QUICKCLOSE

Expert version

Version 2.0

USER REFERENCE GUIDE

January 1999

DISCLAIMER

Richard Stanaway and authorised distributors of the QUICKCLOSE program disclaim any liability for any use of the QUICKCLOSE program.

By purchasing the Quickclose software disk, the purchaser is bound by the following conditions;

Only one calculator is permitted to be loaded with each disk. Multiple installation from one disk is not permitted. Creation of both a backup floppy disk and/or a RAM card copy of Quickclose is permitted however, and recommended.

ACKNOWLEDGEMENTS

Richard Stanaway is extremely grateful for the assistance of the following people for their assistance, advice and proofing of the software;

Steve Pryor, Senior Surveyor with ENERGEX who designed the popular HP42 Survey program.
Gary Couchman, Licensed Surveyor with Gassman & Associates, Beenleigh QLD
Nick Bowden, Geomatic specialist with the Tasmanian Department of Primary Industries, Water and Environment.
David Stanaway who gratefully produced the conversion program, **convert.exe**

and also to the following surveying staff and students at the **Queensland University of Technology** for their valuable advice and support;

Murray Harris, Brian Hannigan, Kevin Jones, Chris Cook, Robert Webb, Graham Blair, John Hayes, Ian Pagan, Steven Steggal, Tyrone Taylor.

Also to his own sanity for making it all possible.

YEAR 2000 COMPLIANCE

QUICKCLOSE software uses a 4 digit year in date and time calculations and is thus year 2000 compliant.

ALGORITHM SOURCES AND REFERENCES

Rüeger, J.M. ***Electronic Distance Measurement, An Introduction***, 3rd Edition, Springer-Verlag, Berlin, 1990
National Mapping Council, ***The Australian Geodetic Datum, Technical Manual***, Special Publication 10, Commonwealth of Australia 1986
NSW Department of Lands, ***Manual of the New South Wales Integrated Survey Grid***, Sydney 1976
Shepherd F A, ***Advanced Engineering Surveying, problems & solutions***, Edward Arnold 1981
Mackie J B, ***The Elements of Astronomy for Surveyors***, 9th Edition, Charles Griffin & Co, 1985
Meeus, Jan, ***Astronomical Algorithms***, Wilmann-Bell, 1991
Bennett GG & Freislich, J.G. ***Field Astronomy for Surveyors***, NSW University Press, 1979
The Stationery Office, ***The Star Almanac for Land Surveyors 1998***, 1997
Hewlett Packard, ***HP48G Series Advanced User's Reference Manual***, 1994
Hewlett Packard, ***HP48G Series User's Guide***, 1994

KERMIT

The Kermit software provided is provided free of charge, being a public domain freeware software product from Columbia University in the City of New York.

To all the surveying students and staff
at the
Queensland University of Technology
Brisbane

CONTENTS

1 INTRODUCTION

The Hewlett Packard HP 48 G series is a programmable hand-held calculator adopting the RPN (Reverse Polish Notation) style of operation familiar to most surveyors. The HP 48GX differs from the 48G in terms of its memory capacity and expendability. The HP 48G is equipped with 29.6kB of user RAM (Random Access memory) and is unexpandable, whereas the HP 48GX is equipped with 179.55kB of user RAM which can be increased substantially (to 1.3 mB) with the insertion of two plug-in RAM cards. Lately HP has released a mid-range calculator, the HP48 G+ which comes with 128kB unexpandable RAM. All calculators have serial and infra-red ports to enable communication between other calculators, computers, printers and total stations. Quickclose programs will not run on earlier S/SX models.

The *HP 48G Series User's Guide* should be referred to for a more detailed explanation of the calculator's operation and capabilities.

1.1 OVERVIEW OF QUICKCLOSE EXPERT

QUICKCLOSE Expert is a comprehensive suite of programs which have been designed to assist surveyors with most field and desk calculations into the next millennium. The component modules are designed to compute a wide range of surveying and geodesy related problems, particularly with the increased usage of the Global Positioning System (GPS) and the adoption of a Geocentric Datum for Australia (GDA94) by the year 2000. Nonetheless, computation of terrestrial surveying measurements are incorporated in the program as and adjunct to GPS. The programs have been designed not to supersede the functions of data collectors and PC based survey packages. Software packages such as STARNET should be used to perform rigorous least squares adjustments of reduced raw survey data.

The program consists of seven main modules;

CLOSE	which performs most cadastral computations
COGO	programs for solving two dimensional plane coordinate geometry problems
LEVEL	a simple level reduction program
UTILS	other useful survey programs
ASTRO	programs for astronomical determination of azimuths and grid bearings
GEOD	programs for surveys and transformations on AMG/GMA/ISG map grids
ROAD	horizontal circular curve & vertical curve setouts, batter staking

1.11 CLOSE module

The close program prompts for bearings and distances of a series of interconnected traverse legs or lines, storing them initially as vectors on the HP48's stack. Data can be modified easily during entry, distances can be entered in links or feet, then converted to metres and bearing corrections can also be applied. At any stage during entry of data, the running misclose bearing, distance and ratio can be displayed back to the start of the close. At the completion of data entry an options menu is displayed allowing the user to extract additional information from the close and to view, edit and print the entered data. A hot key allows a quick return to data entry. The close can be saved into any of five available storage registers for later retrieval. Additional data that can be extracted includes; the calculation of two missing distances, two missing bearings, missing bearing and distance on different lines, area, coordinates, Bowditch adjustment of the close traverse and Bowditch adjusted area. A rotation can also be applied to the current close. A close can be exported to the COGO module.

1.12 COGO module

COGO is a suite of coordinate geometry programs. Coordinate data (Eastings, Northings) is initially entered with point numbers into a choice of five different jobs. An ASCII coordinate data file can be uploaded from a PC making this process easier. With this pre-entered data, other data can be computed by means of traverse, radiation, resection or intersection. Computed point data can be downloaded back to a PC. COGO allows for corrections to be applied to entered bearings, and a scale factor to be applied to entered distances. Joins (bearing and distance) can also be calculated between two coordinates. In both radiation and join programs, the start point can be held fixed and multiple computations made without having to re-enter data. The coordinate traverse program shares many options with the close module (adjustment, editing, area etc...). Offsets from a given line can also be computed. Data can be transformed by rotation and translation (shift) programs.

1.13 LEVEL module

This is a simple module making field reductions of level observations an easy process.

1.14 UTILS module

This module contains a suite of other commonly used programs. Program SECN computes the secant bearing and distance at the intersection of two road straights. Program TRUNC computes the chord bearings and distance of a road or other corner truncation. S→H reduces slope distances into their horizontal and vertical components. Program MLM computes missing line measurement between two radiations. R→CR computes the orthogonal components of a reference mark bearing and distance relative to a boundary line.

1.15 ASTRO module

Both Grid and true bearings (azimuth) can be computed from direct observations of astronomical bodies. Data can be either processed real time using the HP48 internal clock or post-processed later using separate time data. A solar ephemeris algorithm is incorporated into the software to alleviate the need to refer to SALS or similar ephmerides. Data for stars can still be entered manually by input of Right Ascension and Declination from SALS. The inbuilt almanac of southern daylight and circumpolar stars is accurate at epoch October 1998, with apparent positions at that time.
The star prediction programs enable the azimuth, grid bearing and zenith angles to be computed for any star at a given time.

1.16 GEOD module

Quickclose supports three different types of geodetic datum / map projection combinations;

1. GDA94 / MGA94 (Geodetic Datum Australia 1994 / Map Grid Australia 1994) which adopts the Geodetic Reference Spheroid 1980,
2. AGD/AMG (Australian Geodetic Datum 1966 or 1984 / Australian Map Grid) which adopts the Australian National Spheroid, and
3. AGD/ISG which uses the Australian National Spheroid in conjunction with the NSW Integrated Survey Grid.

Raw geodetic data is either entered via the keyboard or imported as an ASCII text file. Data can be stored in up to five different jobs. Raw data can be in the form of;

1. Zone No, Easting, Northing, Spheroid Ht, or
2. Latitude, Longitude, Spheroid height, or
3. X,Y,Z Cartesian coordinates

Data is stored in a native geographic (lat,long,sph.ht) format. Latitudes are negative in the Southern Hemisphere. Imported files can either be in decimal degree or DD.MMSSS format.

Data must be pre-entered in one of the above specified formats before additional computations can be performed.

The SURV menu enables the creation of new data points from either raw or pre- reduced survey data. The COMP menu enables computations to be performed on existing data. Computations include;

1. Grid bearing and Spheroidal distance between two data points.
2. Grid convergence and Point scale factor for a given data point
3. Arc to chord corrections (T-t) and Line Scale Factors between any two grid points
4. Combined height and grid scale factor

Transformations across different datums using different coordinate types can also be performed. Entered coordinates can be viewed and printed quickly in any format (E,N,h Lat.Long.Ht X,Y,Z) and in any specified grid zone if required by means of a Zone to Zone transformation.

Points on different datums can be stored in the same job.

1.17 ROAD module

Data can be computed for a horizontal circular curve, given any two other elements. The setout program computes radiations to a point on a computed curve alignment given a chainage and offset. The vertical curve setout program computes RLs at a given chainage. A batter staking program is also included.

1.2 BASIC OPERATION

The *HP 48G Series User's Guide* should be referred to for a more detailed explanation of the calculator's operation.

1.21 Terminology used in this manual

Any function using the primary keyboard is delimited by [*name*], where *name* is what is printed on the face of the key. For example the ENTER key will be referred to as [ENTER].

Any function using the left-shift keyboard is delimited by [L-S][*name*]$^{shifted\text{-}name}$, where *name* is what is printed on the face of the key and shifted-name is the performed function. For example; to show the previous menu press [L-S] [NXT] ^{PREV}.

Any function using the right-shift keyboard is delimited by [R-S][*name*]$^{shifted\text{-}name}$, where *name* is what is printed on the face of the key and shifted-name is the performed function. For example; to get to the root directory of the calculator press [R-S] ['] ^{HOME}

Any menu label function is delimited by | *menu-label* |, where *menu-label* is the function shown in the menu label on the display.

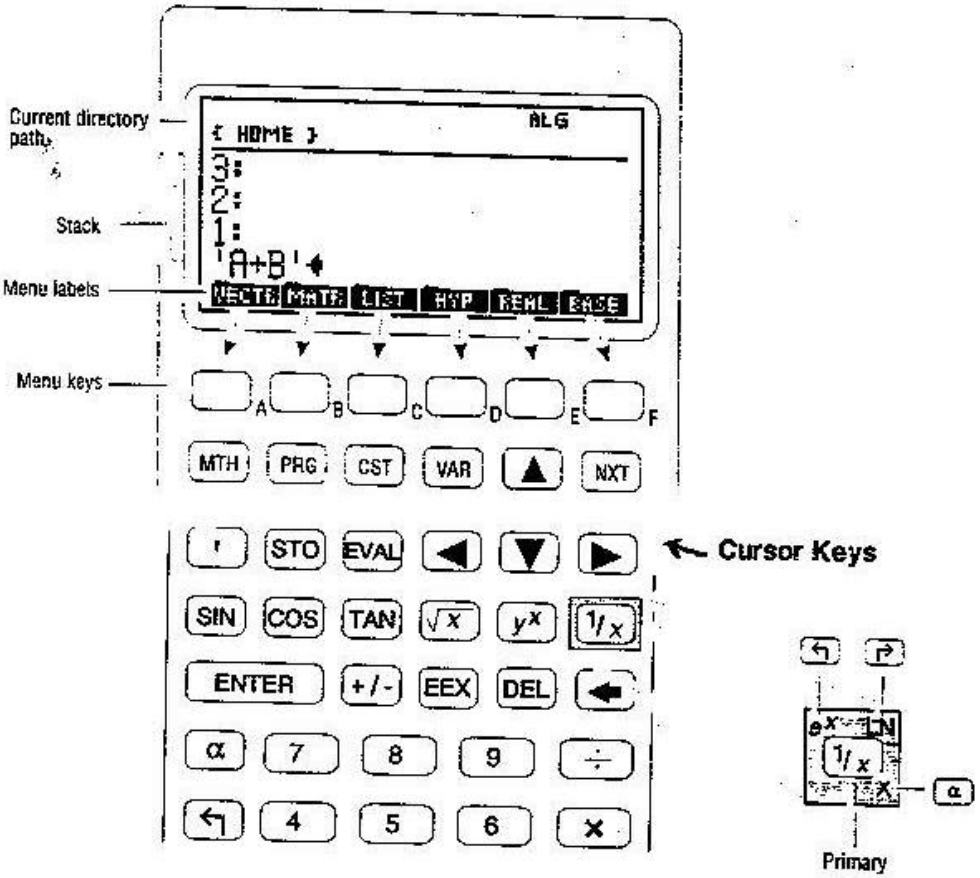

Figure 1. Keyboard and Display

1.22 Keyboard and Display

There are four main keyboards used on the HP48

- The **primary keyboard** is represented by the labels on the face of each key (usually white).
- The **left-shift keyboard** (purple letters) is activated by pressing the purple LEFT SHIFT key herein referred to as the [L-S] key.
- The **right-shift keyboard** (blue letters) is activated by pressing the blue RIGHT SHIFT key herein referred to as the [R-S] key.
- The **Alphabetical keyboard** is activated by pressing the [α] key. Alpha keys are labelled in white with the letter represented, shown at the bottom right of the primary key, see Figure 1.

The display and keyboard is described in Figure 1.

To enter negative numbers, when prompted. Press the [+/-] key after typing the number.

1.23 Cursor Keys

The cursor keys are shown in Figure 1.

The [◄] key moves the cursor left.
The [►] key moves the cursor right.
The [▲] key moves the cursor up.
The [▼] key moves the cursor down.

The [←] key deletes the previous character
The [DEL] deletes the current character, or the whole stack

1.24 Menu keys

The six white keys below the display activate the menu item above each of them in the display.

2 INSTALLATION

2.01 Memory requirements.

The QUICKCLOSE Expert program requires 80 kB of free USER memory on the HP 48GX/G+. The HP48G has insufficient memory to run the Expert version. Each leg of a close, or stored point coordinates requires approximately 30 bytes of user memory, therefore the storage of data is limited only by the available memory on the calculator. If no other programs are used the HP48 G+/GX (unexpanded) will allow 3000 points / 1000 traverse legs to be stored.

To check the free memory on the HP48 press [L-S] [VAR] MEMORY |MEM|
The free user memory (in bytes is shown on level one of the stack). There should be at least 80000 bytes free for operation of QUICKCLOSE EXPERT.

Users of the HP48 G calculators can download the COGOLITE and QLITE
Programs which are based upon the modules as described above.

2.02 Installation procedure from a PC

New Installation

For quicker and more reliable uploading it is recommended to clear the memory of the HP48 prior to installation. Existing data and programs to be retained should be downloaded to a PC or plug-in RAM card. To clear the memory of the HP48, press the [ON] key and the A & F menu keys together (the bottom-left, top-left and top-right keys) and press |NO| at the recover memory prompt.

Upgrading from the Standard version.

Follow the instructions below to upgrade from an existing installation of the Standard version.

To install the QUICKCLOSE software onto the HP48 G/GX two items are required:

1. Serial interface cable
2. QUICKCLOSE software disk

Installation procedure is as follows

1. Connect the serial interface cable to the PC. On most PCs the cable will plug into the 9-pin COM port (COM1). It may be necessary to disconnect the mouse to do this, alternatively, a 9-25 pin adaptor can be attached and the 25pin COM2 port used. Some PCs may have different addresses for ports (COM3 etc ..)

2. Connect the serial interface cable to the 4-pin connector at the top of the HP48, making sure that the HP logo is facing up. (Refer to the user manual p 27-8)

3. If the computer is using a Windows 95/98 operating system it is recommended to re-boot the computer in DOS mode.

4. Insert the QUICKCLOSE software disk into the 3.5" disk drive

5. Start the Windows explorer and click on the "kermit.exe" icon, or
in DOS mode at the command prompt ***a:>*** type ***kermit,*** then the ENTER key
* Installation files must be in the same logged directory as kermit, or set the path to the location of the files by typing ***cwd pathname*** at the kermit prompt.

6. If com port 2 is used (usually the 25 pin serial port)
at the **MS-Kermit>** prompt type ***set po 2,*** then the ENTER key
If com port 1 is used (usually the 9-pin mouse port) skip this step.

7. At the ***MS-Kermit>*** prompt type ***set ba 9,*** then the ENTER key

8. Turn the HP48 [ON]

9. Go to the HOME directory of the HP48 by pressing [R-S][']^{HOME}

10. Press [R-S][►] The display should read ***Awaiting server command***

If upgrading from the standard version

On the PC at the ***MS-Kermit>*** prompt type ***send delold,*** then the ENTER key
Press [ON]
Press [VAR] and the |DELOL| menu key, to purge the old program library. If "object in use" is displayed press [ON] [VAR] [R-S][']^{HOME} and |DELOL| again. Press [R-S][►] again.

11. On the PC at the ***MS-Kermit>*** prompt type ***send exp20.lib,*** then the ENTER key

12. The QUICKCLOSE program will now be uploaded to the calculator, a process which will take approximately fifteen minutes.

If the program is not transferring check the following:
1. The connection is secure
2. that the I/O parameters are correct on the HP48
(User Guide pp27-8) the baud rate should be 9600.
3. That the com1/com2 ports on the PC are open and correctly addressed.
4. If the PC has Autocad Releases 12 or 13, try using another PC, as these versions of AUTOCAD may alter the port addresses.
5. If the file transfer fails, try setting the baud rate on the kermit and HP48 to 2400
6. **If there is limited memory on the HP48, the file may load to 100% quite quickly and "hang" for a few minutes before completion. This is normal. If after five minutes the program still has not loaded, try again, but this time create more free memory on the HP48.**

For new installation

13. At the ***MS-Kermit>*** prompt type ***send inste20,*** then the ENTER key
Wait several seconds until the file is uploaded

or, if upgrading

13. At the ***MS-Kermit>*** prompt type ***send upgrade,*** then the ENTER key
Wait several seconds until the file is uploaded

14. At the ***MS-Kermit>*** prompt type ***exit*** , then the ENTER key

15. Press [ON] then the [VAR] button on the HP48.

16. Press the **|INSTE|** menu key (or **|UPGR|** if upgrading). The current version of the program will be displayed. It while take several seconds for the directory and writeable global variable structure to be set up. At the ***….Press OK*** prompt. Press |OK|. The calculator will turn off. This allows the memory to be reset for the program on the next system boot.

17. Turn the HP48 [ON]. The screen will momentarily blank, this is OK.

18. Press the [VAR] menu key, again and press the **|INST2|** menu key.

    The installation program will now prompt the user for various preferred options. If upgrading only selected options will be prompted, as existing preferences are retained where possible from the earlier version.

20. At the ***STATE OF ORIGIN*** menu.

    Press the [▼] key until the state where the program is to be used is highlighted and then press |OK| or [ENTER].

21. At the ***SELECT DATUM/MAP GRID*** menu.

    Press the [▼] key until the desired datum / map projection combination is highlighted and then press |OK| or [ENTER].

22. At the ***Fix Distance & coordinate display to*** prompt. Either press [ENTER] to accept the default value of 3 decimal places for distances and coordinates, or press the [←] key, type in a different value and press [ENTER]. Distances and coordinates in the GEOD module are fixed at 3 decimal places.

23. At the ***Fix Level RL display to*** prompt. Either press [ENTER] to accept the default value of 3 decimal places for levels, or press the [←] key, type in a different value and press [ENTER].

24. At the ***FIX <) SECONDS*** menu. If the seconds component of angles and bearings is to be displayed without decimals, press [ENTER] with ***No decimal*** highlighted. If angles are to be displayed to 0.1" or 0.01" then press [▼] until the desired display fix is highlighted and press [ENTER]. Output of geographic co-ordinates and grid convergences are fixed at 4 decimal places for seconds.

25. At the ***Select Auto scroll speed (secs)*** prompt. This value is the speed at which automatic scrolling of entered data is displayed. Either press [ENTER] to accept the default value of 1 second, or press the [←] key, type in a different value and press [ENTER].

26. At the ***CO-ORD ORDER*** menu. If the preferred format for coordinate entry and display is Eastings then Northings, press [ENTER] with **E,N** highlighted. If Northings then Eastings is preferred then press [▼] and press [ENTER]. Co-ordinates in GEOD, ASTRO and ROAD modules are always in E,N order.

27. At the ***SELECT PRINTER*** menu. If the current infra-red printer (82240B) is being used press [ENTER]. If the older printer the (82240A) is used then press [▼] and [ENTER].

28. At the ***Edit Date (DD.MMYYYY)*** prompt. Either press [ENTER] to accept the date displayed, or press the [←] key and type in the correct date and press [ENTER]. The first two digits are the day. The next two digits after the decimal point is the month and the last four, the year.

29. At the ***Edit Time*** prompt. Either press [ENTER] to accept the 24hr time displayed, or press the [←] key and type in the correct time and press [ENTER]. The first two digits are the hour. The next two digits after the decimal point are the minutes and the last two, seconds. If the ASTRO module is used it is recommended to synchronise the clock with a time source such as Telstra's 1194 service.

30. ***Daylight saving choose box***. If the time entered in step 28 is standard local clock time and daylight saving is not in operation press |OK| or [ENTER].
If 1 hour daylight saving is in operation press [▼] and |OK| or [ENTER]. This will advance to Time Zone set in the State of Origin configuration by one hour.

The program is now installed, and the main menu displayed. Disconnect the serial cable from the PC and HP48. If the program configuration is required to be changed later refer to section 11.01.

2.03 Backing up the program, data and settings to a RAM card.

1. Install the program into main memory as specified above.
2. Turn the calculator off.
3. Insert a RAM card as specified in the HP 48 User Guide.
4. Turn the calculator back on.
5. Press [VAR] |QCLO| to return to the Quickclose program directory.
6. Press |→RAM|
7. The program and installation program are now saved onto the RAM card and the main menu is displayed after a few seconds.
8. Turn the calculator off and remove the RAM card.
9. To return to the MAIN menu. Turn the calculator on. Press [VAR] |QCLO| |RUN|.

2.04 Reloading the program from a RAM card

1. Ensure the calculator is turned off, and that there is sufficient memory (80kb)
2. Insert a RAM card with the backed up Quickclose program.
3. Turn the calculator back on.
4. Press [L-S] [2] LIBRARY |PORTS| |:1:| |LOAD|
5. The program will be re-installed and the calculator will turn itself off.
6. Remove the RAM card
7. Turn the calculator back on and press [VAR] |QCLO| |RUN| to return to the main menu.

