

12/20/71

SURVEYING PROGRAMS

TABLE OF CONTENTS

P602

(continued)
TABLE OF CONTENTS

502.01	Conversion of Bearings to Azimuth and Vice Versa	
* 502.02	Computation of Bearings From Angle Observations	18.502
* 502.03	Correction of Angular Errors	33.502*
502.04	Summation of Latitudes and Departures	33.502
* 502.041	Traverse by Deflected Angles	34.502
502.042	Summation of Latitudes and Departures	35.502
502.05	Correction of Latitudes and Departures (Compass Rule)	38.502
502.051	Correction of Latitudes and Departures (Compass Rule)	38.502
* 502.06	Inverse Traverse From Coordinates	
* 502.08	Intersection of Two Lines	
502.09	Intersection of Line and Curve (REVISED)	
502.091	Intersection of Line and Curve	
502.10	Intersection of Two Circles	
502.11	Area and Coordinates From Bearings and Lengths	
502.12	Triangle with Three Sides Given	
502.13	Triangle with Two Sides and One Angle Given	
502.15	Triangle with One Side and Two Angles Given	
502.21	Circular Curve Given Radius and Angle or Arc Length	
502.22	Circular Curve, Radius and Chord	
502.23	Circular Curve with Two Tangents Given	
502.24	Circular Curve, Offsets from Tangent	
502.25	Circular Curve, Deflection Angles and Chords	
502.251	Circular Curve, Deflection Angles and Chords	
502.26	Vertical Curve, Offsets from Tangent	
502.28	Circular Curve, Radius from Two Chords and Included Angle	
502.281	Center and Radius through three given points	
502.29	Three Point Problem	
502.291	Three Point Problem, Coordinates Given	
502.30	Area: To cut off specific amount between parallel lines	

12/20/71

TABLE OF CONTENTS

(continued)

502. 31	Specified Area, Two Angles and Two Distances Known
*502. 32	Addition, Subtract, Multiplication, and Division of Angles
502. 33	Included Stadia Shots
502. 34	Curve Staking
502. 35	Earthwork Volume By Average End Area
502. 36	Area of Survey
502. 38	Coordinate Transformation

Title			
Traverse by Deflected Angles			
Number of Sides	2	Lower Decimal Wheel	as desired
		Upper Decimal Wheel	FL

This program is used for traverses where the data is kept in deflected angles. It produces the latitude and departure of each course and the coordinates of the turning points. Further there is provision for curved sections in the traverse. For these sections, the traverse proceeds from the beginning of the curve to the radius point and from there to the end of the curve. The chord length and arc length of the curve are computed. At the end of the traverse, the following data is produced:

- 1) Area - square feet
- 2) Area - acres
- 3) Error of closure - north
- 4) Error of closure - east
- 5) Total length of the traverse
- 6) Total error of closure
- 7) Relative error of closure

Sample run: For curved sections traverse to the radius point. On leaving, depress W before entering angle away from center, if the curve bulges out of the area surveyed, depress Y if it bulges into the area surveyed. Central angles must be less than 180° .

Note that the program has 2 SIDES.

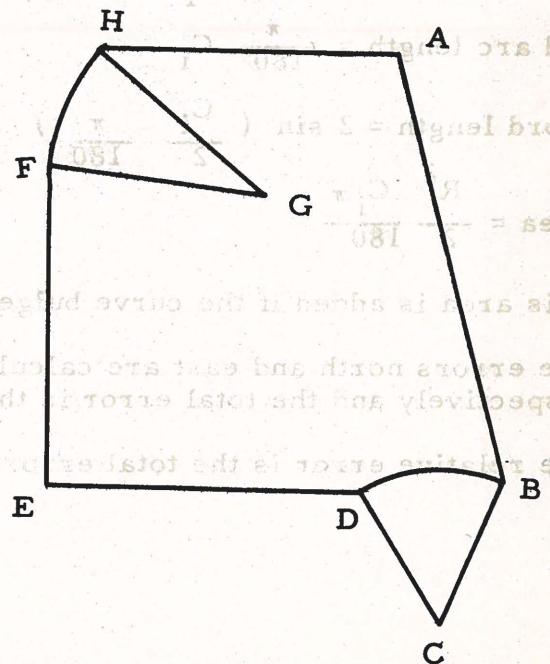
Enter the first side as usual. Then depress SECOND SIDE key and enter second side.

