

SOKKIA

SDR[®] Level 5

User's Guide

Part Number 750-1-0075 Rev 1

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POINT, Inc.— Advanced Measurement Solutions from Sokkia and NovAtel

Contents

Chapter 1	Welcome.....	1-1
1.1	Document Conventions	1-1
1.1.1	Typefaces	1-1
1.1.2	Technical Support.....	1-3
Chapter 2	Software Overview	2-1
2.1	Pre-Survey Operations.....	2-1
2.1.1	Project Management.....	2-1
2.1.2	Station Setup.....	2-1
2.1.3	Coordinate Systems.....	2-2
2.1.4	Instrument Selection	2-2
2.2	Performing Survey Operations.....	2-2
2.2.1	Taking Readings	2-2
2.2.2	Topo.....	2-2
2.2.3	Set Out.....	2-3
2.2.4	Roading.....	2-3
2.2.5	COGO.....	2-3
2.2.6	Controlling Quality	2-3
2.2.7	Full Functionality.....	2-3
2.2.8	Leveling.....	2-4
2.3	Post-Survey Operations	2-4
2.3.1	File Format.....	2-4
2.3.2	Output.....	2-4
Chapter 3	GPS.....	3-1

3.1	Rover Receiver.....	3-2
3.2	Reviewing Azimuth and Elevation.....	3-3
3.3	Reviewing Geometry.....	3-3
3.4	Reviewing Differential Message Information.....	3-3
3.5	Reviewing Satellite Use.....	3-4
Chapter 4	Setting up the Instrument.....	4-1
4.1	Determining Configure Reading Parameters for RTK Surveys.....	4-2
4.1.1	Establishing Tolerances for GPS Instruments.....	4-3
4.2	Defining Unit Formats.....	4-4
Chapter 5	Taking a Reading.....	5-1
5.1	Initiating the Observation.....	5-1
5.2	Observing Offsets.....	5-2
5.2.1	Angle Offset Observations.....	5-3
5.2.2	Single-Distance Offset.....	5-4
5.2.3	Two-Distance Offset Observation.....	5-6
5.3	Averaging Multiple Observations.....	5-7
Chapter 6	Setting Out Design Coordinates.....	6-1
6.1	Working with the Set Out List.....	6-1
6.1.1	Adding Points to the Set Out List.....	6-1
6.1.2	Deleting Points from the Set Out List.....	6-2
6.1.3	Sorting the Set Out List by Azimuth.....	6-3
6.2	Staking Out a Point.....	6-3
Chapter 7	Setting Out a Line.....	7-1
7.1	Staking Out a Line.....	7-2
7.2	Staking Out Relative to a Line.....	7-4
Chapter 8	Taping from Baseline.....	8-1

8.1	Setting Out Points From a Baseline	8-2
Chapter 9	Point Projections	9-1
9.1	Projecting Points.....	9-2
Chapter 10	Setting Out an Arc	10-1
10.1	Staking Out an Arc	10-2
Chapter 11	Transformations	11-1
11.1	Using Helmert Transformation.....	11-1
11.2	Using Linear Transformation.....	11-2
11.2.1	Translation.....	11-3
11.2.2	Rotation.....	11-4
Chapter 12	Working with Survey Jobs.....	12-1
12.1	Creating a New Job.....	12-2
12.2	Opening an Existing Job.....	12-3
12.3	Reviewing Job Statistics and Renaming a Job.....	12-4
12.4	Specifying a Control Job.....	12-5
12.5	Determining Which Job Is Current.....	12-6
12.6	Deleting a Job.....	12-6
12.7	Modifying Job Settings.....	12-8
Chapter 13	Setting Up a Station and Backsight.....	13-1
Chapter 14	Observing a Remote Elevation	14-1
Chapter 15	Creating Roads	15-1
15.1	Creating a Road.....	15-1
15.2	Selecting a Road	15-2

15.3	Accessing Road Statistics and Renaming a Road.....	15-3
15.4	Deleting a Road.....	15-3
15.5	Setting Up a Road Station.....	15-4
15.5.1	Template Point by Offset and Height Difference	15-6
15.5.2	Template Point by Grade and Distance	15-7
15.5.3	Template Point by Distance and Vertical Distance	15-8
15.5.4	Template Sideslope Definition	15-9
15.5.5	Reviewing Template Definitions.....	15-9
15.5.6	Deleting a Template	15-10
Chapter 16	Setting Out Roads	16-1
16.1	Setting Out Cross-Sections	16-2
16.2	Setting Out Sideslopes.....	16-4
16.3	Staking Notes.....	16-5
16.3.1	Incremental	16-5
16.3.2	Accumulative	16-6
Chapter 17	Set Out Road Surface	17-1
Chapter 18	Road Topography	18-1
18.1	Using Road Topography.....	18-1
Chapter 19	Cross-Section Survey	19-1
19.1	Determining Survey Direction.....	19-2
19.1.1	Surveying Left to Right.....	19-2
19.1.2	Surveying Right to Left.....	19-3
19.1.3	Surveying to the Right	19-4
19.1.4	Surveying to the Left.....	19-4
19.2	Performing a Cross-Section Survey.....	19-5
Chapter 20	Building Face Survey	20-1

20.1	Surveying Vertical Planes.....	20-1
20.2	Surveying Nonvertical Planes.....	20-4
Chapter 21	Leveling.....	21-1
21.1	Using the Leveling Program	21-1
21.2	Making Reports/Adjustments.....	21-4
Chapter 22	COGO Options.....	22-1
22.1	Calculating an Inverse.....	22-1
22.2	Calculating and Subdividing Areas	22-2
22.2.1	Subdividing by Rotating from a Fixed Point.....	22-6
22.2.2	Subdividing with a Line Parallel to an Existing Line.....	22-8
22.3	Intersections.....	22-10
Chapter 23	The SDR Database	23-1
23.1	Viewing the Database.....	23-1
23.1.1	Searching by Point or Feature Code	23-2
23.1.2	Opening a Record for Viewing.....	23-2
23.1.3	Editing Notes and Codes.....	23-3
23.1.4	Reviewing Observation Records in the Database.....	23-3
23.1.5	Reviewing Records with Transformation Reduction.....	23-6
23.2	Searching for Coordinates	23-7
23.3	Using Coordinate Search Logic.....	23-7
23.3.1	SDR Search Rules.....	23-8
Chapter 24	Basic Operations.....	24-1
24.1	Reviewing the Welcome and Home Screens	24-2
24.2	Using the Keyboard.....	24-3
24.2.1	Function and Character Keys.....	24-3
24.2.2	Softkeys	24-4

24.3	Understanding the SDR Menu Structure	24-4
24.3.1	Functions Menu	24-6
24.3.2	Survey Menu	24-6
24.3.3	COGO Menu	24-6
24.3.4	Road Menu	24-7
24.4	Customizing the SDR Software	24-7
24.4.1	Customizing Menus	24-7
24.4.2	Customizing Menu Options.....	24-8
24.4.3	Customizing instrument Selections	24-8
24.4.4	Restoring Menus, Options and Instruments	24-9
24.5	Entering Data.....	24-9
24.5.1	Field Types	24-10
24.5.2	Point IDs.....	24-11
24.5.3	Angles.....	24-12
24.5.4	Latitude, Longitude, and Height.....	24-12
24.5.5	Notes.....	24-14
24.6	Understanding System Messages.....	24-15

Chapter 25 Communications 25-1

25.1	Communications Hardware and Parameters	25-1
25.1.1	Setting SDR Communication Parameters	25-2
25.2	Printing Data.....	25-4
25.3	Transferring Data Files.....	25-5
25.3.1	Sending Data to a Computer	25-5
25.3.2	Receiving Data Files from a Computer	25-6
25.3.3	Specifying the Format of Observations	25-6
25.4	Using a Modem	25-7

Appendix A Instrument settings A-1

A.1	Sokkia Instruments	A-1
A.1.1	Single Direction Communication	A-1
A.1.2	Two-Way SETs.....	A-2

A.2	Non-Sokkia Instruments	A-4
A.2.1	Geodimeter	A-4
A.2.2	Laser Atlanta Optics.....	A-4
A.2.3	Laser Technologies	A-4
A.2.4	Nikon Instruments	A-4
A.2.5	Pentax Instruments.....	A-5
A.2.6	Topcon Instruments	A-5
A.2.7	Wild Instruments.....	A-5
A.2.8	Zeiss.....	A-5

Glossary	G-1
-----------------	-------	------------

Index	I-1
--------------	-------	------------

Figures

5.1	Direction to prism from the target point	5-4
5.2	Horizontal/vertical angles and slope distance calc.	5-5
5.3	Two-distance offset.....	5-6
5.4	Comparing previous data and current observation	5-7
7.1	Setting out a line.....	7-1
8.1	Measurements from a baseline.....	8-1
9.1	Point projections.....	9-1
10.1	Arc details	10-1
19.1	Survey cross-section by walking the min. distance	19-1
19.2	Survey cross-sections from the centerline out	19-2
19.3	Direction specified left to right	19-3
19.4	Direction specified right to left	19-3
19.5	Direction specified right.....	19-4
19.6	Direction specified left.....	19-4
20.1	Building face survey	20-1
22.1	Calculating and subdividing areas.....	22-3
22.2	Subdividing lines	22-3
22.3	Parallel subdivision lines	22-4
22.4	Fixed point subdivision.....	22-7
22.5	Complete subdivision.....	22-7

Chapter 1

Welcome

Welcome to SDR[®] Level 5 software, Sokkia's complete field data collection solution. This introduction will give you a tour of SDR functionality, including:

- Document conventions
- Technical support

SDR Level 5 software combines traditional SDR functionality with seamless GPS RTK capabilities on the intuitive Windows CE platform.

1.1 Document Conventions

The following conventions are used in this manual:

1.1.1 *Typefaces*

Main Menu ... Indicates menu bar options and functions

| This symbol is used to separate menu bar options from menu item selections. For example: **File** | **Save**

Dialog box Indicates a small box, opened during interaction with the software, that contains command buttons and options you can select to perform tasks. Dialogs are always shown in title case, bold, italic font. For example, **Save As** dialog box

Fields Indicates options or boxes within a dialog box. Fields are always shown in bold, italic font. For example, **File name** dialog box

- Tabs** Indicates pages in a multi-page dialog box. Tabs are always shown in bold font. For example, **General**
- List**..... Indicates a field, on a dialog box, that expands to offer several options. Lists are always shown in bold, italic font. For example, ***Antenna Model*** list
- Button** Indicates a command button on a dialog box. Buttons are always shown in angled brackets and bold font. For example, **<Close>** button
- Prompt**..... Represents screen prompts and other information displayed on the screen. Prompts are shown in bold, 8pt, helvetica font. For example, **Continue** prompt
- Key** Indicates a keyboard key that causes an immediate action. Keys are always shown in angled brackets and bold font. For example, **<1>**, **<F1>**, **<ESC>**, **<Y>**
- Print** Represents reports or output to a printer. Print is shown in 8pt, courier font. For example, *Report 1*

☒ **Note:** A note box contains text which explains previous text.

**WARNING**

Warning indicates danger to the user.

1.1.2 Technical Support

Technical support for this product is available from your distributor. You also may contact one of the Sokkia subsidiaries listed below. POINT, Inc. welcomes written communications regarding its products.

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Chapter 2

Software Overview

The SDR[®] Electronic Field Book[®] is designed with you in mind. All options use the standard SDR[®] Level 5 functionality making surveying and data collection simple and efficient.

The SDR's functionality will make data collection easier and quicker, while increasing the productivity of your instrument for topographic surveys, setting out, and coordinate geometry (cogo) operations. As well, the SDR is a convenient link to Sokkia software, office-based mapping and design programs, and other software packages.

2.1 Pre-Survey Operations

Successful surveys begin with set up operations. The SDR Level 5 leads you through each step of the setup process quickly and easily.

2.1.1 *Project Management*

All projects are managed within the context of a job stored in the SDR database. Settings are remembered from job to job, so it is unnecessary to set them for each new job. If you are performing an initial traverse operation and then returning for detail pick up, there is no need to switch between jobs.

2.1.2 *Station Setup*

Before taking a reading, you are prompted for a station setup and confirmation of a station and backsight. You can supply coordinates by selecting a point previously observed with a total station or by direct keyboard input. Coordinates or azimuth are required, but they do not need to be known.

2.1.3 **Coordinate Systems**

With the added functionality of selectable systems, the SDR Level 5 provides a seamless transition between GPS/RTK and total station operations. You can designate coordinate systems during job creation.

2.1.4 **Instrument Selection**

The SDR Level 5 works with a variety of total stations, levels, and other instruments. You can change instruments as often as necessary.

The settings established in the **Instrument Setup** screen are stored with your job file. Whenever you change instruments, the SDR will store a new instrument record with the new instrument type and associated settings.

2.2 **Performing Survey Operations**

After the initial setup, you can immediately begin to perform your survey or set out points.

2.2.1 **Taking Readings**

The SDR provides several options to ensure accurate readings. If you are unable to actually set up on the point to be observed, the SDR Level 5 enables you to perform several different kinds of offsets. To further increase the accuracy of your survey, you can take multiple observations to a point and calculate inherent error and corrected calculations.

2.2.2 **Topo**

The SDR Level 5's **Topography** program enables you to collect data on physical elements within an area. The **Topography** program can be used for a variety of different surveys including boundary surveys, cadastral (plot) surveys, contour surveys, and two and three dimensional surveys.

2.2.3 **Set Out**

Setting out can be used for a variety of applications. The SDR Level 5 can be used before construction to initially set out a design or you can double check locations against a design during and after construction.

2.2.4 **Roading**

All options needed to survey, define, and set out a road are contained in the SDR Level 5's **Roading** menu. This feature makes roading quick and efficient using standard SDR workflow - sharing similarities with other SDR options.

2.2.5 **COGO**

The **COGO** menu of the SDR Level 5 provides several options to perform coordinate geometry calculations, including inverses, areas and intersections. You can use these tools to calculate distances, azimuths and coordinates separately from traditional SDR Level 5 methods.

2.2.6 **Controlling Quality**

You have control over the quality of readings by setting survey job tolerances. You can automatically end an observation based on the quality of the solution or choose to manually end the observation.

Through the **Configure Reading** screen, you have the advantage of setting work standards from job to job. The system will remember the parameters set during a previous survey.

2.2.7 **Full Functionality**

The SDR Level 5 delivers multiple options in a single package. The SDR Level 5 can handle nearly any survey operation under any condition.

2.2.8 *Leveling*

Digital or manual levels can be used with the SDR Level 5 to perform differential leveling. By using the ***Leveling*** option to collect accurate elevations, you can improve the accuracy of your survey jobs.

Elevations recorded from the ***Leveling*** option can be used to correct existing data in the SDR database.

2.3 Post-Survey Operations

Your collected data is ready for immediate transfer to a desktop computer or a printer.

2.3.1 *File Format*

Data is stored in the industry-standard SDR file format. You can export files directly to any software package that recognizes SDR files.

2.3.2 *Output*

You can also choose to send SDR jobs to Sokkia's ProLINK desktop software. With ProLINK's Conversion Definition Manager, you can import, convert, edit, reduce, and export a variety of raw data formats. ProLINK's functionality as an intelligent editor for survey data is enhanced by the ability to convert to and from a wide range of file formats.

Chapter 3

GPS

In this chapter

- Rover receiver
- Reviewing azimuth and elevation
- Reviewing geometry
- Reviewing differential message use
- Reviewing satellite use

The GPS Status screens are available to review current conditions and information about the RTK solution.

The status screens provide information such as RMS and DOP values, satellite position and usage, differential or RTK signals, and both rover and base positions, including rover navigation information. These screens enable you to easily determine if conditions and quality are sufficient for the particular observation.

Five status screens are available, which are selected via the softkeys at the bottom of each screen. The last status screen viewed will display when the status screens are initially accessed. The five status screens are:

- **current position**
- **azimuth/elevation**
- **geometry**
- **differential**
- **satellite use**

3.1 Rover Receiver

Initially, the **Current Position** screen displays the current coordinates, speed and direction of the rover receiver.

- **North**
- **East**
- **Ant Elev**
- **Gnd Elev**
- **Speed**
- **Direction**

☒ **Note:** If a plane projection has not been created by initiating the first GStn setup in the current job, then the Lat/Long values will display. Otherwise the current position is based on the determined vector added to the last GStn and transformed based on the most recent calibration.

To toggle between the base and rover receiver information from the **Current Position** screen, use the <→> and <←> keys. The **GPS Stn Position** screen displays the coordinates of the current GPS station.

- **North**
- **East**
- **Elev**

☒ **Note:** If a plane projection has not been created by initiating the first GStn setup in the current job, then the Lat/Long values will display. Otherwise the base position is based on the coordinates to the initial GStn setup.

3.2 Reviewing Azimuth and Elevation

The *Az/El* screen, accessed by the <AZ/EL> softkey, shows satellites tracked by both the base and the rover receivers, indicating those satellites common to both receivers. It also provides information on the azimuth and elevation of the satellite, as well as the signal-to-noise ratio of the L1 frequencies.

The columns display the following fields:

- **Sat**
- **Az**
- **El**
- **N1**
- **Rcv**
- **B=base**
- **R=rover**

3.3 Reviewing Geometry

The *Geometry* screen, accessed via the <GEOM> softkey, displays information related to the quality of the GPS signal being received.

- **PDOP**
- **HDOP**
- **VDOP**
- **HRMS (m)**
- **VRMS (m)**
- **3DRMS (m)**

3.4 Reviewing Differential Message Information

The *Differential* screens, accessed by the <DIFF> softkey, displays information about the differential message sent from the base receiver to the rover receiver.

- **Com sats**
- **Amb status**

The following are receiver specific:

- **BPS age (s)**
- **BPS warn**
 - No ref coord**
 - No ref ant**
 - No ref raw**
 - Bad ref pos**
 - No ref L2**
- **DBEN latency**

3.5 Reviewing Satellite Use

The <SAT> softkey accesses the *Satellite Usage* screen which displays the health and status of each of the satellites in column format.

The leading character in the column indicates the following (if no leading character displays, then the satellite is not tracked by either receiver):

- B(base)
- R(rover)
- C(common is receiver specific)

The trailing letters in the column indicates the following health status:

- H = Healthy
- U = Unhealthy

Chapter 4

Setting up the Instrument

In this chapter

- Determining configure reading parameters for RTK surveys
- Defining unit formats

The SDR can work with a variety of total stations, GPS receivers, and other instruments. You can change instruments as often as necessary. As you switch instruments, select the new instrument type in the ***Instrument Setup*** screen. The following screens will be displayed:

- **Model**
- **Rcvr mode**
- **Base Elev Mask (Base receiver only)**
- **Store obs**
- **Description**
- **Serial No.**

☒ **Note:** The rover's elevation mask is determined in the ***Configure Reading*** screen.

Antenna Setup

Pressing the <ANT> softkey in the ***Instrument Setup*** screen will access the ***Antenna Setup*** screen. You will see the following:

- **Antenna type**
- **Ant meas method**
- **Vertical offset (mm)**
- **Radius (mm)**

4.1 Determining Configure Reading Parameters for RTK Surveys

☒ **Note:** GPS/RTK Receiver settings located in *Configure Reading* will not be applied unless a receiver is connected and a job is open when the screen is accepted.

1. Select single observations or cont. readings from the configure reading screen.
2. Type your parameters in the following fields:
 - Type
 - Auto pt ID (job dependent)
 - GPS view stored
 - Epoch rate (s)

☒ **Note:** The SDR must be physically connected to the base receiver in order for the epoch rate to be changed. You can then access and toggle the epoch rate setting.

- End obsvn
- # of epochs
- Accept float sol
- Amb fix mode
- Elev mask

☒ **Note:** The base receiver's elevation mask is determined in the *Instrument Setup* screen.

- Dynamics
- Fast Solution
- Code list active
- Info blocks
- Code fields
- Beep on epoch
- S-O points
- S-O align

- **Cont record rate**
- **Dist exclusion**
- **Cont reading**
 - Yes - Continuous Reading**
 - No - Single reading**

4.1.1 *Establishing Tolerances for GPS Instruments*

The SDR checks the current status and observations for consistency within specified tolerances. You can set tolerances for various satellite conditions and RTK solution parameters.

These tolerances, in conjunction with Configure Reading settings gives you control over the quality of data associated with observations.

Note: Tolerances can be accepted without being connected to a receiver.

The following tolerances are to be used to warn when observed data fails to meet your specified standards or tolerances.