2.05 To uninstall QUICKCLOSE

In the Quickclose program press [VAR] |UNST|

UN-INSTALL
QUICKCLOSE
Are you sure ?

Press |YES| to completely remove QUICKCLOSE and data, or
Press |NO| if you were just random fingering.

3 RUNNING QUICKCLOSE PROGRAMS

The QUICKCLOSE Expert program library and data files are resident in the **QCLOSE** directory of the HOME (root) directory of the HP48.

3.01 The MAIN menu

To access the **MAIN** menu of QUICKCLOSE programs:

1. If the HP48 is an another sub-directory (the current path is shown in the top left area of the display), press [R-S]['] ^{HOME}.

2. Press the [VAR] key then the **|QCLO|** menu key.

3. Press **|RUN|** to get to the main menu of QUICKCLOSE, other menu options are displayed by pressing the |→| menu key

A listing of QUICKCLOSE library programs is attached in Appendix 2

Menu maps of QUICKCLOSE are outlined in Appendix 1

MAIN MENU Map

(1/2)

CLOSE	**COGO**	**LEVEL**	**CNFG**	**RESET**	®

(2/2)

UTILS	**ASTRO**	**GEOD**	**ROAD**		¬

|CLOSE| Displays the CLOSE module menu
|COGO| Displays the COGO module menu
|LEVEL| Starts the level reduction program
|CNFG| Displays the current configuration and the main configuration menu
|RESET| Resets the QUICKCLOSE program (without clearing data or settings)
| → | Displays the second menu
|UTILS| Displays a menu of utility survey programs
(Secant, truncation, slope dist to HD, Missing line mes. & Ref/Cnr.)
|ASTRO| Displays the ASTRO module menu
|GEOD| Displays the GEOD module menu
|ROAD| Displays the ROAD module menu
| ← | Displays the first menu

3.02 To ensure maximum program speed.

If programs seem to be running slower than usual it is advisable to reset the program. To do this press **|RESET|** in the main menu. This will kill any halted or suspended programs which usually slow operations down. Resetting the program does not delete any data or change any user preference settings.

3.03 Hot Key Menus [CST]

Pressing the **[CST]** key **at any time** during most program operations will display a menu allowing quick access to the major components of the current module. Custom menus for appropriate modules are discussed in more depth in the sections relating to the appropriate menus.

CST menu with CLOSE module

NEW	RETN	VW.PR	MISS	CONV	CLOSE

|NEW| Hot key access to start a new close
|RETN| Resume data entry into current close
|VW.PR| The viewing, printing and co-ordinating menu
|MISS| The misclose and missing line element menu
|CONV| Conversion utilities (HMS+, LKS to M etc...)
|CLOSE| Return to the CLOSE menu

CST menu with COGO module

ADD.D	VW.D	B.COR	D.COR	CONV	COGO

|ADD.D| Add coordinate data to the current job
|VW.D| View coordinate data
|B.COR| Display and edit the current bearing correction
|D.COR| Display and edit the current distance scale factor correction
|CONV| Conversion utilities
|COGO| Return to the COGO menu

CST menu with GEOD module

KEYIN	V.ENH	PINFO	CBD	Z® Z	GEOD

|KEYIN| Key in grid coordinate data
|V.ENH| View grid coordinate data
|PINFO| Compute grid convergence and scale factor for point
|CBD| Compute spheroidal bearing and distance between two points
| Z→Z | View coordinates, grid convergence and scale factor in a different zone.
|GEOD| Return to the GEOD menu

4 CLOSE module

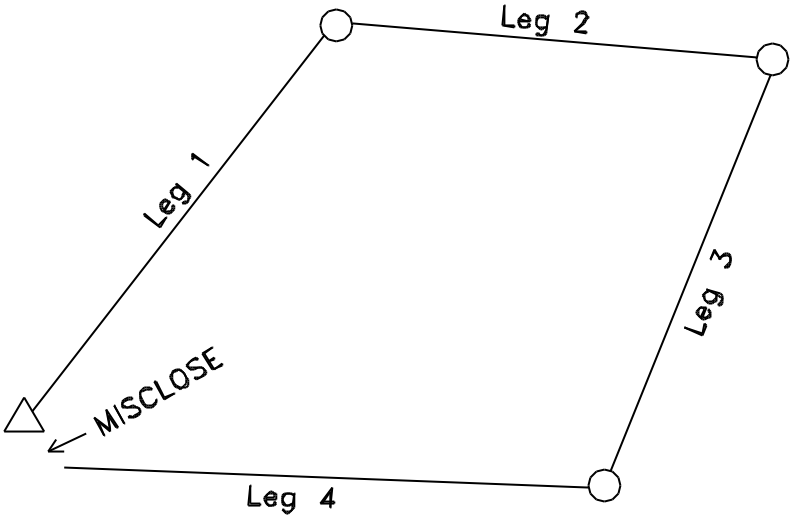

Figure 2. A typical close

To get into the CLOSE module press the **|CLOSE|** menu key from the MAIN menu.

JOB.M	EDIT	VW.PR	MISS	AJ.AR	MAIN

|JOB.M| File management menu (new close, open, delete, export etc..)
|EDIT| Editing menu
|VW.PR| The viewing, printing and co-ordinating menu
|MISS| The misclose and missing line element menu
|AJ.AR| Adjustment and area computation menu
|MAIN| The Main menu of QUICKCLOSE

4.1 STARTING A NEW CLOSE

To run the CLOSE program. Either

a. Press the |JOB.M| **|NEW|** menu keys, or more simply
b. Press the [CST] **|NEW|** keys. (If in CLOSE mode)

> **NOTE Starting a new close clears any current data out of the current close register without saving. If old data is to be kept it should be saved by pressing |JOB.M| |SAVE| and then select a register in which to save the old close.**

At the ***Leg 1 Brg?*** prompt type in the first bearing of the close in DD.MMSS format. Press the [SPC] or [ENTER] key to enter the data. The bearing and distance of the previous leg is displayed for assistance. For leg 1 a leg of bearing 0 and distance 0 is displayed.

(Refer to Section 4.24 for bearing input options)

At the ***Leg 1 Dist?*** prompt type in the first distance in metres.
Press the [SPC] or [ENTER] key to enter the data.
(Refer to Section 4.23 for distance input options)

The program will repeat the above prompts incrementing the leg number by one each time until the program is exited. Data for the previous leg is displayed with each prompt.

4.11 Displaying the running misclose and ratio

Press the **|MISCL|** menu key.

The Misclose will be displayed as follows:

MISCLOSE

Brg	The closing bearing
Dist	The closing distance
Ratio	The proportional ratio of the misclose (Sum of distances / closing distance)
Rev. Brg	The reverse closing bearing (bearing from the start of the close)
D***E***	The difference in Eastings to Close
D***N***	The difference in Northings to Close

Press the [SPC] or [ENTER] key to resume data entry
Press |EXIT| to exit the misclose display and data entry.

To show the misclose from the previous leg press the |MISCL| key again. (This deletes the current line though).

4.12 To exit data entry

Press the **|EXIT|** key.

The close is then stored in the current close register. An options menu is then displayed allowing interpretation, editing and other functions with the current close. (See the next section for a better description).

To continue entering data into the current close press [CST] |RETN| at any time.

4.2 OPTIONS FOR DATA ENTRY

4.21 To reverse the entered bearing (±180°)

If the bearing typed in is to be reversed (i.e. changed by 180°) press the [+/-] key.
Press the [SPC] to enter the bearing. The reversed bearing is then momentarily displayed before the distance is prompted for.

To change the display time for the corrected data. Press **|EXIT|** [CST] **|MAIN| |CNFG| |SPEED|** and type in the desired speed, then press **[ENTER]** [CST] **|RETN|** to resume data entry. Changing the display speed applies to all other sub-programs within QUICKCLOSE which momentarily display data without a key-press.

4.22 Copy the last entered bearing

At the ***Leg # Brg?*** prompt simply press the **|CPY.B|** menu key to copy the last bearing and continue the program. The copied bearing is the momentarily displayed before the distance is prompted for.

4.23 To convert a distance from Links/Feet to metres

If the distance typed in is in links/feet and is to be converted, press the **|LKS®|** or **|FT®|** menu key to convert the distance to metres. The converted distance in metres is momentarily displayed before the bearing of the next leg is prompted for.

4.24 To apply a correction to the bearing typed in

Type in the uncorrected bearing, then press the **|BRG±|** menu key.

4.241 For a “one off” correction

At the ***Brg Corr.?*** prompt type in the correction to be applied in DD.MMSS format. If the correction is negative press the [+/-] key after, to change the sign. Press the [SPC] or [ENTER] key to continue the program. The corrected bearing is momentarily displayed before the distance is prompted for.

4.242 To apply and store a correction.

At the ***Brg Corr. ?*** prompt press the **|ADD.R|** menu key.

At the ***Apply datum correction & store*** prompt type in the correction in DD.MMSS format. If the correction is negative press the [+/-] key after, to change the sign. Press the [SPC] or [ENTER] key to continue the program.

At the ***Store in register (enter no. between 1 & 4)*** prompt **type in** the number for the register number in which the correction is to be stored. Press the [SPC] or [ENTER] key to continue the program. The correction is then stored for later use in the nominated register and the corrected bearing is momentarily displayed before the distance is prompted for.

4.243 To apply a stored correction.

At the ***Brg Corr. ?*** prompt press the menu key (**|R1|** to **|R4|**) where the correction is stored. The correction in DD.MMSS is displayed on level one of the stack. Press the [SPC] or [ENTER] key to continue. The corrected bearing is then momentarily displayed before the distance is prompted for.

If the selected correction is incorrect press the [←] key to remove it off the stack and either reselect a register |R1| to |R4| or type in another correction. Press the [SPC] or [ENTER] key to continue.

4.244 To view the correction registers

At the ***Brg Corr.?*** prompt press the **|VW.R|** menu key. The stored corrections in all four registers will be displayed in DD.MMSS format.

Press the [SPC] or [ENTER] key.

Select a correction register **|R1|** to **|R4|** to apply a stored correction, type in another correction in DD.MMSS format or alternatively press |ADD.R| to apply and store a new correction and then press the [SPC] or [ENTER] key to continue. The corrected bearing is then momentarily displayed before the distance is prompted for.

> **NOTE If no correction is to be applied type in 0 then the [SPC] key, otherwise the program will abort.**

4.25 To delete the last entry (to go back a leg)

Press the **|UNDO|** menu key at any prompt. The last leg is then deleted and re-prompted for. The |UNDO| key can be pressed repeatedly if more than one leg is to be deleted.

4.3 JOB MANAGEMENT

4.31 To save the current or opened close

Press the **|SAVE|** menu key in the EXIT menu or |CLOSE| |JOB.M| **|SAVE|**

At the ***Select register*** prompt
Press the menu key corresponding to the register in which to save the close.
The number of an already opened close is displayed in the upper section of the display.

4.32 To open a saved close

Press |JOB.M| **|OPEN|**

At the ***Open Close No.*** prompt
Press the menu key of the close register to open. The close stored in that register is then placed in the current close register, ready for modification. The number of the close opened is also shown at the top of the display in the annunciator area.

4.33 To resume data entry

Press the [CST] key then the **|RETN|** menu key. The current close is retrieved to the stack and the prompt for the next bearing is displayed. Data entry can be resumed at any time.

4.34 Deleting a close

Press |JOB.M| **|DELE|**

At the ***Delete Close No.*** prompt
Press the menu key of the close to delete, or press |ALL| to delete all close data, including the current close.

4.35 To export a close to a COGO module job.

This program exports the current close into a COGO module job. Coordinates for the start point of the close are entered. The start point is numbered and the points at the end of each traverse leg are then stored in the current COGO job. Numbering of points is sequential from the start.

Press |JOB.M| **|® CG|**

At the ***Enter Start Co-ords*** prompt

:E : Type in the Easting of the start point of the close press the [▼] cursor key
:N : Type in the Northing of the start point of the close and press [ENTER]

At the ***No. Start Pt*** prompt

Type in the point number of the start of the close to be stored in the COGO job.
Press [ENTER].

The user is then directed to the main menu of the COGO module

4.4 EDITING THE CURRENT CLOSE

To edit the current close data

Press the **|EDIT|** menu key in the EXIT menu or |CLOSE| **|EDIT|**
The EDIT menu will be displayed.

4.41 To edit a specific leg of the current close

Press the **|LEG|** menu key.

At the ***Edit Leg No. ?*** prompt type in the number of the leg whose data is to be edited. A dialogue box showing the current bearing and distance of the specified leg will be displayed.

To edit the entered data press the |EDIT| menu key and using the [◄] or[►] cursor keys and the [🡐] key edit the data. Press the |OK| menu key or the [ENTER] key to accept the value. Repeat the process to edit the distance.

To accept all the data press the |OK| menu key or the [ENTER] key.

4.42 To delete the last leg of the current traverse

Press the **|DEL.L|** menu key. The last leg of the current close is deleted.

4.43 To delete a specific leg from the current close

Press the **|DEL|** key.

At the ***Delete Leg No.*** prompt type in the leg number of the current close to be deleted.

Press the [ENTER] key. The specified leg will then be removed. The close legs will be renumbered accordingly.

4.44 To insert a leg into the current close

Press the **|INS|** menu key

The following prompt will appear:

Insert new leg
:Brg : type in the bearing of the leg, press the [▼]cursor key
:Dist: type in the distance of the leg, press the [▼] cursor key
:No. : type in the leg number of the new leg, press the [ENTER] key

The leg is then inserted into the current close and the close legs renumbered.

4.5 TO VIEW AND PRINT THE CURRENT CLOSE

Press the **|VW.PR|** menu key

The viewing and printing menu will be displayed.

4.51 Viewing by single stepping, allowing editing of viewed data

Press the **|VIEW|** menu key.

The bearing and distance for each close leg is displayed.

To view the next data set either press the |CONT| menu key , or the [SPC] or [ENTER] keys.

To edit the currently viewed data press the **|EDITL|** menu key. To edit the data follow the steps as described in the previous section.

To view the misclose of the overall close press the **|MISCL|** menu key. Note that the misclose is that of the total close, not the running close.

To exit the viewing program press the **|ESCAP|** menu key. The user is then directed back to the VW.PR menu.

4.52 To view all entered data without key-stroking

Press the **|QCK.V|** menu key. The data for each leg will be displayed momentarily, one by one. The automatic scrolling speed can be altered in the configuration menu by pressing [CST] |CLOSE| |MAIN| |CNFG| |SPEED|.

4.53 To print the current close data

Firstly, align the infra-red ports of the printer and the HP48. Turn the printer on.

Press the **|PRINT|** key. The current date and time will be printed and a print options menu will be displayed.

4.531 To print the bearings and distances of a traverse

Press **|TRAVS| |B&D|**

If station numbers are to printed:

At the ***Sequence ?*** prompt type in the sequence of stations separated by the [SPC] key and press [ENTER]. To type alphabetic characters press the [α] key to use the alpha keyboard.

or just press [ENTER] if the sequence is not required to be printed

The data will be printed with the misclose and area at the end.

4.532 To print traverse coordinates

The traverse must first have been coordinated (see below) by pressing |VW.PR||COORD|

Press **|TRAVS| |CRDS|**
The coordinates of the traverse will be printed.

4.533 To print a close around a cadastral lot

Press **|LOT|**

At the ***Lot Number ?*** prompt type in the lot number and press [ENTER]

A menu of different plan type options is presented.

At the ***Select plan type*** prompt press the menu key representing the type of plan.

Press **|SP|** for a Survey Plan
Press **|RP|** for a Registered Plan
Press **|CP|** for a Crown Plan
Press **|IDENT|** for an identification survey
Press **|PLAN|** for any other plan
Press **|DP|** for a Deposited Plan

At the ***(plan type) No?*** Prompt type in the plan number and press [ENTER].

At the ***Sequence ?*** prompt type in the sequence of stations separated by the [SPC] key and press [ENTER] or just press [ENTER] if the sequence is not required to be printed. To type alphabetic characters press the [α] key to use the alpha keyboard.

The data will be printed with the misclose and area at the end.

4.534 To print a close around a severance

Press **|SEV|**

A severance type menu is displayed

If the close is a road severance press **|ROAD|** to print.

If the close is a lot severance press **|LOT.S|**

4.535 To print a close around an easement

Press **|EASE|**

At the ***Easement No. ?*** prompt, type in the easement number and press [ENTER]

The program then prompts for lot , plan type and plan number as described above.

4.536 To print a close around a lease

Press **|LEASE|**

The program then prompts for lot , plan type and plan number as described above.

4.54 Co-ordinating the current close

Press the |VW.PR| **|COORD|** menu keys

At the prompt:

Enter Start Co-ords

*

:E : Type in the Easting of the start point of the close, press the [▼]cursor key
:N : Type in the Northing of the start point of the close, press the [ENTER] key

The coordinates of each subsequent point are then displayed by pressing [ENTER] or [SPC]

* If the coordinate format is configured for N,E the coordinates will be reversed.

4.6 COMPUTING THE FULL MISCLOSE AND MISSING LINE DATA

Press the **|MISS|** menu key

A menu of different options is displayed

4.61 To view the total misclose and ratio of the current close

Press the **|MISCL|** menu key

The misclose is displayed as follows:

MISCLOSE 1: n	The proportional misclose as a ratio
b	The bearing to close followed by the distance to close

If the Misclose ratio is less than 1:12000 (i.e. ☹)
allowable misclosures for different specifications are displayed, depending upon the state of configuration.

To resume data entry into the current close press [CST] |RETN|

4.62 To compute two missing bearings

The two missing bearings program allows for the entry of two additional lines at the end of a close with unknown bearings to complete the close. The program calculates the bearings for these lines given the two known distances.

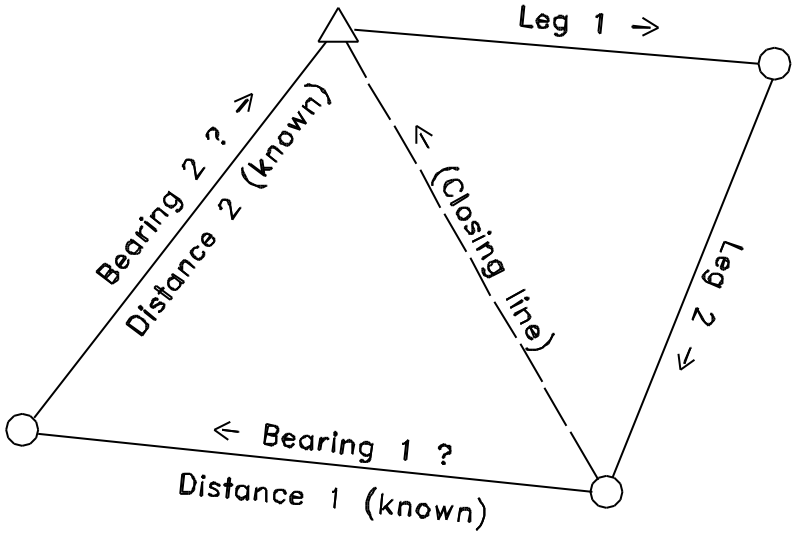

Figure 3. Two missing bearings

Press the **|MBB|** menu key

At the prompt:

2 MISSING BEARINGS

:Dist 1: type in the distance of the first line (from the end of the close)
and press the [▼]cursor key
:Dist 2: type in the distance of the second line (back to the start of the close)
and press the [ENTER] key

Two solutions are given on either side of the closing line as follows:

SOLUTION

Brg 1 Computed bearing of the first line
Dist 1 Given distance of the first line

Brg 2 Computed bearing of the second line
Dist 2 Given distance of the second line

Press [ENTER] to display the second solution
Inspection of the plan should indicate the correct solution.

To resume entry of data into the current close, press [CST] |RETN|

4.63 To compute two missing distances

The two missing distances program allows for the entry of two additional lines at the end of a close with unknown distances to complete the close. The program calculates the distance for these lines given the two known bearings.

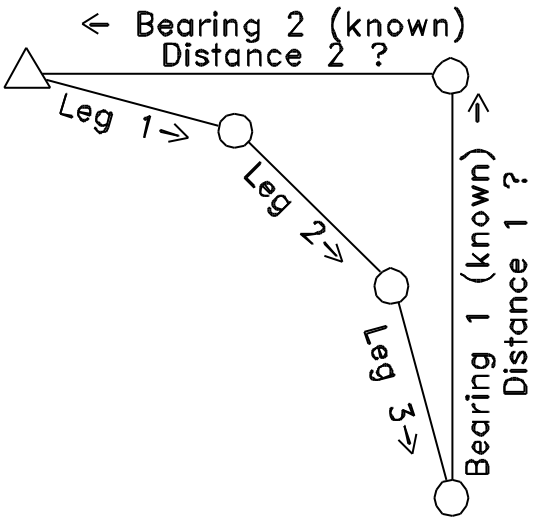

Figure 4. Two missing distances

Press the **|MDD|** menu key

At the prompt:

2 MISSING DISTANCES

:Brg 1: type in the bearing of the first line (from the end of the close)
and press the [▼]cursor key
:Brg 2: type in the bearing of the second line (back to the start of the close)
and press the [ENTER] key

The solution is given as follows:

SOLUTION

Brg 1 Given bearing of the first line
Dist 1 Computed distance of the first line

Brg 2 Given bearing of the second line
Dist 2 Computed distance of the second line

If one or both of the bearings entered are 180° incorrect (i.e. when corner referencing) the entered data will be corrected in the solution by 180°.

To resume entry of data into the current close, press [CST] |RETN|

4.64 To compute missing bearing and distance of two lines

The missing bearing / distance on different lines program allows for the entry of two additional lines with different missing data at the end of a close to complete the close. The program calculates the missing elements of these lines given the two known elements.