		V	Starting Coordinates
A	5362.25	S	North
	-235.75	S	East
			Initial Bearing
	17	S	Degrees
A	0	S	Minutes
	0	S	Seconds
	2	S	Quadrant
AB	275.00	S	Length
	-262.983	B0	Latitude
	80.402	b0	Departure Coordinates
B	5099.266	C0	North
	-155.347	c0	East
	48	S	Deflected Angle
B	0	S	
	0	S	
BC	118.75	S	Length
	-101.788	B0	
	-61.160	b0	
C	4997.477	C0	
	-216.508	c0	
		Y	Leaving Radius Point Curved Section Bent Inward
	119	S	
C	0	S	
	0	S	
CD	118.750	E0	Length
	102.840	B0	
	-59.375	b0	
D	5100.318	C0	
	-275.883	c0	
BD	120.540	A0	Chord Length
BD	126.427	A0	Arc Length

Sample run (continued)

D	- 85	S
DE	0	S
	0	S
	200	S
	- 84.523	B 0
	- 181.261	b 0
E	5015.794	C 0
	- 457.145	c 0
	94	S
E	0	S
	0	S
EF	156.25	S
	145.871	B 0
	- 55.994	b 0
F	5161.666	C 0
	- 513.140	c 0
	90	S
F	0	S
	0	S
FG	200	S
	71.673	B 0
	186.716	b 0
G	5233.339	C 0
	- 326.424	c 0
Radius Point BentOutward		
	- 137	S
G	0	S
	0	S
GH	200.000	E 0
	74.921	B 0
	- 185.436	b 0
H	5308.261	C 0
FH	- 511.860	c 0
FH	146.600	A 0
	150.098	A 0

	147	S
	0	S
	0	S
	281.25	S
	53.665	B 0
	276.082	b 0
	5361.926	C 0
	- 235.778	c 0
Totals		
Area sq. ft.	83887.480	A 0
Acres	1.925	A 0
Error north	- 0.323	A 0
Error east	- 0.028	A 0
Total length	1550.000	d 0
Total error	0.324	A 0
Relative error	0.000	A 0
Manual print of relative error at D. W. S. of 7	0.0002096	A 0



Accuracy: The latitudes and departures are calculated to nine significant digits.

Method: All angles are converted to seconds. The azimuth of each course is equal to the original azimuth plus the sum of the deflected angles B_i to that point.

The angle is then converted to radians, θ_i

$$\begin{aligned} \text{latitude } L_i &= l_i \cos \theta_i \\ \text{departure } D_i &= l_i \sin \theta_i \end{aligned}$$

where l_i = length of that course.

The coordinates

$$\begin{aligned} X_i &= X_o + \sum_{j=1}^n L_j \\ Y_i &= Y_o + \sum_{j=1}^n D_j \end{aligned}$$

are computed, where X_o, Y_o are the coordinates of the first point.

$$\text{Area} = \frac{1}{2} \left| \sum_{i=1}^n [2(X_i - X_o) + L_{i+1}] D_{i+1} \right|$$

For curved sections, the central angle is assumed to be less than 180° .

$$\text{Then the central angle } C_i = 180^\circ - |B_i|$$

$$\text{and arc length} = \frac{\pi}{180} C_i$$

$$\text{chord length} = 2 \sin \left(\frac{C_i}{2} \frac{\pi}{180} \right)$$

$$\text{Area} = \frac{R^2}{2} \frac{C_i \pi}{180}$$

This area is added if the curve bulges out, subtracted if it bulges in.

