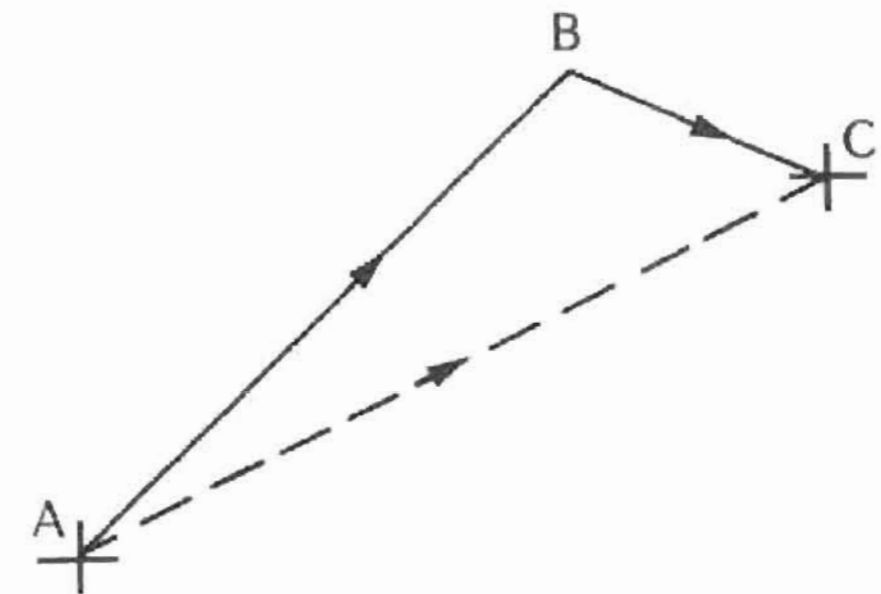


INTERSECTIONS

The Surveyor automatically calculates four kinds of intersections:


- I Length and direction known
- II Two directions known
- III Two lengths known
- IV Angle between the two legs and length of one leg known

When calculating an intersection, the base leg (A-C in the figure) must be defined. This is done on the Surveyor by traversing, using the **FORWARD** or **INVERSE** keys, from A to C. Since the trailing leg of a circular curve input during a traverse is retained as the last leg, it may also be defined as the base leg for intersections.



In all the intersection calculations, there are two knowns. One of them is keyed into the Surveyor, then **INTERSECT** is pressed. The second known is then entered, and **=** is pressed. The Surveyor calculates two unknowns, displays one and puts the other in **Second Function**. Since the knowns are keyed in as decimal numbers (lengths), directions, or field angles, the Surveyor can tell which kind of intersection to perform.

Some of the intersections have two solutions. The second solution is calculated by pressing **=** a second time. You can go back and forth between the two solutions by repeatedly pressing **=**. If any key except **2ND FUNC** is pressed between two **=**'s, then the second solution will not be calculated.

If you ask the Surveyor to do an impossible intersection, it will signal by displaying  .

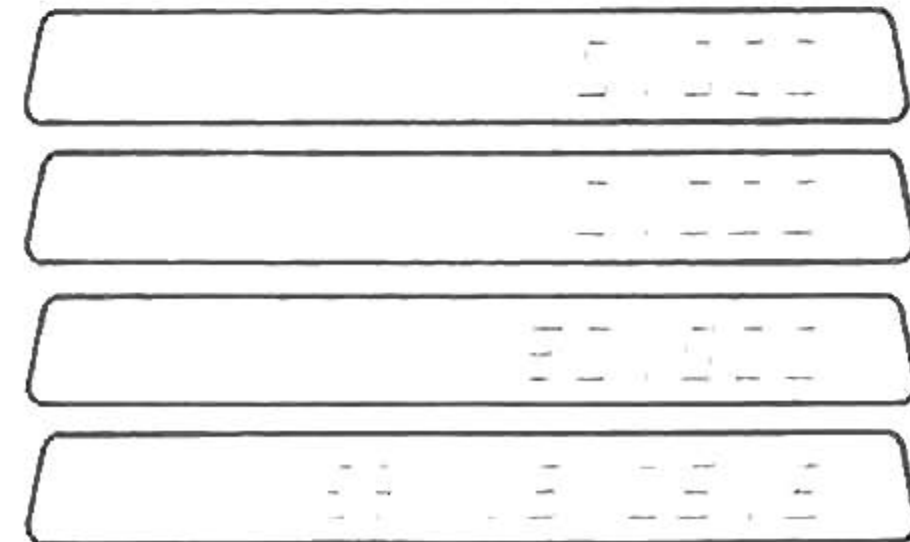
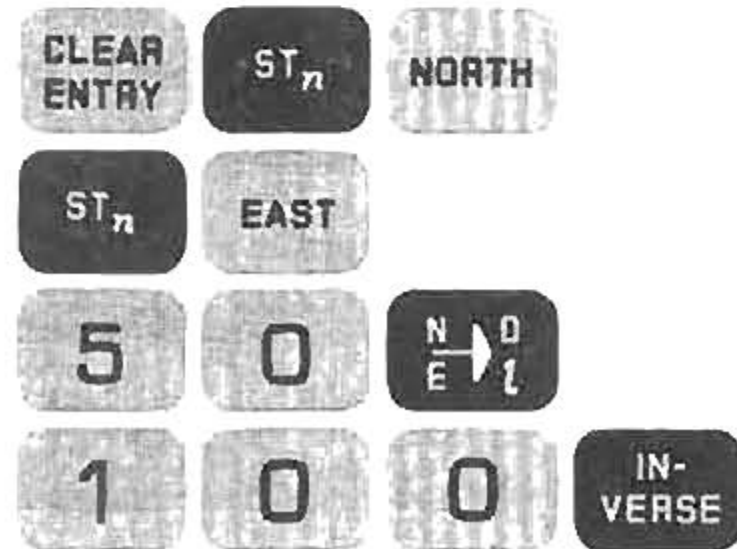
Be careful when doing the intersection that you are thinking of the directions of the three legs involved in the right way:

- The direction of the base leg, AC, is always *from* A to C.
- The direction of the intersection leg starting *from* A is always from A to the intersection point.
- The direction of the intersection leg ending at C is always *from* the intersection point to C.

Examples of the four intersections are given. For all of them the base leg A-C is defined as follows:

Coordinates of A: 0.000N, 0.000E

Coordinates of C: 50.000N, 100.000E



TYPE 1. DIRECTION AND LENGTH KNOWN

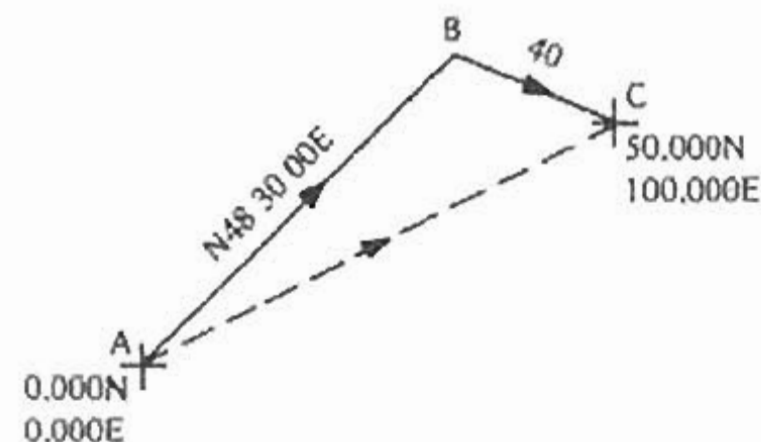
- Traverse the base leg.
- Enter the known direction. This must be an angle, but not a field angle.
- Press **INTER-SECT**
- Enter the known length.
- Press **=**

The unknown direction is displayed; the unknown length is in Second Function. Press **=** again for the second solution.

If you prefer, you may put in the known length before **INTER-SECT**, and the known direction after. The answers still come out in the same order.

Example:

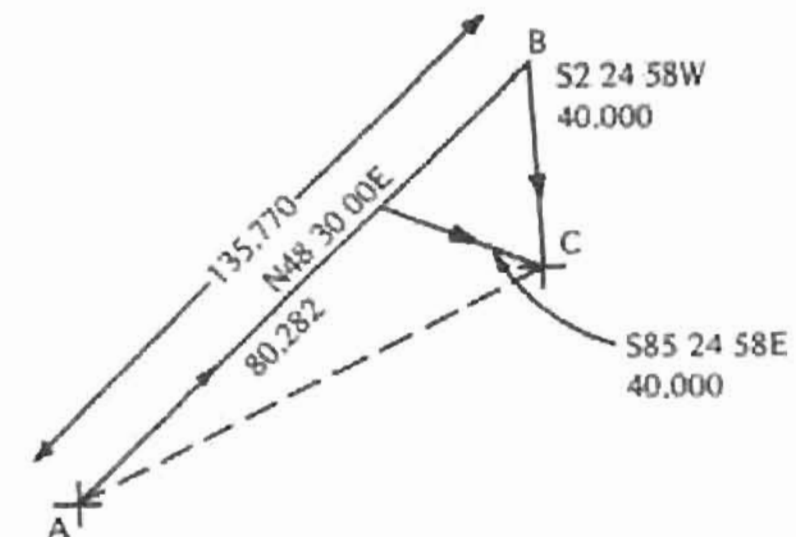
The direction of AB and the length of BC are known:



Leg AC has been traversed (Page 57)

QUAD-RANT	1	4	8	D/M/S	3	0	1 48 30 00	direction of AB
INTER-SECT							1 48 30 00	
	4	0					40.000	length of BC
=							2 85 24 58.2	direction of BC
2ND FUNC							80.282	length of AB
⇌	To get the second solution						3 2 24 58.2	direction of B'C
2ND FUNC							135.770	length of AB'

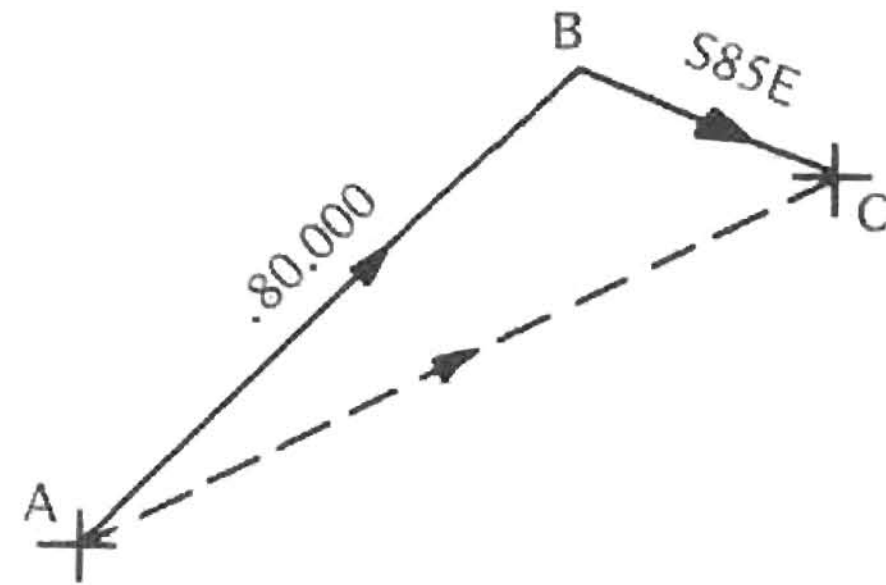
The complete solution:



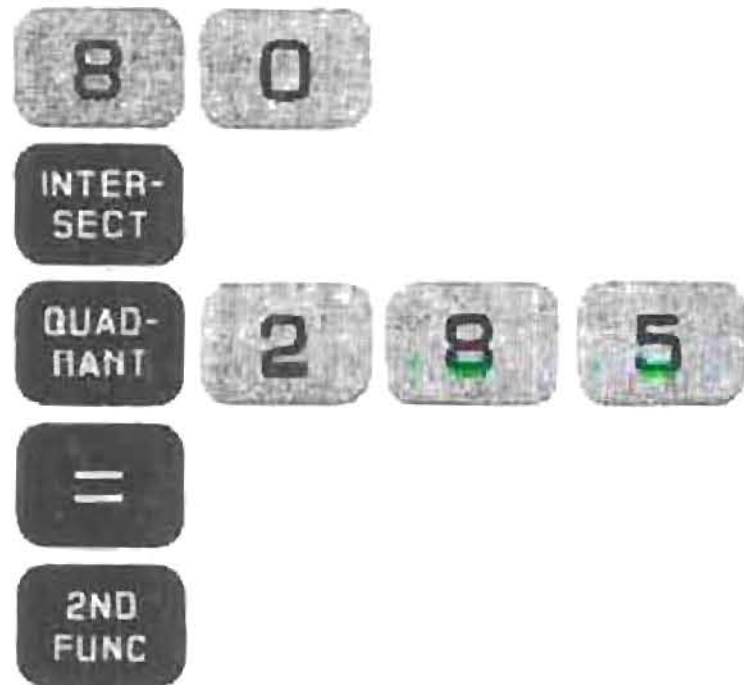
Intersection
Direction and Length Known

Example:

The direction of BC and the length of AB are known:



Leg AC has been traversed (page 57)



Intersection
Direction and Length Known



To get second solution:



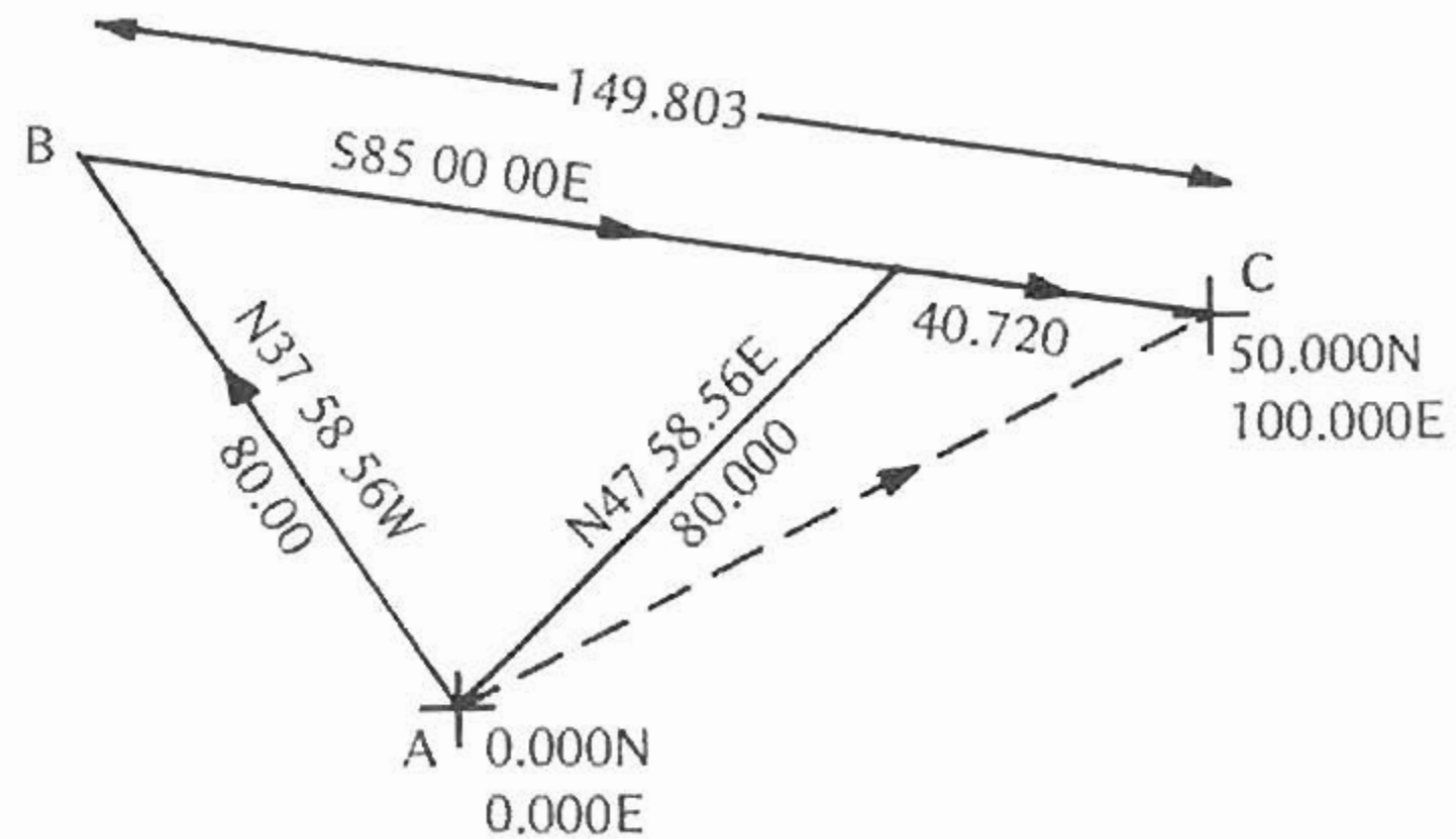
4 37.5856

direction
of AB'

40.720



length
of B'C

The complete solution:

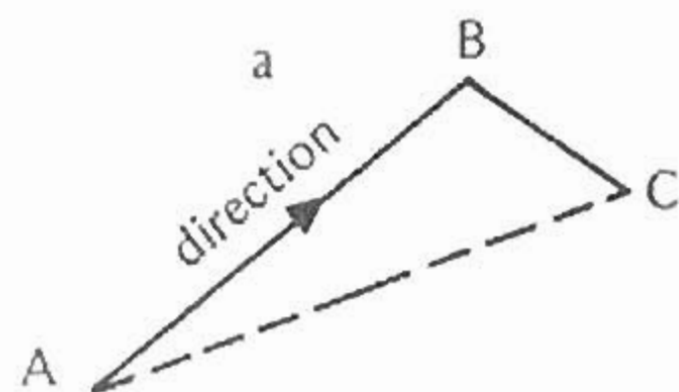


Intersection
Two Directions Known

TYPE II – TWO DIRECTIONS KNOWN

- Traverse the base leg
- Enter the first known direction – this must be an angle, but not a field angle
- Press 
- Enter the second known direction – again this must be an angle but not a field angle.
- Press 

A special case of two-directions-known intersection is when the direction of one leg and the angle between the two unknown legs are known. To solve this, you must do some arithmetic to calculate the direction of the second leg, and then do a Type II intersection. The sequence is slightly different, depending on whether the direction of the first or second side is known.



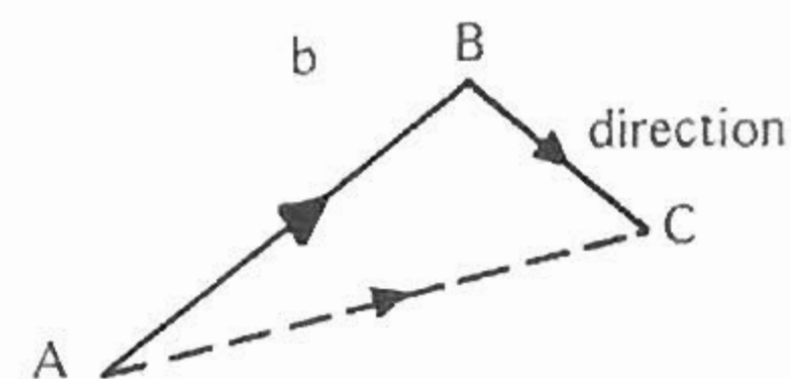
Direction of the first side and relative angle known

- Traverse the base leg
- Enter the direction of the first side
- Press **INTER-SECT** **(** **+**
- Enter the relative angle as a field angle
- Press **)**

The direction of the second side is displayed

- Press **=**

The length of the first side is displayed; the length of the second side is in Second Function.



Direction of second side and relative angle known

- Traverse the base leg
- Enter the direction of the second side
- Press **INTER-SECT** **(** **-**

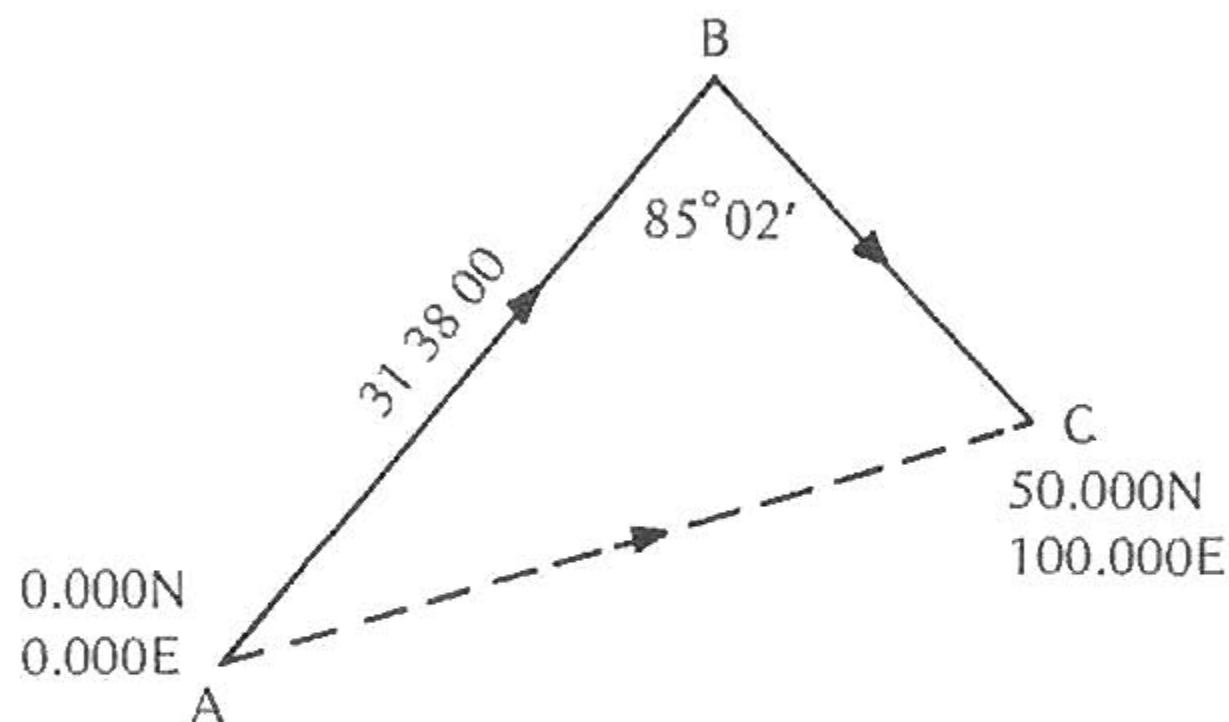
The direction of the first side is displayed

- Enter the relative angle as a field angle
- Press **)**
- Press **=**

The length of the second is displayed. The length of the first side is in Second Function.

Intersection
Two Directions Known

Example: Type IIa

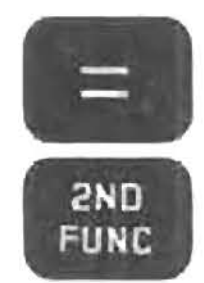


Leg AC has been traversed (page 57)

3 1 D/M/S 3 8
 INTER-SECT (+
 FIELD ANGLE 2 8 5 D/M/S 2
)

31 38 00 direction of AB
 31 38 00
 2 85 02 00 relative angle
 2 53 24 00.0 direction of BC

Intersection
Two Directions Known



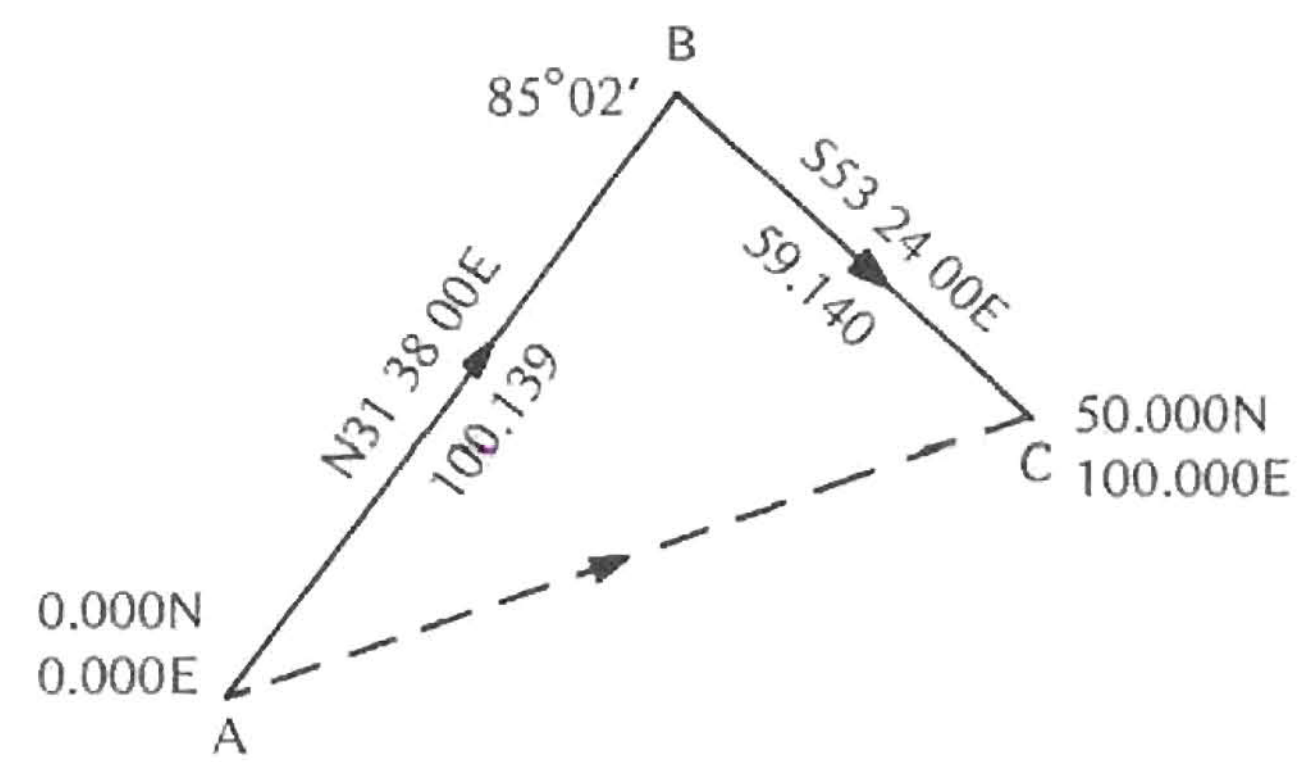
100.139

length of AB

59.140

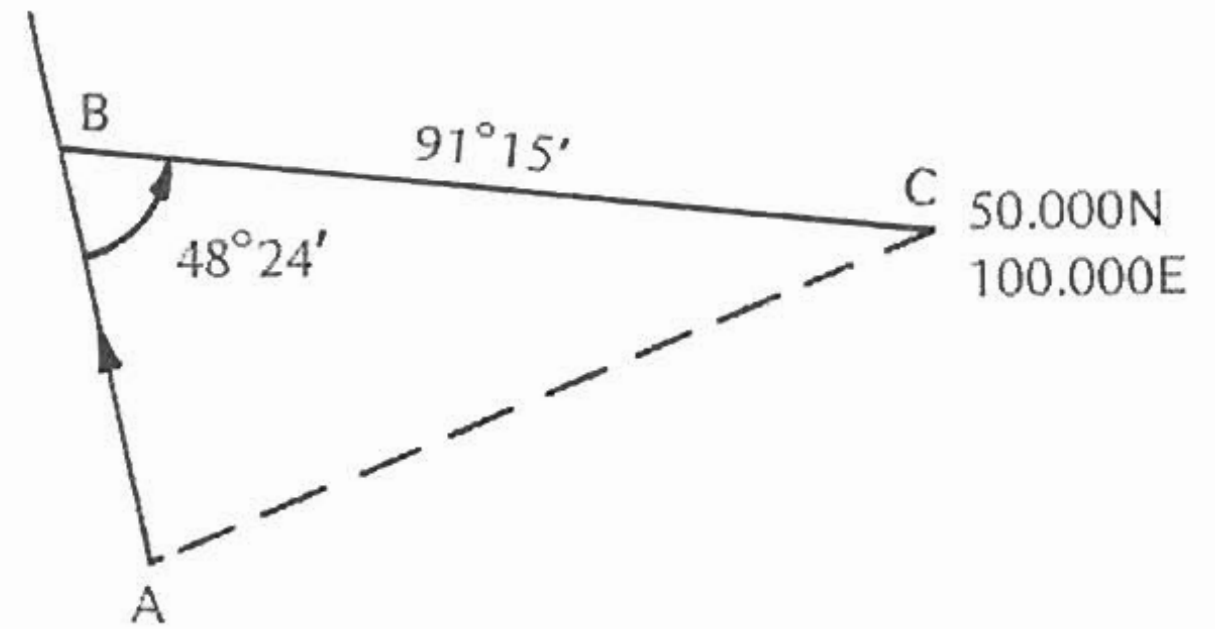
length of BC

The solution:



Intersection
Two Directions Known

Example: Type II b



Leg AC has been traversed (page 57)

direction of BC

relative angle

direction of AB

Intersection
Two Directions Known

=

2ND
FUNC

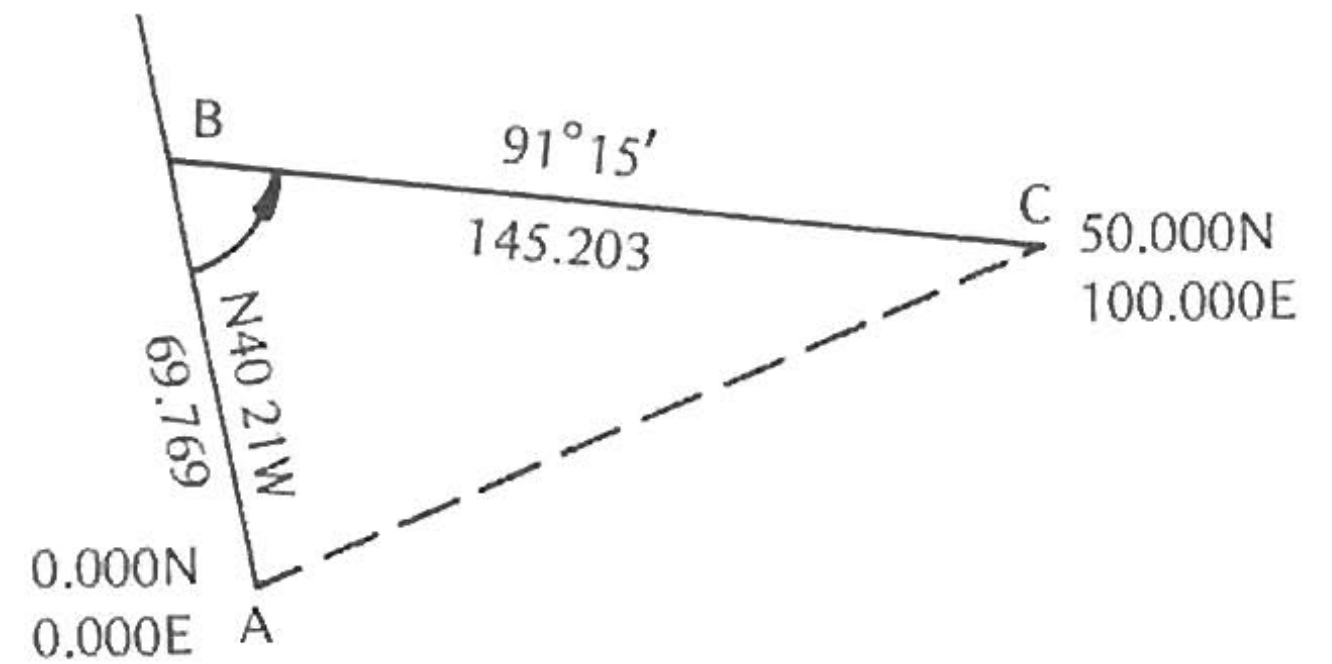
145.203

length of
BC

69.769

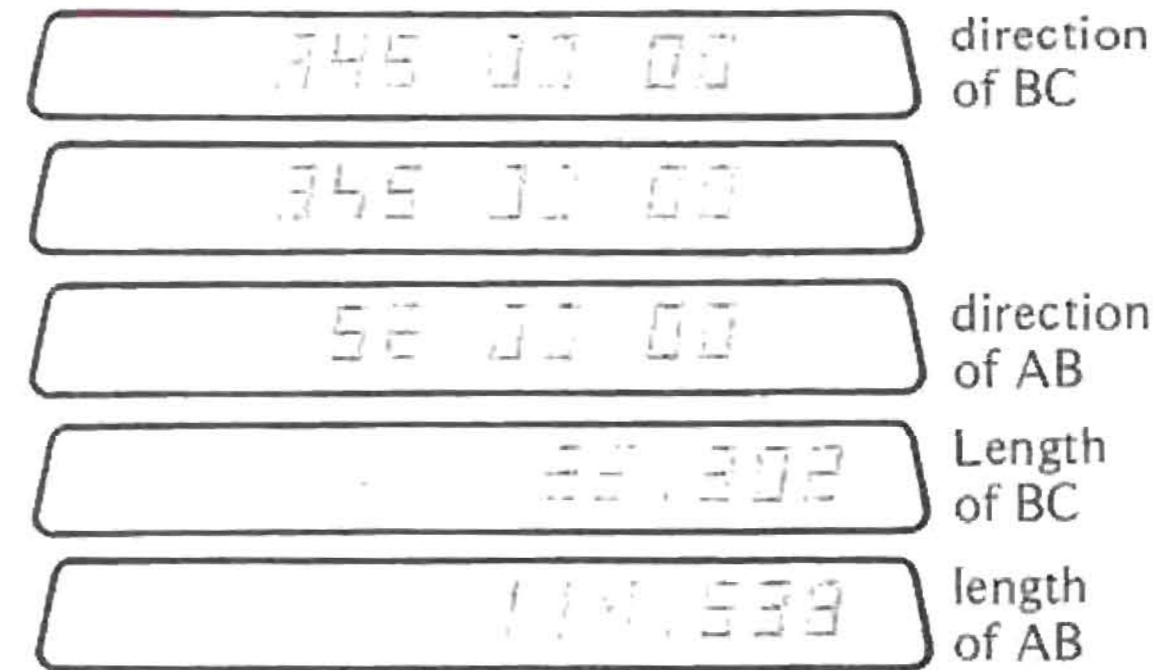
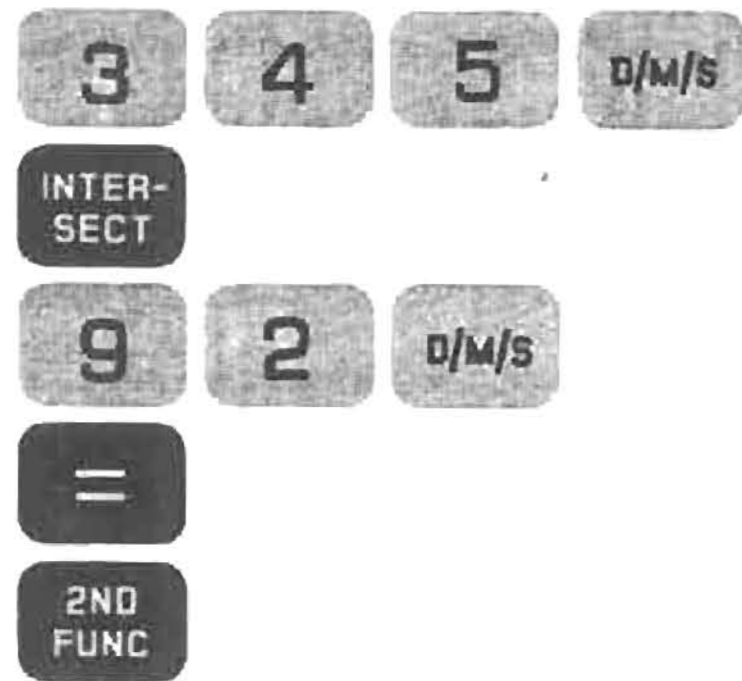
length of
AB

The solution:

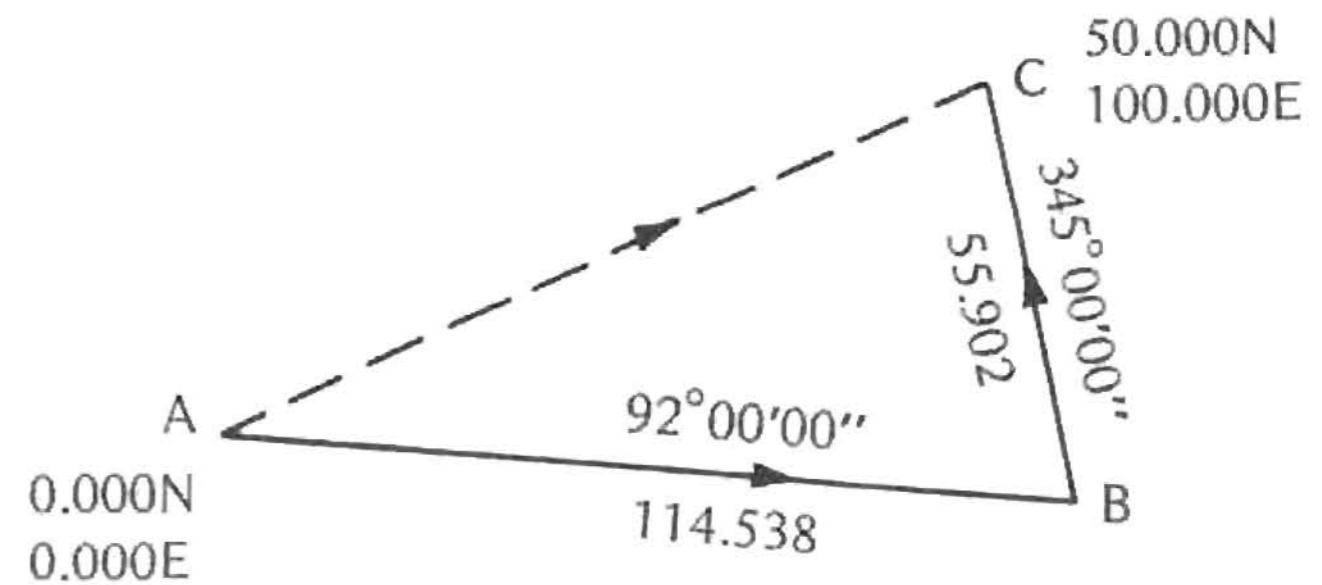


Intersection
Two Directions Known

If the directions are input in reverse order, the lengths will be calculated in reverse order.

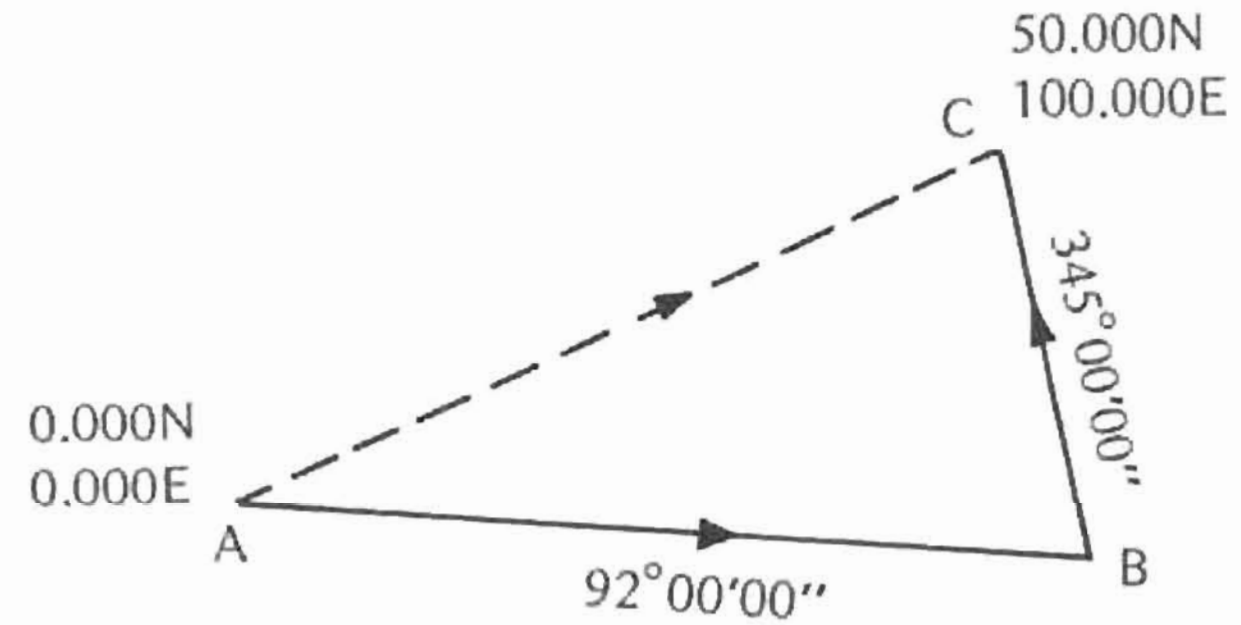


The complete solution is



The unknown length of the first direction is displayed. The unknown length of the second direction is in Second Function.