4.641 Missing bearing on line 1 and distance on line 2

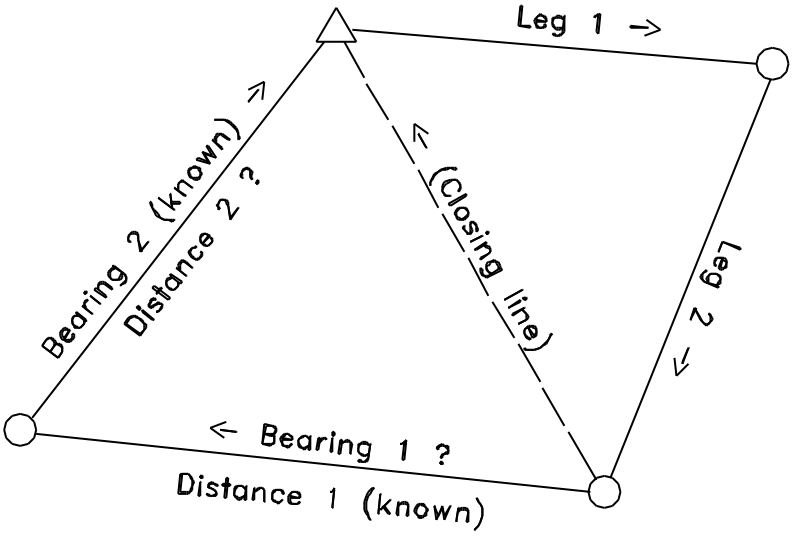

Figure 5. missing bearing 1 and distance 2

Press **|B1D2|**

At the prompt:

MISSING Brg1 Dis 2

:Dist 1: type in the distance of the first line (from the end of the close) and press the [▼] cursor key
:Brg 2: type in the bearing of the second line (back to the start of the close) and press the [ENTER] key

Two solutions are given on either side of the closing line as follows:

SOLUTION

Brg 1 Computed bearing of the first line
Dist 1 Given distance of the first line

Brg 2 Given bearing of the second line
Dist 2 Computed distance of the second line

Press [ENTER] to display the second solution
Inspection of the plan should indicate the correct solution.

To resume entry of data into the current close, press [CST] |RETN|

4.642 Missing distance on line 1 and bearing on line 2

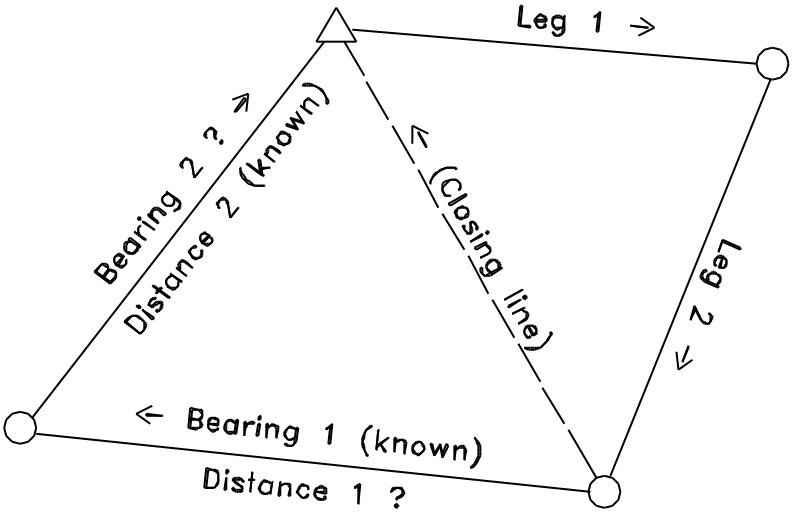

Figure 6. missing distance 1 bearing 2

Press **|D1B2|**

At the prompt:

MISSING Dis1 Brg 2

:Brg 1: type in the bearing of the first line (from the end of the close)
and press the [▼] cursor key
:Dis 2: type in the distance of the second line (back to the start of the close)
and press the [ENTER] key

Two solutions are given on either side of the closing line as follows:

SOLUTION

Brg 1 Given bearing of the first line
Dist 1 Computed distance of the first line

Brg 2 Computed bearing of the second line
Dist 2 Given distance of the second line

Press [ENTER] to display the second solution
Inspection of the plan should indicate the correct solution.

To resume entry of data into the current close, press [CST] |RETN|

4.7 ADJUSTMENT OF CURRENT CLOSE AND AREA CALCULATION

Press the **|AJ.AR|** menu key

An options menu is displayed

4.71 To Bowditch adjust the bearings and distances of the current close.

Press the **|BOWD|** menu key

At the prompt:

Reference Brg

:Leg No: type in the leg number of the reference bearing (bearing to hold fixed)
and press the [▼] cursor key
:Brg : type in the bearing of the reference leg and press [ENTER]

The Bowditch program will then force the current close to close, holding the reference bearing fixed. To view the adjusted bearings and distances press |CLOSE| |VW.PR| |VIEW| or |QCK.V|.

4.72 To calculate the area

Press the **|AREA|** key. The unadjusted area of the close polygon will be displayed in both hectares and square metres.

To resume entry of data into the current close, press [CST] |RETN|.

4.73 To calculate the adjusted area

Press the **|AD.AR|** menu key. The Bowditch adjusted area of the close will be displayed in both hectares and square metres. The bearings and distances remain unadjusted.

To resume entry of data into the current close, press [CST] |RETN|.

4.74 To rotate the current close

Press **|ROTA|**

At the ***Rotate current close by (DD.MMSS)*** prompt, type in the angle for the close to be rotated by. If the rotation is negative also press the [+/-] key.

Press [ENTER]. The current close will be swung by the entered amount.

5 COGO module

To access the COGO module press the **|COGO|** menu key from the MAIN menu.

JOB.M	DATA	SURV	COMP	TRAN	MAIN

|JOB.M| Job management menu for COGO jobs
|DATA| Data management menu (Add, delete, print, import/export etc.)
|SURV| Create new points (Traverse, radiation, resection & intersection)
|COMP| Compute joins, area, offsets
|TRAN| Bowditch adjustment, rotations and shift
|MAIN| The Main menu of QUICKCLOSE

5.01 Bearing and Distance corrections

The current job is displayed, along with the current bearing and distance corrections. By default these are set at 0 & 1 respectively. The current correction applied to entered bearings and scale factor applied to entered distances can be changed within the SURV and COMP menus or by pressing [CST]. To edit and correct the bearing correction applied to entered bearings press |B.COR|. To edit the scale factor applied to entered distances press |D.COR|. When bearings are computed (i.e, in JOIN , the bearing correction is subtracted before the bearing is displayed. The distance scale factor correction is not applied in reverse however.

5.1 THE COGO JOB

5.11 Starting a new COGO job

Press |JOB.M| **|NW.J|**

At the ***New Job No.?*** prompt, press the menu key with the desired job number. The DATA menu will then be displayed. **Data must be added** if any other programs in SURV COMP or TRAN are to be used.

5.12 To change to a different job

Press |JOB.M| **|CHNG|**

At the ***Go to Job No.?*** prompt, press the menu key with the desired job number to change to.

5.13 To delete a job

Press |JOB.M| **|DEL.J|**

At the ***Delete Job No. ?*** prompt, press the menu key with the job number to delete.
This will delete all coordinate data in that job. The deleted job will become the new job number.

5.14 To delete all jobs

Press |JOB.M| |DEL.A|

The prompt ***Delete ALL Data ?*** will appear

If all data in all COGO jobs is to be deleted press |YES|
otherwise press |NO|.

5.2 COGO DATA MANAGEMENT

Coordinate data must be entered prior to performing any of the functions of the COGO module. There are two ways to add data to a COGO Job

5.21 To enter data using the keyboard

Press |DATA| **|ADD.D|**, or [CST] **|ADD.D|**

At the prompt:

Current Job : (current no)
:ID : Type in the point number for the data press the [▼] cursor key
:E : Type in the Easting of the point press the [▼] cursor key
:N : Type in the Northing of the point and press [ENTER]

The program will prompt for further data entry.

To exit the program. Press [ENTER] at a blank Add Data prompt.

Added data automatically overwrites existing point data with the same number.

5.22 To import data from an ASCII text file

A standard coordinate file can be loaded into a COGO job from a PC, thus avoiding the laborious process of manually typing data in via the keyboard.

WARNING! Importing a coordinate file erases any existing data in the current job.

The ASCII text file **must** satisfy the following conditions:
(A Spreadsheet program such as EXCEL is ideal for performing such manipulations)

1. The file name must not start with a number nor be the following; J1 to J5
2. There must be three columns (Pt. number, Easting, Northing), no Heights
3. Columns must be separated by at least one blank space, no commas
4. No blank values are allowed.
5. No spaces are allowed within each entry
6. Point numbers must be fully numeric or alphabetic, in the case of mixed alpha-numeric point identifiers, the last digit must be a number.
7. No other text is allowed in the file (i.e headings, footers, etc...)

5.221 To import an ASCII file

1. Connect the serial interface cable to the PC. On most PCs the cable will plug into the 9-pin COM port (COM1). It may be necessary to disconnect the mouse to do this, alternatively, a 9-25 pin adaptor can be attached and the 25pin COM2 port used.

2. Connect the serial interface cable to the 4-pin connector at the top of the HP48, making sure that the HP logo is facing up. (Refer to the user manual p 27-8)

3. Ensure that the coordinate file is located in the same directory as the kermit software, or, alternatively specify the path within the kermit.

4. Start the Windows explorer and click on the “kermit.exe” icon, or
   in DOS mode at the command prompt type ***kermit***

5. If com port 2 is used (the 25 pin serial port)
   at the ***MS-Kermit>*** prompt type ***set po 2***
   If com port 1 is used (usually the 9-pin mouse port) skip this step.

6. at the ***MS-Kermit>*** prompt type ***set ba 9***

7. at the ***MS-Kermit>*** prompt type ***server***

8. On the HP48 press |DATA|| I/O **||IMPOR|**

9. At the ***File to import*** prompt type in the filename to be imported, in uppercase.
   Press [α] twice to lock the alpha keyboard if necessary. Press [ENTER]

10. IMPOR will then load the data file from the PC to the current job.
11. Press **Ctrl-C** on the PC and type ***exit*** at the kermit prompt.

5.23 To delete points from the current job

Press |DATA| **|DEL.D|**

At the ***Current Job : # Delete Pt. Nos.?*** prompt, either
type in the point number to be deleted, or type in a series points to be deleted separated by the [SPC] key and press [ENTER]

5.24 To view point coordinates from the current job

Press |DATA| **|VW.D|**

At the ***Current Job : # View Pt. Nos.?*** prompt, either
type in the point number to be viewed, or type in a series points to be viewed separated by the [SPC] key
and press [ENTER]

To view all coordinate data press |DATA| |V.ALL|, pressing any key to continue.

5.25 To print all the point coordinate data in the current job

Align the IR printer with the HP48 infra-red port. Turn the printer on.

Press |DATA| |I/O| **|PRIN|** to print the coordinate listing.

5.26 To export coordinate data in ASCII text format

Data in a COGO job can be downloaded to a P.C. as a delimited ASCII text file.
The filename will be J# (# from 1 to 6)The file will appear thus (# is the point number).

```
%%HP: T(3)A(D)F(.);
DIR
     P.#
[ Northing Easting ]
     P.#
[ Northing Easting ]
.
.
END
```

5.261 To export to an ASCII file

1. Connect the serial interface cable to the PC. On most PCs the cable will plug into the 9-pin COM port (COM1). It may be necessary to disconnect the mouse to do this, alternatively, a 9-25 pin adaptor can be attached and the 25pin COM2 port used.

2. Connect the serial interface cable to the 4-pin connector at the top of the HP48, making sure that the HP logo is facing up. (Refer to the user manual p 27-8)

3. Start the Windows explorer and click on the “kermit.exe” icon, or in DOS mode at the command prompt type ***kermit***

4. If com port 2 is used (the 25 pin serial port)
at the ***MS-Kermit>*** prompt type ***set po 2***
If com port 1 is used (usually the 9-pin mouse port) skip this step.

5. at the ***MS-Kermit>*** prompt type ***set ba 9***

6. at the ***MS-Kermit>*** prompt type ***server***

7. On the HP48 press |DATA|| IO |**|EXPOR|**

8. EXPOR will then download the COGO file to the PC.

9. Press **Ctrl-C** on the PC and type ***exit*** at the kermit prompt

5.262 Converting a downloaded file to tabular ASCII format

An exported file can be converted into a three column delimited ASCII file by running the conversion program **CONVERT.EXE** supplied with the QUICKCLOSE software disk. After downloading the file from the HP48, copy the file CONVERT.EXE to the directory or folder where the downloaded file is located (alternatively specify the path)
and at the DOS prompt type;

convert *hp48name*

where hp48name is the name of the file as downloaded. The output filename will have a .txt extension. Alternatively, type

convert *hp48name newname*

where newname is the desired name for the output file.

5.27 To export coordinate data to the CLOSE module

This program exports a sequence of points in the current COGO job into the current close (erasing the exiting close). The program computes the bearings and distances of the entered point sequence and converts them to ‘legs’ in the close.

Press |DATA| | I/O | **|** ® **CL|**

At the ***Point sequence ?*** prompt type in the point numbers of a sequence of points representing a close separated by the [SPC] key and press [ENTER].

5.3 SURVEYING NEW POINTS

5.31 To compute a coordinate traverse

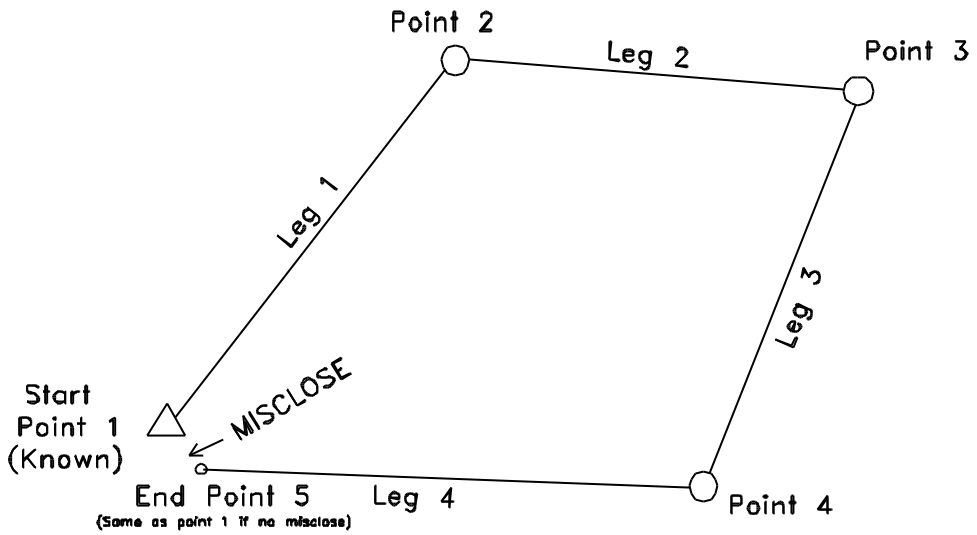

Figure 7. A coordinate traverse

Press |SURV| **|TRAV|**

At the ***:From Pt :*** prompt, type in the point number of the start of the traverse, press [ENTER].

For each traverse leg at the prompt:

From Pt #

:Brg : Type in the bearing of the traverse leg press the [▼] cursor key
:Dist : Type in the distance of the leg , press [ENTER].

If the distance typed in is in Links or feet, press the **|L ® M|** or **|F ® M|** menu keys before pressing [ENTER]. This will automatically convert the distance to metres.

To reverse the entered bearing (i.e. change it by 180°) press the **[+/-]** key.

The coordinates of the next point will be displayed together with a prompt for its point number. This number automatically increments by 1 for each traverse leg.
Press [ENTER] to accept the incremented point number, or edit the point number and then press [ENTER]. The computed coordinates are stored with the entered point number.

To change the correction applied to the entered bearings press |B.COR| after typing in the bearing. To change the scale factor applied to entered distances press |D.COR| after typing the distance in.

To exit the traverse program, press [ENTER] at a blank Brg & Dist prompt.

The corrected bearing and distance is displayed
The coordinates of the point are also displayed.

Edit or accept the point number for the computed coordinates to be stored as and press [ENTER].

At the ***Pt.No. to close to ?*** prompt type in the control point number at the end of the traverse
and press [ENTER].

The misclose from the end of the traverse to the specified control point will be displayed as follows:

MISCLOSE Proportional misclose ratio
b Misclose bearing (from end of traverse to control point)
Misclose distance

Allowable cadastral misclosures are also displayed if the misclose is excessive. The allowable misclosures will differ depending upon which state the program is configured for.

Press any key to display the area of the closed traverse polygon and the Bowditch adjusted area.

5.32 Computing radiations

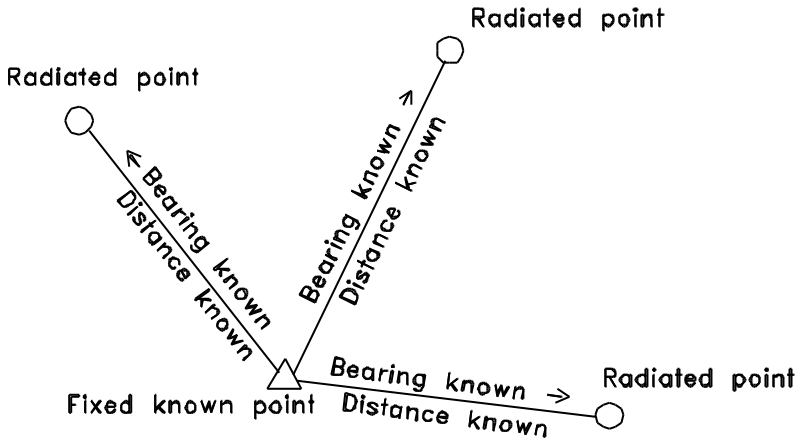

Figure 8. Computing radiations

Press |SURV| **|RADIA|**

At the prompt:

Job (current) Brg Corr and Dist corr
:From Pt : Type in the point number of the origin point and press [ENTER]

the following prompt will appear for each radiation

:From Pt : The entered origin point is displayed
:Brg : Type in the radiation bearing press the [▼] cursor key
:Dist : Type in the distance and press [ENTER]

The coordinates of the radiated point will be displayed together with a prompt for its point number. Type in the point number for the radiated point and then press [ENTER]. The computed coordinates are stored with the entered point number.

To reverse the entered bearing, press the [+/-] key. To convert the entered distance in links or feet to metres, press the |L→M| |F→M| menu keys after typing in the distance.

To change the origin point of radiation computations, at the data prompt press [▲] and overwrite the default origin point.

To exit the radiation computation program, press [ENTER] at a blank data prompt.

5.33 Computing coordinates by three point resection

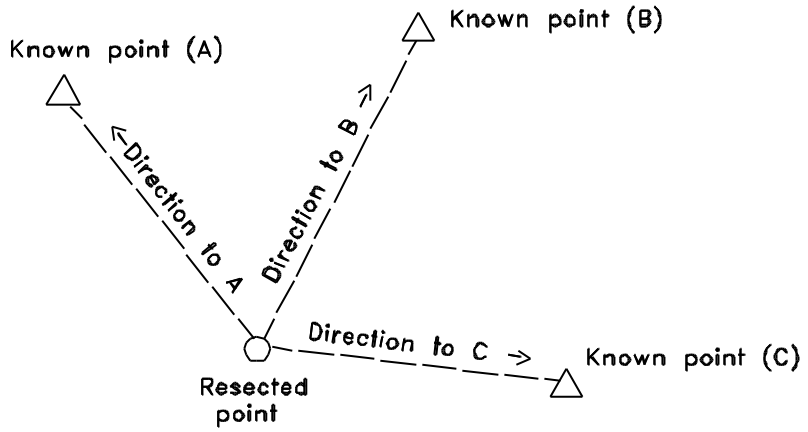

Figure 9. Resection

To compute the coordinates of a resected point press |SURV| |RE.IN| **|RESEC|**
Three directions or “bearings” are observed to three control points (A,B & C) in clockwise order. The bearings may be purely arbitrary as the computation process will compute the “real” bearings to the observed control points.

For each control station A,B and C (in clockwise order)

the following prompt will occur:

Point (A,B then C)
:Pt : Type in the number of the control point press the [▼] cursor key
:<) : Type in the observed direction or “bearing” then press [ENTER]

The coordinates of the resected point are shown as follows:

Resected Point
****E*** Easting
N Northing

Press any key to continue

The following join information is displayed, from the resected point to the observed points. If a bearing correction is current, this is subtracted prior to the join bearings being output to the display.

Joins to point
A The bearing and distance to the first control point
B The bearing and distance to the second control point
C The bearing and distance to the third control point

* If the coordinate format is configured for N,E the coordinates will be reversed.
Press any key to continue

At the ***Store as Pt. ?*** prompt type in the point number for the resected point to be stored as.

5.34 Computing coordinates from intersection of two bearings

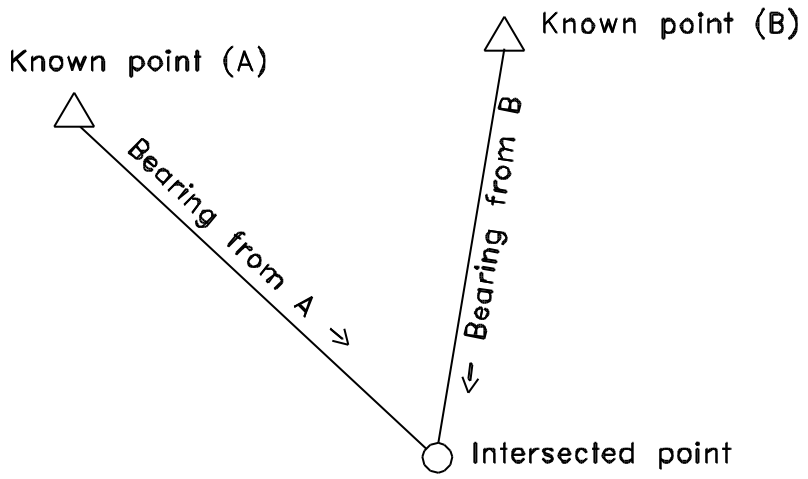

Figure 10. Intersection of two bearings

Press |SURV| |RE.IN| **|IBB|**

At the prompt:

:Pt A: Type in the point no. of the first control point press the [▼] cursor key
:Brg : type in the bearing to the intersected point, press the [▼] cursor key
:Pt B: type in the point no. of the second control point press the [▼] cursor key
:Brg : type in the bearing to the intersected point then press [ENTER]

The Coordinates of the intersected point are displayed as follows:

Intersected Point

****E***	Easting
N	Northing

Press any key to continue.
The following join (and missing distance info) is displayed;

Brg 1	Bearing from point A to the intersected point
Dist 1	Distance from point A to the intersected point
Brg 2	Bearing from point B to the intersected point
Dist 2	Distance from point B to the intersected point

* If the coordinate format is configured for N,E the coordinates will be reversed.
Press any key to continue

At the ***Store as Pt. ?*** prompt type in the point number for the intersected point to be stored as.

