POCKET CALCULATORS 1975

By John Hiley

Pocket Calculators! One almost hesitates to write an article on these mini-wonders as they seem to become cheaper and more sophisticated so rapidly that what is written now may be outdated by the time of publication. Nevertheless, the subject seems too important to dismiss without the attempt.

The past ten years have seen revolutionary advances in the technology available to the legal survey profession. We have electronic distance measuring devices which are light, simply operated and fantastically accurate. There are desk top electronic calculators capable of storing and manipulating vast amounts of data quickly, quietly (remember the noise of some of the rotary calculators) and without error, other than that occasioned by their human operators. These, however, have come at a dollar cost which is significant to the average surveyor and must be at least partially recovered through increased fees or direct charges to the client.

Now at last, the electronic gods have smiled and presented us with a tool which has become so inexpensive that virtually anyone connected with the profession, from surveyor to technician, can easily own one.

Let us make the most of this opportunity to operate more efficiently and productively for the benefit of both surveyor and client (or employer). With the availability in recent years of the desktop calculator, I have noticed a very understandable reluctance to perform any but the most simple calculations in the field. Unfortunately, this frequently means a return trip to the jobsite to monument the survey, which even then may ed obstructions on the precalculated lines.

Hopefully, many of these return trips can now be avoided by making the necessary calculations in the field with a considerable saving in travelling and preparation time.

First, a word about the variety of calculators available. The range of models seems limitless, from the simple four function alkaline battery models, priced as low as $10. to the exotic programmable one costing close to $1000. This paper will deal with those mid-range "scientific" calculators which are produced in very similar format by a seemingly endless number of manufacturers, and at the time of writing cost between $50. and $100.

For normal use, it is recommended that a model with rechargeable Ni. Cad. batteries be used, but if you expect to spend several weeks in a tent, away from a power source, then a model with replaceable alkaline batteries is preferable.

The models being discussed are generally blessed with only one memory register, and on the premise that data re-entry is both inefficient of time and conductive to error, the routines outlined below are directed towards reducing these steps as much as possible.

Latitudes and Departures

This is the classical land survey calculation which in bygone days (not that far bygone either) was solved by such ingenious but laborious devices as traverse tables (is my age showing?), logs, mechanical hand or desk calculators. Any of these required the "looking up" of trig. functions, provided you remembered to bring the tables to the field with you.

ENTER	PRESS	DISPLAY
Seconds		
	÷ 60 +	
Minutes		
	÷ 60 +	
Degrees		
	= M+ F SIN X−M F COS X	
Distance		
	X−Y = X−M =	 Latitude Departure

If your calculator has a rectangular-polar conversion button this problem becomes ridiculously simple, but for those that don't the following routine will produce a latitude and departure in approximately 30 seconds.

I personally prefer azimuths to quadrantal bearings when using the calculator as it then gives the latitude and departure with the correct sign. However, there is no difference in usage. For most work the seconds can be mentally converted to the nearest decimal of a minute, thus saving a further step. The following routine requires the entry of bearing and distance only once.

Inverse from Co-ordinates (or Missing Course)

Two methods of data entry are available for this calculation and the one used will depend on personal preference. Chart 1 illustrates the routine for entry of the co-ordinates of each point sequentially. This method is generally preferable when inversing from a table of co-ordinates. Chart 2 replaces steps 1 to 7 inclusive of Chart 1 and shows the routine for entering the two Northings followed by the two Eastings. This method is perhaps easier to remember, and with minor modifications is also well suited to missing course calculations involving the algebraic addition of several latitudes and departures.

A few notes of caution about this routine:

1. Most calculators do not give any quadrant identification and this must be determined mentally from the input data.
2. For calculators that give trig. functions to 6 places of decimal this routine may only be satisfactory for bearings between 5° and 85° The bearing solution between 85° and 90° is weak because of the TAN-SIN-TAN conversions. This can be overcome by extracting the bearing obtained in Step 11, terminating the routine after the distance solution at Step 16, and re-entering the bearing for conversion to degrees, minutes and seconds.
3. Similarly the distance solution is weak for bearing less than 1°, depending on the length of line and desired accuracy. This is overcome by substituting steps A to E for steps 11 and 12. Unfortunately, this then weakens the bearing solution and again it is advisable to extract the bearing at Step D.