Example:




Leg AC has been traversed (page 57)

9 2 D/M/S
 INTER-SECT
 3 4 5 D/M/S
 =
 2ND FUNC


92 00 00 direction of AB
 92 00 00
 345 00 00 direction of BC
 114.533 length of AB
 55.903 length of BC

Intersection
Two Lengths Known

TYPE III – TWO LENGTHS KNOWN

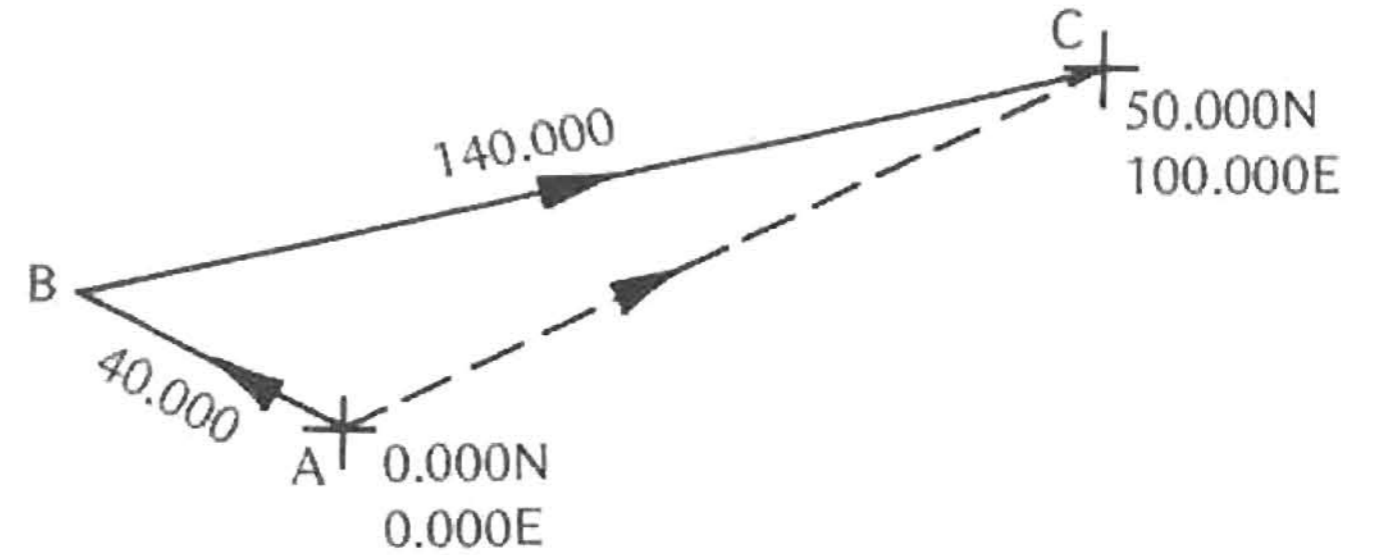
- Traverse the base leg
- Enter the length of the first leg
- Press 
- Enter the length of the second leg
- Press 

The direction of the first leg is displayed, the direction of the second leg is in Second Function.

Press  to get the second solution.

Intersection
Two Lengths Known

Example:



Leg AC has been traversed (page 57)

4 0
 INTER-SECT
 1 4 0
 =
 2ND FUNC

40.000 length of AB
 40.000
 140.000 length of BC
 4 64 30 39.8 direction of AB
 1 76 27 22.1 direction of BC

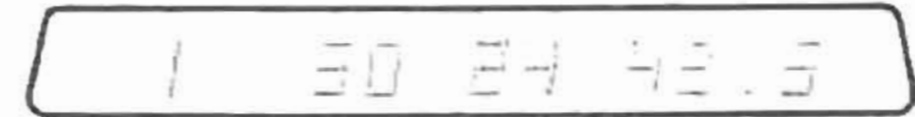
Intersection
Two Lengths Known



To get the second solution

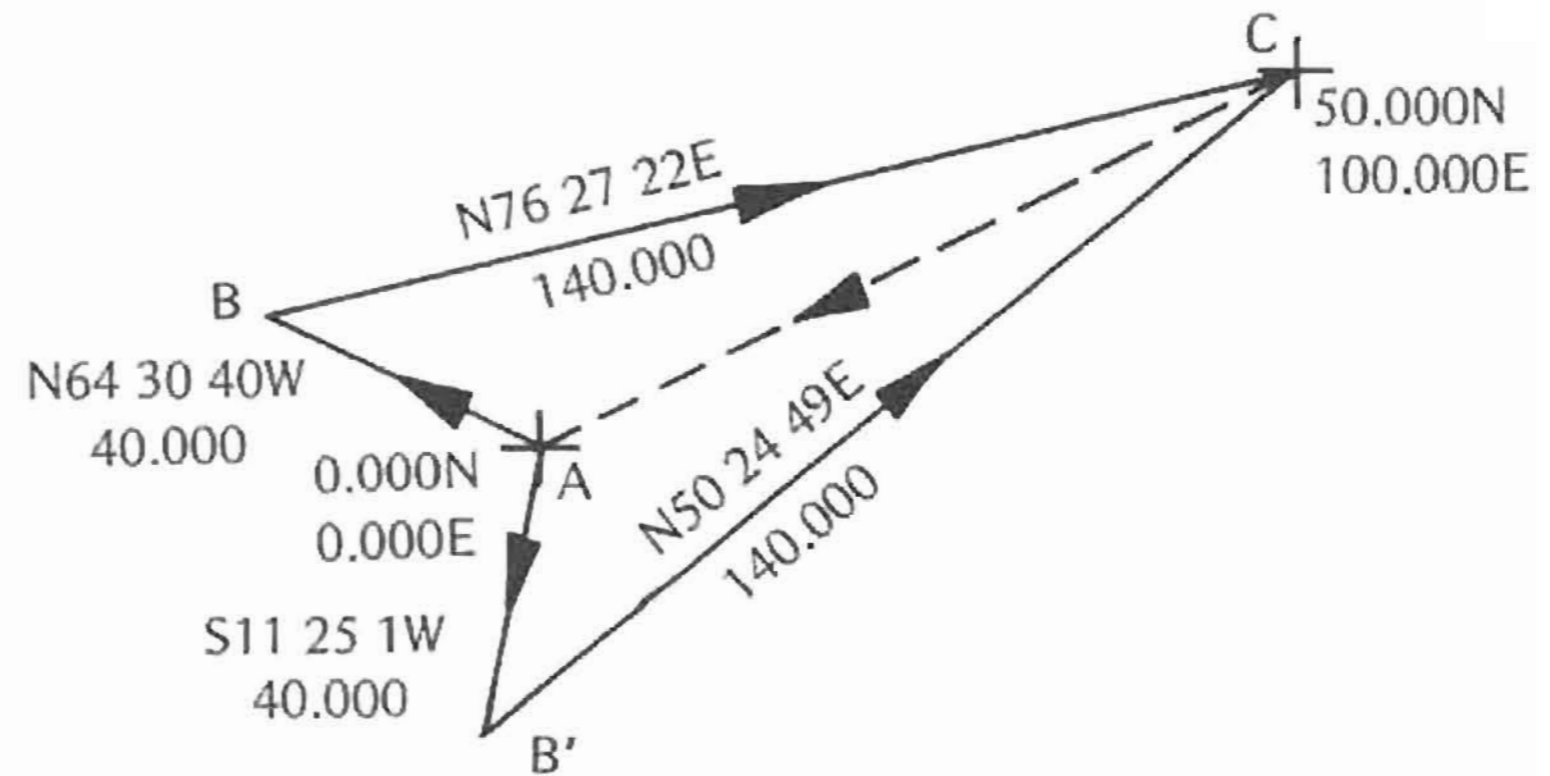


direction
of AB'



direction
of B'C

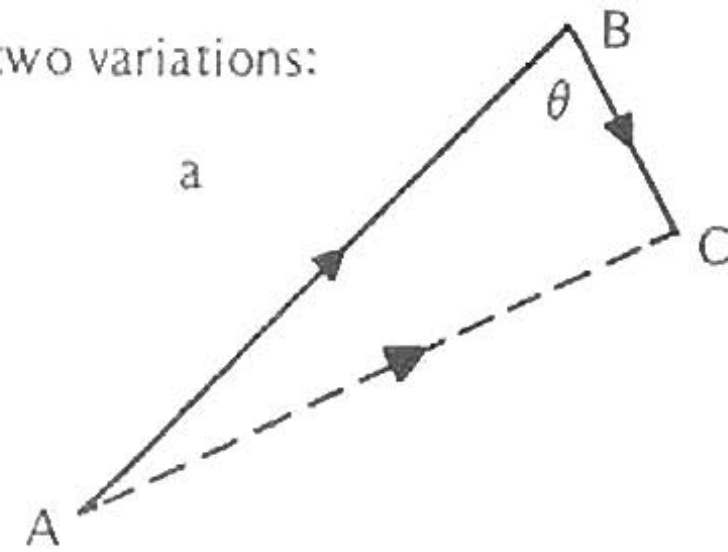
The complete solution is:



The lengths may be input in reverse order. The directions will be calculated in reverse order.

TYPE IV RELATIVE ANGLE AND LENGTH OF ONE LEG KNOWN

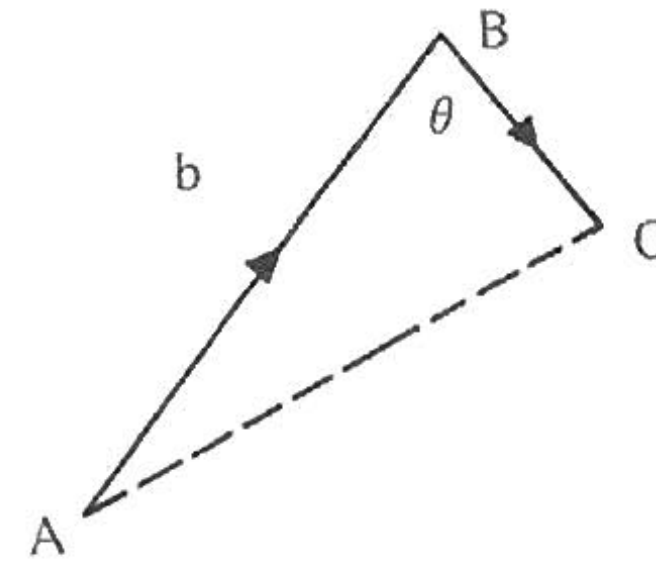
There are two variations:



Length of the first leg and relative angle known

- Traverse the base leg
- Enter the length of the first leg
- Press **INTER-SECT**
- Enter the relative angle as a field angle.
- Press **=**

The direction of the first leg is displayed. The length of the second leg is in Second Function. Press **=** again for the second solution. If the length calculated is negative, the solution is invalid.



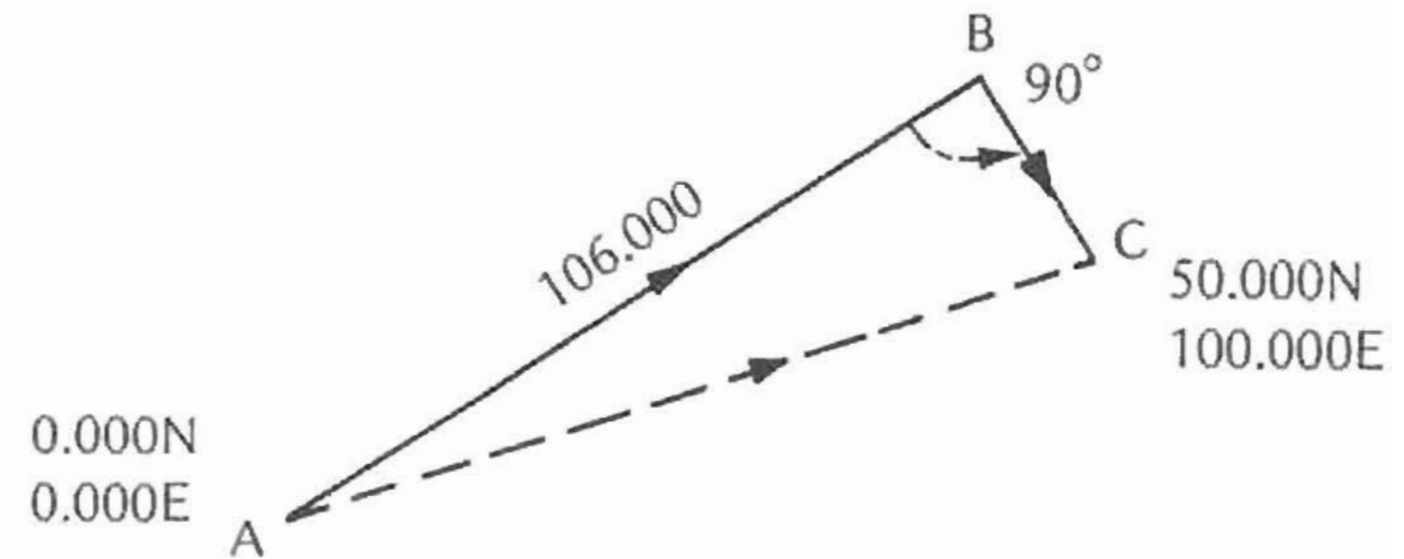
Length of second leg and relative angle known

- Traverse the base leg
- Enter the relative angle as a field angle
- Press **INTER-SECT**
- Enter the length of the second leg
- Press **=**

The direction of the first leg is displayed. The length of the first leg is in Second Function. Press **=** again for the second solution. If the length calculated is negative, the solution is invalid.