5.35 Computing coordinates from intersection of two distances

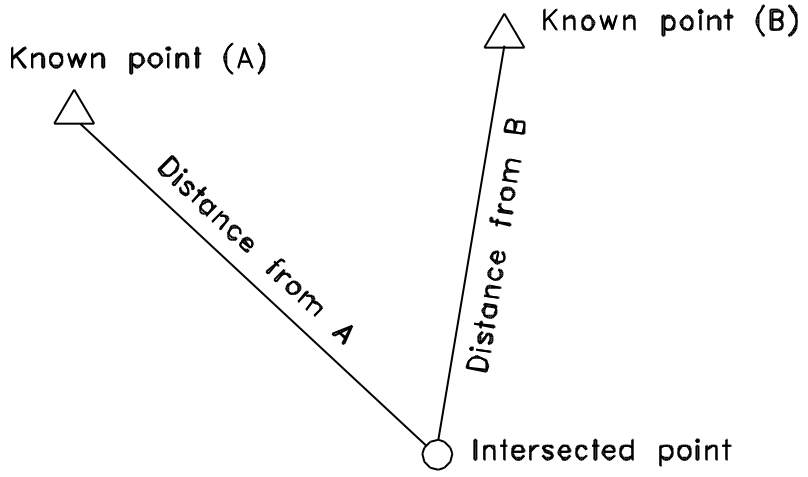

Figure 11. Intersection of two distances

Press |SURV| |RE.IN| **|IDD|**

Convention used: The intersected point lies to the right of the line A to B

At the prompt:

:Pt A:	Type in the point no. of the first control point press the [▼] cursor key
:Dist :	type in the distance to the intersected point, press the [▼] cursor key
:Pt B:	type in the point no. of the second control point press the [▼] cursor key
:Dist :	type in the distance to the intersected point then press [ENTER]

The Coordinates of the intersected point are displayed as follows:

Intersected Point

****E***	Easting
N	Northing

Press any key to continue.
The following join (and missing bearing info) is displayed;

Brg 1	Bearing from point A to the intersected point
Dist 1	Distance from point A to the intersected point
Brg 2	Bearing from point B to the intersected point
Dist 2	Distance from point B to the intersected point

* If the coordinate format is configured for N,E the coordinates will be reversed.

Press any key to continue.

At the ***Store as Pt. ?*** prompt type in the point number for the intersected point to be stored as.

5.4 COORDINATE COMPUTATIONS

5.41 computing joins

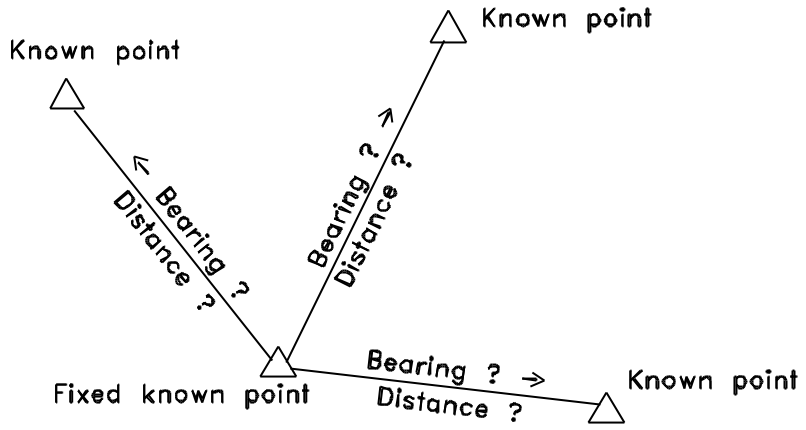

Figure 12. Computing joins

A join is the computed bearing and distance between two points

Press |COMP| **|JOIN|**

at the prompt;

Current Job : #
Brg Corr

:From Pt :

Type in the Point number of the start of the join. Then press [ENTER]

The following prompt will appear for each join;

:From Pt : The from point is displayed
:To Pt. : Type in the point to which the join is to be computed. Press [ENTER]

To change the origin point of the join press [▲] and overwrite the default origin point.

The join computation is displayed between the points. The current bearing correction is subtracted from the actual bearing computed for display. Press any key to compute another join.

To exit the program, press [ENTER] at a blank prompt.

5.42 To compute the area enclosed by a series of points

Press |COMP| **|AREA|**

At the ***Point sequence ?*** prompt type in the point numbers of a sequence of points that form a polygon separated by the [SPC] key. It is not necessary to enter the first point again at the end. Press [ENTER]

The area enclosed by the polygon is displayed in hectares and square metres.

5.43 To compute offsets

To compute Offsets to other points from a line originating at an origin point.

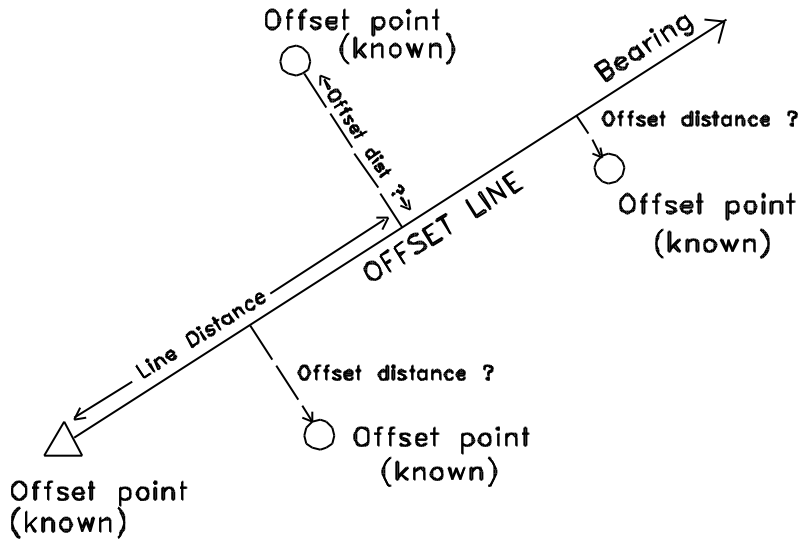

Figure 13. Computing offsets

Press |COMP| **|OFFST|**

At the ***Pt. Origin ?*** prompt type in the point number from which the offset line emanates and press [ENTER]

Press **|BRG|** if the offset bearing from the origin point is known.
At the prompt ***Line Brg?*** Type in the offset bearing, and press [ENTER].

Press **|PNT|** to compute the offset bearing to another known point.
At the prompt ***Line to Pt.?*** Type in the point number of the other end of the offset line and press [ENTER].

At each ***Offset Pt. ?*** prompt type in the point number whose offset is to be computed. Press [ENTER].

Offset data is displayed as follows:

Line Dist. is the distance along the offset line to the offset distance.
Offset Dis. is the offset distance orthogonal to the offset line.

Offsets to the left of the line will be negative.
Offsets to the right will be positive.

The above prompt will loop itself by pressing [ENTER] .

To exit the |OFFST | program, press [ENTER] at a Offset Pt. prompt.

5.5 COORDINATE ADJUSTMENT AND TRANSFORMATION

5.51 To Bowditch adjust coordinates

Press |TRAN| **|BOWDI|**

At the ***Point sequence ?*** prompt type in a sequence of points separated by the [SPC] key of a figure which is to be adjusted. The last point should be a control point and the penultimate point should be the end point of a traverse (or similar)The bearing between the first two points will remain fixed.
Press [ENTER]

5.52 To compute Bowditch adjusted area

NOTE: This program does not adjust coordinates

Press |TRANS| **|AD.AR|**

At the ***Point sequence ?*** prompt type in the point numbers of a sequence of points that form a polygon separated by the [SPC] key. The second last point should be the end of a traverse (or similar). Press [ENTER]

The adjusted area enclosed by the polygon is displayed in hectares and square metres.

5.53 To apply a rotation to a series of (or all) points

Press |TRANS| **|ROTAT|**

At the ***Point sequence ?*** prompt type in the point numbers which are to be rotated separated by the [SPC] key and press [ENTER]

If ALL points in a job are to be rotated press [ENTER] with no point numbers typed in.

At the prompt:

:Rot Pt . : type in the point about which the rotation will be performed press the [▼] cursor key

:q : type in the rotation angle and press [ENTER]. Press [+/-] if the rotation is negative.

5.54 To apply a shift (translation) to a series of (or all) points

Press |TRAN| **|SHIFT|**

At the ***Point sequence ?*** prompt type in the point numbers which are to be shifted separated by the [SPC] key and press [ENTER]

If ALL points in a job are to be shifted press [ENTER] with no point numbers typed in.

Press **|SPEC|** to specify the shift by difference in Eastings and Northings.

At the prompt:
:**DE :*** type in the shift in Eastings and press the [▼] cursor key
:**DN :*** type in the shift in Northings and press [ENTER]
* If the coordinate format is configured for N,E the coordinates will be reversed.

or, press **|PTPT|** to compute the applied shift between two points

At the prompt:
:Pt A : type in the point number of A press the [▼] cursor key
:Pt B : type in the point number of B and press [ENTER]

The difference in Eastings and Northings between point A and B is computed and applied to all the specified points entered.

6 LEVEL module

To run the level program press **|LEVEL|**

1. At the ***RL BS ?*** prompt type in the Reduced Level of the control station (the first backsight) and press [ENTER]

2. Type in the backsight onto the stack and press the **|BS|** menu key

3. To compute the level of an **intermediate sight** type in the IS reading onto the stack and press **|IS|** , its reduced level is displayed

4. To compute the level of a **foresight**, type in the FS reading onto the stack and press **|FS|**, its reduced level is displayed

5. If the FS is entered the next entry must always be a backsight, so the processes above are repeated again if there are change points.

Where the staff is inverted level observations must be made negative by pressing the [+/-] key.

To start a new level reduction, press |LEVEL| at any time

To exit the Level module press |MAIN| and press [DEL] to clear the stack.

7 UTILS module

The UTILS module contains a number of other different but useful survey programs.
Press **|UTILS|** to get into the module

SECN	TRUN	S®H	MLM	R®CR	MAIN

|SECN| Compute Secant at intersection of two road reserves
|TRUN| Compute chords for corner arc truncations
|S→H| Reduce slope distance to horizontal and vertical components
|MLM| Compute bearing and distance between two radiations (tie distance)
|R→CR| Compute rectangular components of a reference bearing and distance.
|MAIN| The Main menu of QUICKCLOSE

7.01 Road intersection secant

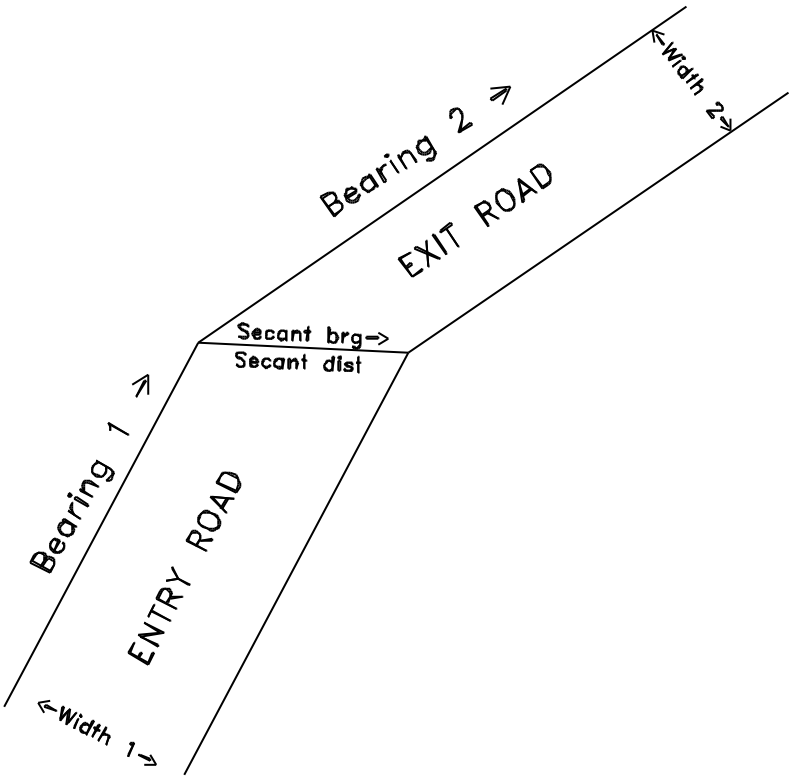

Figure 14. Road Intersection secant

To compute the bearing and distance between two sides of a road intersection press the **|SECN|** key

At the prompt:

:Wid 1: Type in the width of the entry road then press the [▼]cursor key
:Wid 2: Type in the width of the exit road then press the [▼]cursor key
:Brg 1: Type in the bearing of the entry road then press the [▼]cursor key
:Brg 2: Type in the bearing of the exit road then press the [ENTER] key

The secant bearing from the left-hand side to the right-hand side and distance is displayed.

7.02 Compute truncation chords at a corner

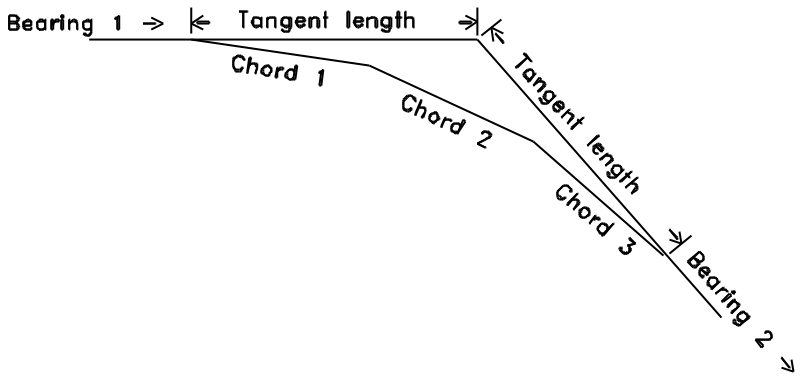

Figure 15. Chord truncation

To compute the chords at a corner truncation press **|TRUN|**

At the prompt:

:Brg 1 : type in the bearing of the entry line (straight) to the corner then press the [▼]cursor key
:Brg 2 : type in the bearing of the exit line (straight) from the corner then press the [▼] cursor key
:TL : type in the design tangent length of the truncation curve then press the [▼] cursor key
:Chords: type in the number of truncation chords then press [ENTER]

The length of the truncation is displayed, and the bearing of the first chord

To display the bearings of subsequent chords, press [ENTER] or [RS]

7.03 Reducing a slope distance

To reduce a slope distance to its horizontal and vertical components press **|S ® H|.**

At the prompt:

:Zen <) : type in the zenith angle measurement then press the [▼] cursor key
:S Dist : type in the measured slope distance then press [ENTER]

The reduced distances are shown as follows:

Zen <) the entered zenith angle is displayed
S Dist the entered slope distance is displayed

H Dist = the Horizontal distance
V Dist = the Vertical distance

To retain the computation on the stack, press [ON]. The height difference will be on level 2 and the horizontal distance on level 1.

7.04 Missing line measurement

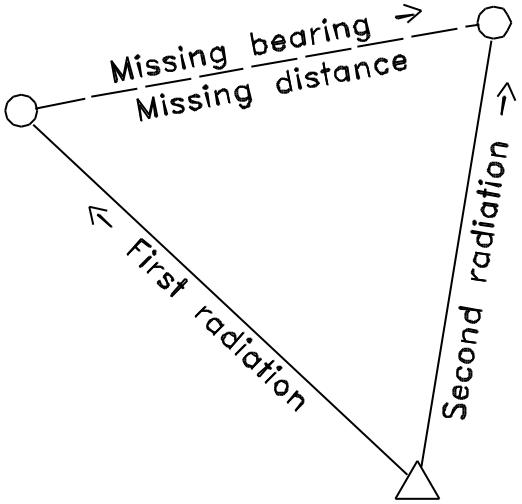

Figure 16. Missing line measurement

To compute the bearing and distance between two radiations press **|MLM|.** The second radiation should be to the right of the first radiation.

At the prompt:

:Brg 1: Type in the bearing of the first radiation press the [▼] cursor key
:Dist 1: Type in the distance of the first radiation press the [▼] cursor key
:Brg 2: Type in the bearing of the second radiation press the [▼] cursor key
:Dist 2: Type in the distance of the second radiation press [ENTER]

The dimensions of the Missing line between the first and second radiated points is displayed.

7.05 To compute line components of a reference bearing and distance.

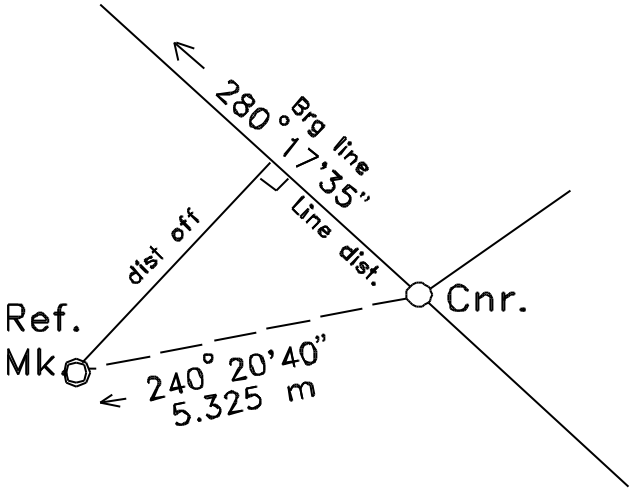

Fig. 17 Rectangular components of a reference bearing and distance

Press **|R ® CR|**

At the prompt;

:Brg line : Type in the bearing of the boundary line (as indicated) away from the corner. If the bearing entered is **to** the corner press [+/-]. Press [▼].
:Ref Brg : Type in the bearing from the corner to the reference. If the reference bearing is **to** the corner (i.e. in NSW) press [+/-]. Press [▼].
:Ref Dist: Type in the distance from the corner to the reference mark. Press [ENTER]

The solution is displayed;

Line from The bearing of the boundary line from the corner
Line to The bearing of the boundary line to the corner.
Cnr ® Ref The bearing from the corner to the reference mark
Ref ® Cnr The bearing from the reference mark to the corner
Ref dist The distance to the reference mark
Line dist The reference distance component along the boundary line (negative if distance is away from the cnr)
dist off The reference distance component off the boundary line. (negative if to the left looking in the direction of bearing from the cnr)

7.06 Conversion utilities

[CST] |CONV|

The CONV menu contains many useful hotkey commands to allow conversion of common units used in surveying.

7.061 To convert a decimal angle to degrees, minutes and seconds

Enter the decimal angle onto the stack
Press **|® DMS|**

7.062 To convert an angle in ° ‘ “ to decimal

Enter the angle in degrees, minutes and seconds onto the stack
Press **|® DD|**

7.063 To convert a distance in links to metres

Enter the distance in links onto the stack
Press **|L ® M|**

7.064 To convert a distance in feet to metres

Enter the distance in feet onto the stack
Press **|F ® M|**

7.065 Adding angles and times in minutes and seconds

Enter the two angles or times onto the stack then press **|HMS+|**
The sum of the two angles is shown on level one of the stack.

7.066 Subtracting angles and times in minutes and seconds

Enter the angles or times onto the stack then press **|HMS-|**
The difference (level 2 - level 1) is shown on level one.

8 ASTRO module

The Astronomy module is designed to enable a surveyor to determine true bearings (azimuths) and map grid bearings to a reference object (RO) by observations of either the sun or a specific star, and also to predict the apparent position of a star by means of an azimuth/grid bearing and zenith angles in both faces.

To get into the ASTRO module press the **|ASTRO|** menu key from the MAIN menu.

AZALT	**AZHA**	**PRED**		**CNFG**	**MAIN**

|AZALT| Compute azimuth by ex-meridian altitude observations
|AZHA| Compute azimuth by hour-angle observations
|PRED| Star prediction
|CNFG| User configuration of the ASTRO module
|MAIN| The Main menu of QUICKCLOSE

8.001 General considerations and precautions in the choice of observed body

It is assumed that the user of the ASTRO module has at least a rudimentary knowledge of astronomical observations and the necessary preparation required to perform them.

In general, determination of azimuth from star observations provides greater accuracy than using the sun. Also, provided sufficient care is taken with time-keeping, the hour-angle method is generally more accurate and simpler than the altitude method.

The best star to use in the Southern Hemisphere for precise azimuth determination is s ***Octantis***, a faint magnitude 4 star that is only 1 degree in declination from the south celestial pole. The further away from the celestial pole one goes, the faster the apparent motion of heavenly bodies, and therefore a greater possibility of reduced accuracy. It is better to observe stars close to elongation (when the apparent motion is vertical). Elongation occurs when the star appears to the left or right of the celestial pole. Nevertheless, if sufficient care is taken with observations and a lower accuracy of azimuth determination is acceptable, then in practice any identified star can be chosen. Stars with an altitude of less than 15° should be avoided if the altitude method is used, due to unreliability of the refraction correction computed at low altitudes. In tropical regions where the celestial pole is at a low altitude it is recommended not to use close circumpolar stars for this reason.

Familiarisation with the different constellations is a definite advantage, alternatively a star atlas or a software package such as ***Skymap*** should be used to assist with star identification.

8.002 Timing accuracy required for observations

The internal clock on the **HP48 must be checked** by comparison with another time standard (VNG radio signal at 5000,8638 & 12984 kHz) or Telstra time service (phone 1194). The internal clock of the HP48 is not particularly accurate, and can drift by as much as 0.03 seconds per hour (0.7 seconds per day) and should be checked within three hours of observations if real-time processing is used with hour-angle observations.

To set the time on the HP48. Type in the time in HH.MMSS format onto the stack. Press [L-S] [4]^{TIME} and then | →TIM| at the exact moment the time is correct. To check the time press |TIME| to verify the setting and in order to establish a personal correction.

Hour angle observations require very accurate time observations. For astronomical bodies close to the celestial equator (such as the sun) **an error of 1 second in time will result in an error of 15 seconds in azimuth**. If a star is observed close to a celestial pole (a circumpolar star) timing is less critical, particular if the star is observed at elongation (when the apparent motion of the star is vertical). Ex-meridian altitude observations do not require an exact time, however the observed time should be accurate to within 30 seconds if possible.