CHART I

	ENTER	PRESS	DISPLAY
	N1		
1		M+	
	E1		
2		−	
	E2		
3		=	Dep.
4		X−M	
5		−	
	N2		
6		=	Lat.
7		X−M	
8		÷	
9		X−M	
10		=	Tan Brg.
	If Tan Brg > 10.0 then extract brg. after next step		
11		F TAN^{-1}	
12		F SIN	
13		÷	
14		X−M	
15		X−Y	
16		=	Distance
17		X−M	
18		F SIN^{-1}	Bearing
	Deg.		
19		CM	
20		M+	
21		−	
22		X	
23		60	
24		=	Minutes
25		X−M	Degrees

A		X−Y	
B		X−M	
C		X−Y	
D		F TAN^{-1}	
E		F COS	

CHART II

N1		
	−	
N2		
	=	Latitude
	M+	
E1		
	−	
E2		
	=	Departure

Unequal Offsets

Although this is not an everyday problem, it's solution might well save a return trip to the field. Frequently, different offset lines are used on two intersecting streets and the derivation of the angle and distance to the true corner is a somewhat cumbersome calculation to perform on a cold windy street corner. Figs. 1 and 2 illustrate two cases of the problem. In all cases b is the larger offset, and, as noted, if Δ is ≠ 90°, an extra step is required.

It is hoped that these few simple routines will stimulate comments, suggestions or further contributions. What will YOUR calculator do? Material pertaining to this subject may be forwarded to John R. Hiley, Box 262, Richmond, Ont., K0A 2Z0 or directly not be completed because of unexpect- to the editor.

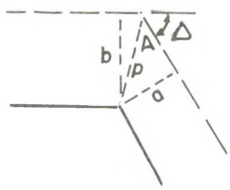

Fig. 1

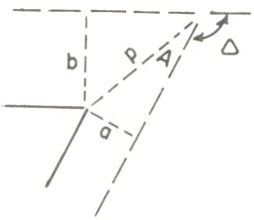

Fig. 2

ENTER	PRESS	DISPLAY
Δ		
	M+	
b		
	÷	
a		
	=	b/a
	X−M	
	F SIN	
	F 1/X	
	X	
	MR	
	=	
	X−M	
	X−Y	
	+/−	
	M+	
	+/−	
	F 1/X	
	F SIN^{-1}	
	÷	
	2	
	=	
	F TAN	
If Δ < 90° then skip next step		
	F 1/X	
	M+	
	MR	
	F TAN^{-1}	
	F COS	
	X−M	
a		
	÷	
	MR	
	=	p
	X−M	
	F SIN^{-1}	A

Removed Stake, Kitchener MD Ordered To Pay Cost of Survey

Judge J. R. H. Kirkpatrick gave Dr. Shajahan Steen of 773 Dunbar Rd., a conditional discharge if the doctor paid the costs of a property survey commissioned by his neighbor Dr. A. E. Stoffman, 14 Rusholme Rd.

Dr. Steen admitted pulling out a surveyor's stake near a hedge dividing his and Dr. Stoffman's property and throwing it in the garbage. He said he thought the stake was put on what he considered his property by persons he thought were going to build a fence around the Stoffman's property.

When Dr. Steen's lawyer, Richard Van Buskirk, protested the judge's move in making his client pay for the costs of the entire survey and not just for replacement of the stake, Judge Kirkpatrick said he would impose a stiffer penalty if that's what the lawyer wanted.

"This offence carries a maximum of a five-year jail term and you're asking for an absolute discharge," said the judge.

Dr. Steen testified he was told by the previous owner the hedge was on his property. He had maintained it since he bought the house. He did not want to see the hedge destroyed by a fence.

Richard Lorentz, the surveyor who drove the stake into the ground, said it was placed atop an iron bar believed to be the original property boundary. It was considered to be a proper boundary marker.

Judge Kirkpatrick rejected Mr. Van Buskirk's plea for an absolute discharge because, he said, Dr Steen's action has "inconvenienced neighbors, police and the court."

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