- **Type**
- **3DRMS (m)**
- **HRMS (m)**
- **VRMS (m)**
- **Com sat**
- **PDOP**
- **HDOP**
- **VDOP**
- **Radio link**
- **warn**

4.2 Defining Unit Formats

The SDR can use different measurement units in different work environments. Units can be changed at any time without invalidating stored data. For example, if a coordinate in the SDR has an elevation of 100.000 meters, that elevation would automatically change to 328.084 feet when the units are changed.

The following are available modifiers:

- **Angle**
- **Dist**
- **Pressure**
- **Temperature**
- **Coord**

☒ **Note:** The conversion factors are $90^\circ = 100$ gons and $90^\circ = 1,600$ mils.

The modified options are:

- **N-E-Elv**
- **E-N-Elv**
- **Other grades**

By accessing the above modified options you then have the options below available:

- **Ratio**
- **Percent**
- **Sideslope grade**
- **Stationing**
- **Dec shown**
- **Zero Azimuth**
- **Speed**

Chapter 5

Taking a Reading

In this chapter

- Initiating an observation
- Observing offsets
- Averaging multiple observations

To increase the accuracy of your survey, you can take multiple observations of a point and calculate the inherent error and corrected calculations of the point. Averaging multiple observations can assist you in collecting accurate data without performing complicated math or having to reobserve points.

5.1 Initiating the Observation

Once you have created a job and established the station and backsight, the SDR is ready to take a reading. To take a reading, or observation follow these steps.

1. Connect your instrument to the SDR using the supplied serial cable before you initiate an observation. Be sure you have selected the correct total station in the ***Instrument*** menu of your SDR.
2. Select **Topography** (or the appropriate option) from the **Survey** menu, or initiate a reading by pressing the <Read> key. The surveying instrument starts measuring, and the SDR displays the observation.

- ☒ **Note:** If you have not established a station and backsight, the SDR will display the Station Setup screen.
-
3. The SDR will display the following observation information:
- **H.obs**
 - **V.obs**
 - **S.Dist**
 - **Cd**
 - **Pt**
- ☒ **Note:** Even though the SDR is connected to a surveying instrument, it is still possible to enter values for the **H.obs**, **V.obs** and **S.Dist** fields while the instrument is taking a reading.
-
4. (*optional*) Use the three softkeys, <OFS>, <OFS-D> and <OFS-2D>, to take offset measurements.
5. (*optional*) Use the <ANGLE> softkey to initiate an angles-only (theodolite mode) reading, and use the <CNFG> softkey to access the **Configuration** menu.
6. Press <OK> to end the observation. The SDR displays **Input accepted** and returns to the **Take BS reading** screen.
- ☒ **Shortcut:** Press <Read> to store the observation and initiate another reading.
-

5.2 Observing Offsets

If you are unable to set up directly on the desired point, you can perform an offset. Offsets measure the distances and azimuths to the desired point and use geometrical formulas to derive the desired points. Three types of offsets are available for topographical (and other) observations.

- **Angle offset**

- **Single-distance offset**
- **Two-distance offset**

5.2.1 **Angle Offset Observations**

The angle offset observation is made with two readings. The first reading observes the vertical angle and distance observed on the prism. To take the second reading, the surveyor rotates the instrument until the target point is in sight. The surveyor then observes the horizontal offset angle. The SDR combines both readings into a single angle offset observation record.

The following steps will allow you to angle offset observations.

1. From the **Take reading** screen, press the <OFS> softkey.
2. The SDR takes the first reading (from the prism) and displays the results.
3. Press the <OK> key to accept the first reading. The SDR prompts you to take the second reading.
4. Rotate the surveying instrument until the target point is lined up in the instrument's sight. Press the <Read> key to take the second reading.
5. The SDR takes the second reading and displays the results.
6. Enter a code in the **Code** field and press the <OK> key to accept the entire reading. The SDR will return to the **Take reading** screen.

5.2.2 Single-Distance Offset

The single-distance offset is made by observing a prism at a known distance from the target point. The direction from the prism to the target is normal to, or along the line of sight from, the instrument to the prism (see Figure 5-1).

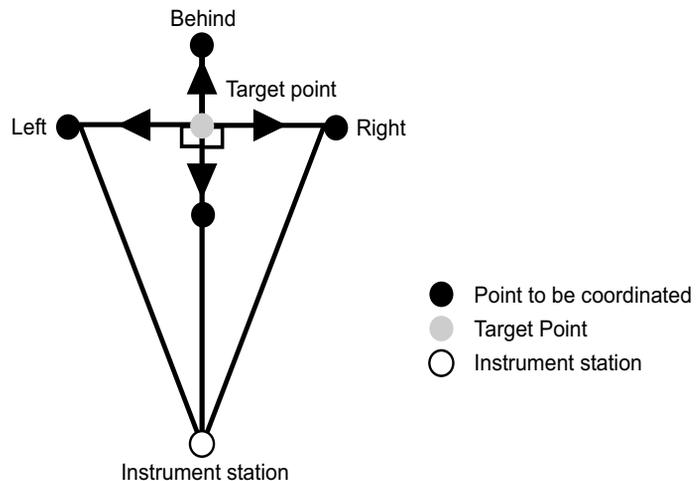


Figure 5-1: Direction to the prism from the target point

The following steps will allow you to single-distance offset an observation.

1. Initiate the single-distance offset observation by pressing the <OFS-D> softkey; the surveying instrument measures the angles and distance to the prism.
2. Enter the Ofs dist and the Dirn to prism.

Interpret the arrow direction from the perspective of the instrument operator as follows:

- Right arrow — prism is to the right of the target point
- Down arrow — prism is in front of the target point

Up arrow — prism is behind the target point
 Left arrow — prism is to the left of the target point.

Use the left and right arrow keys to select the correct direction towards the prism and press <Enter>.

- Once the fields and the measurements are entered, press <OK>. A Note record (example shown below) is generated showing the original measurements and the offset distance and direction used in the calculation. See Figure 5-2.

NOTE OS	100.00 90-00'00"	23-00'00" OS 3.000
Dirn <		
OBS F1 0005-1002	S.Distance 100.045	V.obs 90-00'00"
H.obs		
24-43'06"		
POS TP	North 90.878	East41.835Elev

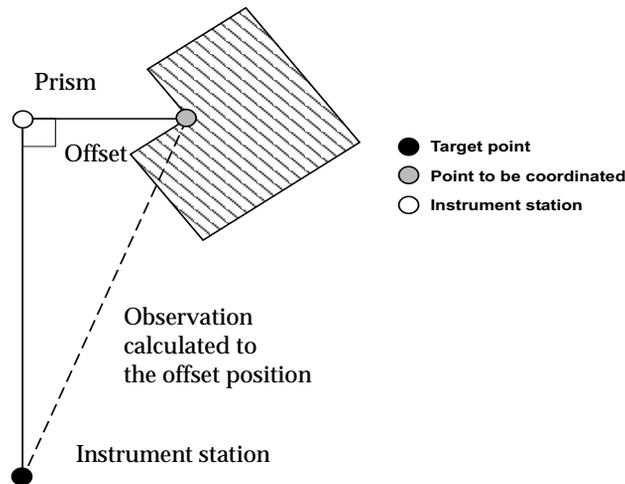


Figure 5-2: Horizontal/vertical angles and slope distance calculation

5.2.3 Two-Distance Offset Observation

The two-distance offset observation is made by using a rod with two prisms attached. The rod extends a known distance past the end of each prism. Both prisms are observed and the SDR calculates the vector between them. The vector is then extrapolated the specified distance to find the target point's coordinates.

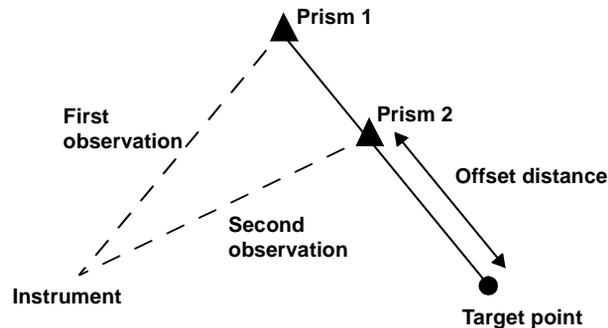


Figure 5-3: Two-distance offset

The following steps will allow you to take a two distance offset observation.

1. Sight on the first prism (furthest from the target point) and initiate the two-distance offset observation by pressing the **<OS-2D>** softkey.
2. Enter an offset distance and a code in the **Code** field. Press **<OK>** to accept the first reading.
3. The SDR prompts you for the second reading.
4. Sight on the second prism and press **<Read>**. The SDR reads the distance and direction to the second prism.

5. Press <OK> to accept the entire observation. The SDR calculates the positions of the two prisms, extrapolates the vector between them for the offset distance and calculates the observation that a prism directly on the target would have made. This calculated observation is stored in the appropriate view.



☒ **WARNING:** The target height (which is not displayed) is implicitly set to zero.

An alternative way of using the two-distance offset is to use one prism on a pole, sliding the prism toward the target for the second reading.

5.3 Averaging Multiple Observations

When you use the topography program to observe a previously observed point or a point already known to the SDR, you are shown the difference between the actual observation and the expected observation expected by SDR based on its data.

The $\Delta SDist$ field shows the difference in slope distance AB and the distance AB' (Figure 5-4). The $\Delta Azmth$ field shows the difference between the azimuth from A to B and the azimuth to the observed point B'. The $\Delta Vang$ field (not illustrated) shows the difference between the expected and observed vertical angles. The **Pt-Pt SDR** field (not illustrated) displays the slope distance between B and B'.

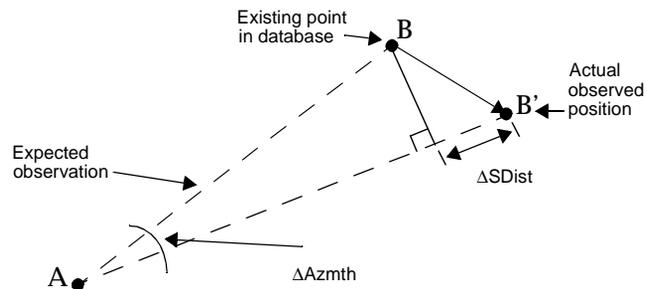


Figure 5-4: Comparing previous data and current observation

The following steps will allow you to average multiple observations.

1. Select the desired option in the **Action** field by pressing the <→> or <←> key (Some of these options may not be available if they are not relevant).

- **Store POS**
- **Store OBS**

-
- Note:** This option may be useful to observe a point within a traverse without overwriting an existing POS observation.
-

- **Check only**
- **Rename**
- **Average**
- **Average BS**

2. Press <**OK**> to continue.
3. Press <**Esc**> to ignore the observation.

Chapter 6

Setting Out Design Coordinates

In this chapter

- Adding points to the set out list
- Deleting points from the set out list
- Staking out a point

6.1 Working with the Set Out List

When setting out design coordinates, the SDR Level 5 displays a list of available points after you enter a station and backsight.

Before setting out points, review the Set Out List for accuracy and efficiency. You may want to add, remove or sort points to eliminate multiple station setups.

You can modify this list by adding points, deleting points or by sorting the points by azimuth.

6.1.1 *Adding Points to the Set Out List*

Before setting out a point, the SDR Level 5 creates a list of the desired points to set out. The default Set Out List is blank, you can add points to the list using one or more of the following options. Select the option that best suits your desired workflow.

1. Press the <INS> softkey to enter a point at a specific place in the list. The SDR Level 5 will insert a blank field in which to enter the new point ID. If the point does not exist in the job, you will be prompted to key in its coordinates.

2. Enter points to the end of the Set Out List by pressing **<Ctrl> + <↓>** to move to the bottom and entering the point ID.
3. Add all the points in the current job to the set out list by first pressing the **<ALL>** softkey. The SDR Level 5 will display a list of three options. Select **Add all POSs to list**.
4. Add a range of point names to the list by pressing the **<RANGE>** softkey.
5. After you have specified the range, the SDR Level 5 adds all the points meeting the conditions to the list.
 - **Point ID**
 - **Distance**
 - **Feature Code**
6. Press the **<OK>** key to start the range selection.
7. After entering points into the list, the cursor will be positioned at the bottom of the list. You can go to the top of the list by pressing **<Ctrl> + <↑>**. Once the set out list is complete, you can navigate to and set out your points.

6.1.2 *Deleting Points from the Set Out List*

You can remove points from the Set Out List at any time.

The following steps allow you to remove points from the set out list.

1. Select **Set out coords** from the **COGO** menu.
2. The set out point list will display. Highlight the point you wish to remove.
3. Press the **** softkey.
4. Select **Delete all from list** from the available list of options.

5. The SDR will then display the modified set out list.

6.1.3 **Sorting the Set Out List by Azimuth**

The following steps will allow you to sort a set out list by azimuth.

1. Select **Set out coords** from the **COGO** menu.
2. The set out point list will display. Press the **<ALL>** softkey to display the available options.
3. Select **Sort by Azimuth**. The SDR will display a **Working...** message that will move up and down the screen as the SDR sorts the list. A long list may take a few minutes to sort. When the sorting process is complete, the point entry list will be displayed. The point names will be in order of increasing azimuth, using the current station as the from point.

6.2 **Staking Out a Point**

The following will allow you to set out a point.

1. Select **Set Out Coords** from the **COGO** menu. The Set Out List will display.

☒ **Note:** If a current station for setting out work, and backsight orientation for the station, has not been defined, the SDR Level 5 will display the **Confirm Stn** screen.

2. Before setting out a point, review the set out list and make any necessary modifications.
3. Choose a particular point from the list of points on the screen to set out by highlighting it and pressing **<Enter>**.

The SDR Level 5 displays the information required to set out the point: the necessary horizontal and vertical angles to observe, the desired slope distance to the point, the reduced horizontal and vertical distances and the azimuth.

4. Align your instrument to the horizontal angle shown. If you are using a two-way SET, the instrument is put into a countdown mode automatically to help you. Rotate the instrument until the countdown reaches zero, then direct the prism pole in line.
5. Sight on the prism and press the **<Read>** key.

Information for setting out the plan position of the point displays in the Navigate screen. The fields display the following information:

- **Right/Left**
 - **In/Out**
 - **Cut/Fill**
 - **Aim H. obs**
 - **Aim V. obs**
6. Press **<Read>** to take as many observations to the prism as you want. After each observation, the **Left/Right, In/Out** and **Cut/Fill** fields are updated to reflect the latest position of the prism relative to the target point.
 7. When you have navigated to the desired point, press **<OK>** to set out the height. Enter information in the following fields:
 - **Fill**
 - **Aim V.obs**
 - **Cut o/s**

☒ **Note:** If you are using a two-way SET, it is automatically put into a vertical countdown mode.

8. (*optional*) Press the <**STORE**> softkey as a shortcut to immediately store the results and return to the point selection screen.
9. (*optional*) Press <**TARGET**> to initiate another reading and to enter a new target height.
10. (*optional*) Press <**Esc**> to return to setting out the plan position. This action might be necessary if the prism pole is inadvertently moved during the setting out of the elevation.
11. Press <**OK**> once a satisfactory elevation has been set out. The SDR then prepares to store the results. It will show you a default point name and code that it will use.

You can modify the target height by pressing the <**TARGET**> softkey. Store the current setout position by pressing the <**YES**> softkey on the **Store Result** screen.

12. Once the position record is generated, the SDR Level 5 returns to the Set Out List. Another point can now be selected for set out. If the list is now empty, you may add more points to the list.
13. Press <**Esc**> to exit the **Set Out Coords** option.

Chapter 7

Setting Out a Line

In this chapter

- Staking out a line
- Staking out relative to a line

The following figure shows a plan view and a profile view of setting out a line.

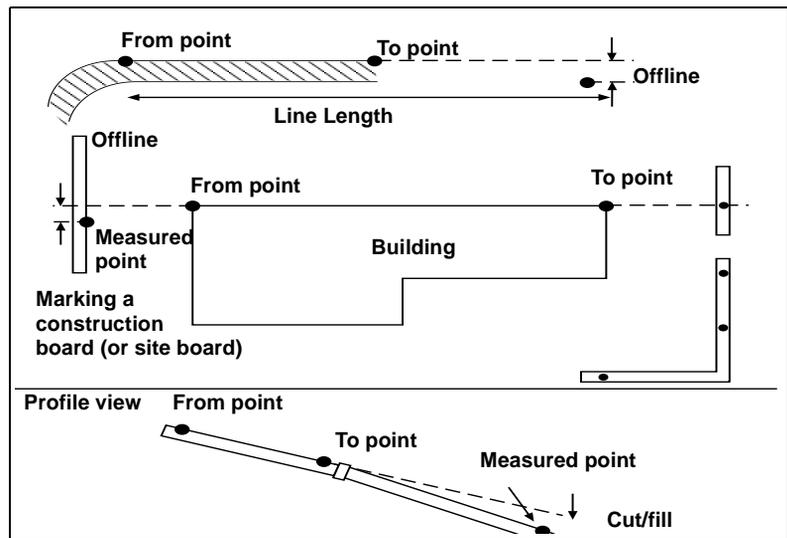


Figure 7-1: Setting out a curb line

You can use the **Set Out Line** option to set out a line or to set out relative to a line. Both procedures include these main steps:

- **Defining the baseline**
- **Selecting set out points**
- **Setting out the points**

7.1 Staking Out a Line

You can specify points along a line by a distance or a whole number of increments, including a horizontal offset to the point.

The following will allow you to set out a line.

1. Select **Set out line** from the *COGO* menu.

☒ **Note:** If a current station for the setting out work, along with the backsight orientation for the station, has not been defined, the SDR Level 5 will display the *Confirm Stn* screen.

2. The *Define baseline* screen displays. Define your baseline by specifying two points. You also can specify one point plus an azimuth, a grade or a vertical angle, to allow the setting out of points along the defined line. If an unknown point name is entered, the *Key in coords* screen will display, allowing you to enter the appropriate coordinate values. The **From** field must be entered.

Press <**READ**> to observe the current location and establish it in the baseline.

When the **Grade** field is selected, <**HORIZ**>, <**1:**> and <**%**> softkeys are presented. The <**HORIZ**> softkey will set the **Grade** field to horizontal. The <**1:**> and <**%**> softkeys control the display and entry of grade values. If desired, up or down vertical grades can also be defined by entering the appropriate vertical angle values to suit the current instrument's **V.obs** setting. For example, if the current instrument setting is for Zenith vertical angles then entering a vertical angle of 0° or 0 gons will result in the **Grade** field displaying **Up (Vert)**.

3. After defining your baseline, press <OK>. The **Set Out Line** screen will display.

Enter information in the following fields:

- **Offset**
- **Len incr**
- **Segments**
- **Line len**

-
- ☒ The < > and < > softkeys decrease and increase the current distance in the **Line len** field, for the point to be set out, by the value in the **Len incr** field.
-

4. (*optional*) The <DSGN> softkey stores the coordinates of the point to set out. Appropriate code and point numbers may be allocated to the points. The calculated values on this screen are not editable. However, if the elevation value is <Null>, you can enter an appropriate elevation value for the point.
5. Press <OK> to return to the **Set out line** screen to compute further points. You can elect to set out any specified position along the baseline by selecting the <OK> key. This will result in the point on the baseline being saved in the database followed by the presentation of the standard setting out screen.

Once the point has been set out as required, press <OK> or <STORE> to save the coordinates of the set out point. A Note indicating how far off line the set out point was from the required line is stored. A negative off line value indicates that the measured point was to the left of the required line.

6. (*optional*) If there are no specific points to set out, for example, if you are checking a curb alignment or a new pipe grade, press the <LINE> softkey.

Once you take a reading to a point you wish to check, the program will report how far off line the observed point was from the defined line. It will also report any cut or fill value from the measured point to the defined line.

7. (optional) The <**STORE**> softkey stores a POS record with the coordinates of the point measured followed by a Note containing the Off-line and Cut/Fill values as reported on the screen.

Select the <**OK**> key to complete the operation. If you have not already saved the measured position using the <**STORE**> softkey, you will be given the opportunity to record the position and Off-line and Cut/Fill Note.

8. (optional) The <**POINTS**> softkey enables you to specify points for setting out along the baseline. Press <**Esc**> to exit.

7.2 Staking Out Relative to a Line

Setting out relative to the line allows the line to be located, then provides distance and offset values to the line. This option also allows you to specify a starting distance (stationing) for the line and a horizontal offset to the line.

The following will allow you to set out relative to a line.

1. Select **Set out line** from the *COGO* menu.

☒ **Note:** If a current station for the setting out work, along with the backsight orientation for the station, has not been defined, the SDR will display the *Confirm Stn* screen.