The DUT correction is a minor correction that should be applied to the time signal received from a radio signal / telephone time. This can be included into the overall clock correction. The DUT correction is usually very small, but for high accuracy azimuths, should be determined.

8.003 Accuracy required for entered position

As a general rule, 1 second (about 30 metres) of error in latitude and longitude will result in an error of about 1 second in azimuth.

The approximate position of the observation can be scaled off a topographic map / UBD (AMG tick marks in red). Position determined from a hand-held GPS is usually sufficient also. In all cases, ensure that the map projection is the same as that configured in the ASTRO program.

8.004 Time of observing

Observations of astro bodies below 15° altitude (Zenith angle > 75°) are not advised due to the unpredictability of atmospheric corrections (refraction), especially for altitude observations. Depending upon the instrument used, observation of bodies above 35° altitude (Zenith angle < 55°) are difficult unless a diagonal eye-piece is fitted.

8.005 Overview of observational procedure

A set of observations in AZALT and AZHA comprises;

Face left (or right) to the RO
Face left (or right) to the astro body
Face right (or left) to the astro body
Face right (or left) to the RO

The greater the number of sets of observations recorded, the more reliable the azimuth determination will be.

Observing the sun

WARNING! A Solar filter must be placed over one of the lenses of the observing instrument if the sun is observed directly, otherwise serious eye damage will result. Total stations that incorporate EDM into the optics will be damaged if laid directly onto the sun and a filter must be placed over the objective lens.

Hour angle method;

As the centre of the sun is practically impossible to be observed accurately (unless a Roelof's prism is fitted) the limb (or edge) of the sun must be observed. AZHA does not compute the semi-diameter of the sun, therefore either the trailling (or leading) limb must be tracked on one face, and the opposite limb must be tracked on the other. When observations are meaned (the program does this) the centre of the sun is deduced, but only if the time between opposite face readings to the sun are kept to a minimum (3 minutes or less), otherwise curvature errors become too excessive.

Altitude method;

This method requires tracking two limbs (a quadrant) of the sun simultaneously (unless a Roelof's prism is fitted) and requires reasonable instrument skill. AZALT does not compute the semi-diameter of the sun, therefore opposite quadrants of the sun must be tracked on alternate faces. For example, if the lower right quadrant is observed on the first face, then the upper left quadrant must be observed on the other (or vice-versa). When observations are meaned (the program does this) the centre of the sun is deduced, but only if the time between opposite face readings to the sun are kept to a minimum (3 minutes or less), otherwise curvature errors become excessive.

Timing between two faces

The reduction algorithm means two faces to an observed body. This alleviates the need to calculate semi-diameter etc.. Three minutes is the maximum time recommended between observations in two faces to the astro body before the error due to curvature becomes excessive.

Observing daylight or dim stars

A number of stars can be observed in daylight with a theodolite or total station. It is almost impossible to observe a daylight star with the naked eye (apart from the sun !) unless the star prediction algorithm |PRED| is used. For high precision azimuth determinations made during the day, it is recommended to obtain an initial estimate of azimuth using the sun. The azimuth determined by a sun observation can thus be verified and refined using a daylight star. The instrument should be pre-focussed, otherwise time will be wasted. Daylight stars are generally only visible if the atmosphere is relatively clear and stable. Stars may not be visible at low altitudes, or if the humidity level is very high.

Don't rely on a single set of observations. The AZALT and AZHA programs will not detect gross blunders in data entry. Garbage in - garbage out ! At least two different methods should be used to verify the accuracy of the azimuth determination.
Total dependence on the AZHA program is unwise, unless the reliability of the time source is guaranteed. Murphy's law is unfortunately a determining factor.

8.006 Notes on the reduction algorithm and ephemeris program

The following corrections are applied automatically in the algorithm;

Earth curvature, atmospheric refraction and parallax.

Dislevelment of the trunnion axis

This is one of the few errors not cancelled by meaning observations in two faces, and becomes more critical if observations are made at higher altitudes (zenith angles closer to zero). The following formula should be used to apply this correction.

(L-R)/((n*v)/TAN(ZD))

where;

L-R= Horizontal difference between readings in two faces
n = number of end readings on the plate bubble
v = angular value of one plate bubble division

Note: The plate bubble will move if directly exposed to the sun, so should be covered if need be.

Accuracy of the solar ephemeris and computation of R.

The solar ephemeris is derived from a simplification of the algorithm outlined by Jean Meeus in ***Astronomical Algorithms***. The simplification model is an adaptation of the model used by G.G.Bennett as outlined in the ***Australian Surveyor, August 1980***. The in-built ephemeris agrees with Jean Meeus to within 1 second for all dates and times up to 2010.

8.01 Configuration of the ASTRO module

Press **|CNFG|**

The current configuration for running programs in the Astronomy module is displayed.

Datum/proj	This is the datum/map grid for which input position data and output grid bearings are based upon.
Position in	position entered either in latitude/longitude or AMG/MGA Zone Number,Easting,Northing
Time Zone	Number of hours local clock time is ahead of Greenwich MT
Processing	Real-time (using HP48 clock), Post (entering times manually)
Press. unit	either mbar/Hpa or mmHg
Clock Corr.	The correction in seconds to be applied to the HP48 clock or manually entered times to obtain the exact local time.

Press **|YES|** to accept the displayed settings.
Press **|CHNG|** to alter the displayed settings

If |CHNG| is pressed. A menu of settings to be changed is displayed.

Press **|CHAN|**	To change the geodetic datum/ map grid
Press **|POSN|**	To change the coordinate type for positions (lat/long or Grid co-ords)
Press **|T.Z|**	To change the time zone
Press **|PROC|**	To change the method of processing obs (real-time or post processed)
Press **|PRESS|**	To change the units of pressure
Press **|CORRE|**	To change the combined clock/personal/DUT correction

8.02 To compute azimuth & grid bearing by ex-meridian altitude method

Firstly, ensure that the configuration settings described above are correct by pressing |CNFG|. In addition, ensure that the HP48 displayed date is correct if observations are being processed real-time. To change the HP48 date type in the date in DD.MMYYYY format onto the stack and then press [L-S] [4] ^{TIME} |→DAT|

Press **|AZALT|**

If results are being post-processed. The following prompt will appear;

Enter Date of
obs. in DD.MMYYYY
format

Type in the local date when the observations were taken. For example
31st December 1999 would be entered as 31.121999

Otherwise if data is being processed “real-time” the current HP48 date will be recorded.

Next,

A Choose list will appear. Using the [▲] [▼] cursor keys select the observed astronomical body type and press either [ENTER] or [OK].

If the observed body is a star, three options are available for entry of stellar coordinates;

For precise azimuth determinations select ***SALS Interpol.***

This options requires extraction of data from the current ***Star Almanac for Land Surveyors***.

Refer to the adjacent tables *RIGHT ASCENSION OF STARS* and *DECLINATION OF STARS.*

At the prompt

Right Ascension
from SALS

:Month 1 :	Type in the Right Ascension of the selected star for the current month and press the | ▼ | key.
:Month 2 :	Type in the Right Ascension of the star for the next month and press [ENTER]

The program will interpolate the Right Ascension for the day of observation

At the prompt

Declination
from SALS

:Month 1 :	Type in the Declination of the selected star for the current month press the | ▼ | key.
:Month 2 :	Type in the Declination of the star for the next month and press [ENTER]

The program will interpolate the Declination for the day of observations

If ***STAR Direct*** is chosen, the following prompt will appear;

STAR Co-ords

:RA :	Type in the Right Ascension of the observed body and press | ▼ |
:Dec :	Type in the Declination of the observed body and press [ENTER]

If STAR Almanac is chosen, for the following CHOOSE list will appear;

APPROXIMATION FOR
s ***Octantis***
a ***Crucis***
a ***Centauri***
Achernar
Canopus
Fomalhaut

Using the [▲] [▼] cursor keys select the observed star and press |OK| or [ENTER]

The Apparent place (Right Ascension and Declination) of the star at the 1st October 1998 will be used in the computation. Due to the effects of precession and proper motion degradation of accuracy will occur over time.

Entering position

If Position configuration is for latitude / longitude

At the prompt;

POSITION
(f is - in S.Hem.)

:f : Type in the latitude of the observation in DD.MMSSS format. Latitudes in the Southern Hemisphere will be negative. Press the | ▼ | key.
:l : Type in the longitude in DD.MMSSS format. Latitudes in the Western Hemisphere will be negative. Press [ENTER]

If position configuration is for Grid Coordinates

At the prompt

POSITION
:Zone : Type in the Grid Zone and press | ▼ |
:E : Type in the Easting and press | ▼ |
:N : Type in the Northing and press [ENTER]

At the prompt

ATMOSPHERIC DATA

:Temp. : Type in the temperature in degrees Celsius. Press the | ▼ | key.
:Press. : Type in the barometric pressure in the units specified in the configuration and press [ENTER]

At the prompt

REFERENCE OBJECT
Face 1 <) ?

Type in the Horizontal angle observed to the Reference Object to which the azimuth / grid bearing is to be computed. Press [ENTER]

If the post processing option is chosen.

Enter the clock time for the first observation to the astro body. In the case of the sun this will be the time of co-incidence of the vertical and horizontal cross-hairs tangential to two limbs (edges) of the sun simultaneously, or if a Roellefs prism is used the centre of the sun.

In the case of a star. The time at which the star crossed the central cross-hair.

At the prompt;

ASTRO BODY
Face 1

:Hor. <): type in the observed horizontal angle to the sun at the time of observation. Press the | ▼ | key.
:Zen. <): type in the observed zenith angle to the sun. Press [ENTER]

The above prompts are repeated for observations on the other face.

At the prompt

REFERENCE OBJECT
Face 2 <) ?

Type in the Horizontal angle on the second face observed back to the Reference Object to which the azimuth / grid bearing is to be computed. Press [ENTER]

The computation is displayed as follows

Datum / Map Grid used Grid Zone
Central Meridian of Grid Zone

To the Reference Object;
Azimuth (True Bearing)
Grid Bearing (with convergence already added)

Note the azimuth/bearing in the field book

If repeated sets of observations are to be made, note the azimuth / grid bearing in a field-book and press **|CONT|** to repeat the process for another set of observations.

Repeated computations should be meaned separately, and if necessary blunders can be ignored.

To exit the program press **|EXIT|**

To repeat a set of observations press |CONT|

8.03 To compute azimuth & grid bearing by hour-angle method

Firstly, ensure that the configuration settings described above are correct by pressing |CNFG|. In addition, ensure that the HP48 displayed date is correct if observations are being processed real-time. To change the HP48 date type in the date in DD.MMYYYY format onto the stack and then press [L-S] [4] ^{TIME} |→DAT|

Press **|AZHA|**

If results are being post-processed. The following prompt will appear;

Enter Date of
obs. in DD.MMYYYY
format

Type in the local date when the observations were taken. For example
31st December 1999 would be entered as 31.121999

Otherwise if data is being processed “real-time” the current HP48 date will be recorded.

Next,

A Choose list will appear. Using the [▲] [▼] cursor keys select the observed astronomical body type and press either [ENTER] or [OK].

If the observed body is a star, three options are available for entry of stellar coordinates;

For precise azimuth determinations select ***SALS Interpol.***

This options requires extraction of data from the current ***Star Almanac for Land Surveyors***.

Refer to the adjacent tables *RIGHT ASCENSION OF STARS* and *DECLINATION OF STARS.*

At the prompt

Right Ascension
from SALS

:Month 1 : Type in the Right Ascension of the selected star for the current month and press the | ▼ | key.
:Month 2 : Type in the Right Ascension of the star for the next month and press [ENTER]

The program will interpolate the Right Ascension for the day of observation

At the prompt

Declination
from SALS

:Month 1 : Type in the Declination of the selected star for the current month press the | ▼ | key.
:Month 2 : Type in the Declination of the star for the next month and press [ENTER]

The program will interpolate the Declination for the day of observations

If ***STAR Direct*** is chosen, the following prompt will appear;

STAR Co-ords

:RA : Type in the Right Ascension of the observed body and press | ▼ |
:Dec : Type in the Declination of the observed body and press [ENTER]

If STAR Almanac is chosen, for the following CHOOSE list will appear;

APPROXIMATION FOR
s ***Octantis***
a ***Crucis***
a ***Centauri***
Achernar
Canopus
Fomalhaut

Using the [▲] [▼] cursor keys select the observed star and press |OK| or [ENTER]

The Apparent place (Right Ascension and Declination) of the star at the 1st October 1998 will be used in the computation. Due to the effects of precession and proper motion degradation of accuracy will occur over time.

Entering position

If Position configuration is for latitude / longitude

At the prompt;

POSITION
(ƒ is - in S.Hem.)

:ƒ : Type in the latitude of the observation in DD.MMSSS format. Latitudes in the Southern Hemisphere will be negative. Press the | ▼ | key.
:l : Type in the longitude in DD.MMSSS format. Latitudes in the Western Hemisphere will be negative. Press [ENTER]

If position configuration is for Grid Coordinates

At the prompt

POSITION
:Zone : Type in the Grid Zone and press | ▼ |
:E : Type in the Easting and press | ▼ |
:N : Type in the Northing and press [ENTER]

At the prompt

REFERENCE OBJECT
Face 1 <) ?

Type in the Horizontal angle observed to the Reference Object to which the azimuth / grid bearing is to be computed. Press [ENTER]

If the post processing option is chosen.

Enter the clock time for the first observation to the astro body. In the case of the sun this will be the time of co-incidence of the vertical cross-hair tangential to either the trailing or leading limb (edge) of the sun, or if a Roellefs prism is used the centre of the sun.

In the case of a star. The time at which the star crossed the vertical cross-hair.

At the prompt;

ASTRO BODY
Hor. <) ?

type in the observed horizontal angle to the sun at the time of observation, Press [ENTER]

The above prompts are repeated for observations on the other face.

At the prompt

REFERENCE OBJECT
Face 2 <) ?

Type in the Horizontal angle on the second face observed back to the Reference Object to which the azimuth / grid bearing is to be computed. Press [ENTER]

The computation is displayed as follows

Datum / Map Grid used Grid Zone
Central Meridian of Grid Zone

To the Reference Object;
Azimuth (True Bearing)
Grid Bearing (with convergence already added)

Note the azimuth/bearing in the field book

If repeated sets of observations are to be made, note the azimuth / grid bearing in a field-book and press |CONT| to repeat the process for another set of observations.

Repeated computations should be meaned separately, and if necessary blunders can be ignored.

To exit the program press |EXIT|

To repeat a set of observations press |CONT|

8.04 Predicting the azimuth and zenith angle of a star

Press **|PRED|** **Note: At present the prediction program is only correct for southern stars.**

The following prompt will appear;

Enter Date of
prediction in
DD.MMYYYY format

Type in the local date of the prediction. For example
31st December 1999 would be entered as 31.121999
Press [ENTER]

The following prompt will appear;

Enter Local
Clock time
for prediction

Type in the time in HH.MMSSS format

A Choose list will appear. Using the [▲] [▼] cursor keys select the observed star coordinate type and press either [ENTER] or [OK].

For precise predictions select ***SALS Interpol.***

This options requires extraction of data from the current ***Star Almanac for Land Surveyors***.

Refer to the adjacent tables *RIGHT ASCENSION OF STARS* and *DECLINATION OF STARS.*

At the prompt

Right Ascension
from SALS

:Month 1 :	Type in the Right Ascension of the selected star for the current month and press the | ▼ | key.
:Month 2 :	Type in the Right Ascension of the star for the next month and press [ENTER]

The program will interpolate the Right Ascension for the day of prediction

At the prompt

Declination
from SALS

:Month 1 :	Type in the Declination of the selected star for the current month press the | ▼ | key.
:Month 2 :	Type in the Declination of the star for the next month and press [ENTER]

The program will interpolate the Declination for the day of prediction

If ***STAR Direct*** is chosen, the following prompt will appear;

STAR Co-ords

:RA :	Type in the Right Ascension of the astro body and press | ▼ |
:Dec :	Type in the Declination of the astro body and press [ENTER]

If STAR Almanac is chosen, for the following CHOOSE list will appear;

APPROXIMATION FOR
s ***Octantis***
a ***Crucis***
a ***Centauri***
Achernar
Canopus
Fomalhaut

Using the [▲] [▼] cursor keys select the observed star and press |OK| or [ENTER]

The Apparent place (Right Ascension and Declination) of the star at the 1st October 1998 will be used in the computation. Due to the effects of precession and proper motion degradation of accuracy will occur over time, but are nevertheless sufficiently accurate for star prediction.

Entering position

If Position configuration is for latitude / longitude

At the prompt;

POSITION
(f is - in S.Hem.)

:f : Type in the latitude of the observation in DD.MMSSS format. Latitudes in the Southern Hemisphere will be negative. Press the | ▼ | key.
:l : Type in the longitude in DD.MMSSS format. Latitudes in the Western Hemisphere will be negative. Press [ENTER]

If position configuration is for Grid Coordinates

At the prompt

POSITION
:Zone : Type in the Grid Zone and press | ▼ |
:E : Type in the Easting and press | ▼ |
:N : Type in the Northing and press [ENTER]

At the prompt

ATMOSPHERIC DATA

:Temp. : Type in the temperature in degrees Celsius. Press the | ▼ | key.
:Press. : Type in the barometric pressure in the units specified in the configuration and press [ENTER]

The prediction is displayed as follows;

STAR PREDICTION at
LT (Local clock time in HMS)

Azimuth	The azimuth (true bearing) to the star at the given time
Grid Brg	The grid bearing to the star at the given Local Time
Zen<) FL	The zenith angle to the star in Face Left
Zen<) FR	The zenith angle to the star in Face Right

The computed zenith angles include atmospheric refraction corrections based upon the input atmospheric data.

To change the star for prediction (without changing any other data) press **|DSTAR|**

To change the time for the prediction (without changing any other data) press **|DTIME|**

To compute the prediction for the current clock-time press **|NOW|**

To exit the prediction program press **|EXIT|**

9 GEOD module

The Geodesy module comprises a series of programs which enable computations on the map grid. GEOD supports three different combinations of geodetic datum and map projection parameters.

1. Geodetic Datum Australia 1994 / Map Grid Australia 1994 (GDA94/MGA94)
2. Australian Geodetic Datum 1966/1984 / Australian Map Grid 1966/1984 (AGD/AMG)
3. Australian Geodetic Datum / NSW Integrated Survey Grid.

Australia is currently in the process of converting to GDA from AGD.
The new GDA is a geocentric datum compatible with GPS. Coordinates (both latitude and longitude and Grid Coordinates will be different between the old and new datums by approximately 200m in a north-easterly direction.

Provision is made within the program to change the AGD to GDA transformation parameters should the need arise.

Points on different datums can be stored within the same job.

To get into the GEOD module press the **|GEOD|** menu key from the MAIN menu.

The current job number, datum and projection combination is displayed.

JOB.M	DATA	SURV	COMP	TRAN	MAIN

|JOB.M| GEOD Job management menu (To change job /configuration)
|DATA| Data management menu (Add, delete, print, import etc.)
|SURV| Create new points (from brg/dist) or traverse
|COMP| Compute (brg & dist) grid convergence, scale factors and T-t corr.
|TRAN| Transform coordinates between datums
|MAIN| The Main menu of QUICKCLOSE

9.1 CONFIGURATION OF THE GEOD MODULE

The current datum/projection is displayed whenever the GEOD menu is active.
Any data entered via the keyboard or imported from an ASCII file will use this datum.

The default datum/projection combination is GDA94/MGA94. To change the current datum/projection press |JOB.M| |CNFG| |CHAN|

A pop-down menu will appear. Use the up/down cursor keys to highlight the desired combination and press |OK| or [ENTER].

To display the current spheroid and map projection parameters press |JOB.M| |CNFG| |DISPP|

9.11 Changing AGD to GDA transformation parameters

By default the transformation parameters are the national seven parameters published in the GDA technical manual. These parameters can be edited as required. To view/edit the seven transformation parameters press |JOB.M| |CNFG| |EDA→|

The parameters can be scrolled through using the cursor keys and edited as required. Press [OK] or [ENTER] to accept the parameters.

9.2 THE GEOD JOB

9.21 Starting a new GEOD job

Coordinate data can be stored in up to five different job directories. Data within the job can be on different datums and projections, but data directly entered or imported must be on the same datum as that configured within the GEOD module.

Press |JOB.M| **|NW.J|**

At the ***New GEOD Job No.?*** prompt, press the menu key with the desired job number. The DATA menu will then be displayed. **Data must be added** for most GEOD functions. Starting a new job will erase all existing data in that job.

9.22 To change to a different job

Press |JOB.M| **|CHNG|**

At the ***Go to Job No.?*** prompt, press the menu key with the desired job number to change to.

9.23 To delete a job

Press |JOB.M| **|DEL.J|**

At the ***Delete Job No. ?*** prompt, press the menu key with the job number to delete.
This will delete all coordinate data in that job. The deleted job number then becomes the current job.

9.24 To delete all jobs

Press |JOB.M| |DEL.A|

The prompt ***Del. All GEOD Jobs?*** will appear

If all data in all GEOD jobs is to be deleted press |YES|
otherwise press |NO|.

9.3 GEOD DATA MANAGEMENT

Press **|DATA|** to display the GEOD module data management menu.

Data must be pre-entered prior to most additional computations being performed. GEOD can handle points on different datums within the same job, however for entry of data, the current configuration must be the same as that of the entered data. Data is stored in a native geographic format (latitude, longitude and spheroid height), so data entered as Grid or Cartesian coordinates will be transformed internally to a geographic format.

9.31 To enter coordinate data using the keyboard

Firstly, ensure that the data being entered is of the same datum/projection as the current configuration.

Press |DATA| **|ADD.D|**

A menu will be displayed. Select the format of the entered data by pressing the appropriate menu key.

9.311 Keying in grid coordinate data

At the prompt;

Current Job : #
Datum/Proj. : #

Select format
for data entry

Press |ENH| **|KEYIN|**

Note : For quick entry of Grid data from anywhere within the GEOD module, press [CST] |KEYIN|

At the prompt;

Datum/Proj
Zone Number ?

Type in the Grid zone of entered data. If the GEOD module is configured for NSW ISG then type in grid zones as follows;

For example;
ISG Zone 55/1 is typed in as 55.1
ISG Zone 54/3 is typed in as 54.3

For each data point the following prompt will appear;

:Pt. No. : Type in the point number to be stored as, press the | ▼ | key
:Easting : Type in the Easting, press the | ▼ | key.
:Northing : Type in the Northing, press the | ▼ | key.
:Spher.Ht : Type in the spheroid height *, press [ENTER]

* If the height data is entered is an AHD or geoidal height, remember to add the 'N' value to obtain the spheroidal height. Use AUSGEIOD or similar models.