Intersection
Relative Angle and Length of One Leg Known

Example: Type IV a



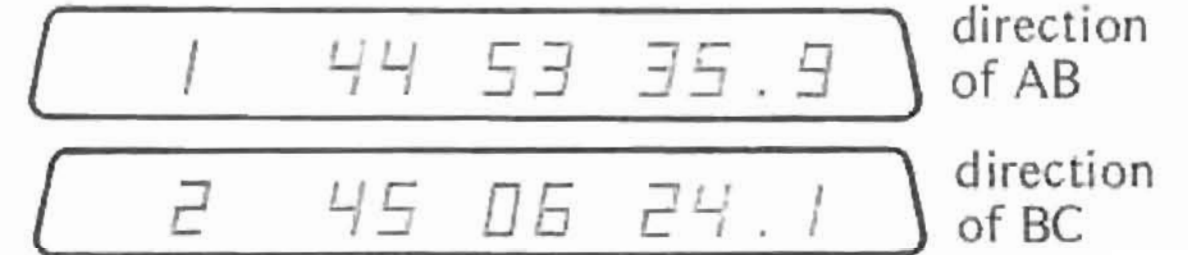
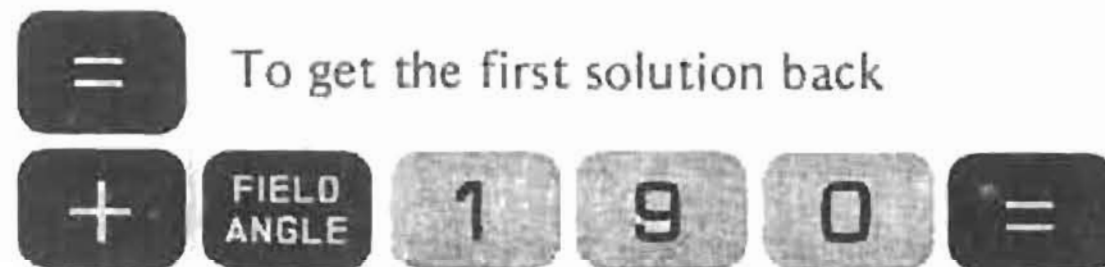
Leg AC has been traversed (page 57)

1 0 6
 INTER-
 SECT
 FIELD
 ANGLE 1 9 0
 =
 2ND
 FUNC
 =
 2ND
 FUNC

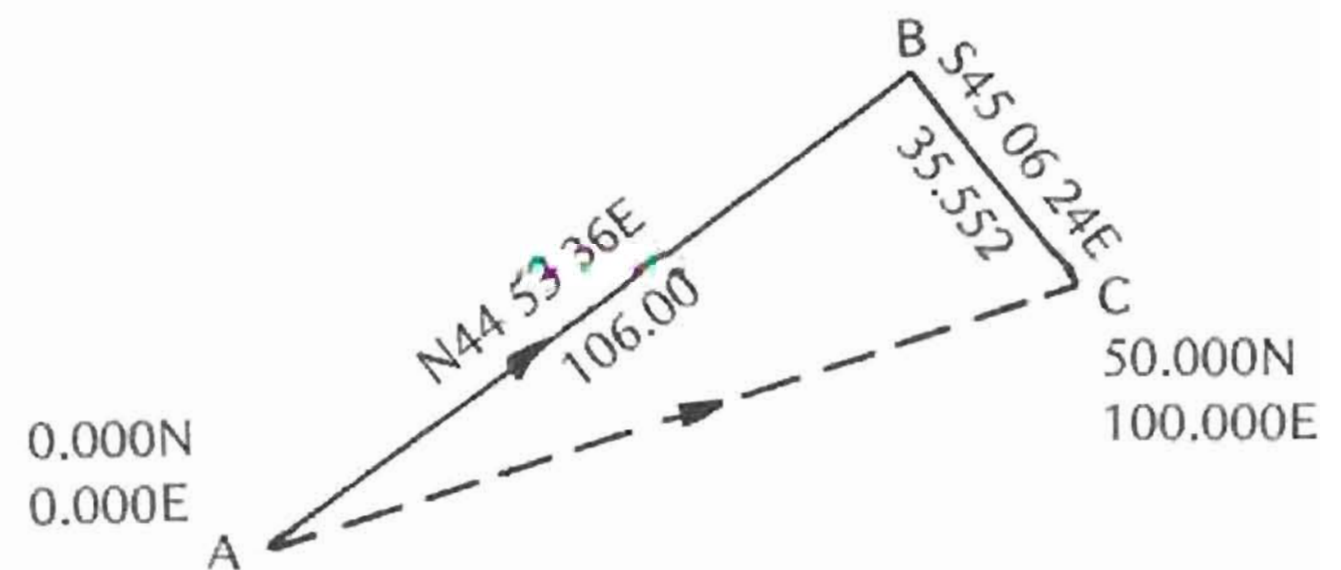
106.000 length
 of AB
 106.000
 1 90 00 00 relative
 angle
 1 44 53 35.9 direction
 of AB
 35.552 length
 of BC
 1 81 58 35.7 direction
 of AB'
 -35.552 negative length:
 solution invalid

**Intersection
Relative Angle and Length of One Leg Known**

The direction of BC can be calculated by going back to the first solution and adding a 90° right deflection to the direction of Leg AB:

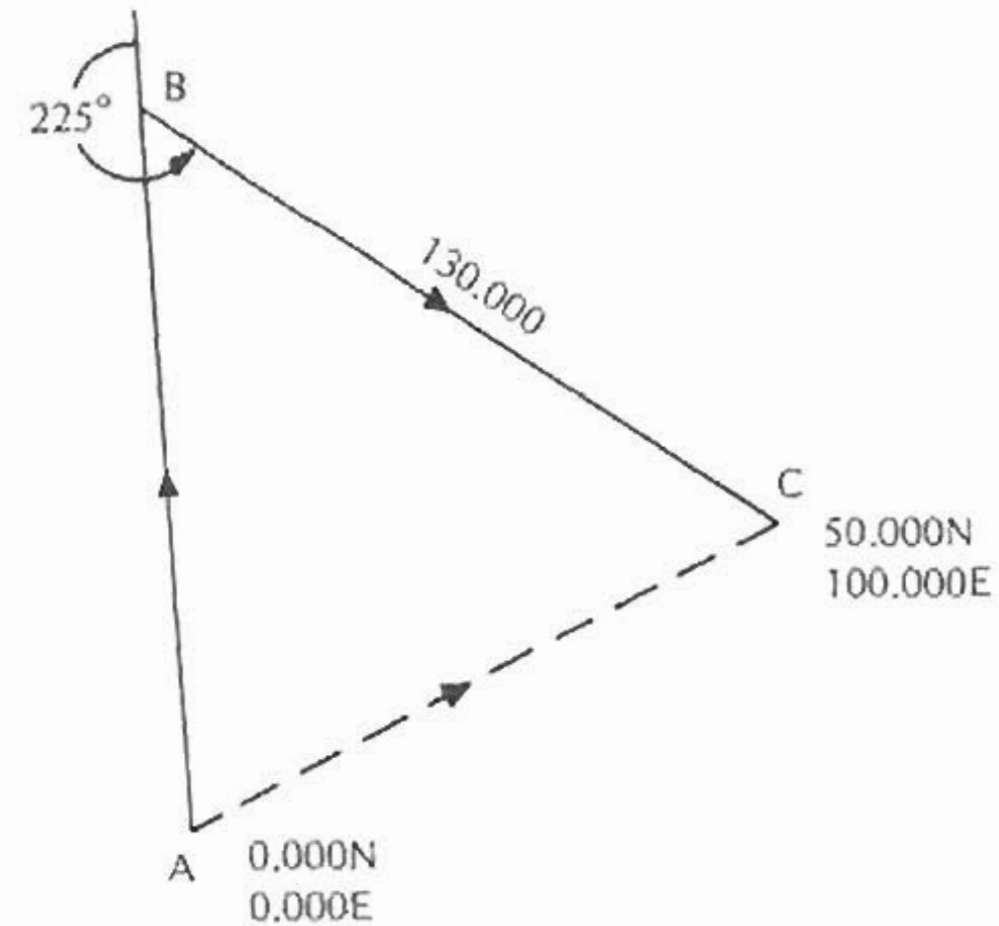


The complete solution is:



Intersection
Relative Angle and Length of One Leg Known

Example: Type IV b



Leg AC has been traversed (page 57)

FIELD ANGLE 4 2 2 5
 INTER-SECT
 1 3 0
 =
 2ND FUNC

4 225 00 00 relative angle
 4 225 00 00
 130.000 length of BC
 3 27 45.4 direction of AB
 130.000 length of AB

= To get the second solution

**2ND
FUNC**

4 E 1 15 33.7

direction
of AB'

32.334

length
of AB'

There are two valid solutions. Choose one and add the relative angle to the direction of AB to get the direction of BC.

The first solution is wanted:

=

1 E 27 43.4

direction
of AB

+

**FIELD
ANGLE**

4

2

2

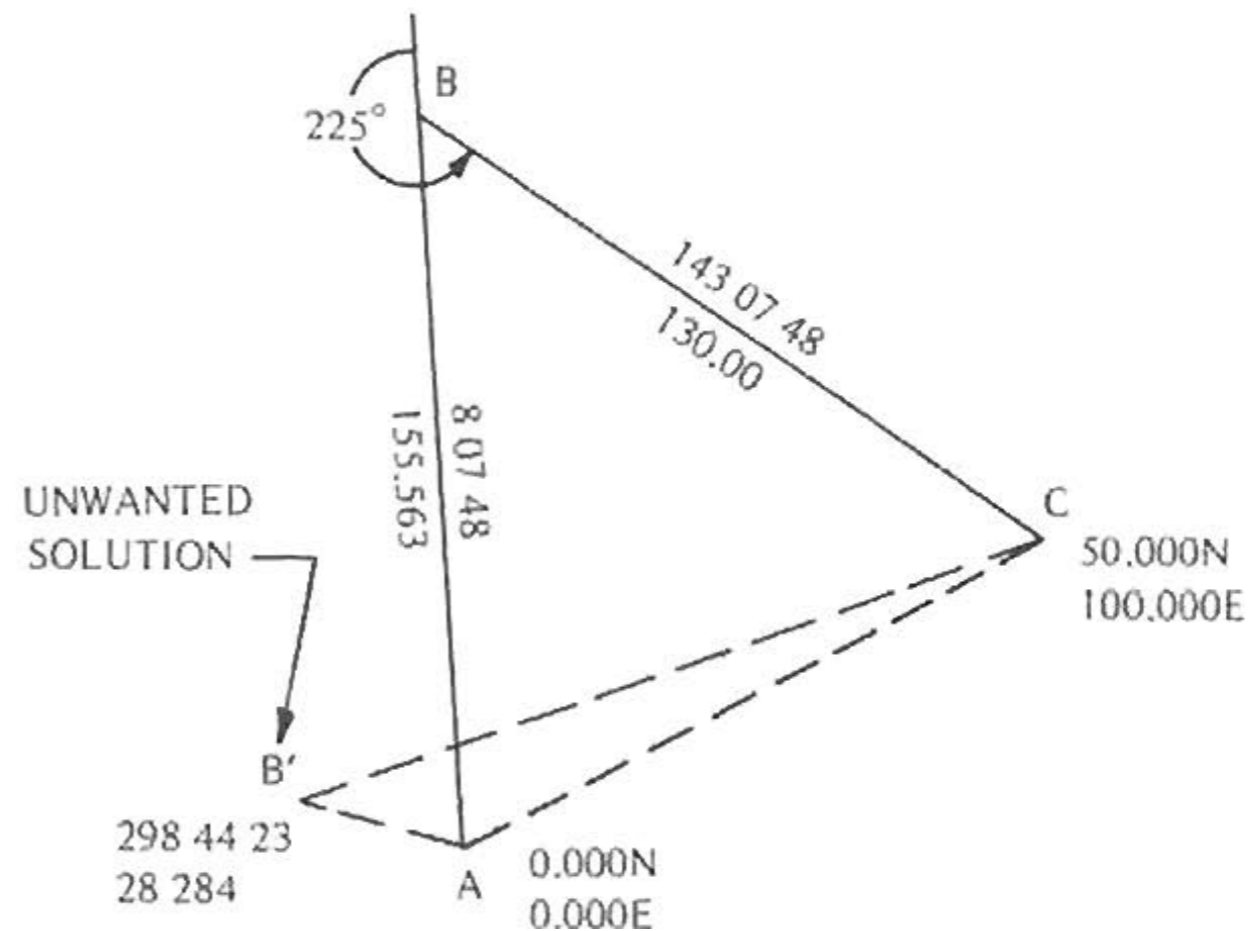
5

=

2 33 33 1.6

direction
of BC

The complete solution is:



ARITHMETIC

Arithmetic is algebraic – that means you press keys like you write equations.