2. The *Define baseline* screen displays. Define your baseline by specifying two points. You also can specify one point plus an azimuth, a grade or a vertical angle, to allow the setting out of points along the defined line. If an unknown point name is

entered, the **Key in coords** screen will appear, allowing you to enter the appropriate coordinate values. The **From** field must be entered.

3. Press <READ> to observe the current location and establish it in the baseline.

When the **Grade** field is selected, <HORIZ>, <1:> and <%> softkeys are presented. The <HORIZ> softkey will set the Grade field to horizontal. The <1:> and <%> softkeys control the display and entry of grade values. If desired, up or down vertical grades can also be defined by entering the appropriate vertical angle values to suit the current instrument's **V.obs** setting. For example, if the current instrument setting is for Zenith vertical angles then entering a vertical angle of 0° or 0 gons will result in the **Grade** field displaying **Up (Vert)**.

4. After defining your baseline, press <OK>. The **Set Out Line** screen will display.

Enter information in the following fields:

- **Offset**
- **Len incr**
- **Segments**
- **Line len**

☒ **Note:** The <←> and <→> softkeys decrease and increase the current distance in the **Line len** field, for the point to be set out, by the value in the **Len incr** field.

5. Select the <LINE> softkey to set out a point relative to the line.

Enter information into the available fields.

- **Offset**
- **Start distance**

6. Press <**READ**> to take a reading and display the **offline**, **In/out** and **Cut/Fill** values.
7. Press <**STORE**> to store the observation and a note record containing the cut or fill values, offline value and distance down the line, including the start distance.

Chapter 8

Taping from Baseline

In this chapter

- Setting out points from a baseline

The Taping from Baseline option enables you to specify and stake out a distance and offset along a baseline. For some instances, a plan may show corners of a building, in terms of distance and offset, from a baseline. The baseline may be defined by survey or boundary points, or two corners of the building itself. Once the two baseline points are specified, distance and offset data can be entered.

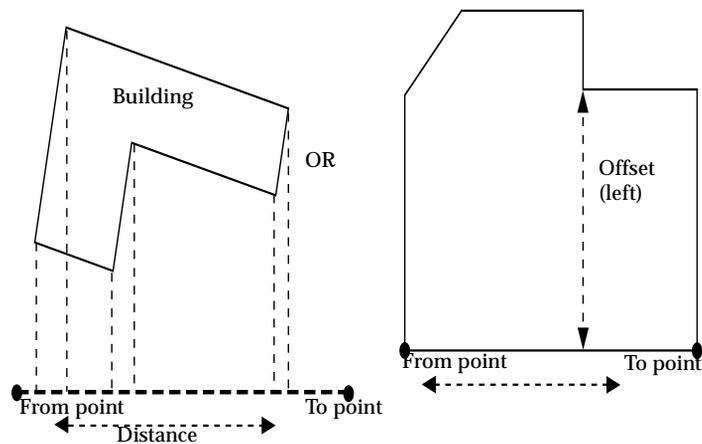


Figure 8-1: Measurements from a baseline

8.1 Setting Out Points From a Baseline

The SDR's **Taping from Baseline** option assists you in setting out points defined in relation to a line instead of coordinate values.

The following steps will show you how to set out points from a baseline.

1. Select **Taping from Baseline** from the *COGO* menu. The **Define Baseline** screen displays.

Define Baseline	
From	<input type="text"/>
To pt	<input type="text"/>
Azimuth	<Null>
V.ang	<Null>
Grade	<Null>
Read	Horizo 1: %

2. Confirm the orientation by pressing **<OK>** or entering a new GStn point ID.
3. Define the baseline by entering either two points or one point plus an azimuth, a grade, or vertical angle.

The **<READ>** softkey is available when either the **From** or **To pt** fields are selected, enabling direct readings to establish these points if desired. If an unknown point name is entered, the **Key in coords** screen will appear, allowing you to enter the appropriate coordinate values. The **From** field must be entered.

When the **Grade** field is selected, **<HORIZ>**, **<1:>** and **<%>** softkeys are presented. The **<HORIZ>** softkey will set the Grade field to horizontal. The **<1:>** and **<%>** softkeys control the display and entry of grade values. If desired, up or down vertical grades can also be defined by entering the appropriate vertical angle values to suit the current instrument's **V.obs** setting. For example, if the current instrument setting is for Zenith vertical angles then entering a vertical angle of 0° or 0 gons will result in the **Grade** field displaying **Up (Vert)**.

4. Press <OK> after the baseline definition has been completed, the **Taping from Baseline** screen displays.

The fields display the following information:

- Dist
- Offset
- d. Elev

5. (*optional*) Press the <STORE> softkey to store a record of the calculated point. Enter a point ID, feature code and elevation if desired.
6. (*optional*) Press the <S-O> softkey to store and stake out the calculated point. The SDR will display the Store Reading screen where you can enter a point ID, feature code and elevation.
7. Press <OK> to continue to the Set Out Coords screen.
8. Select <Esc> to exit the **Taping from Baseline** option.

Chapter 9

Point Projections

In this chapter

- Projecting points

The Point Projection option projects a point onto a line or arc. It calculates distance and offset of a point relative to the specified baseline (or arc), and it computes the coordinates of the intersection point, which can then be directly set out. Elevations are interpolated where possible.

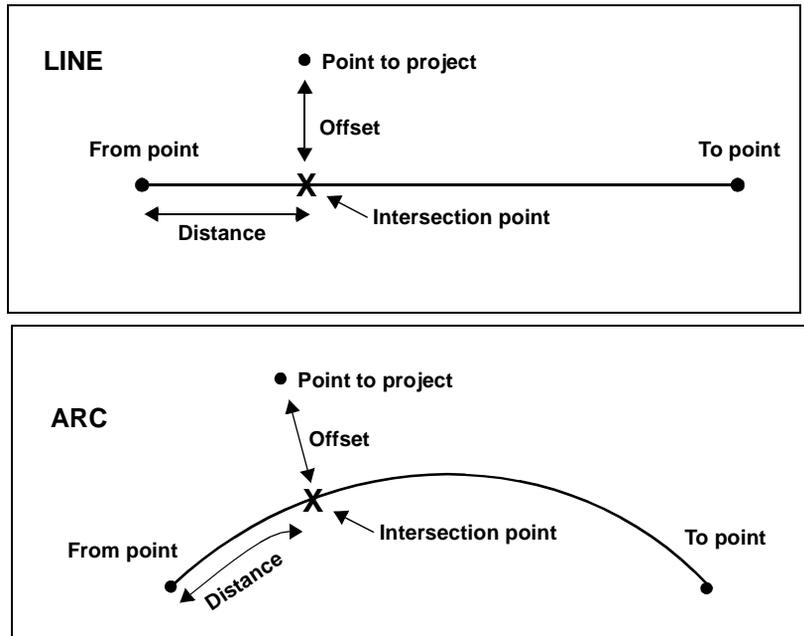


Figure 9-1: Point projections

9.1 Projecting Points

You can project points onto a line or an arc with the SDR.

The following steps will show you how to project points.

1. Select **Point Projection** from the **COGO** menu.
2. Confirm the orientation and press <OK>. The **Define Baseline** screen displays.

Define Baseline	
From	<input type="text"/>
To pt	<input type="text"/>
Azimuth	<Null>
V. ang	<Null>
Grade	<Null>
Read	Horizo
1:	%

-
- ☒ **Note:** If a current station for the setting out work, along with the backsight orientation for the station, has not been defined, you will be prompted to enter this information prior to the display of the **Define baseline** screen.
-

3. Define the baseline or arc by toggling the <ARC>/<LINE> softkey.

The <READ> softkey is available when either the **From** or **To pt** fields are selected, enabling direct readings to be taken to establish these points if desired. If an unknown point name is entered, the **Key in coords** screen will appear, allowing you to enter the appropriate coordinate values. The **From** field must be entered.

When the **Grade** field is selected, <HORIZ>, <1:>, and <%> softkeys are presented. The <HORIZ> softkey will set the Grade field to horizontal. The <1:> and <%> softkeys control the display and entry of grade values. If desired, up or down vertical grades can also be defined by entering the appropriate vertical angle values to suit the

current instrument's **V.obs** setting. For example, if the current instrument setting is for Zenith vertical angles then entering a vertical angle of 0° or 0 gons will result in the **Grade** field displaying **Up (Vert)**.

4. (optional) If you wish to project a point onto an arc, press the <ARC> softkey. The **Define Arc screen** displays.

Enter information in the following fields:

- **Direction**
- **From** (required)
- **To pt** (optional)
- **Center** (optional)
- **Radius** (optional)
- **Angle** (optional)
- **Arc len** (optional)
- **Chord In** (optional)
- **Tan len** (optional)
- **Back tan** (optional)
- **Intersect pt** (optional)

- ☒ **Note:** The **From** field plus one of the other point fields **MUST BE ENTERED**. If points are specified for three of the four possible point fields, the arc details will be computed from the relationship of these points. Otherwise one of the arc definition fields (**Radius**, **Angle**, **Arc len**, **Chord In**, **Tan len** or **Back tan**) can be entered to fully define the arc.

5. Press <OK> after the baseline or arc definition has been completed, the **Point Projection** screen displays.

Enter the point ID you wish to project.

-
- Note:** The <READ> softkey is displayed when the **Pt** field is selected, allowing an instrument reading to a new point to be taken directly. If this <READ> key is selected, the result of the previous calculation will be saved, if applicable.
-

6. Press <Read> to initiate a new reading.

Review the information displayed in the following fields:

- Pt
- Dist
- Offset
- Δ Elev
- Ambiguity
- 3DRMS

-
- Note:** Press <Esc> at any time to discard the current reading and return to the Point Projection Point List screen.
-

7. The <INTERSEC> softkey allows you to compute and save the perpendicular intersection point on the baseline or arc. If you press the <INTERSEC> softkey, a screen is displayed which shows the computed coordinates for the intersection point. You can enter an appropriate code for the point if desired and also change the point number. If the elevation for the intersection point cannot be interpolated, it is displayed as <Null> and you may enter an appropriate value if known.
8. Choose from the following softkeys and options:

- Press **<OK>** or the **<STORE>** softkey to save details of the point projection carried out as Notes in the SDR database. The point number of the projected point, along with the **Dist** and **Offset** values, are recorded in a single Note record. The **d.Elev** value is recorded in a second Note if the value was not **<Null>**.
- The **<S-O>** softkey allows you to directly set out the computed intersection point. You are presented with the standard setting out options once the **<S-O>** softkey has been pressed.

Chapter 10

Setting Out an Arc

In this chapter

- Staking out an arc

In this chapter you will learn how to stake out an arc, which is similar to setting out coordinates or a line. If you have further questions please refer to the *SDR Level 5's Reference Manual*.

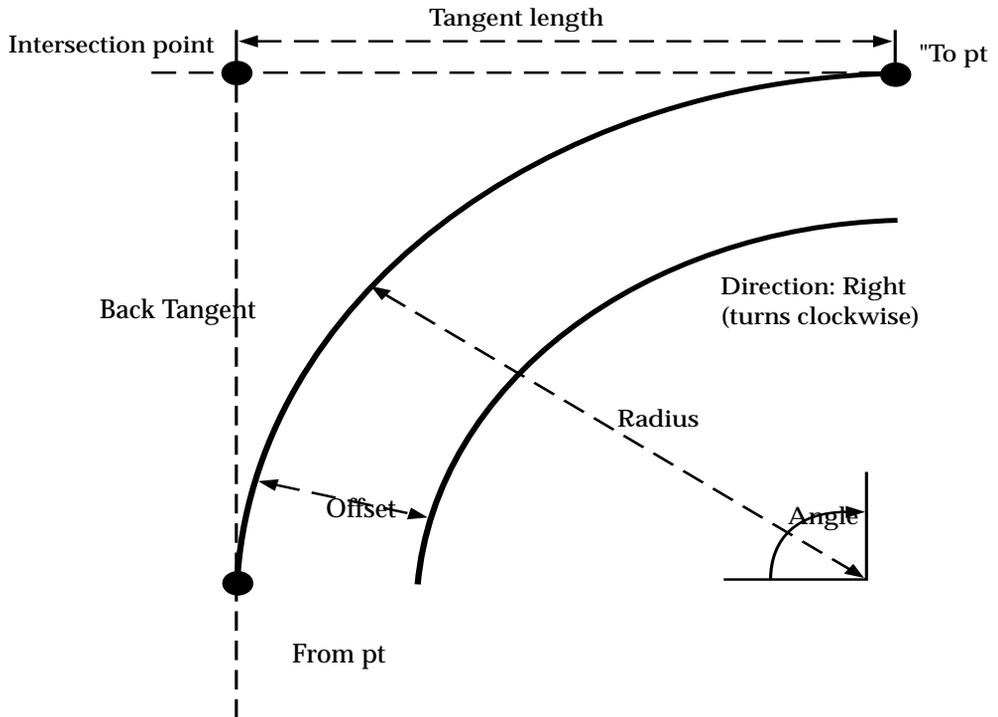


Figure 10-1: Arc details

10.1 Staking Out an Arc

Setting out an arc is similar to setting out coordinates or a line.

The following steps will allow you to set out an arc.

1. Select **Set out arc** from the **Functions** menu. The **Define arc** screen displays.

The **Arc len** field displays the arc length from the From point to the point to be set out. You can enter into the **Arc len** field the appropriate arc length to the point to be set out or you can use the other fields on the screen to determine the arc length.

Define your baseline by specifying two arcs. You can also specify one arc plus an azimuth, a grade or a vertical angle, to allow the setting out of arcs along the defined line.

2. The **Define Arc** screen displays.

Enter the appropriate arc settings in the following fields:

- **Direction**
- **From**
- **To pt** (*optional*)
- **Center** (*optional*)
- **Radius** (*optional*)
- **Angle** (*optional*)
- **Arc len** (*optional*)
- **Chord ln** (*optional*)
- **Tan len** (*optional*)
- **Back tan** (*optional*)
- **Intersect pt** (*optional*)

☒ **Note:** If points are specified for three of the four possible point fields, the arc details will be computed from the relationship of these points. Otherwise one of the arc definition fields (**Radius, Angle, Arc len, Chord ln, Tan len** or **Back tan**) can be entered to fully define the arc. The values for the rest of the fields are calculated and displayed (except for the point fields).

3. (*optional*) The <**READ**> softkey appears when the cursor is on any of the point name fields, to enable direct readings to be taken to establish these points if desired.

If an unknown point name is entered, the **Key in coords** screen will appear, allowing you to enter the appropriate coordinate values.

☒ **Note:** The <**Read**> key on the keyboard can also be used. Pressing <**Read**> will take a reading directly without requiring confirmation of the station and backsight points.

4. Once the arc has been defined, the <**CREATE**> softkey will appear when the cursor is placed on the **Intersect pt** field. If this softkey is selected, the computed coordinates for that point will be stored.

You are given the opportunity to view the calculated coordinates and assign an appropriate code and point name to the point. If the elevation value is <**Null**> you are able to enter an appropriate elevation into the field.

☒ **Note:** This option can be useful for calculating the IP or center point of an arc.

5. When <**OK**> is pressed, the **Set out arc** screen displays. Review the information in the following fields:

- **Offset**
- **Len incr** (Length increment)

- **ΔChordarc**
- **Segments**
- **Set out point at Arc len**

☒ **Note:** The < > and < > softkeys decrease and increase the current arc length (or chord length) to be set out by the value in the **Len incr** field.

6. (optional) Press the <**CHORD**> softkey to set out points along the arc to achieve defined chord lengths rather than arc lengths.

For example, if you want to set out points around an arc so that the chord length between the points is 50 feet, select the <**CHORD**> softkey and enter 50 into the **Len incr** field. Select the <**ARC**> softkey to return to defining the set out points in terms of arc lengths.

7. (optional) Press <**STORE**> to store the coordinates of calculated points along the arc. Appropriate code and point numbers may be allocated to the points. The calculated values on this screen are not editable. However, if the elevation value is <**Null**>, you can enter an appropriate elevation value for the point.
8. Press <**OK**> when you are finished defining the arc to return to the Set out arc screen. You can elect to set out any specified position along the arc by selecting the <**OK**> key. This will result in the point on the arc being saved in the database followed by the presentation of the standard setting out screen.
9. Press <**Esc**> to exit the **Set out arc** option.

Chapter 11

Transformations

In this chapter

- Using helmert transformation
- Using linear transformation

The SDR can compute a Helmert or linear transformation to transform a survey job from one coordinate system to another using coordinate geometry. The two transformations use different methods to recalculate the coordinates into the new coordinate system. You can select the transformation best suited to your survey needs.

11.1 Using Helmert Transformation

The Helmert transformation uses the least squares method to transform the coordinates. To carry out a Helmert transformation you must first create a new job containing the correct datum coordinates of the control points.

The following steps will show you how to perform a Helmert transformation.

1. Create a new job to hold the control points by selecting **Job** from the *Functions* menu.
2. Using the **Keyboard Input** option, enter the correct datum coordinates of the control points.
3. Select **Transformation** from the *COGO* menu.
4. Select **Helmert transform** from the menu and press <OK>.

5. Select the job you want to transform and press <OK>. The SDR will use the job you created in step 1 to store the transformed coordinates.

The SDR will search for any point names common to both jobs, and compare the coordinates in both jobs. It uses the coordinates of the equivalent points in the two jobs to calculate the best transformation Helmert parameters using least squares methods. Once this process is complete, the average deviation error is shown, as a result of the least squares calculation from the redundant data supplied.

6. If an unacceptably large error is calculated, press <Esc> to escape.

Each uncommon point in the selected coordinate system job will be transformed and stored in the new job (job created in steps 2-6). This process may take some time for large jobs. Each point number is shown as it is transformed. The control points common to both jobs are not transformed, as they already exist in both jobs. This also preserves the accuracy of the control points.

11.2 Using Linear Transformation

The linear transformation is a “simple” transformation, avoiding the use of least squares. The linear transformation performs a translation, rotation or both to the coordinates in the selected job.

The following steps will show you how to use a linear transformation.

1. Create a new job to hold the control points by selecting **Job** from the **Functions** menu.
2. Using the **Keyboard Input** option, enter the correct datum coordinates of the control point.
3. Select **Transformation** from the **COGO** menu.
4. Select **Linear transform** from the menu options and press <OK>.

5. Highlight the job you wish to transform and press <OK>.
6. The **Linear Transformation** screen will display.

Enter information in the following fields:

- ΔNorth**
- ΔEast**
- ΔElev**
- Rot Pt**
- Rotation**
- Scale**

☒ **Note:** When calculating the rotation in a linear transformation, you will receive an Invalid Input message if the calculated angle is -100 degrees or more.

7. (*optional*) Press the <OPTNS> softkey to review and edit the transformation options. You can perform either a translation transformation, a rotation transformation or both.

11.2.1 Translation

If you wish to perform a translation transformation, toggle the **Options** field to **Translate**. Enter information in the following fields of the **Transformation Options** screen:

- Pt**
- Org.N**
- Org.E**
- Org.El**
- Dest.N**
- Dest.E**
- Dest.El**

- ☒ **Note:** If you enter a point ID that exists in the database, the SDR will automatically populate the fields with the stored coordinates.
-

11.2.2 *Rotation*

If you wish to perform a rotation transformation, toggle the **Options** field to **Rotation**.

Enter information in the following fields of the **Transformation Options** screen:

- **RotPt**
- **Old Azim** (*optional*)
- **From**
- **To Pt**
- **New Azim** (*optional*)
- **From**
- **To**

- ☒ **Note:** If you enter a point ID that exists in the database, the SDR will automatically populate the fields with the stored coordinates.
-

8. Press <**OK**> to initiate the linear transformation. The SDR will calculate the transformation.
9. A note record is stored stating which job was transformed. The new job (created in step 2-6) will contain the transformed points.
10. Press <**Esc**> to exit Transformation.

Chapter 12

Working with Survey Jobs

In this chapter

- Creating a new job
- Opening an existing job
- Reviewing job statistics and renaming a job
- Specifying a control job
- Determining which job is current
- Deleting a job
- Modifying job settings

Before you can perform a survey, you must create a job file. The SDR stores all the information associated with the survey in the job file, including points, Configure Reading parameters, unit settings and other user-defined parameters. You can store multiple jobs on the SDR, limited only by the amount of memory available.

12.1 Creating a New Job

The following steps will show you how to create a new job.