If the N value is known, the AHD height can be typed in as follows at the :Spher Ht: prompt;

ahdht [SPC] nval [SPC] + [ENTER] where ahdt is the AHD height and nval is the 'n' value.

If no height data is available, type in an approximation, or 0, but be aware that subsequent transformations of the entered point to another datum will be inaccurate as a result.

The above prompt will repeat as often as necessary.
To exit data entry, press the [ENTER] at a blank prompt screen.

Grid coordinate data typed in will then be reduced to geographic format for storage.

9.312 Keying in geographic coordinate data

At the prompt;

Current Job : #
Datum/Proj. : #

Select format
for data entry

Press |φλH| **|KEYIN|**

For each data point the following prompt will appear;

Note: Latitudes in the Southern Hemisphere and longitudes in the western Hemisphere (The Americas) are to be entered as a negative by pressing the [±] key.

:Pt. No. : Type in the point number to be stored as, press the | ▼ | key
:f : Type in the latitude in DD.MMSS format, press the | ▼ | key.
:l : Type in the longitude in DD.MMSS format , press the | ▼ | key.
:Spher.Ht : Type in the spheroid height *, press [ENTER]

* If the height data is entered is an AHD or geoidal height, remember to add the 'N' value to obtain the spheroidal height. Use AUSGEIOD or similar models.

If no height data is available, type in an approximation, or 0, but be aware that transformations to another datum will be inaccurate as a result.

The above prompt will repeat as often as necessary.
To exit data entry, press the [ENTER] at a blank prompt screen.

9.313 Keying in Cartesian coordinate data

At the prompt;

Current Job : *#*
Datum/Proj. : *#*

Select format
for data entry

Press |XYZ| **|KEYIN|**

For each data point the following prompt will appear;

:Pt. No.	***:***	Type in the point number to be stored as, press the | ▼ | key.
:X	***:***	Type in the X coordinate, press the | ▼ | key.
:Y	***:***	Type in the Y coordinate , press the | ▼ | key.
:Z	***:***	Type in the Z coordinate, press [ENTER]

The above prompt will repeat as often as necessary.
To exit data entry, press the [ENTER] at a blank prompt screen.

9.32 To import coordinate data from an ASCII text file

Firstly, ensure that the data being entered is of the same datum/projection as the current configuration

Press |DATA| **|ADD.D|**

9.321 To import an ASCII grid coordinate file

WARNING! Importing a coordinate file erases any existing stored data !

The imported grid coordinate file must obey the following rules;
(A Spreadsheet program such as EXCEL is ideal for performing any necessary manipulations)

1. The file name must not start with a number, nor must it be GJ1 to GJ5.
2. There must be five columns (Pt. number, Zone, Easting, Northing, spheroid height). ISG Zones should be in a form such as for example 55.1 or 55.3
3. Columns must be separated by at least one blank space, no commas
4. No blank values are allowed.
5. No spaces are allowed within each entry

6. Point numbers must be fully numeric or alphabetic, in the case of mixed alpha-numeric point numbers, the last digit must be a number.
7. No other text is allowed in the file (i.e headings, footers, etc...)

Connect up the serial cable as specified in the installation process. Ensure that the coordinate file to be downloaded is in the same directory as the kermit (or specify the path).

At the kermit prompt type ***server***

At the prompt;

Current Job : #
Datum/Proj. : #

Select format
for data entry

Press |ENH| **|IMPOR|**

At the prompt;

File to import ?

Type in the file name on the PC which is to be downloaded into the GEOD data directory.
Press the [α] key to activate the alphabetic keyboard.
Press [ENTER]

The coordinate file will be downloaded and converted into the native latitude / longitude format. A countdown will be displayed.

* If the height data is entered is an AHD or geoidal height, remember to add the 'N' value to obtain the spheroidal height. Use AUSGEIOD or similar models.

If no height data is available, type in an approximation, or 0, but be aware that transformations to another datum will be inaccurate as a result.

9.322 To import an ASCII geographic coordinate file

WARNING! Importing a coordinate file erases any existing stored data !

The imported geographic coordinate file must obey the following rules;
(A Spreadsheet program such as EXCEL is ideal for performing such manipulations)

1. The file name must not start with a number, nor must it be GJ1 to GJ5.
2. There must be four columns (Pt. number, Latitude, Longitude, spheroid height),
3. Columns must be separated by at least one blank space, no commas
4. No blank values are allowed.
5. No spaces are allowed within each entry

6. Point numbers must be fully numeric or alphabetic, in the case of mixed alpha-numeric point numbers, the last digit must be a number.
7. No other text is allowed in the file (i.e headings, footers, etc...)

Connect up the serial cable as specified in the installation process. Ensure that the coordinate file to be downloaded is in the same directory as the kermit (or specify the path).

At the kermit prompt type ***server***

At the prompt;

Current Job : #
Datum/Proj. : #

Select format
for data entry

Press |φλH| **|IMPOR|**

At the prompt;

Select angle format
of file to import

Press **|DEC°|** if the data is in decimal degrees
Press **|DMS|** if the data is in degrees minutes and seconds format (i.e DD.MMSSS)

Note: Latitudes in the Southern Hemisphere and longitudes in the western Hemisphere (The Americas) are to be negative.

At the prompt;

File to import ?

Type in the file name on the PC which is to be downloaded into the GEOD data directory.
Press the [α] key to activate the alphabetic keyboard.
Press [ENTER]

The coordinate file will be downloaded into the GEOD data directory

* If the height data is entered is an AHD or geoidal height, remember to add the 'N' value to obtain the spheroidal height. Use AUSGEIOD or similar models.

If no height data is available, type in an approximation, or 0, but be aware that transformations to another datum will be inaccurate as a result.

9.323 To import an ASCII Cartesian coordinate file

WARNING! Importing a coordinate file erases any existing stored data !

The imported Cartesian coordinate file must obey the following rules;
(A Spreadsheet program such as EXCEL is ideal for performing such manipulations)

1. The file name must not start with a number, nor must it be GJ1 to GJ5.
2. There must be four columns (Pt.number, X ,Y ,Z),
3. Columns must be separated by at least one blank space, no commas
4. No blank values are allowed.
5. No spaces are allowed within each entry
6. Point numbers must be fully numeric or alphabetic, in the case of mixed alpha-numeric point numbers, the last digit must be a number.
7. No other text is allowed in the file (i.e headings, footers, etc...)

Connect up the serial cable as specified in the installation process. Ensure that the coordinate file to be downloaded is in the same directory as the kermit (or specify the path).

At the kermit prompt type ***server***

At the prompt;

Current Job : #
Datum/Proj. : #

Select format
for data entry

Press |XYZ| **|IMPOR|**

At the prompt;

File to import ?

Type in the file name on the PC which is to be downloaded into the GEOD data directory.
Press the [α] key to activate the alphabetic keyboard.
Press [ENTER]

The coordinate file will be downloaded and converted into the native latitude / longitude format.

9.33 To delete coordinate data

9.331 To delete a point

Press |DATA| |DEL.D| **|PNT|**

The following prompt will appear;

Point Number to
Delete ?

Type in the point number to be deleted and press [ENTER]

9.332 To delete a range of points

Press |DATA| |DEL.D| **|RNG|**

At the prompt;

First Point Number
to Delete ?

Type in the first point of a range of points to delete and press [ENTER]

At the prompt;

Delete all points
to Pt. Number ?

Type in the last point to be deleted and press [ENTER]

All point numbers between the first and last point entered (inclusive) will be deleted from the GEOD data directory.

9.333 To delete all data

Press |DATA| |DEL.D| **|ALL|**

At the prompt
Delete all Points ?

Press **|YES|** To confirm deletion of ALL data in the current GEOD job
Press |NO| to exit

9.34 To view and edit coordinate data

9.341 Reviewing all data in current job

Press |DATA| |VW.ED| **|V.ALL|**

Geographic coordinates of all points are displayed, by pressing any key to continue.
Press [ON] to cancel the program.

9.342 Viewing and editing grid coordinate data

To view the grid coordinates for a given point
Press |DATA| |VW.ED| **|V.ENH|**

At the prompt;

Job #
VIEW / EDIT
Pt. ID ?

type in the point number whose grid coordinates are to be viewed and
press [ENTER].

The grid coordinates are displayed. To edit the displayed coordinates or to copy the point ID press |EDIT.D|. Using the cursor keys edit the fields as required and press |OK| or [ENTER].

Note : For quick viewing/editing of Grid data from anywhere within the GEOD module, press [CST] |V.ENH|

9.343 Viewing and editing geographic coordinate data

To view the geographic coordinates (latitude and longitude) for a given point
Press |DATA| |VW.ED| **|V.**fl**|**

At the prompt;

Job #
VIEW / EDIT
Pt. ID ?

type in the point number whose geographic coordinates are to be viewed and
press [ENTER].

The geographic coordinates are displayed. To edit the displayed coordinates or to copy the point ID press |EDIT.D|.

Using the cursor keys edit the fields as required and press |OK| or [ENTER].

9.344 Viewing and editing Cartesian coordinate data

To view the Cartesian coordinates for a given point
Press |DATA| |VW.ED| **|V.XYZ|**

At the prompt;

Job #
VIEW / EDIT
Pt. ID ?

type in the point number whose Cartesian coordinates are to be viewed and
press [ENTER].

The Cartesian coordinates are displayed. To edit the displayed coordinates or to copy the point ID press |EDIT.D|.

Using the cursor keys edit the fields as required and press |OK| or [ENTER].

9.344 Viewing grid coordinate data in a different zone

Press |DATA| |Z→Z| or more readily; [CST] |Z→Z|

At the prompt;
ZONE to ZONE trans.

:Pt. No : Type in the point number to viewed in a specific zone, press | ▼ |,
:View Zone : Type in the zone number for the point to be transformed to, press [ENTER].

ISG Zones are to be entered as follows ; example 55/1 is typed in as 55.1

The grid coordinates for the given point are then displayed in the new zone thus;

New Zone #
E Easting in the new zone
N Northing in the new zone

g Grid convergence in the new zone
k Scale factor in the new zone

Note: Cartesian and geographic coordinates for transformed point do not change

9.35 Printing coordinate data

To print coordinate data in the current job, align the printer and HP48 infra-red ports and press |DATA| |PRINT| and the format for the data to be printed |P.ENH|, |P.φλ| or |P.XYZ|.

9.4 SURVEYING NEW GEODETIC POINTS

New points can be created by either entry of pre-reduced survey observations (spheroidal bearing and distance from existing point) or by direct entry of raw field measurements. It is assumed that raw EDM measurements have already been corrected for the first velocity correction. The first velocity correction is computed within most current EDM equipment by the entry of atmospheric data and/or a ppm correction. There are three approaches to computing geodetic radiations from raw measurements;

1. If a coefficient of refraction is known (or assumed) and the elevation of the target station is unknown, therefore requiring the measurement of a zenith angle

2. If a coefficient of refraction is known (or assumed) and the elevation of the target station is known, and

3. If the coefficient of refraction is unknown, and reciprocal zenith angles are measured.

Method 3 will clearly provide greater precision than 1 & 2, as the coefficient of refraction of light is known to vary considerably depending upon a different combinations of atmospheric conditions. It is recommended to apply meaned atmospheric corrections at both ends of a line in order for higher accuracy to be achieved.

Methods 1 & 2 are usually sufficient, if the following standard coefficients are adopted;

k = 0.13 coefficient of refraction for short range EDM equipment (light wave based)
k = 0.25 coefficient of refraction for long range EDM equipment (microwave based)

9.41 To compute coordinates from grid bearing and spheroidal distance

From the GEOD menu press **|SURV| |CBD|**

At the prompt;

Job #
:From Pt ***:*** type in the point number (from), press [▼]
:Grid Brg ***:*** type in the Grid bearing press [▼]
:Sph dist ***:*** type in the spheroidal distance and press [ENTER]

The computed coordinates are displayed as follows;

Current Projection Zone #

E2 Computed Easting
N2 Computed Northing
Sph ht Computed spheroid height

Computed coordinates are always displayed in the same zone as the start point.

Press any key to continue. The geographic data is displayed;

f latitude of computed point
l longitude of computed point
Store as point ?

Type in the point number to be stored as
press [ENTER].

9.42 To compute coordinates from single ray observation with known station heights

This will reduce raw field data directly in the computation of a geodetic radiation. The reduction is rigorous provided that atmospheric data is entered into the distance measuring equipment to compute the first velocity correction. This program is appropriate for long range EDM measurements where elevations of the forward/to stations are known.

Entered heights should be spheroidal heights. If station elevation data is related to the Australian Height Datum (AHD) or is an orthometric height, the geoid-spheroid separation value 'N' should be added if higher accuracy is to be achieved.

Press **|RADI.H|**

At the prompt;

INSTRUMENT STN.

:Pt. No : Type in the point number of the instrument station at A, Press [▼]
:Ht. EDM: Type in the height of the EDM equipment above the station mark
Press [ENTER]

MEASUREMENTS

:Grid brg : Type in the grid bearing to the target station, press [▼]
:Mes.dist : Type in the measured distance to the target, press [ENTER]

TARGET DATA

:Stn ht : Type in the elevation of the station observed, press [▼]
:Ht.Refl: Type in the height of the reflector above the station mark.
Press [ENTER]

Edit Coefficient
of Refraction
(k)

Accept, or edit the coefficient of refraction for the given data. Press [ENTER]

The raw survey data is reduced and the coordinates and elevation of the target station displayed thus;

Current datum Zone #

E Easting
N Northing
sph ht spheroid height

sph dst the reduced spheroid distance between the two points

press any key to continue
at the prompt;

Store as Pt

Type in the point number for the computed coordinate to be stored as and press [ENTER].

9.43 To compute coordinates from single ray observation with zenith angle and coefficient of refraction

This will reduce raw field data directly in the computation of a geodetic radiation. The reduction is rigorous provided that atmospheric data is entered into the distance measuring equipment to compute the first velocity correction. This program is appropriate for a single short range EDM measurement constituting a distance measurement and a zenith angle and if the coefficient of light (k) is well estimated.

Press **|RADI.Z|**

At the prompt;

INSTRUMENT STN.

:Pt. No : Type in the point number of the instrument station at A, Press [▼]
:Ht. Theo: Type in the height of the theodolite, press [▼]
:Ht. EDM: Type in the height of the EDM equipment above the station mark
Press [ENTER]

MEASUREMENTS

:Grid brg : Type in the grid bearing to the target station, press [▼]
:Mes.dist : Type in the measured distance to the target, press [▼]
:Zen.<) : Type in the measured zenith angle, press [ENTER]

TARGET DATA

:Ht. Tgt : Type in the target height at the observed station, press [▼]
:Ht.Refl: Type in the height of the reflector above the station mark.
Press [ENTER]

At the prompt;

Edit Coefficient
of Refraction
(k)

Accept, or edit the coefficient of refraction for the given data. Press [ENTER]

At the prompt;

Deviation of the vertical in seconds

Accept the default deviation of 0, or edit the deviation if known. Press [ENTER]

The raw survey data is reduced and the coordinates and elevation of the target station displayed thus;

Current datum Zone #

E Easting
N Northing
sph ht spheroid height

sph dst the reduced spheroid distance between the two points

press any key to continue
at the prompt;

Store as Pt

Type in the point number for the computed coordinate to be stored as and press [ENTER].

9.44 To compute coordinates from reciprocal rays with zenith angle measurements

This will reduce raw field data directly in the computation of a geodetic radiation. The reduction is rigorous provided that atmospheric data is entered into the distance measuring equipment to compute the first velocity correction. This program is recommended for the reduction of most single short range EDM measurements where reciprocal observations have been made. The coefficient of light (k) is computed and displayed.

Press **|RADI.R|**

At the prompt;

INSTRUMENT STN.A

:Pt. No : Type in the point number of the instrument station at A, Press [▼]
:Ht. Theo: Type in the height of the theodolite, press [▼]
:Ht. EDM: Type in the height of the EDM equipment above the station mark
Press [ENTER]

FWD.MEASUREMENT A ® B

:Grid brg : Type in the grid bearing to the target station, press [▼]
:Mes.dist : Type in the measured distance to the target, press [▼]
:Zen.<) : Type in the measured zenith angle, press [ENTER]

At the prompt;

Deviation of the vertical in seconds

Accept the default deviation of 0, or edit the deviation if known. Press [ENTER]

TARGET DATA AT B

:Ht. Tgt : Type in the target height at the observed station, press [▼]
:Ht.Refl: Type in the height of the reflector above the station mark.
Press [ENTER]

INSTRUMENT STN.B

:Ht. Theo: Type in the height of the theodolite, press [▼]
:Ht. EDM: Type in the height of the EDM equipment above the station mark
Press [ENTER]

REV.MEASUREMENT B ® A

:Mes.dist : Type in the measured distance to the target, press [▼]
:Zen.<) : Type in the measured zenith angle, press [ENTER]

At the prompt;

Deviation of the vertical in seconds

Accept the default deviation of 0, or edit the deviation if known. Press [ENTER]

TARGET DATA AT A

:Ht. Tgt : Type in the target height at the observed station, press [▼]
:Ht.Refl: Type in the height of the reflector above the station mark.
Press [ENTER]

The raw survey data is reduced and the coordinates and elevation of the target station displayed thus;

Current datum Zone #

E Easting
N Northing
sph ht spheroid height

computed k = the computed coefficient of refraction for the given observations
sph dst the reduced spheroid distance between the two points

press any key to continue
at the prompt;

Store as Pt

Type in the point number for the computed coordinate to be stored as and press [ENTER].

9.45 Computing a traverse given reduced angles and spheroidal distances

Press |SURV| **|TRAV|**

At the prompt;

Start Stn Type in the station ID at the start of the traverse. Press [ENTER]

At the prompt;

RO Stn Type in the station ID observed as the RO at the start. Press [ENTER}

The computed Grid bearing to the RO is displayed. Press any key to continue.

For each set of observations in an angle traverse the following will be displayed;

At Pt #
RO Brg The grid bearing to the previous station

:Angle: Type in the reduced clockwise horizontal angle between the back and forward stations. Press [▼].
:Sph D: Type in the spheroidal distance, press [ENTER]

The coordinates of the forward station are computed and displayed;

E Easting of forward station
N Northing of forward station
Store as point ?

Type in the point ID for the computed station to be stored as. Press [ENTER]

To exit the program, press [ENTER] at a blank screen prompt.

9.5 GEODETIC COORDINATE COMPUTATIONS

9.51 Computing the grid bearing and spheroidal distance between two points

Press |COMP| **|BDC|**

At the prompt;

Current Datum/Projection
Compute brg & dist

:From Pt: Type in the first point number, press | ▼ |
:To Pt : Type in the second point number, press [ENTER]

The computed bearing and distance between the first and second points are displayed as follows;

Current Datum/map grid
Grid Bearing from pt to pt
Computed Forward grid bearing
Grid Bearing (reverse)
Computed Reverse grid bearing
Spheroidal distance

If the second point lies in a different grid zone, the computed bearing is related to the zone in which the first point lies.

9.52 Computing the grid convergence and scale factor for a given point

Press **|PINFO|**

At the prompt;

Grid Convergence
& Scale factor
at pt ?

Type in the point number where the grid convergence and scale factor is to be ascertained. Press [ENTER]

The information is displayed as follows;

At Pt #

g **=** The grid convergence
k **=** The point scale factor

The data is retained on the stack for further use. Press [ON]. The scale factor is on level 2 and the grid convergence in decimal degrees on level 1.

The data is computed in the “correct” grid zone. If the grid convergence and scale factor for the given point is to be determined in another zone press **|Z® Z|**

9.53 Computing the arc to chord corrections and line scale factor between two points

Press **|LINFO|**

At the prompt;

Current datum
Compute T-t & K

:From Pt: Type in the point number of the start of the line, press [▼]
:To Pt : Type in the point number of the end of the line, press [ENTER].

Computed data is displayed as follows;

Current datum/map projection Zone #
From Pt # to Pt #

d ® the forward arc to chord correction
d ¬ the reverse arc to chord correction

K the line scale factor

The arc to chord (or t-T) correction is added to the grid bearing (derived from field observations) to derive the Plane bearing (for computation).
A spheroidal distance is multiplied by the line scale factor to determine the plane distance (for computation).

If the second point lies in a different grid zone, the computed data is related to the zone in which the first point lies.

The computed data is retained on the stack for additional computations. Press [ON]

9.54 Computing the combined sea level and grid scale factor.

Many distances (engineering and cadastral) are often only corrected for slope to determine a local horizontal ground distance. To compute the combined sea-level and grid scale factor necessary for plane map grid computations;

Press **|COMBI|**

At the prompt;

Current projection

:Mean E : Type in the mean Easting of the line, press [▼]
:Mean Ht : Type in the mean height above the spheroid of the line, press [ENTER].

The computed combined scale factor is displayed.

At the prompt
Save as COGO
Scale factor ?

Press |YES| to save the scale factor in the COGO module. Press |NO| to exit.

Geoidal heights can be used instead of spheroidal heights in the majority of small scale surveys, however if possible the N value (geoid/spheroid separation) should be used. For example to enter an AHD height with an n value, at the prompt for :Mean Ht: above type; AHDHt [SPC] nval [SPC] + [ENTER}, where AHDHt is the AHD mean height and nval is the separation.

9.55 Computing a small scale AMG/ISG/MGA traverse.

The combined scale factor above can be stored as the scale factor in the COGO module (as described). The COGO module can then be used for small scale map grid surveys, producing coordinates on the map grid.

The error resulting from using a standard scale factor is approximately 4mm per km on MGA/AMG surveys (1.5mm on ISG) . **More importantly** the error resulting from using a standard height is approximately 16mm per 100 metres elevation difference. If the N value (geoid-spheroid separation) is ignored, the resulting error is 1.5mm per km for an ignored separation of 10m.

9.6 GEODETIC COORDINATE TRANSFORMATION

Coordinates in GEOD are transformed between datums using the standard seven parameter similarity values provided by AUSLIG. The seven parameter transformation is rigorous, however it should be understood that deficiencies exist in the definition of older datums and corrections should be applied to transformed coordinates based upon published datum distortion models. Locally derived transformation parameters can be used alternatively by pressing |JOB.M||CNFG| |EDA→|.