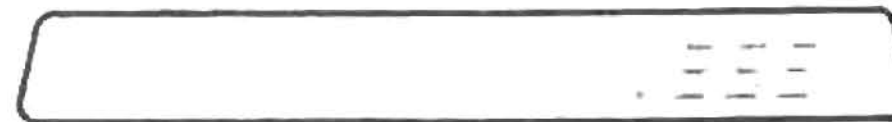
Try 2×3



Add, subtract, multiply, divide and exponentiation work the same way:

Try some more

$2 \div 3$



2^3



$\sqrt[3]{2}$



You can chain operations

$2 \times 3 - 4$



$\frac{2 \times 3 - 4}{5}$



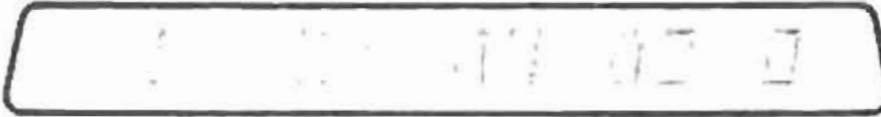
The examples above are all decimal numbers.

Try some angles:

$2^{\circ}15' + 18^{\circ}49'$

2 D/M/S 1 5 +
1 8 D/M/S 4 9 =

BRG
AZ



$41^{\circ}38'58'' \times 3$

4 1 D/M/S 3 8 D/M/S
5 8 × 3 =

BRG
AZ



Notice that numbers and angles may be mixed. The rule is: If anything in the algebraic string is an angle, the answer is an angle. The exception to the rule is: Dividing an angle by an angle results in a decimal number.

Parentheses

The two parentheses keys are called "open" and "close." They are used to include bracketed operations in algebraic strings.


Example:

$\frac{2 \times 3}{(5 + 6)}$

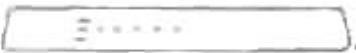



2 × 3 ÷ (
5 + 6) =










Arithmetic Parentheses

The "bracketed operation" inside the parentheses can include any operation on the keyboard except . In effect, the algebra before the open is suspended, and doesn't continue until close is used.

Several rules about parentheses:

- You can nest the parentheses 2 deep—attempting more causes .
- You don't need to press  inside the parentheses, although it doesn't hurt. Note that in the above example, there is no  after the 6.
- A close not preceded by a corresponding open causes .
- Constant Operation

When you press  ,  ,  ,  ,  the display and the operation are automatically remembered. Enter another number and press  to complete the operation.

You can now simply enter a new number, press  again, and the calculation will be completed using the number and operation originally remembered.

Example:

2 x 3



2 x 4



AVERAGING ANGLES

If you want to average a number of readings, you must use chain algebra to calculate the sum and divide by the number of readings. This way, the sum of the angles won't be reduced to between 0° and 360° (even though it is displayed that way during the chain) before the divide occurs.

As an example, average the following four readings.

$91^\circ 45'$

9 1 D/M/S 4 5 +

$91^\circ 47'$

9 1 D/M/S 4 7 +

$91^\circ 46'$

9 1 D/M/S 4 6 +

$91^\circ 45'$

9 1 D/M/S 4 5 ÷

4 =

91 45

91 47

91 46

91 45

4

MATH FUNCTIONS



As you might expect, this gives you the square root of the number in the display.



The square root of a negative number causes error (displays ). And if for some reason you take the square root of an angle, you will get a decimal number, not an angle.



This obviously gives you the reciprocal of the number in the display.



If you try to take the reciprocal of zero, you'll get . And the reciprocal of an angle gives you a number, not an angle.



This key considers the display to be degrees, and converts it to the equivalent angle in radians. The display can be either an angle or a number, and the radians calculated are a decimal number.

To convert radians into degrees, do the following sequence:



The result is decimal. Remember that whenever you want to convert a decimal to an angle, press



Example:

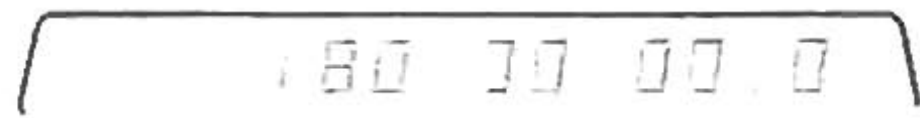
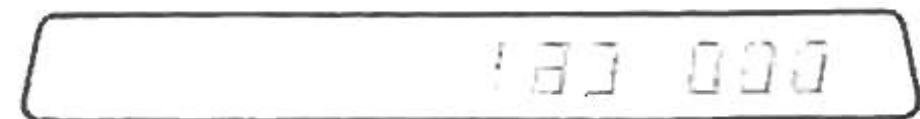
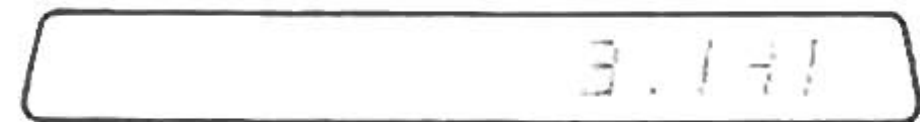
Convert 180 degrees to radians




Go back to degrees




Display it as an angle





This gives you cosine and sine of the angle in display. The angle can be positive or negative, of any size, and can be either in decimal or angle form. The cosine is displayed; the sine is stored in the Second Function register and can be displayed by pressing  .



This gives you the arccosine and arcsine of the number in the display. Arccosine is limited to the range 0 to 180°; arcsine to the range -90° to +90°. If you try to find the arccosine/arcsine of a number outside the range -1 to +1, you get  .

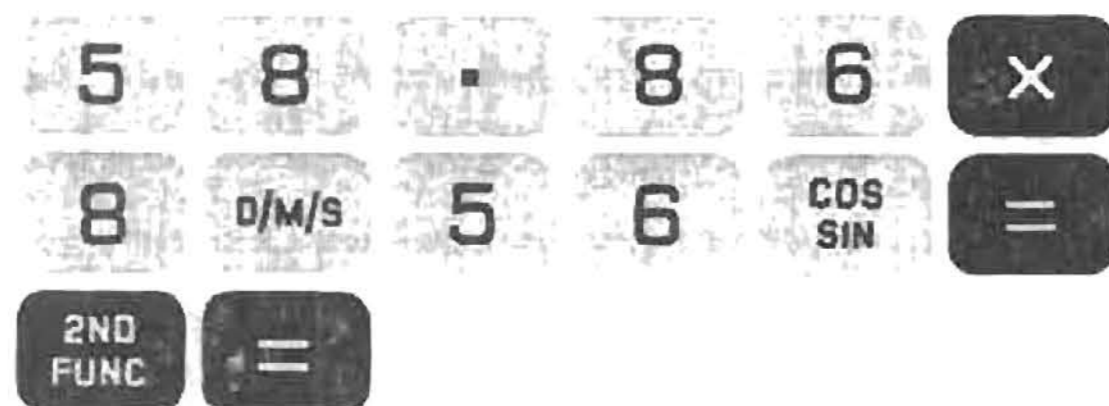
ARITHMETIC & FUNCTIONS COMBINED

You can combine arithmetic with math functions. Simple conversion from slope length and vertical angle to horizontal length and elevation difference uses this.

Example:

Slope length: 58.86 feet

Vertical angle: 8° 56'



horizontal length



elevation difference

Notice that the constant multiply feature was used to compute the elevation difference

TRIG FUNCTIONS

You can do all the normal circular trig functions on the Surveyor.

Here is a reference table of the forward functions.

FUNCTION	DISPLAY	
$\cos \theta$	θ	
$\sin \theta$	θ	
$\tan \theta$	θ	
$\sec \theta$	θ	
$\csc \theta$	θ	
$\cot \theta$	θ	

Here are the inverse trig functions:

FUNCTION	DISPLAY	
$\cos^{-1} x$	x	
$\sin^{-1} x$	x	
$\tan^{-1} x$	x	
$\sec^{-1} x$	x	
$\csc^{-1} x$	x	
$\cot^{-1} x$	x	

STORAGE REGISTERS





The Surveyor has ten registers for storing data. The registers are named 0 through 9. The data in a register can be changed only through use of the **ST_n** key. When the Surveyor is turned off, all data is lost.

To store the displayed number or angle in a register, press **ST_n** followed by a digit to name the register. The previous contents of that register are lost.

To recall from a register, press **RCL_n** followed by a digit to name the register. The contents of the register are not disturbed.









Storing during a calculation sequence won't disturb the sequence. Similarly, a register may be recalled for use during a calculation sequence.

Example:









2	3	ST_n	6			23 stored in register 6		
2	×	RCL_n	6	=				
2	×	RCL_n	6	+	ST_n	7		46 stored in register 7
5	=							sequence completed

Register Arithmetic

You can do arithmetic directly into and out of the registers. The sequences are given below. The letter n means any digit key, 0-9, to name a register.

		n	adds the display to register n
		n	subtracts the display from register n
		n	multiplies the display into register n
		n	divides the display into register n



For all the store-arithmetic operations, the display is not changed, and the register contains the result of the arithmetic.

		n	adds register n to the display
		n	subtracts register n from the display
		n	multiplies register n into the display
		n	divides register n into the display



For all the recall-arithmetic operations, the register is not changed, and the display shows the result of the arithmetic. As with direct register storing and recalling, register arithmetic can be done during calculation sequences.

Rectangular ↔ Polar

RECTANGULAR ↔ POLAR

The  and the  keys perform another function, along with the traversing operations. They convert polar coordinates to rectangular coordinates and vice-versa.

If you know the latitude and departure of a leg, and want to convert it to its corresponding direction and horizontal length:

- Enter the latitude (positive North, negative South)
- Press 
- Enter the departure (positive East, negative West)
- Press 

The direction of the leg is displayed, and the horizontal length is put in the Second Function register.

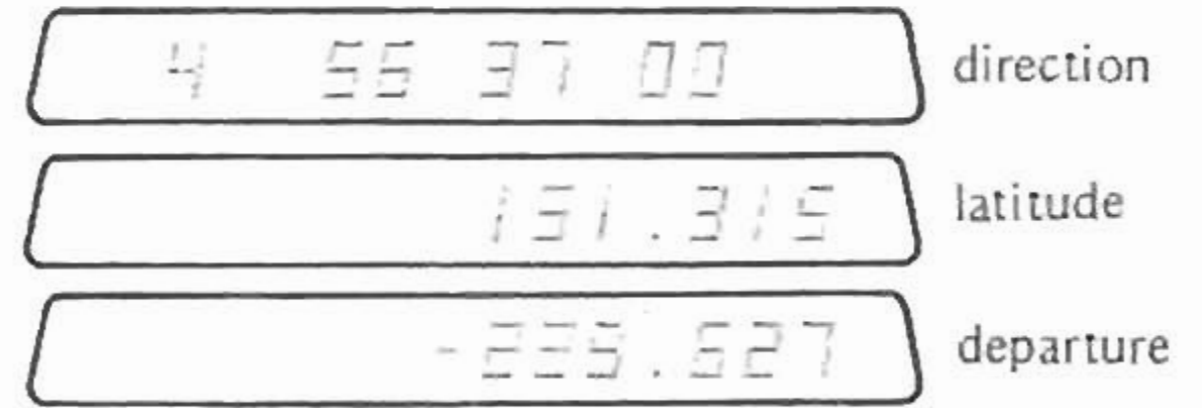
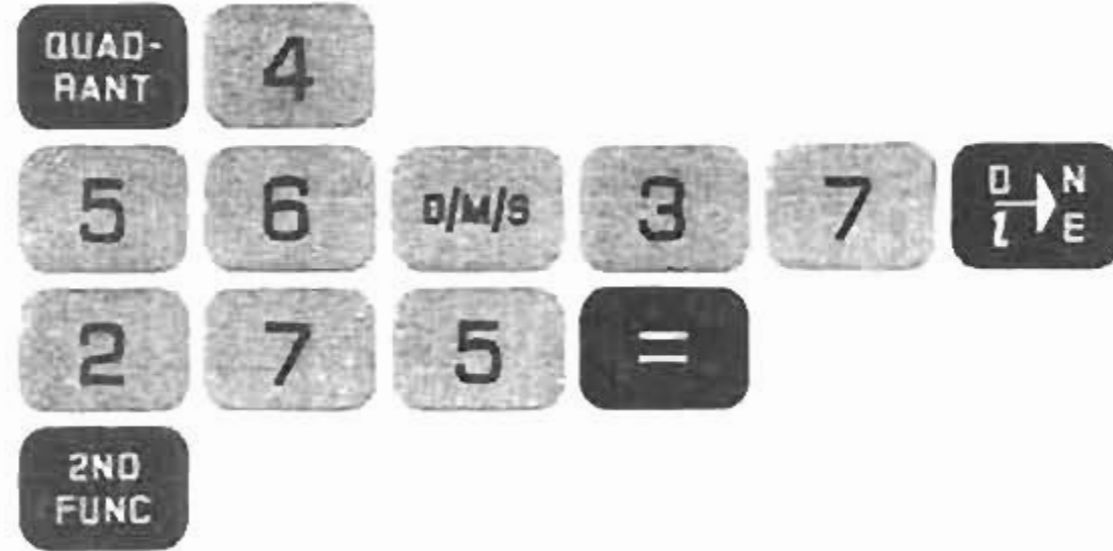
If you know the direction and horizontal length of a leg, and want to convert it to its corresponding latitude and departure:

- Enter the direction
- Press 
- Enter the horizontal length
- Press 

The latitude of the leg is displayed (again positive North, negative South), and the departure (positive East, negative West) is put in the Second Function register.