The errors north and east are calculated as the sum of the latitudes and departures respectively and the total error is the square root of the sum of the squares.

The relative error is the total error divided by the total length of the traverse.

MAR 13 1975

Maine P-602 Surveyors

Owen Haskell Land Surveyors
South Portland

Howard Babbidge
Topsham

Robert P. Titcomb
Cape Elizabeth

Herrick Salbury, Inc.
Blue Hill

Professionals, Inc.
Rockport

Kolman Timberlands Consultants
Brewer

Maine P-652 Surveyors

Prentiss & Carlisle
Bangor

Desroberts & Henry
Biddelford & Kittery

Clinton Waite, Inc.
No. Leeds

Land Use Consultants, Inc.
Portland

Vess E. Irvine
Ogunquit

Philip D. Spiller
Westbrook

MAR 13 1975

Maine P-101 Surveyors

James W. Sewall Co.
Old Town

Carl Storer
Yarmouth

J.U. Wiesendanger
East Wintrop

Kleinschmitt, Inc.
Pittsfield

Wright Pierce Barnes & Wyman
Topsham

Desroberts & Henry
Biddeford & Kittery

Carroll Taylor & Associates
Auburn

Robert P. Titcomb
Cape Elizabeth

Dale Caruthers
Gorham

Sagadahoc Land Survey
Bath

Clinton Waite, Inc.
No. Leeds

Lawrence P. Rolfe
Portland

Andrew Shyka
Bangor

Thomas Griffin Associates
Portland

Andrews And Lane
Lincoln

American Engineering
Bangor

MAR 13 1975

P-652

Vern Dingman
P. O. Box 305
Hampstead, New Hampshire 03841

Tom Stevens
171 Main Street
Salem, New Hampshire 03079

John Breckinridge
40 Belknap Avenue
Newport, New Hampshire 03773

Doug Grella
14 Clay Street
Littleton, New Hampshire 03561

Richard Bartlett
9 Winthrop Street
Concord, New Hampshire 03301

Grant Davis
44 Elm Street
Dover, New Hampshire 03820

Amherst Survey Associates
P. O. Box 73
Amherst, New Hampshire 03031

Dave O'Hara
24 Tremont Square
Claremont, New Hampshire 03743

Troy Associates
12 Euclid Avenue
Hudson, New Hampshire 03051

Harold E. Johnson, Inc.
8 Taylor Street
Laconia, New Hampshire 03246

P-652, MLU

David Noyes
Center Hill Road
Epsom, New Hampshire 03234

Robert Bristol
Rowell Hill
North Sutton, New Hampshire 03260

Carter & Tower Associates
Province Road
Strafford, New Hampshire 03884

Jerry Hambrook
Vittum Hill Road
Center Sandwich, New Hampshire 03227

*LeClair Associates
Etna Road
Hanover, New Hampshire 03755

Durgin Engineering
600 Greenland Road
Portsmouth, New Hampshire 03801

Dave Garcelon, Inc.
Danforth Road
Pittsburg, New Hampshire 03592

MAR 13 1975

P-602 Surveyors

Piantidosi Associates
24 Ledge Road
Hudson, New Hampshire 03051

John W. Dargin
600 Greenland Road
Portsmouth, NH 03801

Robert Bristol
Rowell Hill
North Sutton, New Hampshire 03260

Robert W. Shaw Associates
Main Street
Colebrook, New Hampshire 03576

Parker Surveys
Lafayette Road
Seabrook, New Hampshire 03833

P-602 MLU Surveyors

Rayco Engineering
4 Downing Street
Concord, New Hampshire 03301

Thad Thorne
Brown Field Road
Center Conway, New Hampshire 03814

DiBernardo Associates
Route 5
Bellows Falls, Vermont 05101

Dick Joyce
Mount Snow Village
West Dover, Vermont 05356