Accuracy of the transformation algorithm

For a sample of test points around Australia, forward/reverse transformations only differed by a maximum 0.2mm.

Notes on spheroid heights

A spheroidal height is the height above (orthogonal to) the spheroid, and should not be confused with AHD heights, which are essentially heights above the geoid (orthometric heights), or mean sea-level surface. GPS computes spheroidal heights, whereas the majority of existing elevation data is in terms of the Australian Height Datum which is related to the geoid over Australia. The difference between the two heights is referred to as the 'N' value (geoid-spheroid separation). The N value is added to a geoidal height to obtain the spheroid height.

NOTE: The spheroid height must be known (and entered into data) in order for accurate transformations between datums to be computed.

9.61 To transform coordinates from AGD to GDA

Press |TRAN| **|A® G|**

The following prompt will appear;

Job Number
Datum

:AGD Pt ID : Type in the AGD point number to be transformed and press [ENTER]
To type in raw AGD coordinates, press [ENTER] with no data typed in.

If the point does not exist, or if raw AGD coordinates are to be entered the following prompt will appear;

AGD co-ord type ?

If raw geographic co-ordinate data ($\phi\lambda$h) is to be transformed press **|**f l **HA|**

At the prompt;
AGD Co-ords
:f : Type in the latitude (negative in S.Hem)and press | ▼ |
:l : Type in the longitude and press | ▼ |
:Sph ht: Type in the spheroid height and press [ENTER]

If raw grid co-ordinate data is to be transformed press **|ENHA|**

At the prompt;
:Zone: Type in the AMG Zone and press | ▼ |
:E : Type in the Easting and press | ▼ |
:N : Type in the Northing and press | ▼ |
:Sp.ht: Type in the Spheroid height and press [ENTER]

If raw Cartesian co-ordinate is to be transformed press **|XYZA|**

At the prompt;
AGD Cartesian
:X : Type in the X coordinate and press | ▼ |
:Y : Type in the Y coordinate and press | ▼ |
:Z : Type in the Z coordinate and press [ENTER]

The transformed coordinates will be displayed thus;

GDA 94 Zone #
E MGA Easting
N MGA Northing

f GDA latitude
l GDA longitude
Sph. ht . GDA spheroid height

Press any key to continue,

Cartesian coordinates will be displayed .;

Cartesian co-ords

X GDA X
Y GDA Y
Z GDA Z

If the transformed point is to be stored as is
Press |YES|, or |NO| if not.

If |YES| is pressed at the prompt;

Point ID

edit the existing number (the original point transformed or 0)
and press [ENTER].

Store as Pt ?

Type in the point number to be stored as, and press [ENTER]

9.62 To transform coordinates from GDA to AGD

Press |TRAN| **|G® A|**

The following prompt will appear;

Job Number
Datum

:GDA Pt ID : Type in the GDA point number to be transformed and press [ENTER]
To type in raw GDA coordinates, press [ENTER] with no data typed in.

If the point does not exist, or if raw GDA coordinates are to be entered the following prompt will appear;

GDA co-ord type ?

If raw geographic co-ordinate data ($\phi\lambda$h) is to be transformed press **|**f l **HG|**

At the prompt;
GDA Co-ords

:f :	Type in the latitude (negative in S.Hem)and press | ▼ |
:l :	Type in the longitude and press | ▼ |
:Sph ht:	Type in the spheroid height and press [ENTER]

If raw grid co-ordinate data is to be transformed press **|ENHG|**

At the prompt;

:Zone:	Type in the MGA Zone and press | ▼ |
:E :	Type in the Easting and press | ▼ |
:N :	Type in the Northing and press | ▼ |
:Sp.ht:	Type in the Spheroid height and press [ENTER]

If raw Cartesian co-ordinate is to be transformed press **|XYZG|**

At the prompt;
GDA Cartesian
:X : Type in the X coordinate and press | ▼ |
:Y : Type in the Y coordinate and press | ▼ |
:Z : Type in the Z coordinate and press [ENTER]

The transformed coordinates will be displayed thus;

AGD Zone #
E AMG Easting
N AMG Northing

f AGD latitude
l AGD longitude
Sph. ht . AGD spheroid height

Press any key to continue,

Cartesian coordinates will be displayed .;

Cartesian co-ords

X GDA X
Y GDA Y
Z GDA Z

If the transformed point is to be stored as is
Press |YES|, or |NO| if not.

If |YES| is pressed at the prompt;

Point ID

edit the existing number (the original point transformed or 0)
and press [ENTER].

Store as Pt ?

Type in the point number to be stored as, and press [ENTER]

9.63 To transform coordinates from ISG to GDA

Press |TRAN| **|I® G|**

The following prompt will appear;

Job Number
Datum

:AGD/ISG Pt ID : Type in the AGD or ISG point number to be transformed and press [ENTER]
To type in raw ISG coordinates, press [ENTER] with no data typed in.

If the point does not exist, or if raw ISG coordinates are to be entered the following prompt will appear;

AGD/ISG co-ord type ?

If raw geographic co-ordinate data ($\phi\lambda$h) is to be transformed press **|**f l **HA|**

At the prompt;
AGD Co-ords
:f : Type in the latitude (negative in S.Hem)and press | ▼ |
:l : Type in the longitude and press | ▼ |
:Sph ht: Type in the spheroid height and press [ENTER]

If raw grid co-ordinate data is to be transformed press **|ENHI|**

At the prompt;
:Zone: Type in the ISG Zone (foe example 55.1) and press | ▼ |
:E : Type in the Easting and press | ▼ |
:N : Type in the Northing and press | ▼ |
:Sp.ht: Type in the Spheroid height and press [ENTER]

If raw Cartesian co-ordinate is to be transformed press **|XYZA|**

At the prompt;
AGD Cartesian
:X : Type in the X coordinate and press | ▼ |
:Y : Type in the Y coordinate and press | ▼ |
:Z : Type in the Z coordinate and press [ENTER]

The transformed coordinates will be displayed thus;

GDA 94 Zone #
E MGA Easting
N MGA Northing

f GDA latitude
l GDA longitude
Sph. ht . GDA spheroid height

Press any key to continue,

Cartesian coordinates will be displayed .;

Cartesian co-ords

X GDA X
Y GDA Y
Z GDA Z

If the transformed point is to be stored as is
Press |YES|, or |NO| if not.

If |YES| is pressed at the prompt;

Point ID

edit the existing number (the original point transformed or 0)
and press [ENTER].

Store as Pt ?

Type in the point number to be stored as, and press [ENTER]

9.64 To transform coordinates from GDA to ISG

Press |TRAN| **|G® I|**

The following prompt will appear;

Job Number
Datum

:GDA Pt ID : Type in the GDA point number to be transformed and press [ENTER]
To type in raw GDA coordinates, press [ENTER] with no data typed in.

If the point does not exist, or if raw GDA coordinates are to be entered the following prompt will appear;

GDA co-ord type ?

If raw geographic co-ordinate data (ϕλh) is to be transformed press **|**f l **HG|**

At the prompt;
GDA Co-ords

:f :	Type in the latitude (negative in S.Hem)and press | ▼ |
:l :	Type in the longitude and press | ▼ |
:Sph ht:	Type in the spheroid height and press [ENTER]

If raw grid co-ordinate data is to be transformed press **|ENHG|**

At the prompt;

:Zone:	Type in the MGA Zone and press | ▼ |
:E :	Type in the Easting and press | ▼ |
:N :	Type in the Northing and press | ▼ |
:Sp.ht:	Type in the Spheroid height and press [ENTER]

If raw Cartesian co-ordinate is to be transformed press **|XYZG|**

At the prompt;
GDA Cartesian

:X :	Type in the X coordinate and press | ▼ |
:Y :	Type in the Y coordinate and press | ▼ |
:Z :	Type in the Z coordinate and press [ENTER]

The transformed coordinates will be displayed thus;

ISG Zone #
E ISG Easting
N ISG Northing

f AGD latitude
l AGD longitude
Sph. ht . AGD spheroid height

Press any key to continue,

Cartesian coordinates will be displayed .;

Cartesian co-ords

X GDA X
Y GDA Y
Z GDA Z

If the transformed point is to be stored as is
Press |YES|, or |NO| if not.

If |YES| is pressed at the prompt;

Point ID

edit the existing number (the original point transformed or 0)
and press [ENTER].

Store as Pt ?

Type in the point number to be stored as, and press [ENTER]

9.65 To transform ISG coordinates to AMG

Press |TRAN| **|I® A|**

The following prompt will appear;

Job Number
Datum

:ISG Pt ID : Type in the ISG point number to be transformed and press [ENTER]
To type in raw ISG coordinates, press [ENTER] with no data typed in.

Enter ISG Co-ords
:Zone : Type in the ISG Zone number (e.g 55.3), press | ▼ |
:E : Type in the ISG Easting, press | ▼ |
:N : Type in the ISG Northing, press [ENTER]

The transformed co-ordinates will be displayed;

AMG Zone # AMG Zone number
E AMG Easting
N AMG Northing

Press any key to continue. If the transformed point is to be stored as is
Press |YES|, or |NO| if not.

If |YES| is pressed at the prompt;

Point ID

edit the existing number (the original point transformed or 0)
and press [ENTER].

Store as Pt ?

Type in the point number to be stored as, and press [ENTER]

9.66 To transform AMG coordinates to ISG

Press |TRAN| **|A® I|**

The following prompt will appear;

Job Number
Datum

:AMG Pt ID : Type in the AMG point number to be transformed and press [ENTER]
To type in raw AMG coordinates, press [ENTER] with no data typed in.

Enter AMG Co-ords
:Zone : Type in the AMG Zone number, press | ▼ |
:E : Type in the AMG Easting, press | ▼ |
:N : Type in the AMG Northing, press [ENTER]

The transformed co-ordinates will be displayed;

ISG Zone # ISG Zone number
E ISG Easting
N ISG Northing

Press any key to continue. If the transformed point is to be stored as is
Press |YES|, or |NO| if not.

If |YES| is pressed at the prompt;

Point ID

edit the existing number (the original point transformed or 0)
and press [ENTER].

Store as Pt ?

Type in the point number to be stored as, and press [ENTER]

10 ROAD module

The Road module enables the surveyor to compute characteristic data for a horizontal circular curve, set out a circular curve (including offset points), set out a vertical parabolic curve and also to set out batter points.

To get into the ROAD module press the **|ROAD|** menu key from the MAIN menu.

CURV	**SETOU**	**VERCV**	**BATTE**		**MAIN**

|CURV| Compute elements of a horizontal circular curve
|SETOU| Compute and setout a horizontal circular curve
|VERCV| Setout a vertical parabolic curve
|BATTE| Setout batter points where they intersect natural surface
|MAIN| The Main menu of QUICKCLOSE

10.01 To compute horizontal circular curve data

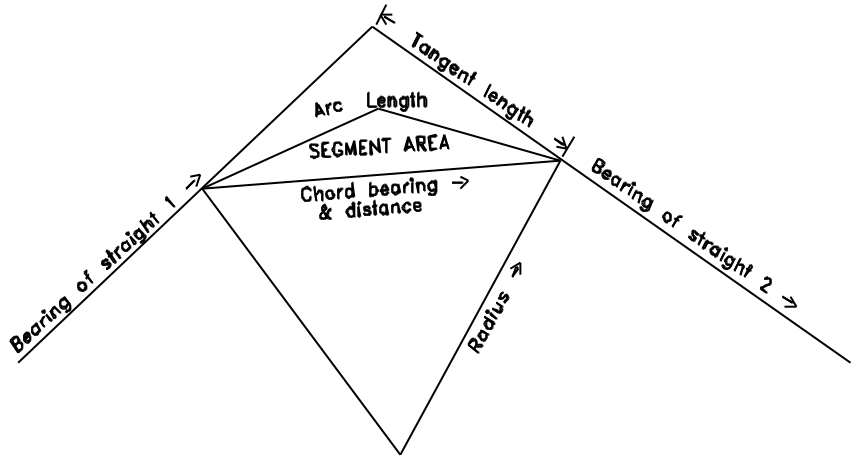

Figure 18. A horizontal curve

Press the **|CURV|** menu key

A choice of three different combinations of data is displayed in the menu.
The bearings of the entry and exit straights must always be known.

10.011 Radius and straight bearings known

Press the **|R.**q**|** key

at the prompt:

:Brg 1 : type in the bearing of the first straight then press the [▼] cursor key
:Brg 2 : type in the bearing of the second straight then press the [▼]cursor key
:Radius: type in the radius of the curve then press [ENTER]

the curve data is displayed as shown thus;

*******CURVE DATA*****
Radius the radius of the curve (as entered)
Arc Length the length of the curve
Tangent L. The tangent length
Chord Brg. The bearing of the long chord
Chord Dist. The length of the long chord
Seg. Area The area of the segment between the curve and the chord.

Press the |CONT| key to continue.

10.012 Arc length and straight bearings known

Press the **|AL.**q**|** key

Entry and display of the data is similar to the above except enter the curve length instead of the radius.

10.013 Tangent length and straight bearings known

Press the **|TL.**q**|** key

Entry and display of the data is similar to the above except enter the tangent length instead of the radius.

10.02 To set out a horizontal circular curve

In order to set out a circular curve with or without offsets, the coordinates and chainage of the start of the curve and the instrument station for the setout must be computed first.

To set out chainage and offset points on a circular curve. Press **|SETOU|.**

At the prompt;

SET UP COORDS

:E : Type in the Easting of the instrument station, press | ▼ |
:N : Type in the Northing, press [ENTER]

At the prompt;

CURVE ORIGIN
:E : Type in the Easting of the start of the horizontal curve, press | ▼ |
:N : Type in the Northing, press | ▼ |
:Chainage: Type in the Chainage of the start of the horizontal curve, press [ENTER]

If the chainage of the start of the curve is irrelevant, type 0.

A menu will appear, from which to select the known combination of curve data elements. The steps are identical to those in 10.01 above.

The computed curve data is displayed as above. Press the |CONT| key to continue.

For each set out point, the following prompt will appear;

SET OUT

:Chainage : The Chainage to be set out, press | ▼ |
:Offset : The Offset from the centre line. Press | ▼ |
If the centre line is being set out, the offset will be 0 !

Sign convention for offsets

Offsets to the left of the centreline (when looking from the curve origin point) are to be entered as negative offsets by pressing [+/-].

The computed join between the instrument station and the set out point is displayed as follows;

Chainage	The entered chainage of the set out point
Offset	The entered offset of the set out point
at E	The Easting of the point to be set out
N	The Northing of the point to be set out
Brg	The bearing from the instrument to the set out point
Dist	The horizontal distance from the instrument

Press any key to continue, prompts for additional setout points will appear as often as necessary.

To exit the SETOUT routine, press the [ENTER] at a blank prompt screen.

10.03 To set out a vertical curve

To compute Reduced levels of points on the centreline of a vertical curve. Press **|VERCV|**.

At the prompt;

Entry TP data

:Chainage	***:***	Type in the chainage of the start of the vertical curve (the tangent point), press | ▼ |
:RL	***:***	Type in the Reduced Level of the tangent point, press [ENTER]

At the prompt;

Grade data

:Length	***:***	Type in the length of vertical curve, press | ▼ |
:Entry %	***:***	Type in the gradient of the entry slope, press | ▼ |
:Exit %	***:***	Type in the gradient of the exit slope. press [ENTER]

If the gradients are given as a ratio (i.e. 1 : 500) type;
100 [SPC] xxx [SPC] / [▼] , at the grade prompts where xxx is the ratio.

The critical points of the vertical curve are then displayed thus;

VERTICAL CURVE

Ch. Entry	The entered chainage for the entry TP
RL	The entry RL and the entry grade in %
Ch. Apex	The chainage for the highest (or lowest) on the curve
RL	The RL of the highest (or lowest) point on the curve
Ch. Exit	The computed chainage of the exit TP
RL	The exit RL and the exit grade in %

Press any key to continue the program

The following prompt will appear for each chainage on the vertical curve, whose RL is to be computed;

Compute Rls
Enter chainage ?

:Chnge :

Type in the chainage to compute, and press [ENTER]

The RL at the given chainage is computed displayed. Press any key to continue.
To exit the program, press [ENTER] at a blank chainage prompt.

10.04 To set out batter points

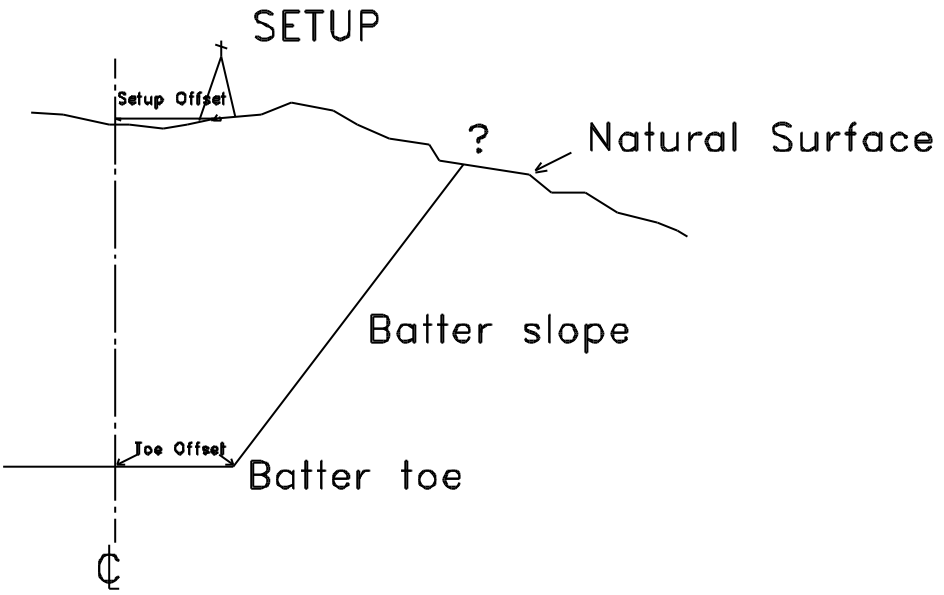

Fig. 19 Batter staking

Press **|BATTE|**

Sign conventions used;

Offsets to the left of the centreline (when looking from the start of the alignment) are to be entered as a negative.

Fill batters are to be entered with a negative grade.

At the prompt;

Batter toe details

:Offset	***:***	Type in the Offset to the start of the batter. For fill batters, this will be the offset to the top of the batter slope. For cut batters this will be the offset to the toe. Press | ▼ |
:RL	***:***	Type in the RL of the batter origin. Press | ▼ |
:Slope	***1:***	Type in the grade of the batter. Press [ENTER]

At the prompt;

SETUP DATA

:Offset	***:***	Type in the offset of the instrument from the centreline, press | ▼ |
:Stn RL	***:***	Type in the RL of the instrument station, press | ▼ |
:Ht Inst	***:***	Type in the height of instrument, press [ENTER]

At the prompt;

Ht Reflector ?

A default value of 0 is displayed. Use the |🡐| key to edit this value, for the height of the reflector/ prism used to set out the batter points. Press [ENTER]

The intersection of the batter slope with the existing ground surface (natural surface) is an iterative process. The measuring instrument should be set up so that it displays horizontal and vertical distance components.

For each trial shot the following prompt will appear ;

Natural surface

± dist if - offst

:Horiz Dis	***:***	Type in the measured horizontal distance to the reflector. If the distance is measured on the left hand side of the centreline (see convention above) and the distance is measured away from the centreline, the distance should be entered as a negative. Likewise, if the distance is measured on the right hand side of the centreline, and the distance is measured towards the centreline, it entered as a negative. Press | ▼ |
:Delta Ht	***:***	Type in measured height difference (Inst to prism) Press [ENTER]

The estimate of the batter point is displayed thus;

Batter estimate

Offset	The offset to the estimated batter intersection point
RL	The RL estimate of the batter intersection point
Go on	The horizontal distance for the prism to move away from the instrument (negative if the prism has to come towards the instrument)
Go up	The height difference to come up (negative if down)
(slope equiv.)	The combination of the above elements as a ground distance.

The displayed information should provide the survey assistant with a better estimate of where to position the prism for the next sample shot.

Press **|CONT|** to re-enter another sample point. The previously entered reflector height is prompted for each time. Press **|EXIT|** to exit the program.

The tolerance with which the batter point is to be found is at the discretion of the surveyor. For most purposes if the error (Go on / up) is less than 0.1 the displayed Offset and RL can be recorded as the actual point.

11 SERVICE INFORMATION

11.01 Changing main configuration

If after installation of the program the main configuration is to be changed press |MAIN| **|CNFG|.** The current configuration settings will be displayed along with a menu to change the settings. To change configuration settings that are module specific (GEOD and ASTRO) refer to the appropriate section of the manual.

Main Configuration display

State of use Q = Queensland, N = New South Wales / Victoria
W = Western Australia, S = South Australia, T = Tasmania
To change, press **|STATE|**

Dists/Co-ords ***d d.p.*** where d is the number of decimal places distances and co-ordinates are displayed to (default is 3)
To change d press |FIX.U| **|DSTCO|**

Reduced levels ***l d.p.*** where l is the number of decimal places levels are displayed to (default is 3)
To change l press |FIX.U| **|LEVEL|**

<) Seconds ***a d.p.*** where a is the number of decimal places seconds are displayed to (default is 0)
To change a press |FIX.U|**|ANGL|**. A pop-down menu will appear. Use the [▼]cursor key to select the desired seconds display and then press |OK| or [ENTER].

Autoscroll spd. ***s sec*** shows the delay time for displaying of messages in the program and also how quickly the programs such as QCK.V scroll through close data (default is 1 sec).
To change the speed press **|SPEED|**

Co-ord order #,# shows the order in which coordinates are displayed (default is E,N).
To change the coordinate order press **|C.ORD|.** A pop-down menu will appear. Use the [▼]cursor key to select the desired coordinate order and then press |OK| or [ENTER].

IR Printer ***type*** shows the current IR printer configuration
To change the printer press **|PRINT|.** A pop-down menu will appear. Use the [▼]cursor key to select the desired printer and then press |OK| or [ENTER].

To return to the main configuration from the |FIX.U| menu press |CNFG|

11.02 Troubleshooting

11.021 If a program crashes, or to back out of a program

If the program produces an error message, press the [ON] key (twice if necessary) to clear the message. If garbage is left on the stack press the [DEL] key to clear the stack. To get back into the QUICKCLOSE program press the [CST] key to display the customised menu for QUICKCLOSE.