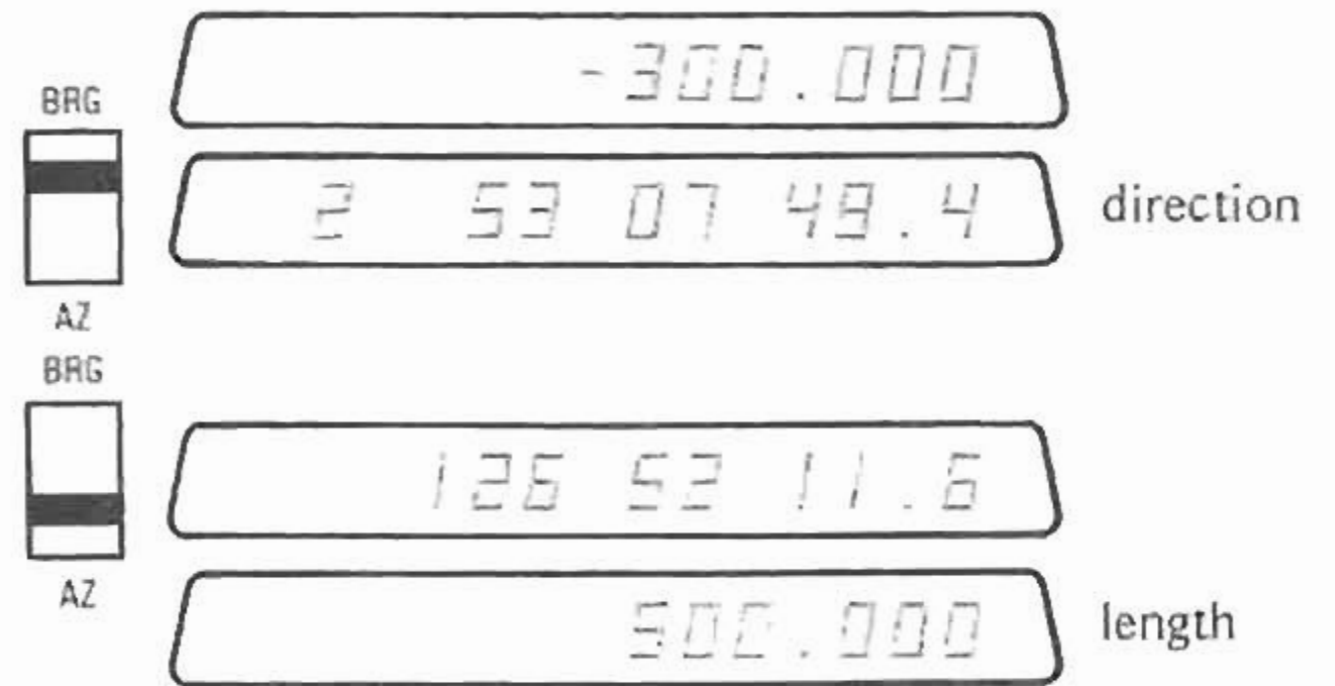
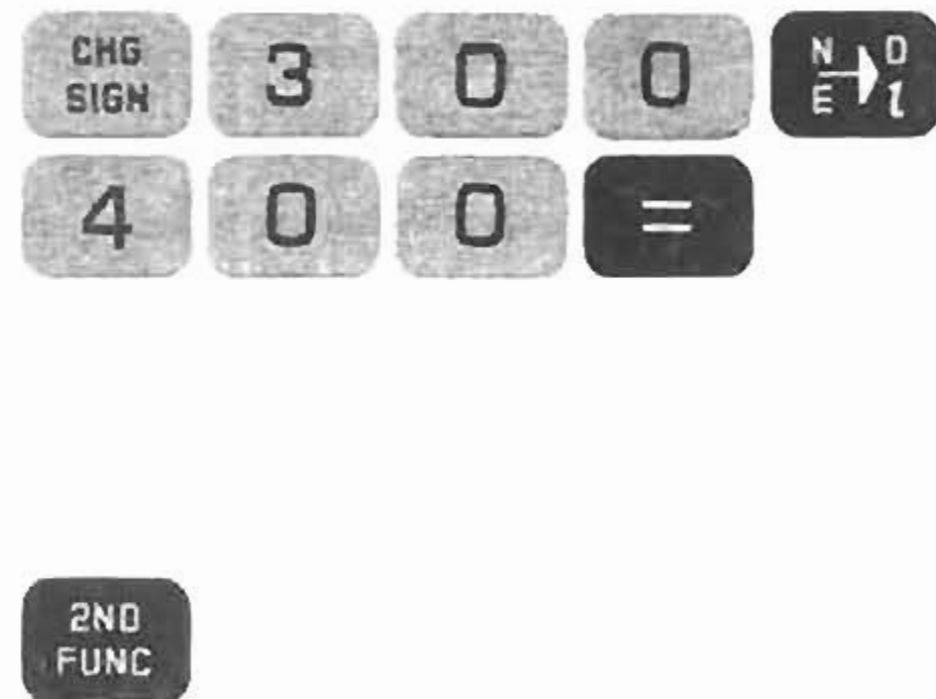
Try an example:

Direction – N56 37W, length 275 feet.



Another example:

Latitude = -300, Departure = 400







PROGRAMMING




The Surveyor can be programmed to remember sequences of keystrokes. Programming is a valuable time saver. It lets you work through a calculation once and then have it ready to automatically work for you as often as it is needed.

The Surveyor has two separate program memories. Each memory holds up to 80 keystrokes. Programs remain in the memories as long as the Surveyor is turned on.

Here are a few basic rules to keep in mind when using the programming feature of the Micro Surveyor:

- There is room in each of the two memories for 80 program steps. If you go past 80 steps, you are back at step 01 and your original program steps are erased by the new steps.
- Programming is essentially working a particular calculation sequence when the Surveyor is in LOAD. 
- Once loaded the Surveyor works through the sequence automatically when it is needed.
- If you make a mistake while loading a program, switch from LOAD to RUN and back to LOAD. Start loading the program again at Step 01.
- Use  at the points in the program where you want the program to stop for a variable to be entered or a calculation to be displayed.
- Once the program is loaded, switch to RUN to run the program.
-  starts the program running until the first programmed stop is encountered.
- The two 80 step memories are separate. The program switch  controls which of these 2 memories is being used. The

program switch cannot be used as a program step. You can only switch from one memory to the other when the RUN/LOAD switch is in the RUN position.



- If you use  or  when a program is running, the program stops, the display is cleared.  starts the program again from Step 01.

With these basic rules in mind here is the step by step procedure for writing a simple program.

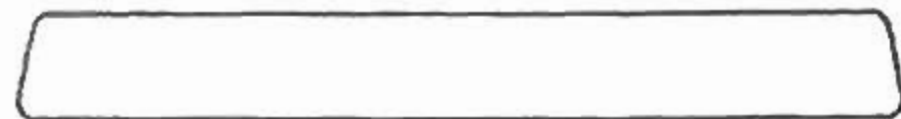
The area of a circle is given by:

$$A = \pi r^2 \quad (\pi = 3.14159)$$

With programming, calculating the area once, let's you automatically find the area for a circle of any radius.

To write a program to calculate the area of a circle, put the program memory switch in the "1" position . Place the RUN/LOAD switch in the LOAD position .

The display looks like this:



The two digit number at the far right of the display tells you the step number to be loaded next. Every time you press a key this number increases by one. Step 01 follows step 80.

Programming

To load the program to calculate the area of a circle.

Do This

Remarks

See This

START
STOP

Stop the program
to enter the vari-
able (r).

00

This stop also dis-
plays the calculated
Area.

X

Calculates r^2

00

=

00

X

00

3

00

.

Calculates A

00

1

00



RUN



LOAD

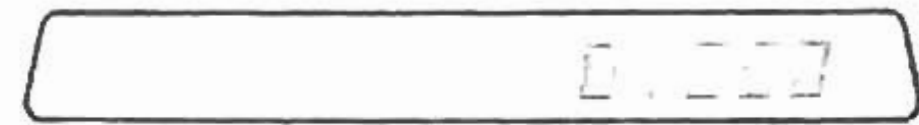
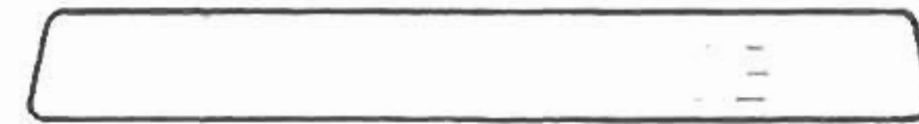
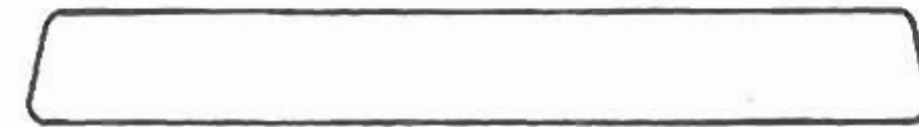
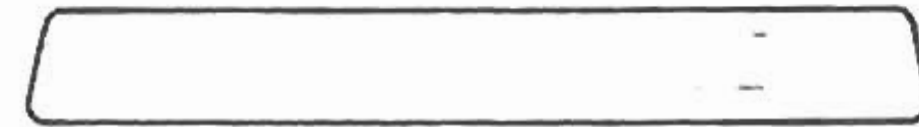
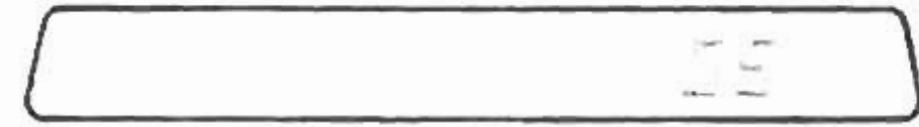
The program is loaded and ready to run. To run the program:

Do This

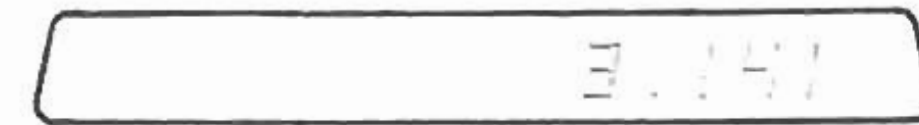
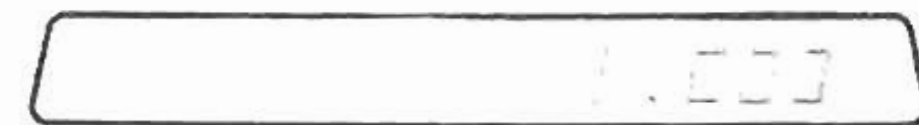
1. 
2. Enter r 
3. 

A is displayed

4. Go back to 2.
To enter a new r.




See This



This table shows the calculated areas of circles with several different radii.

r	A
1	3.141
2	12.566
3	28.273
4.26	57.010

A very practical program can be written that rotates the bearings of a traverse as each leg is entered.

Switching to memory 2  allows us to preserve the circle program in memory 1 and load the new program into memory 2.

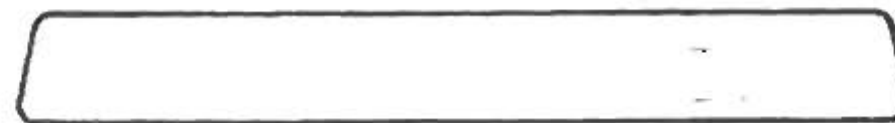
Do This

Remarks

See This



This adds the entered (unrotated) bearing to the angle of rotation that will be stored in register 0.





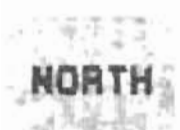
Calculates and enters the rotated bearing for traversing.



Displays the rotated bearing and stops for the entry of the distance.



Calculates North and East coordinates of the rotated leg.



Displays the North coordinate.





Displays the East coordinate.





Programming

With the program loaded, here is how to run it.

Do This

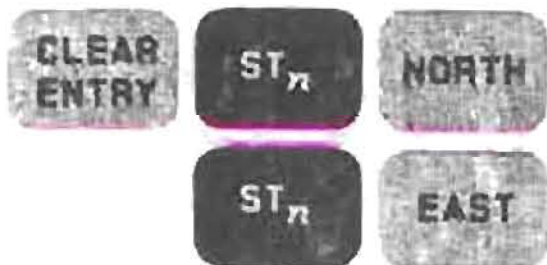
1. Calculate and enter the angle of rotation (+ or -)



2. Store the angle of rotation into register 0



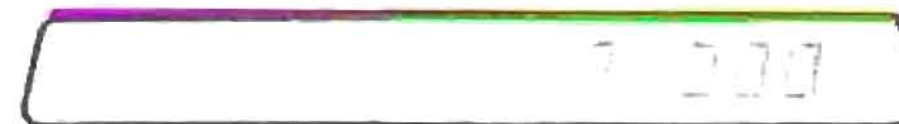
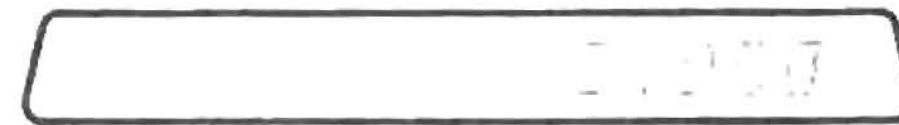
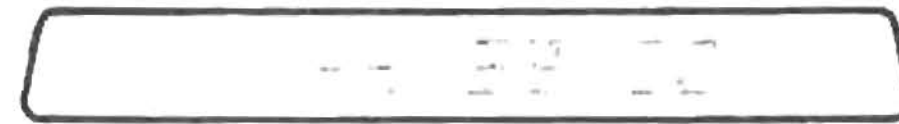
3. Store the beginning North and East coordinates



4. Enter the unrotated bearing



See This

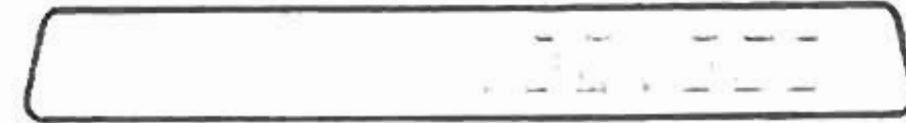


*Do This**Remarks**See This*

5.  The rotated bearing displays.



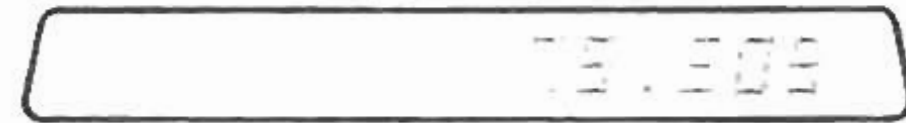
6. Enter the distance



7.  North coordinate displays



 East coordinate displays



8. Go back to 4. to continue traversing.

9. Go back to 1. to start a new traverse.

Programming

Here is another sample program that reduces stadia measurements to their horizontal and vertical components. The input variables are the stadia distance, the vertical angle (horizontal is zero), and the distance from the midhair stadia reading to the upper (or lower) hair readings.