McKenna Associates
171 Middle Street
Portsmouth, New Hampshire 03801

T & M Surveys
59 Prospect Street
Lebanon, New Hampshire 03756

Parker Surveys
Lafayette Road
Seabrook, New Hampshire 03833

Nolte Associates
Temple Street
Nashua, New Hampshire 03060

John Keller
Austin Road
Bethlehem, New Hampshire 03574

Trojano-Rhines Survey
Route 3
Plymouth, New Hampshire 03264

Dauchy Associates
Route 130
Jamaica, Vermont 05343

Ernest Veinotte & Associates
27 North Main Street
Concord, New Hampshire 03301

Peter Hodges
Route 3
Holderness, New Hampshire 03245

Kearwood, Inc.
Pleasant Street
New London, New Hampshire 03257

Ed Herbert
Lowell Road
Windham, New Hampshire 03087

MAR 13 1975

New Hampshire and Vermont Surveyors
P-101 Surveyors

Thaddeus Thorne
Brown Field Road
Conway, New Hampshire 03818

HAP Associates
Main Street
Raymond, New Hampshire 03077

Southern Vermont Surveys
Route 103
Chester, Vermont 05143

Ledgewood Properties
154 Pleasant Street
Claremont, New Hampshire 03743

Bob Todd
Francestown Road
New Boston, New Hampshire 03070

Don Poppema
Center Barnstead
New Hampshire 03225

Ernie Veinotte
27 North Main Street
Concord, New Hampshire 03301

David Noyes
Center Hill Road
Epsom, New Hampshire 03234

Profile Surveys, Inc.
Route 103
Claremont, New Hampshire 03643

Manchester City Engineers Office
Union Street
Manchester, New Hampshire 03031

Grant Davis
44 Elm Street
Dover, New Hampshire 03820

Dave Berry
15 Hillcrest Drive
Rochester, New Hampshire 03867

Edmond Bergeron
Lowell Road
Windham, New Hampshire 03087

Elwin Macomber
Route 25
Plymouth, New Hampshire 03264

Al Schaal
Peterborough
New Hampshire 03458

Bill Smith
Quebec Road
Lyman, New Hampshire 03585

Robert Thorndike
Golden Brook Road
Pelham, New Hampshire 03076

Roy Piper
678 West Street
Keene, New Hampshire 03431

Bev Pearson
4 Worthley Road
Derry, New Hampshire 03038

Southern Vermont Engineering
P. O. Box 266
Brattleboro, Vermont 05301

Dave O'Hara
24 Tremont Square
Claremont, New Hampshire 03743

Richard K. Parker
Lafayette Road
Seabrook, New Hampshire 03874

Dick Joyce
Mt. Snow Village
West Dover, Vermont 05356

Jason Blais
1 Pleasant Street
Meredith, New Hampshire 03253

Frank Sprague
99 Highland Street
Hudson, New Hampshire

Hamilton Engineering
D. W. Highway
Nashua, New Hampshire 03060

MAR 13 1975

Pembroke Land Surveys
99 North Main Street
Salem, New Hampshire 03079

John French
8 Garland Street
Plymouth, New Hampshire 03264

Ray Marshall
Mann's Hill
Littleton, New Hampshire 03561

Harry Harrington
Tanglewood Estates
Keene, New Hampshire 03231

LeClair Associates
Etna Road
Hanover, New Hampshire 0375

Great East Land Surveys
Forrest Hills
Sanbornville, New Hampshire 03872

Jerry Hambrook
Vittum Hill Road
Genter Sandwich, New Hampshire 03227

Verne Dingman
Main Street
Hampstead, New Hampshire 03341

Davis & Benoit
Route 102
Londonderry, New Hampshire 03053

Richard Etsell
Conway
New Hampshire 03818

Charland Associates
Laconia