11.022 To Reset QUICKCLOSE

If other unfamiliar annunciators or messages remain displayed in the status area, or the program is behaving erratically or slowly, it is advisable to reset the program. To do this press |MAIN| **|RESET|.**

11.023 If QUICKCLOSE can't be found !

Press [ON] [R-S] ['] ^{HOME} [VAR] |QCLO| |RUN|

11.024 To reset the calculator

If the calculator does not respond to any keystroke and 'hangs' it will be necessary to reset the calculator. To do this refer to p5-17 of the *HP 48G Series User's Guide.* It is quite possible that the HP48's memory may be lost in the process.

11.025 If the calculator crashes and memory is lost ☹.

Tough! The program will need to be re-installed as described in section 2.02

11.03 Service support

If problems or faults occur with the calculator contact the calculator supplier.
If problems occur with the program itself, the programmer ***Richard Stanaway*** can be contacted by email at ***quickclose@quickclose.com.au***

An internet World Wide Web page is for QUICKCLOSE is maintained at:

http://www.quickclose.com.au

where the programmer's current contact details and email address can be found as well as links to the ***on-line feedback page***.

To submit feedback on the program go to the following web address:

http://www.quickclose.com.au /feedback.htm

or to **view existing feedback** visit:

http://www.quickclose.com.au /hp48feed.htm

11.04 Comments, faults, criticisms, suggestions and feedback

Four are welcomed for the benefit of future versions of the program. Please contact either SOKKIA or the programmer direct with any feedback. (Same details as above).

APPENDIX 1 QUICKCLOSE EXPERT MENU MAPS

MAIN (1/2)

CLOSE	COGO	LEVEL	CNFG	RESET	→

MAIN (2/2)

UTILS	ASTRO	GEOD	ROAD		←

CLOSE

JOB.M	EDIT	VW.PR	MISS	AJ.AR	MAIN

JOB.M

NEW	OPEN	SAVE	DELE	→CG	CLOSE

EDIT

LEG	DEL.L	DEL	INS	CONV	CLOSE

VW.PR

PRINT	VIEW	QCK.V	COORD	CONV	CLOSE

MISS

MISCL	MBB	MDD	B1D2	D1B2	CLOSE

AJ.AR

BOWD	AREA	AD.AR	ROTA	CONV	CLOSE

COGO

JOB.M	DATA	SURV	COMP	TRAN	MAIN

JOB.M

NW.J	CHNG	DEL.J	DEL.A		COGO

DATA

ADD.D	DEL.D	VW.D	V.ALL	I/O	COGO

I/O

IMPOR	EXPOR	PRINT	→CL	DATA	COGO

SURV

TRAV	RADIA	RE.IN	B.COR	D.COR	COGO

RE.IN

RESEC	IBB	IDD	B.COR	D.COR	COGO

COMP

JOIN	AREA	OFFST	B.COR	D.COR	COGO

TRAN

BOWDI	AD.AR	SHIFT	ROTAT		COGO

CNFG

STATE	FIX.U	SPEED	C.ORD	PRINT	MAIN

FIX.U

DSTCO	LEVEL	ANGL		CNFG	MAIN

UTILS

SECN	TRUN	S→H	MLM	R→CR	MAIN

ASTRO

AZALT	AZHA	PRED		CNFG	MAIN

GEOD

JOB.M	DATA	SURV	COMP	TRAN	MAIN

JOB.M

NW.J	CHNG	DEL.J	DEL.A	CNFG	GEOD

CNFG

CHAN	DISPP	EDA→			GEOD

DATA

ADD.D	DEL.D	VW.ED	PRINT	Z→Z	GEOD

ADD.D

ENH	φλH	XYZ		DATA	GEOD

ENH / φλH / XYZ

KEYIN	IMPOR		DATA	GEOD

DEL.D

PNT	RNG	ALL		DATA	GEOD

VW.ED

V.ENH	V. φλ	V.XYZ	V.ALL	DATA	GEOD

PRINT

P.ENH	P. φλ	P.XYZ		DATA	GEOD

SURV

CBD	RADI.Z	RADI.H	RADI.R	TRAV	GEOD

COMP

BDC	PINFO	LINFO	COMBI	Z→Z	GEOD

TRAN

A→G	G→A	I→G	G→I	I→A	A→I

ROAD

CURV	SETOU	VERCV	BATTE		MAIN

[CST] (In CLOSE Module)

NEW	RETN	VW.PR	MISS	CONV	CLOSE

[CST] (In COGO Module)

ADD.D	VW.D	B.COR	D.COR	CONV	COGO

[CST] (In GEOD Module)

KEYIN	V.ENH	PINFO	CBD	Z→Z	GEOD

CONV

→DMS	→DD	L→M	F→M	HMS+	HMS-

APPENDIX 2 QUICKCLOSE EXPERT PROGRAM LISTING

CLOSE Module functions

NAME	Function	Menu Path from|MAIN||CLOSE|	Page
AD.AR	Adjusted Area of Current Close	|AJ.AR| |AD.AR|	38
AJ.AR	Adjustment/Area menu I	|AJ.AR|	37
AREA	Compute Area of current Close	|AJ.AR| |AREA|	38
B1D2	Missing Bearing 1 Distance 2 diff. lines	|MISS| |B1D2|	35
BOWD	Bowditch adjust current close	|AJ.AR| |BOWD|	37
→CG	Export current close to COGO module	|JOB.M| |→CG|	28
COORD	Compute coordinates of current Close	|VW.PR| |COORD|	32
D1B2	Missing Distance 1 Bearing 2 diff. lines	|MISS| |D1B2|	36
DEL	Delete leg from current close	|EDIT| |DEL|	29
DELE	Delete a saved close	|JOB.M| |DELE|	28
DEL.L	Delete last leg in current close	|EDIT| |DEL.L|	29
EDIT	Editing menu for current close	|EDIT|	29
JOB.M	Data management menu in	|JOB.M|	28
INS	Insert leg into current close	|EDIT| |INS|	30
LEG	Specify leg to edit in current close	|EDIT| |LEG|	29
MBB	Compute two missing bearings	|MISS| |MBB|	33
MDD	Compute two missing distances	|MISS| |MDD|	34
MISCLO	Display and print the full misclose	|MISS| |MISCL|	33
MISS	Missing data and misclose MENU	|MISS|	33
NEW	Start New Close	|JOB.M| |NEW|	24
OPEN	Open saved close from register	|JOB.M| |OPEN|	28
PRINT	Print CLOSE data (options)	|VW.PR| |PRINT|	31
QCK.V	Quick view current close data	|VW.PR| |QCK.V|	30
RETN	Resume data entry in current close	[CST] |RETN|	25
ROTA	Apply rotation to current close	|AJ.AR| |ROTA|	38
SAVE	Save current close to register	|JOB.M| |SAVE|	28
VIEW	View data in current close	|VW.PR| |VIEW|	30
VW.PR	Viewing & Printing menu	|VW.PR|	30

COGO Module functions

NAME	Function	Menu Path from|MAIN||COGO|	Page
AD.AR2	Adjusted Area of COGO Polygon	|TRAN| |AD.AR|	53
ADD.D	Add data to COGO job by keyboard	|DATA| |ADD.D|	40
AREAM	Compute area of COGO Polygon	|COMP| |AREA|	51
B.COR	View/edit correction applied to bearings	|SURV| or |COMP|, |B.COR|	39
BOWDI	Bowditch adjust coordinates in COGO	|TRAN| |BOWDI|	53
CHNG	Change the current COGO job	|JOB.M| |CHNG|	39
→CL	Export COGO polygon to CLOSE module	|DATA| |I/O||→CL|	43
COMP	Computation menu	|COMP|	50
DATA	Data management menu	|DATA|	40
D.COR	View/edit scale factor applied to distances	|SURV| or |COMP|, |D.COR|	39
DEL.A	Delete all jobs in COGO module	|JOB.M| |DEL.A|	40
DEL.D	Delete point number from COGO job	|DATA| |DEL.D|	42
DEL.J	Delete COGO job	|JOB.M| |DEL.J|	40
EXPOR	Export coordinate data to .TXT file	|DATA| |I/O||EXPOR|	42
IBB	Intersection of two bearings	|SURV| |RE.IN| |IBB|	47
IDD	Intersection of two distances	|SURV| |RE.IN| |IDD|	48
IMPOR	Import ASCII.txt file into current COGO job	|DATA| |IMPOR|	41
IO	Input output menu for coordinate data	|DATA| |I/O|	40
JOB.M	Job management menu	|JOB.M|	39
JOIN	Compute joins between points	|COMP| |JOIN|	50
NW.J	Start new COGO job	|JOB.M| |NW.J|	39
OFFST	Compute offsets	|COMP| |OFFST|	51
PRIN	Print coordinate data in current COGO job	|DATA| |I/O| |PRINT|	42
RADIA	Compute radiations	|SURV| |RADIA|	45
RE.IN	Resection / Intersection menu	|SURV| |RE.IN|	46
RESEC	Compute a three point resection	|SURV| |RE.IN| |RESEC|	46
ROTAT	Apply rotation to COGO points	|TRAN| |ROTAT|	53
SHIFT	Apply a shift (translation) to COGO job	|TRAN| |SHIFT|	53
SURV	Survey menu to create new points	|SURV|	44
TRANS	Transformation menu	|TRAN|	53
TRAV	Compute a coordinate traverse	|SURV| |TRAV|	44
V.ALL	View all coordinate data in JOB	|DATA| |V.ALL|	42
VW.D	View point in COGO job	|DATA| |VW.D|	42

Miscellaneous and UTILS programs

NAME	Function	Menu Path from |MAIN|	Page
ANGL	Set Angle seconds FIX	|CNFG| |FIX.U| |ANGL|	114
CNFG	Configuration menu and display	|CNFG|	114
CONV	Conversion utilities menu	[CST] key in COGO,CLOSE	60
C.ORD	Set Coordinate order preference	|CNFG| |C.ORD|	114
DSTCO	FIX Distance / coordinate display	|CNFG| |FIX.U| |DSTCO|	114
F→M	Convert Feet to metres	[CST] |CONV| | F→M|	60
FIX.U	Fix Units menu in CNFG	|CNFG| |FIX.U|	114
L→M	Convert Links to metres	[CST] |CONV| | L→M|	60
LEVEL	Level reduction program	|LEVEL|	55
LEVELS	FIX Reduced Level display	|CNFG| |FIX.U| |LEVEL|	114
MAIN	Main menu of QUICKCLOSE program		22
MLM	Missing line measurement	|UTILS| |MLM|	58
PRINTER	Select infra-red printer	|CNFG| |PRINT|	114
R→CR	Polar to rectangular program	|UTILS| |R→CR|	59
RESET	Reset QUICKCLOSE program	|RESET|	115
S→H	Reduce slope distance to HD & VD	|UTILS| | S→H|	58
SECN	Compute Road Intersection secant	|UTILS| |SECN|	56
SPEED	Change speed of automatic scrolling	|CNFG| |SPEED|	114
STATE	Select State of origin	|CNFG| |STATE|	114
TRUN	Compute truncation chords of curve	|UTILS| |TRUNC|	57
UTILS	Utility programs Menu	|UTILS|	56

ROAD Module programs

NAME	Function	Menu Path from |MAIN||ROAD|	Page
BATTER	Compute batter points	|BATTE|	111
CURV	Compute horizontal curve data	|CURV|	107
SETOUT	Set out a circular curve	|SETOU|	109
VERCV	Set out a vertical curve	|VERCV|	110

ASTRO Module programs

NAME	Function	Menu Path from |MAIN||ASTRO|	Page
AZHA	Azimuth from Hour-angle observations	|AZHA|	69
AZALT	Azimuth from ex-meridian altitude observations	|AZALT|	65
CNFGA	Configuration of the ASTRO module	|CNFG|	65
PRED	Compute Star Prediction data	|PRED|	72

GEOD Module programs

NAME	Function	Menu Path from |MAIN||GEOD|	Page
ADD.DG	Menu for adding coordinate data to GEOD	|DATA| |ADD.D|	78
A→G	Transform coordinates from AGD to GDA	|TRAN| | A→G|	97
A→I	Transform coordinates from AMG to ISG	|TRAN| |A→I|	106
BDC	Compute spheroidal brg & dist from coords.	|COMP| |BDC|	94
CBD	Compute coords. from spheroidal brg & dist	|SURV| |CBD|	87
CHANGE	Change geodetic datum / map projection	|JOB.M| |CNFG| |CHAN|	76
CHNGG	Change GEOD Job	|JOB.M| |CHNG|	77
CNFGG	Configuration menu for GEOD	|JOB.M| |CNFG|	76
COMBIN	Compute combined ht / grid scale factor	|COMP| |COMBI|	96
COMPG	Computation menu for GEOD	|COMP|	94
DATAG	Data management menu for GEOD	|DATA|	78
DEL.AG	Delete All GEOD Jobs	|JOB.M| |DEL.A|	77
DEL.DG	Delete coordinate data	|DATA| |DEL.D|	84
DEL.JG	Delete a GEOD job	|JOB.M| |DEL.J|	77
DISPP	Display current datum / projection params.	|JOB.M| |CNFG| |DISPP|	76
EDA→G	Edit AGD to GDA transform. parameters	|JPB.M| |CNFG| |EDA→|	77
ENH	Menu to Enter Grid coordinate data	|DATA| |ADD.D| |ENH|	78
G→A	Transform coords from GDA94 to AGD	|TRAN| |G→A|	99
G→I	Transform coordinates from GDA94 to ISG	|TRAN| |G→I|	103
IMPOREN	Import an ASCII Grid coordinate file	|DATA| |ADD.D||ENH| |IMPOR|	80
IMPORLLH	Import an ASCII Geographic coord file	|DATA| |ADD.D| |φλH| |IMPOR|	81
IMPORXYZ	Import an ASCII Cartesian coordinate file	|DATA| |ADD.D| |XYZ| |IMPOR|	83
I→A	Transform coordinates from ISG to AGD	|TRAN| |I→A|	105
I→G	Transform coordinates from ISG to GDA94	|TRAN| |I→G|	101
KEYINEN	Keyboard entry of Grid coordinate data	|DATA| |ADD.D| |ENH| |KEYIN|	78
KEYINLLH	Keyboard entry of Geographic coord data	|DATA| |ADD.D| |φλH| |KEYIN|	79
KEYINXYZ	Keyboard entry of Cartesian coord data	|DATA| |ADD.D| |XYZ| |KEYIN|	80
φλH	Menu to add Geographic coordinate data	|DATA| |ADD.D| |φλH|	78
LINFO	Compute line scale factor & T-T	|COMP| |LINFO|	95
NW.JG	Start New GEOD job	|JOB.M| |NW.J|	77
P.ENH	Print grid coordinate data	|DATA| |PRINT| |P.ENH|	86
P. φλ	Print geographic coordinate data	|DATA| |PRINT| | P. φλ|	86
P.XYZ	Print Cartesian coordinate data	|DATA| |PRINT| |P.XYZ|	86
PNT	Delete coordinate data point	|DATA| |DEL.D| |PNT|	84
PINFO	Compute Grid convergence and scale fact.	|COMP| |PINFO|	94
PRINT.DG	Print MENU	|DATA| |PRINT|	86
RADI.H	Compute radiation, using Stn. Heights	|SURV| |RADI.H|	88
RADI.R	Compute radiation, reciprocal zenith angles	|SURV| |RADI.R|	91
RADI.Z	Compute radiation, single zenith angle, k	|SURV| |RADI.Z|	89
RNG	Delete data (range from/to)	|DATA| |DEL.D| |RNG|	84
SURVG	SURVEY menu	|SURV|	87
TRANG	TRANSFORMATION menu	|TRAN|	97
TRAVG	Geodetic traverse using angles	|SURV| |TRAV|	93
V.ALLG	View all GEOD geog. data in current job	|DATA| |VW.ED| |V.ALL|	85
V.ENH	View Grid coordinate data	|DATA| |VW.ED| |V.ENH|	85
V. φλ	View Geographic coordinate data	|DATA| |VW.ED| |V. φλ|	85
V.XYZ	View Cartesian coordinate data	|DATA| |VW.ED| |V.XYZ|	86
VW.EDG	View and Edit menu	|DATA| |VW.ED|	85
XYZ	Menu to add Cartesian coordinate data	|DATA| |ADD.D| |XYZ|	78
Z→Z	View coordinates in a different Grid Zone	|DATA| | Z→Z|	86

APPENDIX 3
FLAG SETTINGS AND SYSTEM INFORMATION

QUICKCLOSE Expert System flag settings

CF	Resulting Action
-21	Overflow expressed as 10E500
-33	I/O Directed to serial port
-34	Print via IR port
-35	Objects transmitted in ASCII form
-37	Single spaced printing
-38	automatic linefeed at printer
-51	Fraction mark (.)
-60	Alpha lock off
-62	user mode inactive

System flags that are cleared

SF	Resulting Action
-3	Symbolic arguments (e.g. π) evaluate to numbers
-22	Infinite result displayed as 10E500
-36	Input overwrite
-40	Display clock at all times in the status area.
-41	24-hr format for clock
-42	d/m/y date format

System flags that are set

QUICKCLOSE Expert user flag settings

Flag	Clear condition	Set condition
1	No saved close in current register	Close No.1 in current register
2	No saved close in current register	Close No.2 in current register
3	No saved close in current register	Close No.3 in current register
4	No saved close in current register	Close No.4 in current register
5	No saved close in current register	Close No.5 in current register
6*	Only whole seconds displayed	Decimals of a second displayed
7*	Easting, Northing – coordinate order	Northing, Easting - coordinate order
8*	82240B IR printer	82240A IR printer
9	Indefinite loops	End indefinite loop sequence
10	Program control flag	Program control flag set
11	Auxiliary program control flag	Auxiliary program control flag set
12*	Geographic coords used in ASTRO	Grid coordinates used in ASTRO
13*	Real-time processing of ASTRO obs	Post-processing of ASTRO obs
14*	Barometric press. units in mbar/hpa	Barometric pressure units in mm Hg
15	Observed body ; Sun	Observed body ; Star
16	Azimuth by hour angles	Azimuth by ex-meridian altitudes

User flags indicated by * are permanent configuration settings
All other flags are set/clear within program execution and are clear by default

Global user variables used by QUICKCLOSE Expert

VARIABLE	Purpose
RUN	Accesses EXPERT library and displays main menu
→RAM	Backup program, settings and Data to RAM card
UNSTALL	Uninstall QUICKCLOSE
J1	COGO Job1 Data directory
J2	COGO Job2 Data directory
J3	COGO Job3 Data directory
J4	COGO Job4 Data directory
J5	COGO Job5 Data directory
GJ1	GEOD Job1 Data directory
GJ2	GEOD Job2 Data directory
GJ3	GEOD Job3 Data directory
GJ4	GEOD Job4 Data directory
GJ5	GEOD Job5 Data directory
CST	Custom menu
A	Angle seconds display FIX
BC	Bearing correction (Decimal degrees) in COGO
B.COR	Program to Change bearing correction
CL	Current close - storage register
CL1	Close No. 1 storage resister
CL2	Close No. 2 storage register
CL3	Close No. 3 storage register
CL4	Close No. 4 storage register
CL5	Close No. 5 storage register
D	Distance and coordinate display FIX
DC	Scale factor applied to distances in COGO
D.COR	Program to change scale factor
D.M	Current Geodetic datum / Map projection
DUT	Combined DUT and clock correction (seconds)
F→M	Convert Feet to metres
J	Current job number
JG	Current GEOD Job Number
L	Level display FIX
L→M	Convert Links to metres
R1	Rotation register 1
R2	Rotation register 2
R3	Rotation register 3
R4	Rotation register 4
S	scroll speed in seconds
C1	Start coordinates
STA	State of origin
TEMP	Temporary storage variable 1
TEMP2	Temporary storage variable 2
A8G9.T	AGD84 to GDA94 Transformation parameters
Z	Time zone (hours ahead of GMT)

USER key definitions used by QUICKCLOSE

CONT command assigned to SPC key { 94.1 } in USER mode

APPENDIX 4 DATUM, PROJECTION AND TRANSFORMATION PARAMETERS

SPHEROID PARAMETERS

AUSTRALIAN NATIONAL SPHEROID

Defining parameters

Semi-major axis	6378160 metres
flattening	1 / 298.25 exactly (0.00335289186924)

Derived parameters

Semi-minor axis	6356774.7192 metres
eccentricity	0.0818201799961
second eccentricity	0.0820954371046
c	6399617.22456 metres

Meridian distance series expansion coefficients

A0	0.998324257884
A2	0.00251466796382
A4	0.00000263917453451
A6	0.000000003418294029

n	0.00167926112511
mean length of 1° of the meridian (G)	111133.348786 m

GEODETIC REFERENCE SPHEROID 1980

Defining parameters

Semi-major axis	6378137 metres
flattening	1 / 298.257222101 (0.00335281068118)

Derived parameters

Semi-minor axis	6356752.31414 metres
eccentricity	0.0818191910428
second eccentricity	0.0820944381609
c	6399593.62586 metres

Meridian distance series expansion coefficients

A0	0.998324298444
A2	0.00251460707284
A4	0.00000341804613675
A6	0.000000003418294029

n	0.00167922039463
mean length of 1° of the meridian (G)	111132.952548 m

TRANSVERSE MERCATOR MAP PROJECTION PARAMETERS

Universal Transverse Mercator (UTM)

adopted by the Australian Map Grid (AMG)
and Map Grid Australia (MGA);

Zone width	6°
Central meridian scale factor	0.9996
Easting of central meridian	500,000 metres
Northing of equator	10,000,000 metres (for latitudes < 0)
	0 metres (for latitudes > 0)

New South Wales Integrated Survey Grid

Zone width	2°
Central meridian scale factor	0.99994
Easting of central meridian	300,000 metres
Northing of equator	5,000,000 metres

7 PARAMETER SIMILARITY TRANSFORMATION PARAMETERS

AGD84 to GDA94 National parameters

rotation convention, looking outwards from origin

ΔX	-117.763 metres	
ΔY	-51.510 metres	
ΔZ	139.061 metres	
rX	-0.292”	(-1.41565594884E-6 radians)
rY	-0.443”	(-2.14772460732E-6 radians)
rZ	-0.277”	(-1.34293389667E-6 radians)
scale	-0.191ppm	(0.999999809)