The equations are:

$$H = S \cos^2 \alpha \text{ (horizontal distance)}$$

$$V = S \sin \alpha \cos \alpha - M \text{ (change in elevation)}$$

Where

S = Stadia Distance

α = Vertical Angle

M = Midhair Distance

To load the program:

Do This

Remarks

See This



This program will replace the circle program in program in memory 1.



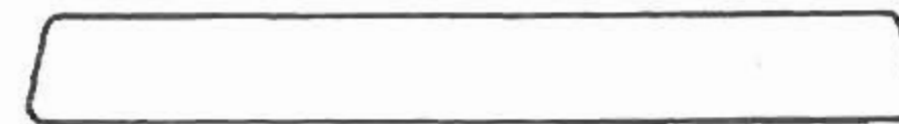
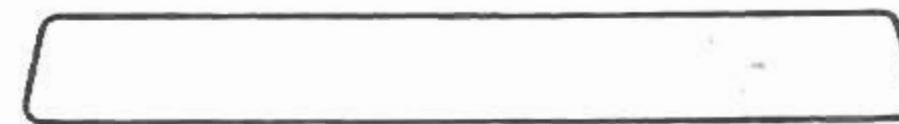
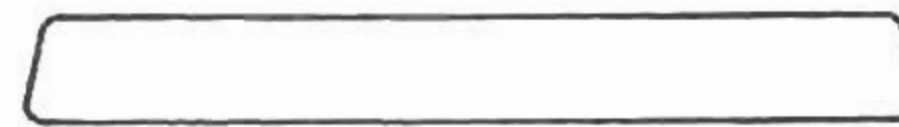
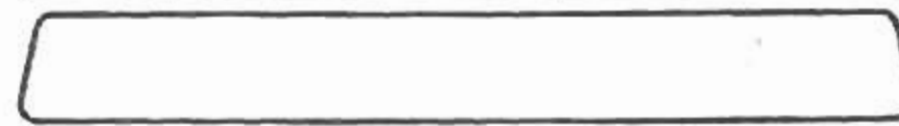
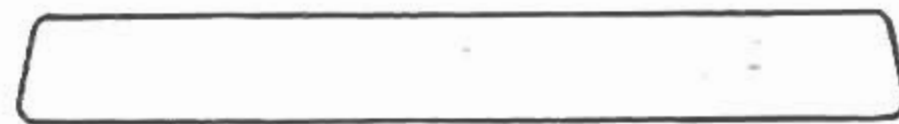
Recalls a which will be pre-stored in register 0



Calculates $\cos a$



Calculates $\cos^2 a$



Do This

Remarks

See This

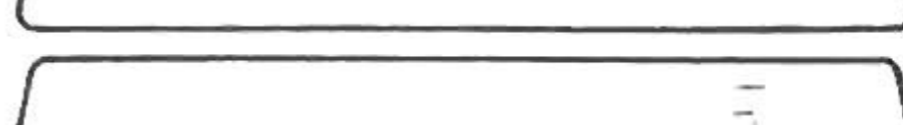
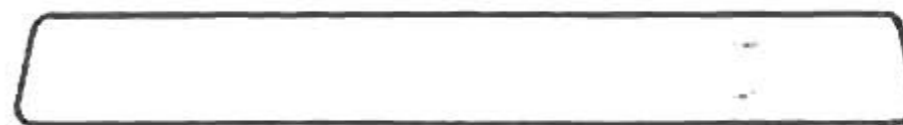
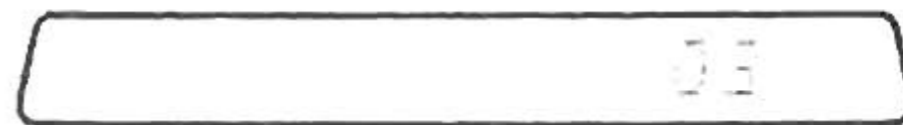
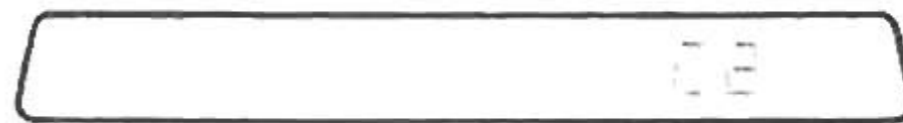
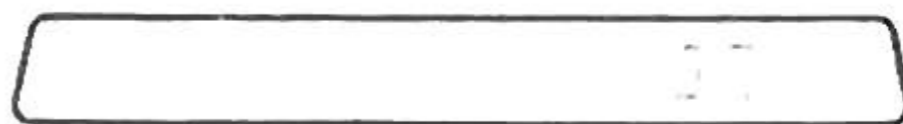


Calculates $S \cos^2 a$
(S is pre-stored in register 1)

Displays H

Calculates $\cos a$

Calculates $\sin a \cos a$



RCL_n

×

1

Calculates
 $S \sin \alpha \cos \alpha$ RCL_n

-

2

Subtract M (midhair
distance pre-stored
in register 2) from
 $S \sin \alpha \cos \alpha$ in dis-
playSTART
STOPDisplays V (vertical
distance)

RUN



LOAD

17

18

19

20

21

22

23

0.000

Programming

To run the program:

Do This

1. Enter a and store in register 0.



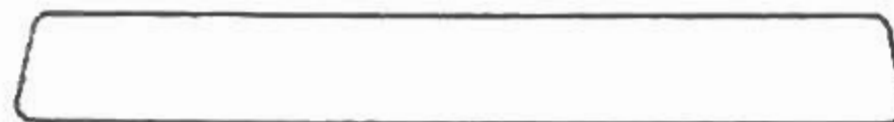
2. Enter S and store in register 1.



3. Enter M and store in register 2.




See This

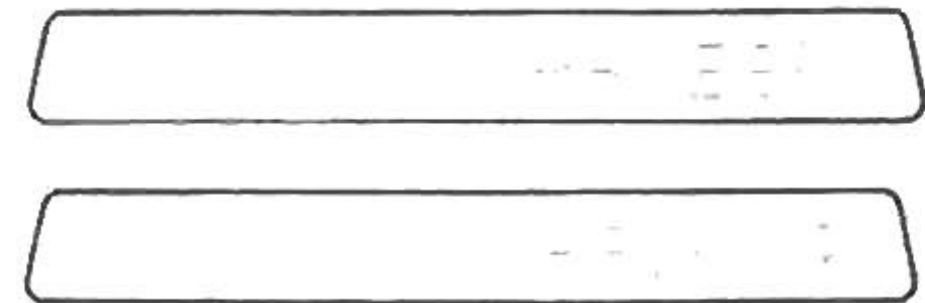


Do This

Remarks

See This

4.  H Displays
5.  V Displays
6. For a new calculation go back to Step 1.






With this program you can quickly reduce all your stadia notes. Try the program with the stadia measurements shown below.

Stadia Measurements		
α	S	m
9°17'	148	0.74
4°13'	82.5	0.41
6°20'	110	0.55


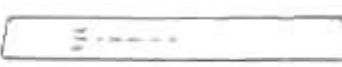

Calculates H and V	
H	V
144.284	22.413
82.053	5.639
108.661	11.510

PROGRAMMING HINTS, TRICKS AND NOTES

1. When a program is stopped, you can do any keyboard calculations. But if the program is stopped in the middle of a sequence (algebra, register storage, etc.) then many of the keyboard operations will try to complete the sequence. For this reason, using the program steps    is not good practice, since you must be careful when doing keyboard operations at the STOP.

2. If a program is stopped somewhere other than at the beginning, you can go to the beginning by switching to LOAD and back to RUN.

3. When a program is running (not at a STOP) if you press  or  the program will stop and go back to the beginning.

4. If you cause  when programming (by pressing two keys at once, for instance), the  will stay on the display. What is in program may be incorrect. You must switch back to RUN, , and begin the program again.

5. The two programs, PROG 1, and PROG 2, are independent. You must be in RUN to switch from one to the other, and when you do, the program goes to beginning.

6. If you don't have a STOP somewhere in the program, it will continuously loop.

7. It is sometimes convenient to have the program show a special number when it is stopped for entry of data. That way you know where the program is and what data is to be entered.

If a 1 had been put into the sample program before the first , then the display always shows 1.000 when the program stops for the entry of a.

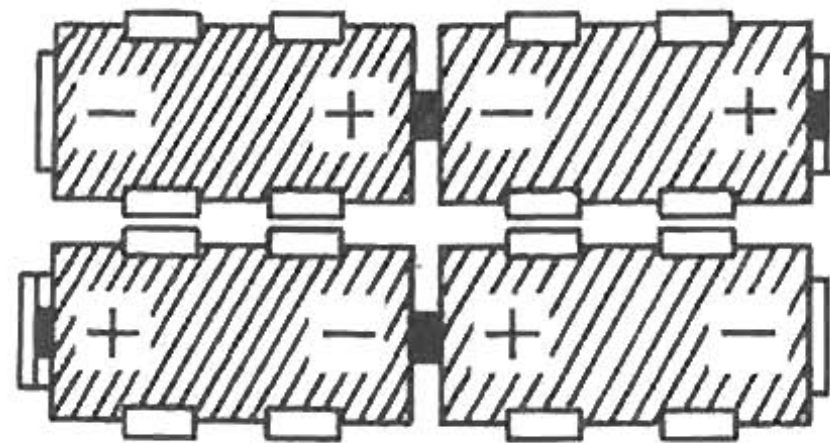
BATTERIES AND RECHARGING

The Micro Surveyor may operate from the AC voltage adapter supplied with the computer or from the batteries when operation from the AC line is inconvenient.

The batteries supplied with the Micro Surveyor may be discharged and recharged approximately 1000 times during their useful life. When fully discharged, the batteries may be recharged in 16 to 20 hours by connecting the computer to the AC adapter and the adapter to the AC line. Battery recharging occurs regardless of the position of the ON/OFF switch and does not interfere with calculations.

The AC adapter supplies 300 to 350 milliamperes of charging current to the batteries. For this reason only Compucorp part number 3400017 or similar nickel-cadmium batteries rated for at least three ampere-hours should be used in the Micro computer. If you do need to use other types in an emergency, DO NOT connect the AC adapter. Attempting to recharge a rechargeable battery rated at less than 3 ampere-hours or a dry cell may burst the batteries and damage the computer. Such damage is NOT covered by warranty or equipment service agreement.


















To replace the batteries, turn the Micro Surveyor over, squeeze together the two round plungers at the top of the case, and pull the door open. Remove the batteries and replace with fresh ones, observing the polarity shown in the illustration.



All nickel-cadmium batteries exhibit an apparent reduction of capacity after a number of cycles of partial discharging and recharging. You may easily correct this by running the computer on batteries until the display goes completely blank, and then recharging the batteries for 16 to 20 hours. Care must be taken not to continue the discharge period beyond the point when the display goes blank. You may use the computer during the recharge period.

The Micro Surveyor concentrates many thousands of logic circuits into a small volume, so the metal label on the bottom may feel noticeably warm to the touch. This temperature is normal and should cause no alarm provided it does not exceed 120° F (49° C).

KEY INDEX

	3		8		15
	3		4		7
			6		9
			9		35
			9		43
			25		56
			25		83
					
					
					
					
	2				
	2				
	2				



84



86



90



84



86



27



82



78



90



82



78



90



78



78



79



78



79



78

INDEX

AC Adapter	105	Degrees, Decimal	4
Angles	4	Error	3
Averaging of	81	Field Angles	15
Display of	4	Codes	15
Elevation	23	Entry of	15
Vertical	23	Example	16
Zenith	23	Traversing with	17
Entry of	4	Intersections	56
Area	43	Direction and Length Known	58
Arithmetic	78	Relative Angle and One Length Known	73
Batteries	105	Two Directions Known	62
Bearing	6	Two Lengths Known	70
Display of	6	Inversing, Point to Point	25
Entry of	6	Math Functions	82
Quadrant Codes	6	Numerical Entry	2
Charger	105	On-Off Switch	1
Corrections	3	Parentheses	79
Curves in Traverse	35	Perimeter	43

Polar to Rectangular	88
Powers	78
Programming	90
Rectangular to Polar	88
Registers	86
Roots	78
Second Function	8
Side-Shots	28
Statia Reduction	98
Traversing	7
Bearing-Distance	9
Field Angle-Distance	17
Example	42
Trig Functions	85

2 54 27 38

Compucorp®