1. Select the **Job** option from the **Functions** menu. The **Select Job** screen displays.

-
- ☒ **Note:** If no jobs are created in the SDR, the **Create Job** screen appears when you select **Job** from the **Functions** menu.
-

2. Press the <NEW> softkey to display the **Create Job** screen.

3. Enter information in the following fields.

- **Job**
- **Select XFM** (*cannot be changed later*)
- **Point ID**
- **Trans.**
- **Description** (*display only*)
- **Zone**

- **Point ID** (*Cannot be changed later*)
 - Numeric** (4)
 - Alpha** (14)
- **Plane Curvature**
- **Record elev** (*Cannot be changed later*)

Note: If you choose to use alphanumeric point names, verify that your office software will process them correctly (The output formats differ from the SDR2x formats).

Note: When **Record elev** is set to **No**, any corrected records are given a vertical angle of 90°. This forces all subsequent calculations to take place in two-dimensional (horizontal) space.

4. Once you have set these job parameters, press <OK> or <Enter>. The **Note** screen displays.
5. Enter your note records. The number of notes you can enter is limited only by available memory. Press <Enter> or <OK> to accept and store the note records.

12.2 Opening an Existing Job

The following steps will show you how to open an existing job.

1. Select **Job** from the **Functions** menu. The **Select job** screen displays.
2. Use the <↑> and <↓> keys to highlight the desired job.
3. When a job name is highlighted, press the <VIEW> key to review and verify the job and data.
4. Press <Esc> or <OK> to return to job selection.
5. Press <Enter>. The selected job will become the current job.

12.3 Reviewing Job Statistics and Renaming a Job

You can review current information and rename the current job in the **Job Statistics** screen. This screen is accessed from the **Select Job** option of the **Functions** menu. The <STAT> softkey will display the job statistics for the job currently highlighted on the **Select Job** screen.

Job Statistics	
ID	j
Job size (k)	2
Recs used	5
Date	Oct-26-00
Time	18:25:13
Point count	0

The **Job Statistics** screen contains the following fields:

- **ID**
- **Job size (k)** (*display only*)
- **Recs used** (*display only*)
- **Date** and **Time** (*display only*)
- **Point count** (*display only*)

☒ **Note:** You can also rename the current job in the **Job Settings** screen.

Press <OK> or <Esc> to return the **Select job** screen.

☒ **Note:** You can also rename a job in the **Job Settings** screen, accessed from the **Functions** menu.

The following steps will show you how to rename a job.

1. Select **Job** from the **Functions** menu. The **Select Job** screen displays.
2. Highlight the name of the job in the **Select Job** screen.

3. Press the <STAT> softkey to display the job statistics.
4. The **ID** field presents the current name for the job. You can edit this field to enter the new name for the job.
5. Press the <Enter> or <OK> key to complete the entry and change the job name. The **Select Job** screen will display with the new job name.

12.4 Specifying a Control Job

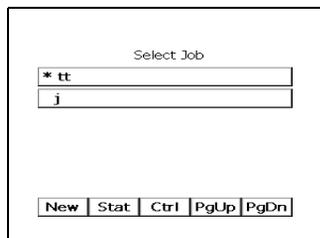
When you are working within a job, you might want to use control points already present in another job. By using a control job, you are working with one job file and using a separate job designated as a control job. The control job can contain specific points, station locations or known positions you wish to use in your current job file. Only one control job can be specified at any one time.

-
- ☒ **Note:** Data stored in a control job is not altered. The SDR uses points, station locations, and other control job information for reference only.
-

The following steps will show you how to determine a control job.

1. Select **Job** from the **Functions** menu. The **Select Job** screen displays.
2. Use the <↑> and <↓> keys to highlight the name of the job you want to use as a control job.

3. Press the <CTRL> softkey. An asterisk (*) will be displayed to the left of the job name designating it as a control job.



To cancel the job as a control, press the <CTRL> softkey again.

- ⊗ **Note:** You can designate only one control job at a time. If another job was already specified as the control job, it will automatically be cancelled whenever you press the <CTRL> softkey.

4. Once the control job has been tagged, highlight the job you wish to work with and select <Enter> or <OK>.

12.5 Determining Which Job Is Current

You can verify the current job several ways in the SDR:

- pressing <Esc> to access the **Home** screen
- **Select Job** screen from the **Functions** menu; the current job is highlighted
- **Job Settings** screen from the **Functions** menu

Any observations or notes made will be stored in the current job.

12.6 Deleting a Job

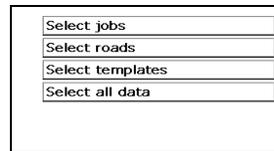
You can remove any existing job to free up memory, but first you will be warned that you must transfer or print the job data. The SDR requires you to transfer or print the job to safeguard your data.

The following steps show you how to delete a job.

1. Select **Job Deletion** from the **Functions** menu.

☒ **The *Job Deletion* screen is used for the deletion of roads and templates as well as survey jobs, so you need to select the specific file type you wish to remove.**

2. Use the <↑> and <↓> keys to highlight **Select jobs**.
3. Press <Enter> or <OK> to view the available jobs. If no jobs are available, the SDR advises you to send or print the jobs first.



A screenshot of a software interface showing a list of four options in a vertical menu:

- Select jobs
- Select roads
- Select templates
- Select all data

Jobs marked **N/A** indicates that the job can not be deleted.

4. Place the cursor on the job you wish to delete. Use the <←> or <→> keys to toggle the setting from **No** to **Yes**.
5. Press <OK> to delete any jobs marked **Yes**. When prompted to confirm the deletion, select the <OK> softkey.

12.7 Modifying Job Settings

You can review and modify several of the choices made when creating a job. Select **Job Settings** from the **Functions** menu to display the **Job Settings** screen.

Job Settings	
Job	<input type="text" value="tt"/>
Atmos crn	<input type="button" value="No"/>
C and R crn	<input type="button" value="No"/>
Sea level crn	<input type="button" value="No"/>

The **Job Settings** screen lets you change some of the options selected on the **Create Job** screen, including the current job name. If any **Job Settings** are changed, a Note JS record will be saved on the database. This contains a sequence of four digits.

Note JS record		
Digit in Sequence	Represents	Entry options
First	Atmospheric Corrections	0 = Off 1 = On
Second	Curvature and Refraction Correction	0 = Off 1 = On
Third	Refraction Constant	0 = 0.14 refraction constant 1 = 0.20 refraction constant
Fourth	Sea Level Corrections	0 = Off 0 = On

This Note record is primarily for informational purposes when parameters are changed. Some software packages may use this record for reduction purposes.

Chapter 13

Setting Up a Station and Backsight

In this chapter

- Station and backsight setup

When you perform surveying tasks (such as taking a reading, setting out and roading), your SDR needs information about instrument location, station, and backsight. The initial, and subsequent, instrument location setups are referred to as stations. Setting up a station establishes a base point for the survey. Observing backsight increases the quality of your survey and establishes a known direction for the survey.

☒ **Note:** You do not need to set your station on a known point. If your station is an unknown point or an RTK, a calibration may be performed or you can use the Resection or Professional Positioning option to determine the location.

The following steps will show you how to set up a station and backsight.

1. Connect your instrument to the SDR using the supplied serial cable before you initiate an observation. Be sure you have selected the correct total station in the **Instrument** menu of your SDR. Also be sure your surveying instrument is in the proper mode for operation with your SDR.

2. From the **Survey** menu, select **Topography**. The **Station Setup** screen will display.

Confirm orientation

Strn

BS pt

-
- ☒ **Note:** You can access the **Station Setup** screen by accessing other surveying functions in the **Survey**, **COGO**, **Road** or **Level** menus.
-

3. Press the <OK> key to accept the station setup. The **Confirm Orientation** screen will display.

Avoid BS

Confirm?

Yes No

4. Enter the backsight point ID in the **BS pt** field.

If the point is unknown, the SDR displays two menu options: **Key in coords**, **Key in azimuth**. You can choose to enter either the backsight coordinates (**Key in coords**) or the azimuth from the current station point to the backsight point (**Key in azimuth**).

5. Once the backsight data is entered, the SDR prompts you to measure the backsight point. Press <Read> to observe the backsight point. Press <OK> when the measurement is complete.
6. (optional) The offset softkeys, <OFS>, <OFS-D>, <OS-2D>, <ANGLE>, allow you to observe an offset backsight.

7. Press <OK> to store and save the station and backsight details. You can then proceed to take readings or press <Esc> to return to the **Survey** menu.

Chapter 14

Observing a Remote Elevation

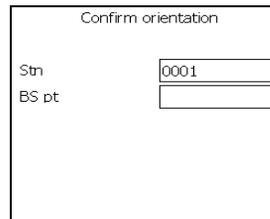
In this chapter

- How to take a reading

Using the remote elevation program, you can observe a point even if you cannot actually reach it. With this option, you use two observations - one for the base point and one for the vertical angle to calculate the point's elevation.

The following steps will show you how to take a reading.

1. Select **Remote elevation** from the **Survey** menu.
2. The SDR prompts you to confirm your station and backsight.



Confirm orientation	
Strn	0001
BS pt	

3. The SDR will prompt you to observe the base reading.

Direct the rodman to place the prism rod directly under or over the desired point. Point the survey instrument to the prism and press <**Read**> to observe the base point. The SDR displays the observation.

4. Press <**OK**> to accept the base point observation.
 5. Sight your instrument on the desired point and press <**Read**> to observe the vertical elevation to the desired point.
-
- Note:** The **Height** field indicates the difference in height from the base point of the prism point to the observed target point.
-
6. Press the <**STORE**> softkey to accept the result and store it as a **POS** (position) record. To observe the point again, press <**Read**>.
 7. Press <**Esc**> to exit the **Remote Elevation** option.

Chapter 15

Creating Roads

In this chapter

- Creating a road
- Selecting a road
- Accessing road statistics and renaming a road
- Deleting a road
- Setting up a road station

Roading Roads are independent of jobs; however, they function in similar ways. The same management functions are available for roads as for jobs:

- **Creating a road**
- **Selecting a road**
- **Reviewing road statistics**
- **Deleting roads**

When you initially create a road, the SDR saves the road and any associated templates independently. You can import coordinates from the current job into the road file, although only the coordinates will be saved (point numbers will not be saved).

15.1 Creating a Road

To work with the roading features, you need to identify an existing road or create a new one. You can create multiple roads, however the SDR will only work with one road at a time.

The following steps will show you how to create a new road.

1. Choose **Select road** from the **Roading** menu.
2. Access the **Create Road** screen by pressing the <NEW> softkey.

☒ **Note:** If no roads have been created, the **Create Road** screen will display by default.

3. Enter a name, up to 16 characters.



☒ **Warning:** Roads are independent of survey jobs. They can have the same names as jobs, but this is not recommended.

4. Confirm a projection scale factor for the road. The scale factor is for internal SDR use, and must be the same as any job scale factor you use to set out the road or for road topo.
5. Press <Enter> to accept the road name and scale factor
6. Enter any information in the **Note** screen, then press <Enter>.
7. You are now ready to continue your roading job.

☒ **Note:** Once a road has been created, it is considered the “selected” road; you do not need to select it. All road programs will use it as the definition until a different road is selected.

15.2 Selecting a Road

The following will show you how to select an existing road.

1. Choose **Select road** from the **Roading** menu.
2. Use the <↑> and <↓> keys to highlight the desired road and press <Enter>.

The <PGUP> and <PGDN> softkeys allow you to page through numerous roads.

3. You can now add or modify templates, set out roads or perform road topography.

☒ **Note:** Once a road has been selected, all road programs will use it as the definition until a different road is selected.

15.3 Accessing Road Statistics and Renaming a Road

Using the *Road Statistics* screen, you can display the statistics for a road and rename the road.

The following steps will show you how to access road statistics.

1. Choose **Select road** from the *Road* menu.
2. Highlight the road to be accessed.
3. Select the <STAT> softkey.

- ID
- Job size (k) (information only)
- Recs used (information only)
- Date and Time (information only)
- Point count (information only)

4. Press <Enter> to accept changes or <ESC> to return to the *Select road* screen.

15.4 Deleting a Road

Once you have transmitted a road to your office computer (or printed it out on a printer), you can remove it from memory.

The following steps will show you how to delete a road.

1. Select **Job deletion** from the *Functions* menu.

2. Highlight **Select roads** and press <Enter>.

The SDR checks to see if any roads have been transmitted and are available for deletion. If there are none, a message advises you to send or print the roads first. You must either print or transfer a road or road template before it will become available for deletion.

3. If any roads are available for deletion, a list displays. Available roads/templates are marked **No**; unavailable ones are marked **N/A**.
4. Place the cursor on the road you are deleting, then use the <←> or <→> keys to toggle settings from **No** to **Yes**.
5. Press <Enter> to delete the road.

☒ **Note:** The <ALL> softkey allows all roads, which have been either printed or transferred, to be selected for deletion.

15.5 Setting Up a Road Station

Setting up a road station provides a known point for your road work. Whenever the **Road topo**, **Set out road** or **Set out road surface** options are selected, a road station must be set up.

The following steps will show you how to set up a road station.

1. Select **Set Out Road** from the **Roading** menu. When utilizing an RTK a calibration must be performed.

☒ **Note:** You can also access this screen by selecting **Road Topo** or **Set Out Road Surface** from the **Roading** menu.

review information in the following fields:

- **GPS Station**
- **North, East, Elevation**

2. Press <OK> to display the **Set Out Road** screen.

The <INCR> and <CPT> softkeys toggle the screen view and associated softkeys.

3. Select the template point by using the right and left arrow softkeys.

When finished Press <OK>.

Templates must not fold on themselves so as to create an overhang although two consecutive points may be at the same offset (one vertically above the other).

The following steps will show you how to define a template.

1. Choose **Define template** from the **Roading** menu.

Note: If no templates exist, the **Create template** screen displays first.

2. The **Select template** screen displays. Access the **Create template** screen by pressing the <NEW> softkey.
3. Enter a template name and press <Enter>. The Note screen will display.
4. (*optional*) Enter as many descriptive notes as needed.
5. Press <Enter> when you are done. The **Template Elements** screen will display.
6. Define your template by adding template elements. Add as many elements as necessary to define your road template.

- **Templ-Offs/Htdiff**
- **Temp-Grade/Dist**
- **Temp-Dist/VDist**

•Templ-Sideslope

The softkeys access the following options:

- <REVIEW>
- <UNDO>

7. After an element is added, the template elements menu displays. Continue to add elements as required.
8. When you are finished defining the shape of the template, select the **Templ-Sideslopes** element to join the edge of the template and the existing terrain at a catch point.
9. (*optional*) You can review the template definition by pressing the <REVIEW> softkey. This step will show you the records that currently define the template.
10. Press <Enter> to view specific details about a highlighted element. or press <Esc> to save and exit the template definition option.

15.5.1 **Template Point by Offset and Height Difference**

This element will normally start your roading template definition. Define a height difference and an offset to the highest section of the road from the centerline. The SDR will interpolate the slope for the template element. You can specify superelevation and widening in this screen or as a separate element in the template.

Enter appropriate values for the following fields:

- **Offset**
- **HtDiff**
- **Apply Super**
- **Apply Widen**
- **Cd**

Press <Enter> to accept the screen and return to the template menu. The defined point is joined to the previous template point to form the shape of the template. The element information is stored in the database in the following format.

```
TEMP ELEMENT      Grade%-3.000H.dist 25.000V.dist -0.750
                  Offset 25.000HtDiff -0.750Apply super Yes
                  Apply widen YesCd HIGHWAY
```

15.5.2 *Template Point by Grade and Distance*

If you need to add another section onto your roading template defined by a grade and distance, use this option. Specify the grade and distance from the end point of your previous template element. You can specify superelevation and widening in this screen or as a separate element in the template.

Enter information in the following fields:

- **Grade**
- <%> and <1:>
- **Distance**
- **Apply Super**
- **Apply Widen**
- **Cd**

Press <Enter> to accept the screen and return to the template menu. The defined point can be considered to be joined to the previous template point to form the shape of the template. The element information is stored in the database in the following format.

```
TEMP ELEMENT      Grade%-3.000H.dist 25.000V.dist -0.750
                  Offset 25.000HtDiff -0.750Apply super Yes
                  Apply widen YesCd HIGHWAY
```

15.5.3 *Template Point by Distance and Vertical Distance*

If you need to add another section onto your roading template defined by a vertical distance and distance (length), use this option. Specify the distance from the end point of your previous template element and the vertical distance between the two points. The SDR will interpolate the slope for you. You can specify superelevation and widening in this screen or as a separate element in the template.

Enter appropriate values for the following fields:

- **Dist**
- **VDist**
- **Apply Super**
- **Apply Widen**
- **Cd**

Press <Enter> to accept the screen and return to the template menu. The defined point can be considered to be joined to the previous template point in order to form the shape of the template. The element information is stored in the database in the following format:

```
TEMP ELEMENT      Grade%-3.000H.dist 25.000V.dist -0.750
                  Offset 25.000HtDiff -0.750Apply super Yes
                  Apply widen YesCd HIGHWAY
```

15.5.4 **Template Sideslope Definition**

The sideslope element will normally end your template definition. Define a cut grade and a fill grade in this screen. When you are setting out the road, the SDR determines whether you are in cut or fill and uses the appropriate grade to set out the sideslope.

Define grades like you did in the **Temp-Grade/Dist** template point definition. However, the numbers are always positive. Cut grades are assumed to rise as they get further from the centerline, and fill grades are assumed to fall.

Enter information in the following fields:

- **Cut**
- **Fill**

Press <Enter> to accept the screen.

15.5.5 **Reviewing Template Definitions**

The SDR provides an option to review a template definition similar to the method of reviewing database records. You can access the Template Review option by selecting **Review template** from the **Roading** menu. After selecting the template you wish to review and pressing <OK>, the screen will display.

The softkeys access the following options:

- <SRCH>
- <PREV>
- <NEXT>
- <PGUP>
- <PGDN>

☒ **Note:** You can only modify a template during the definition of a template.

15.5.6 *Deleting a Template*

The SDR provides a safeguard against deleting unarchived templates.

Once you have transferred a template to your office computer (or printed it out on a printer), you can remove it from memory.

The following steps will show you how to delete a template.

1. Select **Job deletion** from the *Functions* menu.
2. Highlight **Select templates** and press <Enter>.

The SDR checks to see if any templates have been transferred and are available for deletion. If no templates have been transferred, a message advises you to send or print the templates first.

3. Available templates are marked **No**; unavailable ones are marked **N/A**.
4. Place the cursor on the template you are deleting, then use the <<-> or <->> keys to toggle settings from **No** to **Yes**.
5. Press <Enter> to delete the template.

☒ **Note:** The <ALL> softkey allows all available templates to be selected for deletion.

Chapter 16

Setting Out Roads

In this chapter

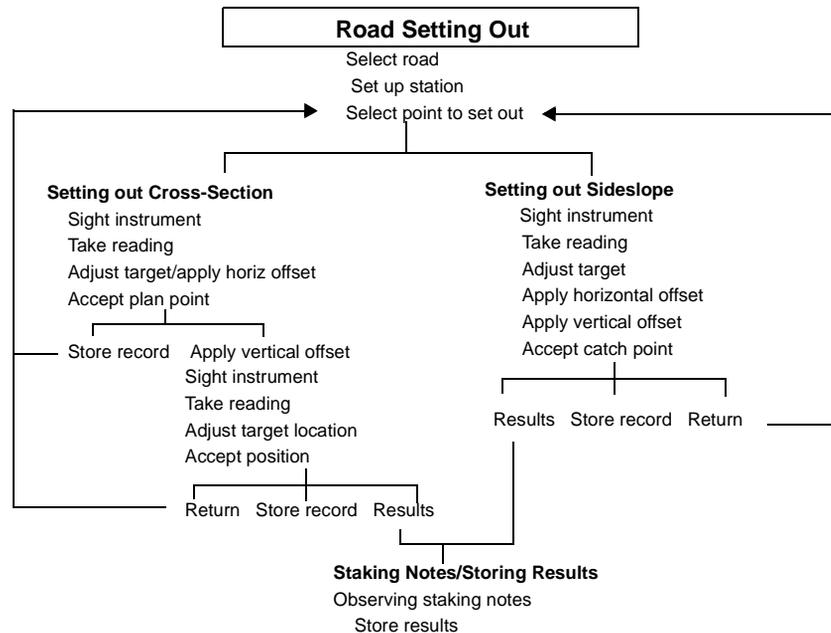
- Setting out cross- sections
- Setting out sideslopes
- Staking notes

The SDR Level 5 roading program is designed for setting out a road once it has been defined. You can set out any point along the road by specifying its station and offset. The **Set Out Road** option is similar to other SDR set out options. The SDR allows you to set out the entire road or specific points. You can select from three different set out options, depending on the road sections with which you are working.