New Hampshire

Seppala & Aho Construction Co.
New Ipswich
New Hampshire 03071

Blynn Merrill
Canaan
New Hampshire 03741

Dickson, Holden & Associates
58 Manchester Street
Concord, New Hampshire 03301

A. E. Maynard
12 Progress Avenue
Nashua, New Hampshire 03060

W. C. MacAdam
New Boston Road
Francestown, New Hampshire 03043

Nolte Associates
Temple Street
Nashua, New Hampshire 03060

Lakes Region Survey Service
1 South Main Street
Wolfeboro, New Hampshire 03894

Don Mellen
School Street
Hillsboro, New Hampshire 03244

Jack Hills
1700 South Willow Street
Manchester, New Hampshire 03101

Tyrone Hunter
Route 10
East Lempster, New Hampshire 03605

DeCesare & Lang
North Main Street
Salem, New Hampshire 03079

Jeff Evans
Route 114
Sutton, New Hampshire

Harold Fosher
Route 3
Concord, New Hampshire 03301

Robert Colbath
South Main Street
Wolfeboro, New Hampshire 03894

Paugusport Development Corp.
Route 3
Weirs Beach, New Hampshire 03236

Bruce Pohopek
42 Adelle Drive
Dover, New Hampshire 03820

Ron Mitchell
Maple Brook Drive
Gilford, New Hampshire

MAR 13 1975

Ed Herbert
Lowell Road
Windham, New Hampshire 02087

Cliff Richer
122 Cheney Street
Newport, New Hampshire 03773

Harold E. Johnson, Inc.
8 Taylor Street
Laconia, New Hampshire 03246

Ed Rostron
Upper Queen Street
Boscawen, New Hampshire 03301

Everett Leach
Milford Road
Amherst, New Hampshire 03031

Rudy Townsend
RFD #7
Williamstown, Vermont 05679

Ron Natoli & Associates
Route 104
New Hampton, New Hampshire 03256

Woodland Survey Service
113 Stark Street
Laconia, New Hampshire 03246

Warren Cate
31 Pleasant Street
Franklin, New Hampshire 03235

Amherst Surveys
6 Miles Road
Amherst, New Hampshire

Roland Therrien
255 River Road
Manchester, NH 03301

FEB 26 1975

2/1/75

GENERAL ELECTRONIC BUSINESS MACHINES, INC.

PRICE LIST

CAS INSTRUMENT

<u>Model</u>	<u>Retail</u>
2500-II	49.95
1500	49.95
2550	59.95
3500	69.95
3510	79.95
4000	89.95
SR10	64.95
SR11	69.95
SR16	89.95
SR50	124.95
SR51	224.95
500	249.95
620	299.95
70 (clock)	29.95
71 (clock)	39.95

ROCKWELL

*10R (12/box)	24.88
*20R (12/box)	39.88
30R	49.88
01R adaptor	5.95
*12R (12/box)	29.95
21R	49.95
31R	59.95
5-1202SR	99.95
61R	79.95
63R	99.95
80R	139.95
82R	169.95

CORVUS

*401 (6/box)	29.95
312	39.95
322	49.95
411	69.95
300	69.95
415	59.95

SINCLAIR

Ex w/mem	79.95
----------	-------

KINGSPPOINT

SC40	139.95
------	--------

CANON

<u>Model</u>	<u>Retail</u>
*LE84 (10/box)	24.95
*LD80 (10/box)	34.95
*LE85 (10/box)	39.95
LE81M	59.95
L804	59.95
L810	99.95
FC80	129.95
F5	129.95
Pock II	159.95
F7	249.95
Adaptor	5.00
Chg. & NiCd	10.50

*HEWLETT PACKARD

21	125.00
35	195.00
70	275.00
45	245.00
55	395.00
80	395.00
46	725.00
46A	825.00
65	795.00
81	925.00

BOWMAR

MX55	49.95
MX90	79.95
MX100	129.95
MX140	159.95

KEYSTONE

2010	54.95
2030	69.95
2040	74.95
2050	124.95

LITRONIX

2230	34.95
2240	44.95
2260	44.95

CRAIG

4509B	34.95
Adaptor	5.00
Charger	10.00

VICTOR 302
2/26/75 CHAMPION 319⁰⁰ STOVERS