- **Set out Road**
- **Set out Sideslope**
- **Set out road surface**

You can access the first two set out options by selecting **Set Out Road** from the **Roading** menu.

The following diagram shows the available options and the processes of setting out specific points:



16.1 Setting Out Cross-Sections

The following steps will show you how to set out cross-sections.

1. Choose **Set Out Road** option from the **Roading** menu.
2. (optional) If you have not selected a current road, the **Select road** screen displays. Highlight the road you wish to set out and press <OK>.
3. Confirm the GPS station by pressing <OK> or entering a new Stn point ID.
4. When the **Set Out Road** screen displays, select the point on the associated template by using the arrow keys.

5. The <INCR> and <CPT> softkeys toggle the **Station Increment** field on or off. When finished, press <OK> to display the **Navigate** screen. Locate the desired point using the directions indicated in the **Navigate** screen. The SDR will continually update the screen as you move, indicating if you are moving closer to or farther from the point.

☒ **Note:** The first two fields in the **Navigate** screen will appear differently depending on the selections you made in the **Configure Reading** screen.

The fields in the **Navigate** screen include the following:

- Sta crn
- Left/Right
- Azimuth
- ΔNorth
- ΔEast
- Sta.ing
- Offset
- Cut/Fill
- Ambiguity
- 3DRMS

The **Navigate** screen softkeys access the following options:

- <STORE>
- <DSGN>
- <ANT>
- <CNFG>
- <STAT>

6. Press <OK> to set out the point's elevation.
7. To store the results, press <OK> or the <STORE> softkey.

Pressing <OK> displays the **Store Results** screen. From this screen you can store two types of records. The <RPOS> softkey stores an RPOS record and a note of the observation. The <RCHK> softkey stores an RCHK record.

After storing the record, the SDR Level 5 returns to the **Set Out Road** screen to set out the next point.

16.2 Setting Out Sideslopes

The following steps are showing you how to set out a sideslope.

1. Use the <→> and <←> keys to select the sideslope element of the template.
2. The **Adjust Target Location** screen displays.

The fields display the following information:

- Cut or Fill
- Sta crn
- Xsect crn
- Sideslope at
- 3DRMS
- Ambiguity
- Design slope
- Grade

The following softkeys are available:

- <STORE>
- <READ>
- <ANT>
- <CONFIG>
- <STAT>

3. Press <OK> to store the results. The SDR Level 5 will display the **Store Results** screen.

The following fields will need to be reviewed for informational purposes.

- Pt
- Cd
- ΔSta
- ΔOffset
- Cut or Fill
- N
- E
- El
- Sta..ing
- Offset

The softkeys access the following options:

- <RPOS>
- <RCHK>
- <RPT>
- <OPTNS>
- <NO>

16.3 Staking Notes

After completing the set out steps for a sideslope, the **Store results** screen gives you the opportunity to access the **Staking Notes** report before returning to the **Set out Road** screen.

Press the <RPT> softkey to insert a Slope Staking report into the database.

The format of the staking notes can be changed with the <OPTNS> softkey. Select one of the two available options: **Incremental** or **Accumulative**.

16.3.1 Incremental

This option provides staking notes to each node on the cross-section in respect to its adjacent, outer node.

Once you press the <**RPT**> softkey, the staking notes are displayed according to the format defined via the <**OPTNS**> softkey.

Consider a template with nodes representing the center, bottom of curb, top of curb, edge of road, and the sideslope. The **Incremental** option gives the slope staking notes for each node with respect to the next outer node.

16.3.2 **Accumulative**

This option provides staking notes to each node on the cross-section in respect to a single reference point. The reference point can be the catch point or an offset of the catch point.

The **Reference Point** may be defined as one of the following:

- **Catch Point**
- **Offset**

If the reference point was set to offset, each node would be defined with respect to the catch point offset (if supplied).

Storing Results

Staking notes for individual nodes can be stored to the database, as displayed on the staking notes report screens, by pressing the <**STORE**> softkey. You can access the various nodes by using the <<-> and <->> softkeys. Pressing <**Esc**> will return you to the **Store Results** screen.

The **Store Results** screen allows you to return to the **Set out Road** screen with or without storing the results. You can change either or both the point name and code if necessary. The options for leaving the **Store Results** screen are as follows:

- Press <**RPOS**> to store a roading position record (RPOS) record and return to the **Set out Road** screen. An RPOS shows the northing, easting, elevation, station and offset of the point that was set out.

The following example shows the type of data that will be stored in the database with an RPOS record.

```
ROAD POS RO AUTO1001Sta.ing 81.983Offset -35.000
                          North 10395.564East 84285.594Elev 29.509
                          Cd EDGE OF ROAD

NOTE RO                   Fill 2.091d.North -0.038d.East -0.250
```

- Press <**RCHK**> to store a roading check record (RCHK) and return to the **Set out Road** screen. An RCHK record shows the differences of station, offset and elevation from the design point.

The following example shows the type of data that will be stored in the database with an RCHK record.

```
ROAD CHK RO AUTO1002   Sta.ing 82.000d.Chn -0.017
                          Offset -35.000d.Offset 0.252 Elev 29.509
                          d.Elev -2.091
                          Cd EDGE OF ROAD

NOTE RO               Fill 2.091   d.North -0.038d.East -0.250
```

☒ **Note:** For either type of record, an additional note is stored, giving the cut/fill and the differences in northing and easting.

- If you want to return to setting out, press <Esc>. You will be returned to the **Aim Horiz Circle** screen. This might be necessary if the prism pole is inadvertently moved during the setting out of the elevation.
- Press the <NO> softkey to return to the **Set out Road** screen without storing any results.

Upon returning to the **Set Out Road** screen, you will be prompted for the next point to set out.

Chapter 17

Set Out Road Surface

In this chapter

- Steps to set out a road

The SDR roading program is designed for setting out a road once it has been defined. You can set out any point along the road by specifying its station and offset. You can select from three different set out options, depending on the road sections you are working with.

- **Set out Cross-Section**
- **Set out Sideslope**
- **Set out Road Surface**

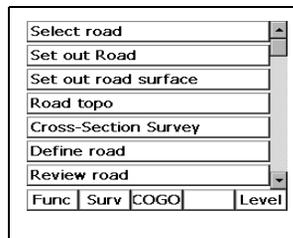
The Set Out Road Surface option is used to set out the vertical component of a road definition. This option allows you to set out the cut or fill of any point on a surface.

-
- ☒ **Note:** Horizontal setting out (station distance, offset, stationing) is not applicable here, because a surface rather than a point is being set out.
-

The following are steps to show you how to set out road surface.

1. Choose **Select Road** from the **Roading** menu.
2. Highlight the road you wish to set out and press <**OK**>.

3. Select **Set out road surface** from the **Roading** menu.



4. Confirm the GPS station by pressing <OK> or entering a new GStn point ID.
5. The SDR will display the **Take Reading** screen.

Review the information in the following fields:

- Ambiguity
- 3DRMS
- Epochs

The softkeys available are:

- <STOP>
- <STAT>

6. Press <OK> to accept the current reading and set out the elevation. The SDR will display the **Setting Out Elevation** screen.

The fields display the following information:

- Cut or Fill
- Ambiguity
- 3DRMS
- Cut O/S
- Design Elev

The softkeys available are:

- <STORE>
- <READ>
- <ANT>
- <CONFIG>
- <STAT>

☒ **Note:** Press <Esc> at any time to discard the current reading and return to the **Take Reading** screen.

7. Press <OK> to store the results. The SDR will display the **Store Results** screen.
8. Press <Esc> to exit the **Set Out Road Surface** screen.

Chapter 18

Road Topography

In this chapter

- Using road topography

Road Topography enables you to quickly take readings on specific or random points to verify their position as compared to the road definition. The procedure to collect road topography information is similar to collecting standard topography. With the road topography option, you can collect stationing (chainage) along the road as well as offsets.

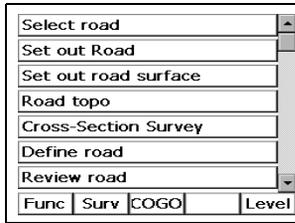
18.1 Using Road Topography

You can take multiple readings with the road topography option. Before observing points along a road, you will need to create a road.

The following steps show you how to use road topography.

1. Choose **Select Road** from the **Roading** menu.
2. Highlight the road you wish to set out and press <OK>.

3. Select **Road topo** from the **Roading** menu.



4. Confirm the RStn Station by pressing <OK> or entering a new RStn point ID.
5. The SDR will initiate an observation and display the **Take Reading** screen.

Review the information in the following fields:

- GSTN
- Ambiguity
- 3DRMS
- Epochs left

The softkeys access the following options:

- <CNFG>
- <STAT>

6. Once the reading is complete, enter and review information in the following fields.

- Pt ID
- Sta..ing
- Offset
- N
- E
- El
- Cut/Fill
- Code

7. (*optional*) Press <**OK**> to save the raw observation and an RPOS record with Note record.
8. (*optional*) Press <**Read**> to accept the reading and take another reading.

Chapter 19

Cross-Section Survey

In this chapter

- Determining survey direction
- Performing a cross-section survey

The Cross-Section Survey option enables you to survey cross-sections of roads or other linear features. This option works similar to topography. When surveying a cross-section, the SDR observes points along a series of stations. The procedural approach to cross-section surveying enables you to efficiently collect a larger number of points. Depending on the location and desired observations, you can conduct the survey using one of two methods:

- walking the minimum distances (see Figure 19-1)
- surveying from the centerline outward (see Figure 19-2)

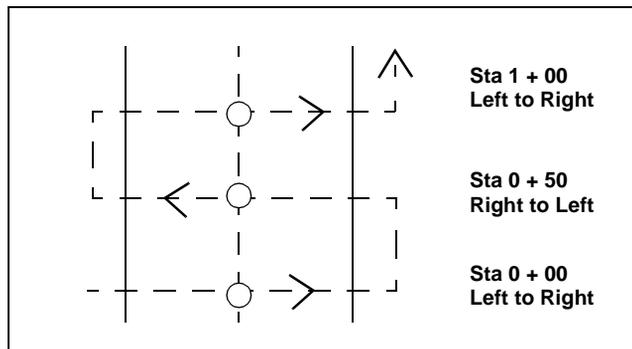


Figure 19-1: Survey cross-section by walking the minimum distances

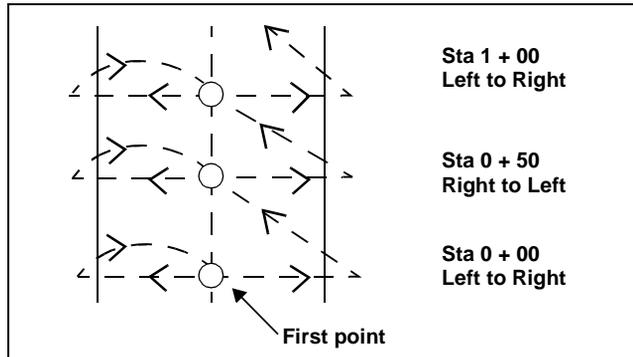


Figure 19-2: Survey cross-sections from the centerline out

The SDR automatically calculates the offsets from an observation designated as the centerline point.

19.1 Determining Survey Direction

You can perform cross section surveys in several different directions. You can specify the survey direction in the **Direction** field of the *Cross-Section Survey* screen. Select the method that best suits your survey and workflow.

- Surveying left to right
- Surveying right to left
- Surveying to the right
- Surveying to the left

19.1.1 Surveying Left to Right

The **Left>Right** option in the **Direction** field enables you to survey across a road starting at the left of the road. The first noncenterline point surveyed must be to the left of centerline. Depending on the

number of prisms and preferred method, you can alternate readings from side to side or survey the left side of the road and then the right side.

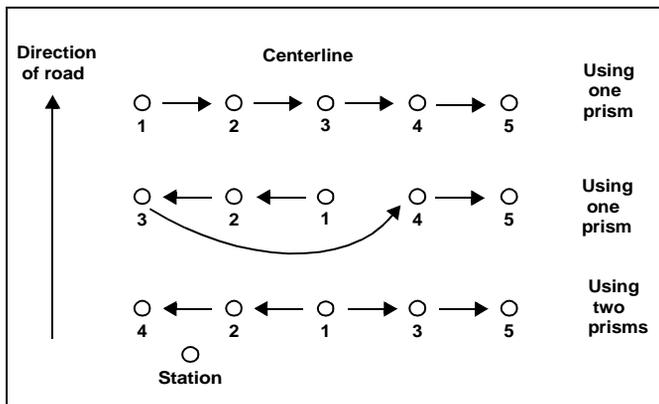


Figure 19-3: Direction specified left to right

19.1.2 Surveying Right to Left

When surveying Right to left, your first noncenterline observation must be to the right of the centerline. You can proceed across the road or survey the right side of the road and then the left.

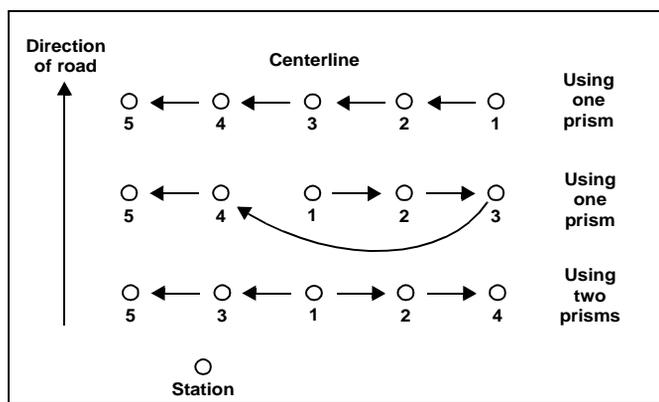


Figure 19-4: Direction specified right to left

19.1.3 Surveying to the Right

You can begin on, or to the left of, centerline and proceed right when surveying to the right. However, the rod man does not reverse direction after each cross-section; all cross-sections begin on or to the left of centerline and proceed right.

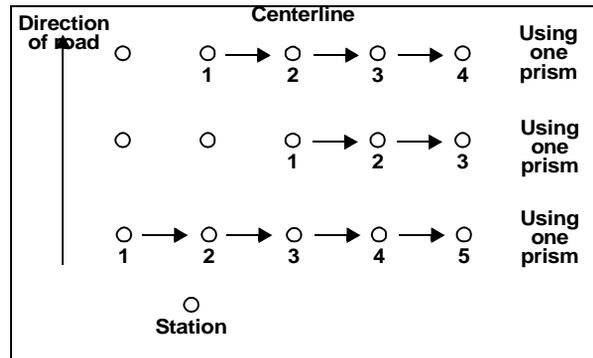


Figure 19-5: Direction specified right

19.1.4 Surveying to the Left

When surveying to the left, you can start on or to the right of the centerline and proceed left. However, the rod man does not reverse direction after each cross-section; all cross-sections begin on or to the right of centerline and proceed right.

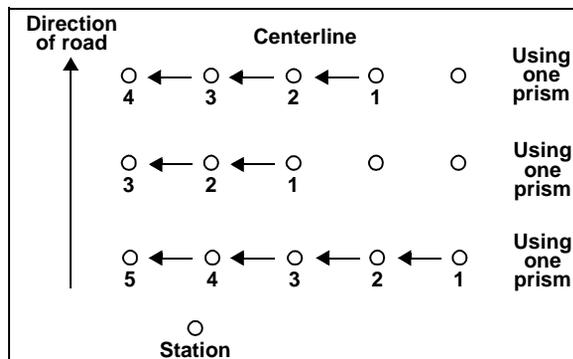


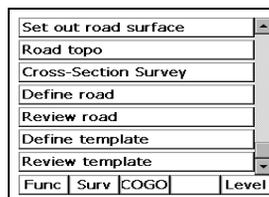
Figure 19-6: Direction specified left

19.2 Performing a Cross-Section Survey

You can use cross-section survey to take multiple observations quickly. This surveying method can be used to collect information about ground details, sections of road or other topographical data.

The following steps will show you how to use Cross-section survey.

1. Select **Cross-Section Survey** from the **Roading** menu.



2. Confirm the orientation by pressing <OK> or entering a new GStn point ID.
3. The **Cross-Section Survey** screen will be displayed.

Enter information in the following fields:

- Road
- Sta incr
- Sta.ing
- Direction

Note: You can enter any name into the **Road** field.

The softkeys available are:

- <STA->
- <STA+>

4. The SDR will initiate an observation and display the **Take Reading** screen.

5. Review the information in the following fields:

- **GSTN**
- **Amb status**
- **3DRMS**
- **Epochs left**

The softkeys available are:

- **<CNFG>**
- **<STAT>**

Note: Press **<Esc>** at any time to discard the current reading.

6. Press **<OK>** to store the record. The SDR will prompt you to identify the centerline point.

If the point is not the centerline, press **<Read>** to continue surveying the cross-section.

If the point you just observed is the centerline point, press **<OK>** to accept the **Centerline point** field. You can then toggle the **Finished Section** field to **Yes** or **No**.

Note: You do not have to observe the centerline point. If you confirm you do not want to take the centerline reading, all the points on this section will have **<Null>** offsets.

If you select **Yes**, the SDR will display the **Cross-Section Survey** screen. Enter the new stationing value and survey the next cross-section.

If you are not finished with the cross-section, select **No**. Continue taking readings with the **<Read>** key until finished with the cross-section.

Once you have completed at least one cross-section, you may choose not to specify station value for subsequent cross-sections. If you do not specify station value, the SDR uses the horizontal distance between the new cross-section's centerline point and the last section as the station increment.

When saving, observations initially have a <Null> offset. When you select **Yes** in the **Finished Section** field, the SDR calculates offsets for each surveyed cross-section and updates the database records.

Chapter 20

Building Face Survey

In this chapter

- Surveying vertical planes
- Surveying nonvertical planes

The Building Face Survey option enables points on both vertical and nonvertical planes to be coordinated by angle-only observations. This feature is most often used to pick up details of a building where the prism cannot be placed.

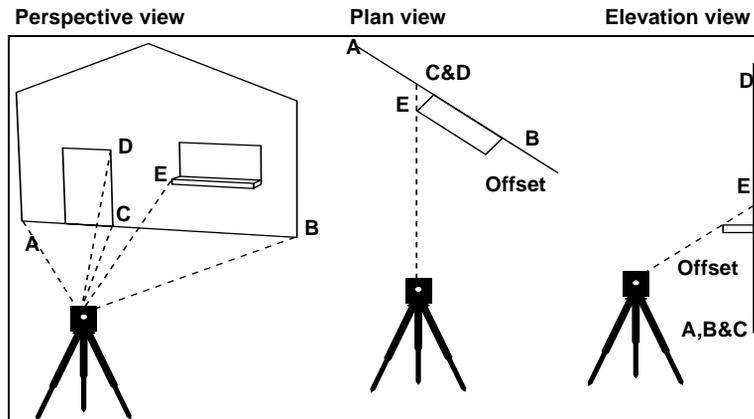


Figure 20-1: Building face survey

20.1 Surveying Vertical Planes

You can use the SDR to survey the vertical face of a building or other vertical planes.

The following steps will show you how to survey a vertical plane.

1. Select the **Building Face Survey** option from the **Survey** menu.

Set Collection
Set Review
Building Face Survey
Collimation
Remote Elevation
GPS Status
Keyboard Input
Func
COGO
Road
Level

2. The SDR will display the **Define Plane** screen.

Define plane	
Pt 1	<input type="text"/>
Pt 2	<input type="text"/>
Pt 3	<input type="text"/>
Local coords	<input type="text" value="No"/>
Type	<input type="text" value="No soluti"/>
Read	<input type="text"/>

Enter the point information in the **Define Plane** fields.

- **Pt 1**
- **Pt 2**
- **Pt 3**
- **Local coords**
- Set this field to **No** to compute the coordinates in North, East, and Elevation coordinates.
- Set the **Local coords** field to **Yes** to have calculated coordinates referenced to Point A as the origin of the local coordinate system.

Calculated points are recorded with three coordinates; Horizontal distance from Point A, Elevation, and offset from the plane. Point A is the origin of the local coordinate system, positive east is in the direction from A to B, and positive elevations come from the plane

toward the instrument. Setting the **Local coords** field to **Yes** provides a simple way of directly plotting the building face with no further processing.

☒ **Note:** If a point is entered that has a null northing or easting, a **Null position** message will be displayed.

☒ **Note:** If you want to define a local coordinate system, the horizontal coordinates cannot have any <Null> coordinates. If you want local coordinates, an elevation value must be entered also; the SDR cannot determine local coordinates without an elevation for point A.

3. Once you have specified the two defining points for the building face plane, press <OK>. The SDR will determine the available solution. One of the following messages will display:

- No solution
- Vertical
- 3D

A note is saved in the SDR database recording the point numbers of the two points defining the building face plane, and whether local coordinates are in effect.

4. You can either press <READ> or the <ANGLE> softkey to take readings to points on the building face. The SDR will store the observed points on the building face using angle-only observations.

You can enter an offset value in the **Ofs dist** field to record a known offset distance from the building face plane.

-
- ☒ **Note:** A positive offset distance indicates the observed point is “in front” of the plane, as observed from the occupied station. A negative offset distance indicates the observed point is “behind” the building face plane.
-

If you are saving the building face points in a local coordinate system, the local coordinates of the two points defining the plane will automatically be saved using the next two autopoint numbers.

-
- ☒ **Note:** You can access the *Configure Reading* screen by pressing <CNFG>.
-

5. Press <Esc> to exit the Building Face Survey option.

20.2 Surveying Nonvertical Planes

Surveying a nonvertical plane is similar to surveying a vertical plane. Once the plane has been defined, and you understand how the local coordinate system works for nonvertical planes, picking up detailed observations follows the same general process.

The following steps will show you how to survey a nonvertical plane.

1. Select the **Building Face Survey** option from the **Survey** menu.
2. The SDR will display the *Define Plane* screen.

Define plane	
Pt 1	<input type="text"/>
Pt 2	<input type="text"/>
Pt 3	<input type="text"/>
Local coords	<input type="text" value="No"/>
Type	<input type="text" value="No soluti"/>
Read	<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>

Enter the point information in the **Define Plane** fields.

- Pt 1
- Pt 2
- Pt 3
- Local coords

Note: When defining a nonvertical plane, the three points cannot be in a line. If the points are linear, you will get the warning message **Linear** and the **Type** field will display **No solution**.

You can also use the <**READ**> softkey provided to fix the points by observation, if desired.

3. Once you have specified the three points that define the nonvertical plane, press <**OK**>. The SDR will determine the available solution. One of the following messages will display:

- No solution
- Vertical
- 3D

A note is saved in the SDR database recording the point numbers of the two points defining the building face plane, and whether local coordinates are in effect.

If you are defining a local coordinate system when surveying a nonvertical plane, no coordinate values may be <**Null**>.

4. You can either press <**READ**> or the <**ANGLE**> softkey to take readings to points on the building face. The SDR will store the observed points on the building face using angle-only observations.

You can enter an offset value in the **Ofs dist** field to record a known offset distance from the building face plane.

- ☒ **Note:** A positive offset distance indicates that the observed point is “in front” of the plane, as observed from the occupied station. A negative offset distance indicates that the observed point is “behind” the building face plane.
-

If you are saving the building face points in a local coordinate system, the local coordinates of the two points defining the plane will automatically be saved using the next two autopoint numbers.

- ☒ **Note:** You can access the **Configure Reading** screen by pressing <CNFG>.
-

A positive offset distance indicates that the observed point is “in front” of the plane, as observed from the occupied station. A negative offset distance indicates that the observed point is “behind” the building face plane.

5. Press <Esc> to exit the Building Face Survey option.

Chapter 21

Leveling

In this chapter

- Using the leveling program
- Making reports/adjustments

You can use a digital or manual level with the SDR to perform differential leveling. By using the leveling option to collect accurate elevations, you can improve the accuracy of your survey job. The elevations recorded from the Leveling option can be used to correct existing data in the SDR database. The SDR has two **Leveling** options:

- **Leveling**
- **Report/Adjust**

21.1 Using the Leveling Program

A level loop consists of several observations, or setups. The process begins by backsighting a known elevation and ends by reading a known elevation, which can be the starting point or another known point. A level loop allows you to collect and average multiple elevation observations to produce an accurate elevation value. Leveling loops can be used to adjust elevation readings in the same way Traverse Adjustment options are used to average traverse readings.

The following steps show you how to use the leveling program.

1. Select **Leveling** from the **Level** menu.

Instrument Setup	
Type	Level
Model	Manual
Level Desc	<No text
Level S/N	000000
Stadia	1:100.000

2. The SDR will display the **Select Job** screen. Select the job with which you wish to work and press the <OK> key.

☒ **Note:** If you have not created a job, you will be prompted to create a new job.

3. The **Instrument Setup** screen displays. Review your current instrument settings and make any necessary changes. Be sure to select Level as your instrument.
4. When finished, press <OK>.

Instrument Setup	
Type	Level
Model	Manual
Level Desc	<No text
Level S/N	000000
Stadia	1:100.000

5. The SDR displays the **Leveling** screen.

The **Instr Setup** field displays the number of existing leveling setups in the current job. The number will increment after each level loop observation.

Press the <INV ROD> softkey to take a reading with an inverted rod. Inverse readings are taken when the point of interest is too high to place the rod on top. In these cases, the rod is inverted and the bottom

of the rod is elevated until it touches the point. An example is standing under a bridge and taking an elevation to the underside of the bridge.

6. The SDR will prompt you to observe the backsight. Press **<Read>** to initiate an observation of the backsight point.
7. Press **<OK>** to start observing elevations with the SDR. The Level Reading screen contains the following fields:

- Cd
- Pt
- Offset
- Top Wire
- Mid Wire
- Low Wire
- Dist

Note: If **Manual** was chosen as the instrument and **3-wire readings** was also selected, all three fields will be displayed. Manually enter the desired values with the keyboard. Three- and singlewire readings are chosen from the **Configure Reading** screen.

Note: Once the SDR has two of the wire readings, it will calculate the distance. If you enter another distance, tolerances will be checked using the stadia constant. The wire readings will also be checked by comparing the $(\text{Top} + \text{Low}) / 2$ compared with the Mid Wire.

8. You can now take sideshots by pressing **<Read>** or **<INV ROD>**.
9. Press **<OK>** when you want to move your leveling instrument. The SDR displays a confirmation message.

-
10. Press the <YES> softkey to continue. The SDR increases the instrument setup number by one (1) and displays the Level Reading screen.
 11. The SDR will fill the **BS pt** field with the name of the last point you observed before moving the instrument. You may accept the point ID or enter a new one based on your survey needs. Four options are available for the **BS pt** field:
 - You can accept this point.
 - You can enter the name of a point already in your level loop.
 - You can enter the point name of another point in the SDR database.
 - You can enter a point name for a completely new point of unknown elevation.
 12. Continue your survey by taking sideshots. Use <Read> or <INV ROD> softkeys.
 13. When you are finished observing the level loop, take a foresight reading to a known point or move your instrument and backsight a point of known elevation. The SDR will automatically close the loop.

21.2 Making Reports/Adjustments

Once enough readings have been taken to define a Level Loop, you can adjust or print the level loop.

The following steps show you how to adjust and print a level loop.

1. Select the **Report/Adjust** option from the Level menu.
2. The SDR will prompt you to enter the starting point ID of your level loop.

3. Enter the starting point and press the <OK> key. The SDR builds the route. The SDR will pause when a route branch is detected and you need to decide which path to take, or when a point that could be used as a close point has been found.

When the loop has been entered, press <OK> and the main **Report/Adjust** screen will be displayed. This screen contains the following fields:

- From
- To Pt
- D.Elev
- Dist
- Adj Selector
- Method Selector
- Weighted
- Linear

Two softkeys are available:

- <REPORT>
- <STORE>

-
- ☒ **Note:** When the SDR adjusts the loop, ALL points in between the Start and End points are adjusted. Therefore, if you have known bench marks, use these as the Start and End points of the loop. This method gives you control over what points will be adjusted and what points will not.
-

Chapter 22

COGO Options

In this chapter

- Calculating an inverse
- Calculating and subdividing areas
- Intersections

The COGO menu of the SDR provides several options to perform coordinate geometry calculations, including inverses, areas and intersections. You can use these tools to calculate distances, azimuths and coordinates separately from traditional SDR methods.

22.1 Calculating an Inverse

The following steps show you how to calculate an inverse.

1. Select **Inverse** from the *COGO* menu.
2. Enter a **From** point and a **To** point in the *Inverse* screen.

The screenshot shows a window titled "Inverse". Inside the window, there are two input fields: "From" and "To pt". Below these fields is a "Read" button followed by four empty boxes for numerical output.

3. Once you enter these points in the appropriate fields, press **<OK>**. If either of the points is not known, you have an opportunity to enter the coordinates.

4. Once the coordinates of both points are known, the vector between them is calculated and displayed.
5. If you press <OK>, the data is stored in the database as a reduced (**RED**) record. If you do not wish to save the result, press <Esc> to exit to the menu.

22.2 Calculating and Subdividing Areas

You can use the SDR to calculate area and subdivide the area. This option may be useful when determining lots, building sites or other purposes. When calculating the area, you will need to specify a set or corner points. To calculate an area, you need to specify at least three points. The SDR will check the integrity of the shape by verifying:

- the point exists
- both the northing and easting values are not null
- the point is not a duplicate entry
- the line created between the point and the previous point does not cross any of the existing edges (to avoid a figure 8)

The SDR uses the point order to determine the shape of the area. For example, the area specified by entering point numbers 1, 2, 3, 4, 5 or 5, 4, 3, 2, 1 implies the same shape. However, numbers 1, 2, 3, 4, 5 and 1, 2, 5, 3, 4 imply different shapes.

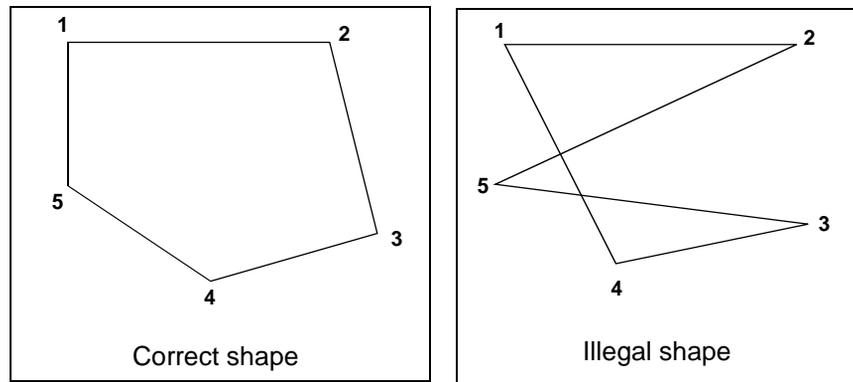


Figure 22-1: Calculating and subdividing areas

If the order of the points cause edges to overlap, as in the second example, the SDR will display an “Illegal shape” message. You can add or remove points in the **Define Area** screen to correct the error.

After calculating the area, you can subdivide the area in one of two ways:

- Make the subdividing line pass through one of the corner points. The coordinates of the intersection point of the subdividing line

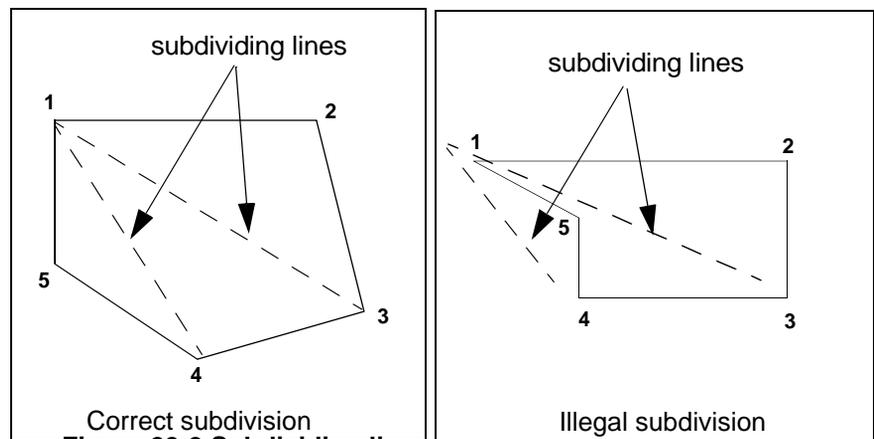


Figure 22-2 Subdividing lines

and the area's perimeter are calculated.

- Make the subdividing line parallel to a given line. The two points where the subdividing line intersects the perimeter of the area are calculated.

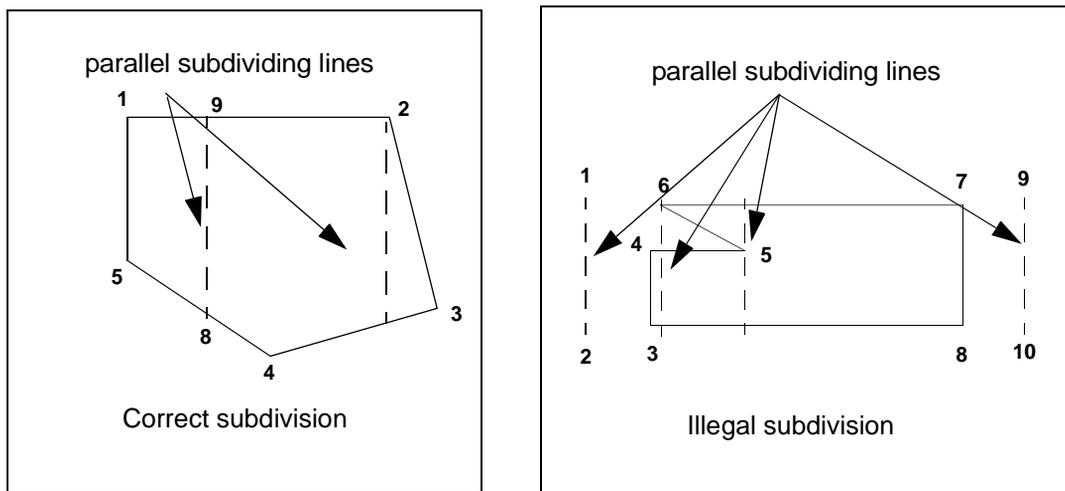


Figure 22-3: Parallel subdivision lines

-
- ☒ **Note:** All coordinates calculated by this program are stored as POS records with an AR derivation code.
-

The following steps show you how to calculate an area.

1. Select **Areas** from the *COGO* menu.
2. Enter the corner points in the **Define Area** screen. You can enter point IDs using the keyboard or by using the softkeys.

- Enter each point in a **To pt** field

☒ **Note:** If coordinates do not yet exist, entry of a starting point will first display the **Key in Coords** screen.

- Press the **<RANGE>** softkey to enter all points within a specific range.

- Press the **<ALL>** softkey and select **Add all POSs to list** to enter all POS points.

3. Review the points entered in the **Define Area** screen. The SDR will use the point order to define the area.

You can delete points by highlighting the point and pressing the **** softkey.

- ☒ **Note:** You can remove all points from the **Define Area** screen by pressing the <DELALL> softkey. A confirmation message will display.
-
- ☒ **Note:** Do not enter the initial point number at the end of the list of point numbers or a duplicate point error occurs. The **Areas** program includes this edge implicitly.
-
4. Press <Enter> at the **To point** prompt to end point entry. Press <OK> to start area calculation.
-
- ☒ **Note:** If an error is detected, an error message displays and the SDR will display the **Define Area** screen. Review the specified points and remove or add points as necessary.
-

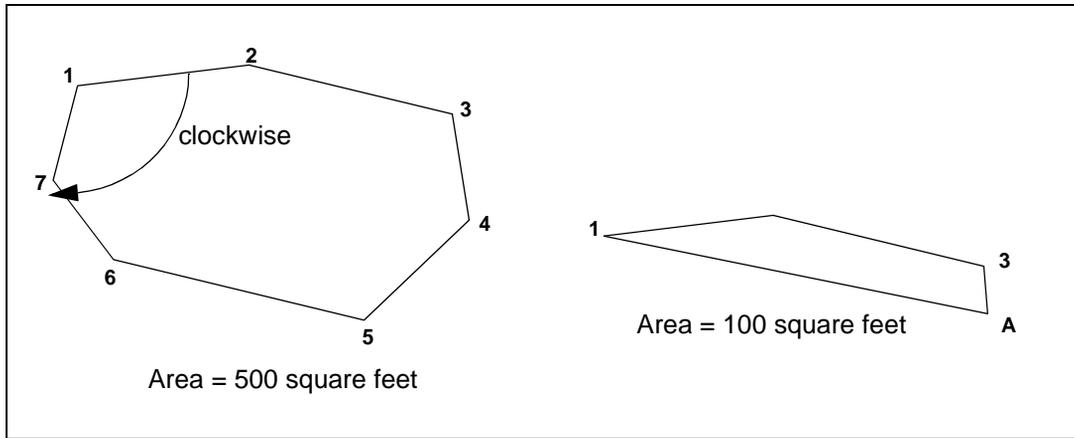
The SDR will display the results of the area calculation. To change the units of the area, press the <UNITS> softkey.

5. Press <OK> if you want to store the NOTE AR record and continue with the subdivision. Extra notes are stored with the point numbers that outline the area. Press <Esc> to discard the calculation.
6. If the area is stored, a menu with the two methods of subdividing displays.
7. Press <Esc> to exit the program without subdividing.

22.2.1 **Subdividing by Rotating from a Fixed Point**

After calculating an area, you can subdivide the area for a variety of purposes. The SDR can subdivide an area using one of two methods:

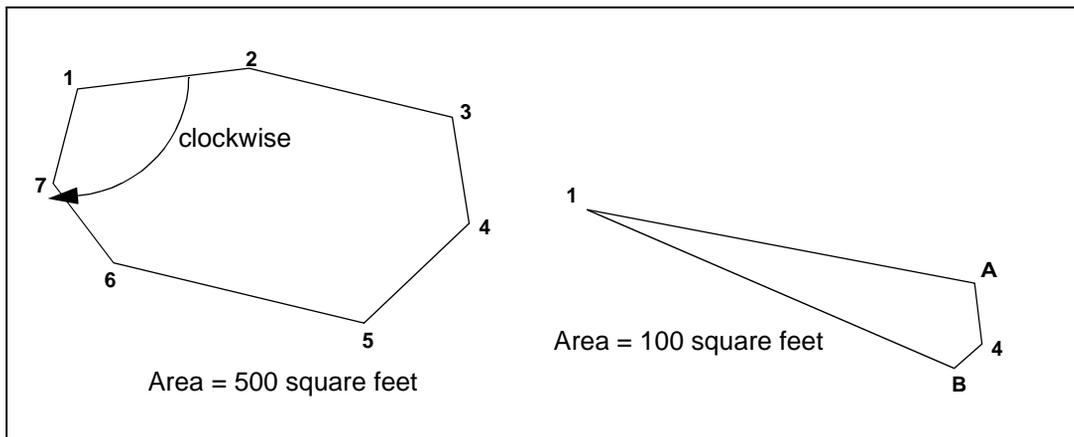
- subdividing by rotating from a fixed point
- subdividing with a line parallel to an existing line



Subdividing an area by rotating a fixed point clockwise

Figure 22-4: Fixed point subdivision

After each subdivision, the SDR checks the remaining area to determine if another subdivision can be created. If a subdivision is available, the SDR will display the **Fixed Point Subdiv** screen.



Subdividing an area by rotating a fixed point clockwise

Figure 22-5: Complete subdivision

The following steps are for completing subdivision.

1. After the area is calculated, select **Fixed Point Subdiv** and press <Enter>.
2. The Fixed Point Subdiv screen enables you to specify the subdivided area you wish to create.

Enter information in the following fields:

- **From**
- **Area (sqft)**
- **Subdiv Pt ID**
- **Direction**

Note: To change the units, press the <UNITS> softkey.

3. Press <OK> to start the subdivision. The SDR will display the coordinates of the newly calculated end point.

Note: The SDR will display an “Illegal Shape” error if a problem exists in the defined subdivision. Review the fields in the **Fixed Point Subdiv** screen to correct the error.

4. Press <OK> to store a **POS** record for the calculated position or <Esc> to discard it.

22.2.2 **Subdividing with a Line Parallel to an Existing Line**

After calculating an area, you can subdivide the area for a variety of purposes. The SDR can subdivide an area using one of two methods:

- subdividing by rotating from a fixed point
- subdividing with a line parallel to an existing line

The following steps are for completing the subdivision

1. After the area is calculated, select **Parallel Line Sub** and press **<Enter>**.
2. Create the line you wish to use to subdivide the area by specifying the end points in the **From** and **To pt** fields of the **Parallel Line Sub** screen.

The SDR will use the defined line to generate parallel lines to subdivide the calculated area.

- **From**
- **To pt**
- **Area (sqft)**
- **Subdiv Pt ID**

☒ **Note:** If the points have not been observed, the SDR will display the **Key in Coords** screen.

☒ **Note:** To change the units, press the **<UNITS>** softkey.

3. Press **<OK>** to start the subdivision. The SDR will create the first subdivision by creating a line parallel to the line defined in step 2, creating a subdivision with the specified area. The SDR will start the subdivision with the point within the area closest to the defined line.

The SDR will display the coordinates of the newly calculated end point.

☒ **Note:** The SDR will display an “Illegal Shape” error if a problem exists in the defined subdivision. Review the fields in the **Fixed Point Subdiv** screen to correct the error.

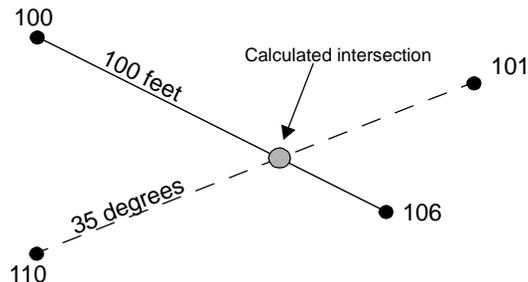
4. Press **<OK>** to store the subdivision **POS** records, or press **<Esc>** to discard them.

5. Continue to subdivide the area until complete.
6. Press <Esc> to exit the option.

22.3 Intersections

You can calculate a point intersection in the field using the SDR's **Intersection** option. The SDR can calculate any point generated by the crossing of two vectors. To calculate an intersection, you will need one of the following combinations:

- Two azimuths
- Azimuth and distance
- Two distances



-
- ☒ **Note:** In the azimuth and distance method, you cannot use the same point for the starting point for both the azimuth and the entered distance. This specification is the same as entering an azimuth and distance from the selected point. If you want to use this method, use the **Key in Azmth / Dist** function from the **Keyboard Input** option.
-

When computing an intersection, there may be two possible solutions. The <OTHER> softkey enables you to view both solutions before deciding which record you wish to store.

The following steps show you how to compute an intersection.

1. Select the **Intersections** option from the **COGO** menu.
2. Enter the first point in the **Pt 1** field.
3. Specify the azimuth or horizontal distance for **Pt 1** by highlighting one. You can specify either an azimuth or a horizontal distance, but not both.
4. (*optional*) Press the <**POINTS**> softkey and one of two screens appears, either **Azimuth from Points** or **Distance from Points**, depending on the currently selected field. Each of these screens has **From** and **To pt** fields.

Enter the points you wish to use to calculate the distance or azimuth. The SDR will compute the inverse between the two points to use for the intersection.

Press <**READ**> to initiate a point observation and enter it in the selected field.

5. Enter the second point for the intersection calculation in the **Pt 2** field. Follow Steps 2 through 4 above to enter the intersection azimuth or distance for **Pt 2**.
6. Press <**OK**> to initiate the intersection computation. The computed intersection coordinates display.
7. (*optional*) If two possible intersection solutions exist (often the case with azimuth and distance and two distances), then the <**OTHER**> softkey appears. Select the <**OTHER**> softkey to navigate between the two solutions.
8. (*optional*) Review the information displayed in the **Solution** screen. Edit the point ID, feature code and elevation if desired.
9. (*optional*) Press <**S-O**> to set out the computed point.

10. Press the <STORE> softkey or <OK> to save the intersected point, or discard the result by pressing <Esc>. If you enter values in the **Code**, **Pt** or **Elev** fields, then choose to discard the calculation result, a confirmation prompt will display.

Chapter 23

The SDR Database

In this chapter

- Viewing the database
- Searching for coordinates
- Using coordinate search logic

The SDR stores all observations, notes and calculated results in a database. This database is a list of records of different types, stored in chronological order. Each job's database starts with a **JOB** record, which defines the job's name, and continues with records within that job stored in the order they were generated.

23.1 Viewing the Database

You can view the SDR database at any time by pressing **<View>**. When the database screen is first accessed, the most recent record is highlighted. The **<↑>** and **<↓>** keys move the highlight bar forward or backward one record at a time. After you have located the desired record, press **<Enter>** or **<→>** to view the record details. Press **<←>** to return to the database list to search or view more records. Press **<Esc>** at any time to exit the database review.

Several softkeys are available in review mode:

- **<SRCH>**
- **<PREV>**
- **<NEXT>**
- **<PGUP>**
- **<PGDN>**

23.1.1 Searching by Point or Feature Code

After accessing the database with the <View> key, you can search the database for records containing a particular point ID or feature code.

The following steps will show you how to search for a specific point ID or code.

1. Press the <SRCH> softkey to display the Database Search screen.
2. Enter the point name in the **Pt** field and/or the code in the **Code** field.

☒ **Note:** If both a point name and a code are entered, the SDR first looks for point name matches. If none are found, then it searches for code matches.

3. Press <PREV> or <OK> to search backward or <NEXT> to search forward chronologically. The first matching record is highlighted. You can open the found record or repeat the steps to continue your search. If no matches are found, a message, "Search failed," displays.

23.1.2 Opening a Record for Viewing

You can open any record displayed in the database list to view the stored information. However, you can only edit code fields and notes.

The following steps will show you how to open a record.

1. Press the <View> key to access the database.
2. Highlight the record you wish to view and press <-> or <Enter> to open the record.
3. If more fields are available for this record, an arrow will display in the last field. To view these fields, press <->.

4. Use the <EDIT> softkey to edit notes and codes.
5. The <↑> and <↓> keys open the next adjacent record in the indicated direction.
6. To return to the database list, press <Esc>, <OK> or <←>. You can exit the database review by pressing <Esc> or <OK> from the database list.

23.1.3 *Editing Notes and Codes*

Most of the information stored in the database records is not available for editing; however, you can modify code fields or notes with the exception of program-generated notes such as Traverse closure information.

The following steps will show you how to edit a record.

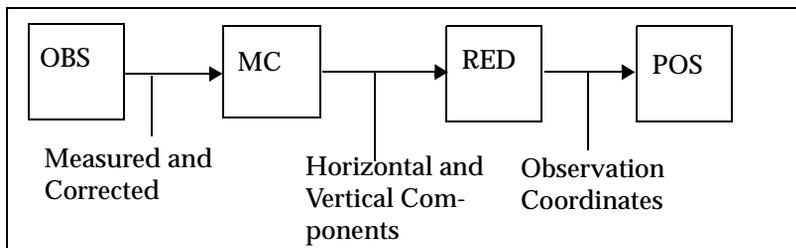
1. Press the <View> key to access the database.
2. Highlight the record to be edited and press <Enter>.
3. If the Cd field is not visible, press <→> to move to the next screen of data that contains the Cd field, or press the <EDIT> softkey to move directly to the Cd field.
4. Modify the code field or note.
5. Press <OK> when you are finished editing. Press <Esc> to return to the records being viewed.

23.1.4 *Reviewing Observation Records in the Database*

When you access the database with the <View> key and open a GPS observation record (GOBS), the data displays in the current view.

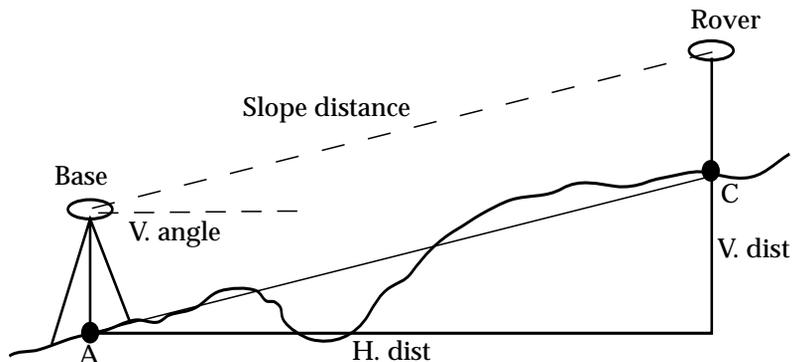
-
- ☒ **Note:** The initial view presented is specified in the **GPS view stored** field in the **Configure Reading** option under the **Functions** menu. Upon viewing an observation, you will not necessarily see the raw data.
-

The available views are as follows:



-
- ☒ **Note:** Actual stored data does not change when different views are selected; the raw data is always retained. Only the method of data presentation changes.
-

The components of these views are illustrated as follows:



The views are represented as follows:

The **GOBS** view is the azimuth, vertical angle, and slope distance from the base antenna to the rover antenna.

The **GREDED**..... view is the horizontal distance and the vertical distance from A to C.

The **GPOS** view is the coordinate at C.

The **POS**..... view is the coordinate at position C with the transformation determined from the most recent calibration applied, if available.

☒ **Note:** The illustration does not show the azimuth, which is part of the **GOBS** and **GREDED** views.

23.1.4.1 Accessing the Observation Record Views

The softkeys at the bottom of the screen, excluding the **<EDIT>** softkey, refer to different views you can see of this observation. The softkeys access the following:

- **<EDIT>**
- **<GOBS> (GPS observation)**
- **<GREDED> (GPS reduced)**
- **<GPOS> (GPS position)**
- **<POS> (position)**

Store the data in any of the views. When you look at the record again, it will be presented in the view you selected and saved. When you press one of the softkeys, such as the **<GREDED>** softkey, the softkey changes to **<SAVE>**. If you press it again, that view will be saved (The **<SAVE>** softkey vanishes, confirming that the record is saved in the new view mode).

☒ **Note:** Actual stored data does not change: the raw data is always retained. Only the method of data presentation changes.

Once you have saved a particular view, the SDR treats the observation as a record of that type for all other purposes.

When you transfer job data, you can transfer observation records in more than one view. Observation records are set to transmit in current view as a default. Use the <OPTNS> softkey on the **Communications** screen to differentiate transmission views. The **Communications** screen is displayed by selecting **Communications** in the **Functions** menu.

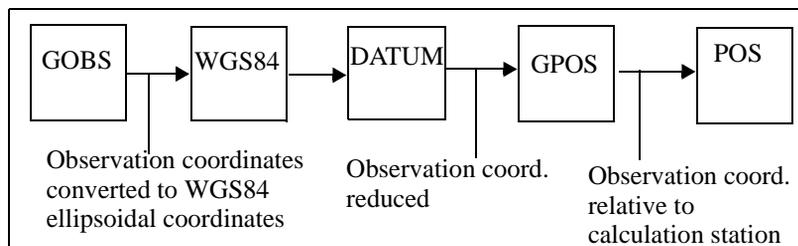
-
- ☒ **Note:** The ability to store observations in **GOBS** view or **POS** view has useful implications when combined with the SDR's search rules for calculating coordinates. For example, you can store your observation to override or ignore particular observations after they have been sorted. If you feel an observation is especially accurate, store it in **POS** view. This observation view is used by the SDR to calculate coordinates.
-

23.1.5 Reviewing Records with Transformation Reduction

When you access a GPS observation record and have selected a transformation for the current survey job your view options begin with the GOBS record.

The softkeys at the bottom of the screen, excluding the <EDIT> softkey, refer to different views you can see of this observation. The softkeys access the following:

- <GOBS> (GPS observation)
- <WGS84>
- <DATUM>
- <GPOS> (GPS position)
- <POS> (position)



You can store the data in any of the views. When you look at the record again, it will be presented in the view you selected and saved. When you press one of the softkeys, such as the <GPOS> softkey, the softkey changes to <SAVE>. If you press it again, that view will be saved (The <SAVE> softkey vanishes, confirming that the record is saved in the new view mode).

23.2 Searching for Coordinates

If you want to find out what coordinates the SDR will use for a particular point name, use the manual entry option **Key in Coords** access from the **Keyboard Input** option in the **Survey** menu or the **COGO** menu. In the **Key in Coords** screen, specify the point name in the **Pt** field. The SDR then displays the point coordinates if they are known or can be calculated.

-
- ☒ **Note:** To avoid creating a POS record from this action, press <Esc> in the **Key in Coords** screen after you review the information.
-

23.3 Using Coordinate Search Logic

A **POS** view record is, most typically, an observation (**GOBS/OBS**) in position (**POS**) view. However, **MC** and **RED** records can also be stored in **POS** view. These three types of **POS** view records (**GOBS/OBS** in **POS** view, **MC** in **POS** view, and **RED** in **POS** view) are equal in precedence to true **POS** (or **STN**) records in the coordinate search rules.

POS will search for last **POS** record in database

GPOS will search for last **GPOS** record in database

GRED/RED will search for last **RED** or **GRED** record in database

OBS MC will search for last **OBS MC** record in database

GOBS/OBSwill search for last **OBS** or **GBOS** record in database

When the SDR program searches for the coordinates of a point, it always uses the latest information, except that **POS** and **POS** view records are used before more recent **GOBS/OBS** records.

The SDR searches for the latest coordinates of the station point to calculate the target's coordinates from the observation.

Coordinates are one of the following:

- Station record (**GSTN/LLHSTN**)
- Position record (**POS**)

Coordinates can be calculated from one of the following:

- An observation record (**GOBS/OBS**) stored in **POS** view
- An observation record stored in raw or reduced view
- A reduced record (**GRED/RED**)

23.3.1 SDR Search Rules

When searching for the coordinates of a point, the SDR uses the following rules:

Rule 1: Observations in **POS** view are treated as a **POS** record.

Rule 2: The SDR uses **POS**, **GSTN**, **STN** and **POS** view records before using **GOBS/OBS** records even if the **GOBS/OBS** record is more recent.

Rule 3: If there are no applicable **POS**, **GSTN**, **STN**, or **POS** view records, the SDR will use the most recent **GOBS**, **OBS**, **GPOS**, **MC**, **GRED** or **RED** record. The record's view is no longer significant.

Rule 4: If no such record can be found, the search fails.

Rule 5: Coordinate searching is iterative.

Chapter 24

Basic Operations

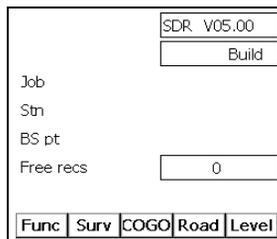
In this chapter

- Reviewing the welcome and home screens
- Using the keyboard
- Understanding the SDR menu structure
- Customizing the SDR software
- Entering data
- Understanding system messages

Before working with your SDR Level 5 in the field, you may want to review this chapter. This chapter explains several unique keys to access menu options and special functions as well as the menu structure and available options.

24.1 Reviewing the Welcome and Home Screens

When you initially turn the SDR on, it will display the boot sequence, including the **Welcome** screen:



```
SDR V05.00
Build
Job
Stn
BS pt
Free recs 0
Func Surv COGO Road Level
```

The **Welcome** screen displays, indicating software version number and the operating software currently loaded.

Pressing <Esc> or <OK> displays the **Home** screen. You can return to the **Home** screen at any time by repeatedly pressing <Esc>. The **Home** screen displays several types of information including:

- **date**
- **time**
- **name of current job (file name)**
- **current instrument station**
- **current backsight point**
- **number of free records remaining**

The **Home** screen is the starting point of your SDR operation. From this screen, you can access any menu of options by selecting one of the five softkeys at the bottom of the screen as described in the next section.

☒ **Note:** If the SDR was used in a previous session, it will return to the screen displayed when the SDR was turned off.

24.2 Using the Keyboard

The SDR's multi-function button keypad is platform dependent and designed to facilitate your workflow. The keypad is arranged in detail in the following diagram.



The SDR has several special keys in addition to key combinations to access special functions and create special characters.

The standard operating keys are as follows:

- <Esc>
- <Ctrl> +< R>
- <Shift>
- <OK>
- <↑> and <↓>
- <←> and <→>

24.2.1 Function and Character Keys

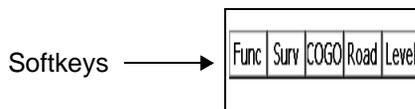
To access special functions or enter special characters, use the <Func> or <Shift> keys to create key combinations. To enter a key combination, press the <Ctrl> or <Shift> key first, then the key

corresponding to the desired function or character. For example, to turn off the SDR, press the gold <Ctrl> key, then press the <ESC> key. The functions available with the gold <Ctrl> key are as follows:

- <Ctrl>+<⏏>
- <Ctrl>+<L>
- <Ctrl>+<SP (Ins)>
- <Ctrl>+<Bksp (Del)>
- <Ctrl>+<M>
- <Ctrl>+<C>
- <Ctrl>+<O>

24.2.2 Softkeys

The bottom line of the SDR screen lists available softkeys. A softkey's function depends on the mode or screen you are in at the time, or settings you have pre-selected. Only the softkeys relevant to your current task appear.



Access the softkeys by pressing the specific key you would like to implement. The available softkeys will change depending on the functions and options on the SDR.

24.3 Understanding the SDR Menu Structure

A menu provides a list of SDR actions or selections. You can access the menus with softkeys located at the bottom of the **Home** screen or the opening screen of any menu. Press <Esc> repeatedly to get to the **Home** screen.

The SDR has up to five main menus. The availability of each menu depends on which SDR software options are installed on your SDR:

- **Func**
- **Surv**
- **Cogo**
- **Road**
- **Level**

☒ **Note:** The SDR requires a job in the system before many routines will function. The **Create job** screen will display if there is no current job.

Each menu lists several options that are organized according to specific tasks. The options available in SDR GPS/RTK are outlined in the following table:

Func	Surv	Cogo	Road	Level
Job	Topography	Set Out Coords	Select Road	Keyboard Input
Instrument	GPS Coord System	Set Out Line	Set Out Road	
Job Settings	Set Review	Set Out Arc	Set Out Road Surface	
Configure Reading	GPS Status	Inverse	Road Topo	
Tolerance	Keyboard Input	Areas	Cross-Section Survey	
Units		Intersections	Define Road	
GPS Controller		Point Projection	Review Road	
Communications		Taping from Baseline	Define Template	
Date & Time		Transformation	Review Template	
Job Deletion		Keyboard Input		
Calculator				
Feature Code List				
Hardware				
Upgrade				
User Program				
Language				

To perform a task with the SDR, such as determining unit settings or setting out a line, you must access a menu option.

The following steps will show you how to access or leave a menu option.

1. Access the appropriate menu.
2. Highlight an option by moving the highlight bar with the <↑> and <↓> keys or by pressing the letter key corresponding to the option's first letter. If two or more options start with the same letter, press the letter key more than once to step through the options.
3. Press <Enter> to select a highlighted option, or press <Esc> to leave a menu without selecting any option.

24.3.1 **Functions Menu**

The **Functions** menu is used to set up or start survey jobs. It also controls all communications between the SDR and any other devices, such as a personal computer.

You can access the **Functions** menu with the <FUNC> softkey.

24.3.2 **Survey Menu**

The **Survey** menu contains the programs most frequently used in the field for data collection. The other menus for field work are the **COGO** and **ROAD** menus.

Access the **Survey** menu with the <SURV> softkey.

☒ **Note:** Menu items specific to GPS RTK and total station work are described in detail in the **SDR Level 5 Reference Manual**.

24.3.3 **COGO Menu**

The **COGO** menu contains programs used frequently in the field for coordinate geometry calculations and setting out field work. The other menu for field work is the **Survey** menu.

Access the **COGO** menu with the <COGO> softkey.

Resection and **Keyboard input** are in this menu and in the **Survey** menu.

24.3.4 Road Menu

The **Road** menu contains programs used in the surveying, definition, and setting out of roads. Access the **Road** menu with the <ROAD> softkey.

24.4 Customizing the SDR Software

You can customize the SDR software for your specific tasks. The **Configuration Manager** screen lets you deactivate menu items to customize the SDR menus to facilitate your specific tasks. The **Configuration Manager** screen can be activated only from the **Home** screen.

24.4.1 Customizing Menus

You can use the **Configuration Manager** screen to customize your menu selections by removing or adding specific menus.

The following steps will show you how to customize menus.

1. Press the <Esc> key until the **Home** screen displays. The **Home** screen displays the currently available menus as softkeys at the bottom of the screen.
2. Press the <Ctrl>+<M> Level 5 key to start the **Configuration Manager**.
3. You can deactivate any of the five main menus from this screen. Press the <↑> or <↓> key to choose a menu, press the <←> or <→> key to toggle it **Yes** or **No**. Press <OK> or <Enter> to accept and exit the **Configuration Manager** screen.

4. When you return to the **Home** screen, the deactivated main menu item is no longer displayed and the softkey is unavailable.

24.4.2 Customizing Menu Options

In addition to adding or removing menus, you can specify options within the menu structures. Use the **Configuration Manager** screen to organize your menu options for specific surveys or tasks, improving your workflow.

The following steps will show you how to customize menu options.

1. You can also deactivate specific items under a main menu selection. For example, highlight **Road** on the **Configure** screen and toggle its setting to **Yes** with the <<-> or <-> key.
2. Press the <OPTNS> softkey. The SDR displays all options available under the selected main menu item. Options available include: select a road, set out road, set out road surface, road topography, cross-section survey, define road, review road, define template and review template.
3. Toggle individual items to **No**. Press <OK> or <Enter> to deactivate the selected items. The deactivated items will not be displayed when the main menu item is chosen.

24.4.3 Customizing Instrument Selections

You can also shorten the list of selectable instruments using the **Configuration Manager**. Reducing the list of selectable instruments can aid surveyors in selecting the instrument types and reduce confusion by eliminating a broad spectrum of instrument choices.

The following steps will show you how to customize instrument selections.

1. Press the <INSTR> softkey on the **Configure** screen.

2. Toggle individual instrument types to **No**, then press the <OK> or <Enter> key to deactivate the selected items.

☒ **Note:** The SDR will automatically reactivate instruments if you load a job file that previously used an instrument which is now deactivated.

24.4.4 Restoring Menus, Options and Instruments

Use the previously described procedures to activate disabled menus, menu options or instruments. To restore menus, options and instruments, you should select **Yes** instead of **No** next to each item.

24.5 Entering Data

Most screens in the SDR allow you to enter information. Information is entered into a specific line (field) on the SDR screen. Some fields have options you can select using the arrow keys; other fields require you to enter data.

In the **Create Job** screen, you can enter a variety of information including:

- **job name**
- **applied XFM file**
- **scale factor**
- **point ID format**
- **record elevation**
- **curvature and refraction correction**
- **sea level correction**
- **plane curvature correction**

This screen contains option, numeric and alphanumeric fields.

If the number of fields in a screen exceeds the space limitation on the first page, a second page is used to display the extra fields. The additional fields slide bar in the right corner of the first and/or last

fields signifies that more fields are accessible for that form. To view the additional pages, use the <↓> key on the last field or the <↑> key on the first field.

The following steps will show you how to enter data.

1. Use the <↑> and <↓> keys to move from field to field.
2. Enter data into the appropriate fields. The fields can be accessed in any order.
3. Press <OK> to accept entered values. If you do **not** want to continue, press <Esc>.
4. To edit data, highlight the field. Then make your editing changes or type a new value. The <Bksp Del> key backspaces over data and removes it.

24.5.1 *Field Types*

Three types of fields are used when you are reviewing or changing data:

- **Numeric**
- **Alphanumeric**
- **Option**

The type of field will determine how you can modify the data in that field.

24.5.1.1 **Numeric Fields**

Numeric fields include serial numbers, distance values and other values. Numeric fields accept only the digits 0 through 9, decimal points or a leading minus sign.

24.5.1.2 Alphanumeric Fields

Alphanumeric fields include notes, observation codes and other user-entered information. They can contain alphabetic (uppercase and lowercase) characters, numeric characters and special characters (such as +, -).

To toggle between upper and lower-case alpha characters, press <Shift>.

24.5.1.3 Option Fields

Option fields provide a list of possible selections, such as **Yes** or **No** options. The selections will toggle in the field when the <←> or <→> key is pressed. The option that is displayed when you move to another field (by pressing <↑>, <↓>, <Enter> or <OK>) is the entry for that field.

When you are in an option field, you cannot enter any alpha or numeric characters from the keypad. You must choose a selection from the choices provided.

For example, the **Point ID** field can be changed from **Alpha (14)** to **Numeric (4)**, by pressing <←> or <→>.

24.5.2 Point IDs

You can identify collected survey points in the SDR by names or numbers. When you create a new job, you must decide whether you want to use four-digit point numbers or 14-character point names. This option is selected via the **Point ID** field in the **Create Job** screen.

The four-digit point numbers are compatible with the SDR2, SDR20, SDR22 and SDR24 Electronic Field Books.

If you choose to use alphanumeric point names, verify that your office software will process them correctly (The output formats differ from the SDR2x formats). The Sokkia Software modules prior to version 4.02 do not support the SDR alphanumeric point names. Sokkia Software Versions 4.02 and above support this new format.

24.5.3 **Angles**

Angle fields include horizontal and vertical observation values, azimuths, and so on. If angle units are set to degrees, angle fields are entered in this form:

ddd.mmss

Where *ddd* is the number of degrees, *mm* is the number of minutes and *ss* is the number of seconds.

☒ **Note:** Angles are stored to an accuracy of hundredths of a second, but are displayed only to an accuracy of a rounded second.

Once you press <Enter>, the field displays in the form:

ddd ° mm'ss" (Unless quadrant bearings are used)

The acceptable value range for most angles is 0° to 359°59'59". The acceptable range for latitude angles is -90° to 90°. The acceptable longitude angle range is from -180° to 180°.

24.5.4 **Latitude, Longitude, and Height**

The key in options for local datum latitude, longitude, and height values are combined with the option to key in WGS84 values.

The following steps will show you how to manually input latitude/longitude height values.

1. Select **Lat/Long/Height** from the **Keyboard Input** screen.

Key In WGS84	
Pt	1000
Lat	<Null>
Lon	<Null>
Height	<Null>
Cd	<No text
<input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	

The **Key In Datum** screen will display.

Key In WGS84	
Pt	1000
Lat	<Null>
Lon	<Null>
Height	<Null>
Cd	<No text
Datum <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/> <input type="text"/>	

-
- ☒ **Note:** The **<WGS84>** and **<DATUM>** softkeys act as a toggle between the **Datum** and **WGS84** screens.
-

Enter Information into the following fields:

- Latitude
- Longitude
- Height
- Cd

2. When finished press **<OK>** to store the entered values The SDR will store the keyed in values as either a Datum KI or WGS84 KI record.

24.5.5 Notes

Notes are used to enter additional information about an observation. A note can consist of three lines of 20 characters (including spaces) or a total of 60 characters. The note record is stored, printed and transmitted as a continuous 60-character string but is split on 20-character boundaries on the screen.

Notes can be entered into the database at any time by pressing <Note>. Notes also can be inserted into the database during database review (accessed by <View>). The note is inserted before the currently highlighted database record.

Press the <TIME> softkey to manually store the current time and date. The <TIME> softkey will not appear when you are creating a job or when you are in the database review mode.

☒ **Note:** You can set an option for an automatic time stamp in the Data and Time screen.

The <FC ON> <FC OFF> softkey is used to turn on or off feature codes when entering Notes.

The following steps will show you how to enter a note.

1. Enter descriptive notes at any time by pressing <Note>.
2. Enter the information.
3. To turn on or off the Feature Code Insert option, press the <FC ON> softkey or the <FC OFF> softkey.

You will not see the <FC ON> or <FC OFF> softkeys if the **Code list active** option is set to **No** on the *Configure Reading* screen.

☒ **Note:** When the <FC OFF> softkey is visible, the feature code insert option is **On**; pressing the <FC OFF> softkey turns this option **Off**. The same logic is true for the <FC ON> softkey.

4. Press <Enter> or <OK> to store the note in the database; press <Esc> to discard it.

24.6 Understanding System Messages

There are two types of system messages, the first displays as a line within the current screen, the other clears the current screen and displays the message. The SDR will display a system message if

- **SDR cannot continue normal operation**
- **required field has not been entered**
- **tolerance has been exceeded**
- **option is not available at this time**
- **issue arises that requires user intervention**

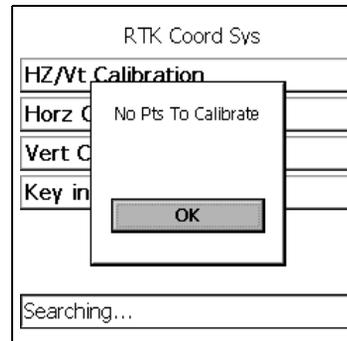
A system message may display because of a disconnected instrument, ambiguous or meaningless values (such as, the same point name for a station point and an observed point). If possible, correct the cause of the system message before continuing to operate the SDR.

The first system message displays on one line of the screen (just above the softkeys or on the top line), while the rest of the screen remains intact. The message remains until you press any key.

The screenshot shows a screen with the following elements:

- Top line: "Take Reading" followed by an empty input field.
- Second line: "Stn" followed by an empty input field.
- Third line: "Topo" followed by an empty input field.
- Bottom section: A horizontal bar containing the text "Null not allowed".
- Bottom section: A row of five softkey buttons labeled "OFS", "OFS-D", "Os-2d", "Angle", and "Crfg".

The second system message type clears the screen, displays the message, and instructs you to press any key to continue.



Chapter 25

Communications

In this chapter

- Communications hardware and parameters
- Printing data
- Transferring data files
- Using a modem

You can print or transfer data from the SDR to a personal computer by serial cable or by modem. Using the **Communications** option, you can send and receive SDR jobs, templates, and roads.

25.1 Communications Hardware and Parameters

When transferring data to or from a personal computer, the SDR uses a serial connection (If necessary use an adapter plug to connect the serial cable to your personal computer). The SDR is supplied with a serial cable to connect to a personal computer. Insert the Fischer connection to the SDR and the serial connection to an available serial port on your personal computer. If you are using a generic communications program to communicate with the SDR, set communications parameters in the program and the SDR to:

Baud rate 1200
Flow Control Xon/Xoff
Data bit 8
Stop bits 1
Parity None
Parity check Off

Carrier detect..... Off

25.1.1 **Setting SDR Communication Parameters**

The SDR communicates with external devices with the top or bottom serial port. Parameters must be set in the SDR to ensure proper communication. The SDR is supplied with a serial cable to connect to a personal computer. Insert the Fischer connection to the SDR and the serial connection to an available serial port on your personal computer.

When communicating with the SDR, review and change the communications parameters in the communications program and the SDR to the following:

Baud rate Ensure consistent rates on the SDR and the PC or device.

Flow Control Xon/Xoff

Data bit..... 8

Stop bits 1

Parity..... None

Parity check Off

Carrier detect..... Off

The communications parameters chosen for your personal computer must match those of the SDR. You can change the communication parameters using the <COM> softkey from the **Communications** screen.

The following steps are for setting SDR communication parameters.

1. Select **Communications** from the **Functions** menu.

2. Press the <COM> softkey. The Communications screen will appear, use this to set communications and parameters.

Port	Bottom
Modem	No
Baud rate	9600
Word length	8
Parity	Not set
Stop bit	1
Output delay	0
File	No

- Port
- Modem
- Baud rate

-
- ☒ **Note:** This field selects the port for communications with a computer only. Always use the bottom port for communication with an RTK instrument.
-
- ☒ **Note:** The same baud rate must be selected on both the SDR and the computer or printer connected to it.
-
- ☒ **Note:** This field controls the baud rate for communications with a computer. The baud rate for communications with an instrument is set automatically and depends on the instrument.
-

- Word length
- Parity
- Stop bits
- Output delay
- File

3. Press the <Enter> or <OK> key to save your settings.

25.2 Printing Data

You can print data directly from the SDR by connecting it to a printer via the top or bottom serial port.

-
- ☒ **Note:** The printer must be set to the same baud rate and parity as the SDR for the printout to work properly.
-

The following steps are to print data.

1. Select **Communications** from the *Functions* menu.
2. Select the **Printed** option in the **data format** field.

The softkeys access the following options:

- <OPTNS>
- <COM>
- <SEND>

3. Press the <SEND> softkey to select your data.
4. Choose **Select jobs**, **Select roads**, or **Select template** and set each job, road or template you want to print to **Yes**. To print all jobs in the SDR, choose either **Select all data** or **Select jobs** and then press the <ALL> softkey.
5. Make sure your serial printer is connected and ready, and press the <OK> key.

The SDR sends a formatted report to the printer and starts a new page for each job.

25.3 Transferring Data Files

You can connect an SDR directly to a personal computer to send and receive data files. These capabilities are accessed by selecting **Communications** from the **Functions** menu and using one of a variety of communications software.

25.3.1 Sending Data to a Computer

You can send your SDR job files and observational data from the SDR to a personal computer.

The following steps are showing how to send data to a personal computer.

1. Select **Communications** from the **Functions** menu.
2. Select **SDR** in the **data format** field.

The softkeys access the following options:

- <OPTNS>
- <COM>
- <SEND>
- <RECV>

3. Press the <SEND> softkey to select your data.
4. Choose **Select jobs**, **Select roads** or **Select templates** and set the value of each job, road or template you wish to send to **Yes**. To send all jobs or data in your SDR, choose **Select all data** and then press the <ALL> softkey.
5. Make sure your receiving computer is connected and ready. Then, press <OK>.
6. The SDR sends the selected jobs to the computer. During transmission, a status message displays.

- ☒ **Note:** The computer must be set to the same baud rate and parity as the SDR for the transmission to work properly.
-

25.3.2 *Receiving Data Files from a Computer*

You can transfer files from a personal computer to the SDR. You can transfer SDR job files, feature code lists and roading templates to the SDR.

The following steps show how to receive data from a personal computer.

1. Select **Communications** from the *Functions* menu.
1. Select **SDR** in the **Data format** field.
2. Press the <RECV> softkey. The SDR will display a message, “Waiting for input.”
3. Start the communications program you have chosen for your personal computer and begin transmitting jobs from there.

25.3.3 *Specifying the Format of Observations*

Observation records in the SDR database can be printed and transmitted in the same ways that they can be viewed.

The following steps show how to specify observation formats.

1. Select **Communications** from the *Functions* menu.
2. Select **SDR** in the **data format** field.
3. Press the <OPTNS> softkey to display the *Send Records In* screen.

4. Select the views you want by setting each view to **Yes**. The current view is the view you selected to store the record; it is the first view you see in the database.

If you set more than one view to **Yes**, the SDR transmits more than one record for each observation record in the database.

Send partial job

You can use the **Send partial job** option presented here to indicate that you only wish to send a portion of a job. If you set this option to **Yes** then, whenever you use any output options, you will be given the opportunity to send only part of a job.



Send all GPS as POS

Setting the **Send all GPS as POS** option to **Yes** allows you to output all GPS data in the **Printed output** or **Comms output** options as **POS** records.

Send all as POS

Setting the **Send all as POS** option to **Yes** allows you to output job data in the **Printed output** or **Comms output** options which contains only **POS** records for the points in the selected job(s). The output files obtained using this option have all the points in the job(s) output only as **POS** records with each point output just once and only the latest coordinates for each point used. This differs from the output obtained by setting the **POS** view to **Yes**, where station (**STN**) records, back bearing (**BKB**) records etc. are still sent, but all the observation (**OBS** or **MC**) and reduced (**RED**) records are output as **POS** records.

25.4 Using a Modem

The SDR supports the use of Hayes-compatible modems. The SDR initializes the modem and uses it to dial the necessary numbers for you to contact a personal computer.

The following steps show how to use a modem.

1. Connect the modem to the SDR using the modem port in the top of the SDR.
-
- ☒ **Note:** You will need to remove the top cap of the SDR to access the modem port.
-
2. Select **Communications** from the **Functions** menu.
 3. In the **Data format** field, select any data format to send or receive.
 4. Press the <COM> softkey to access the **Communications Parameters** screen. Select the modem by toggling the field to **Yes**.

Port	Bottom
Modem	Yes
Baud rate	9600
Word length	8
Parity	Not set
Stop bit	1
Output delay	0
File	No

5. Press <OK>; the **Communications** screen will display again.
6. Press the <SEND> softkey and select a job(s) to send entering **Yes** next to the job name.

To select all jobs or data in your SDR, press the <ALL> softkey.

7. Press <OK>; the Modem Parameters screen displays.

Enter information in the following fields:

- **Phone number**
- **Init string**
- Some special characters used in modem initialization sequences (such as &,;,?, etc.) do not appear on the SDR keyboard. These can be entered using the <FUNC> key.
- **Dial type**

8. Press <OK> to initialize the modem, dial the number, and begin communication.

☒ **Note:** When sending to the modem, the SDR may display “CTS/DSR detected” on the bottom line. This message has no effect on the data transfer and should be ignored. To eliminate the message, you can use a null modem cable connected from the bottom port of the SDR to the modem.

When the communication session is over, the receiving personal computer may send a message to indicate whether the transmission was successful. This message displays on the SDR's screen so you do not have to make a separate phone call to check validity. The message consists of normal ASCII text, ending with a carriage return character.

☒ **Note:** The bottom port has more lines connected than the top port, try it if you have problems.

Appendix A Instrument settings

In this appendix

- Communication with instruments
- Sokkia and non-Sokkia instruments

The SDR supports a variety of instruments. When using Sokkia instruments with the SDR, most instrument settings will already be established. If you are not using a Sokkia instrument, refer to your instrument's documentation for specific information.

A.1 Sokkia Instruments

When using the SDR with Sokkia theodolites and total stations, there are simple guidelines to store data correctly. There are also operational differences between two-way SETs and older instruments. This information is discussed in the following sections.

A.1.1 *Single Direction Communication*

Prior to creating a survey job, certain parameters must be set on the SDR and the instrument it communicates with.

Units

Both the SDR and the total station or theodolite must be set to the same measurement units (feet/meters, gons/degrees and vertical angle zenith/horizontal).

Prism Constant

The prism constant should be set on *either* the SDR or the instrument, but *NOT* both. Otherwise, the correction is applied twice. If the prism constant is entered in the SDR, a record of this will display in the printout.

PPM Correction

PPM should be set *either* on the instrument or via SDR pressure and temperature entries at the station setup, but not both.

Tracking

The tracking mode on the instrument can be switched on or off; it does not affect the SDR. However, if the SDR tracking parameter in the **Configuration** menu is set to **YES**, the SDR does not stop the EDM after a distance measurement. If the instrument is set to a single EDM measurement, the tracking mode will not be available.

A.1.2 Two-Way SETs

The two-way SETs have full two-way communications. Target height, backsight azimuth, temperature and pressure and other values can be manually entered. Avoid confusion about where to enter information by *entering all your survey information into the SDR, not the SET*. The SDR creates a permanent record of your field work, sends this information to the SET and checks to make sure no data has been inadvertently changed.

The values such as the PPM and prism constant will be set the same in both the SDR and the SET, contrary to the instructions for non-two-way SETs. Configure the SET and SDR using the following parameters:

Parameter	SET	SDR	SDR location
Baud rate	1200 or 2400	SDR will automatically detect setting	Comms
Parity	NO	set in SET	Comms
Checksum	On or Off	set in SET	N/A
Curvature and Refraction	set in SDR	On or Off	Job Settings
Instrument		Two-way SET	Configure Reading

☒ **Note:** For information on setting parameters in the SET, refer to the SET documentation.

The following steps show how to set parameters on the SDR.

1. Set up the SDR with the correct angles and distance units for your survey requirements.
2. In the **Instrument** screen, choose **Two-way SET**. If the SDR is connected, it immediately sends its serial number, vertical angle type and prism constant. The latter two settings may be changed if required.
3. Choose the orientation option required.
4. Set up on a station and take a backsight reading. The SDR sends all relevant unit settings and values to the SET and gives an **INSTR PARAMS SET** message.
5. On each subsequent reading, the units and PPM are checked.

A.2 Non-Sokkia Instruments

With all non-Sokkia instruments, it is recommended you enter corrections in the SDR rather than the instrument. By using this method, a record of corrections is maintained in the SDR database.

A.2.1 Geodimeter

The standard SDR (top) cable with a male DB25 connects to the female 25-pin connector on the Geodimeter's Y-cable. Plug the connector at the junction of the "Y" into the Geodimeter. You also can plug the remaining connector into an external battery pack.

A.2.2 Laser Atlanta Optics

The SDR supports the ProSurvey 1000 laser range finder from Laser Atlanta Optics, Inc. Configure the ProSurvey 1000 to communicate in standard mode (4800 baud, no parity, 8 bits, 1 stop bit).

A.2.3 Laser Technologies

The SDR supports the Criterion 300 and Criterion 400 laser range finders from Laser Technologies, Inc. Configure the Criterion 300/400 and SDR using the following parameters:

Parameter	Criterion
Baud rate	4800
Parity	NO
Stop bits	1
Vertical observations	

A.2.4 Nikon Instruments

The SDR supports the Nikon DTM-A series of instruments and the Nikon D-50 instrument. A special cable (Sokkia Product No. 5306-66) is required to convert the Nikon pin configuration to the SDR pin configuration. Even though the same type of connector is used, do *not* connect the SDR connector directly to the Nikon instrument.

When you have established the settings, press the <ENT> key on the Nikon to accept the new setting.

A.2.5 Pentax Instruments

The SDR provides software to interface with the Pentax PTS-10, PTS-II, PTS-III, PTS-V and PCS. A special cable is required to convert Pentax cabling to the SDR's Hirose standard cabling configuration.

A.2.6 Topcon Instruments

The GTS-3 setting supports the older GTS-3 instruments, although a special hardware interface or factory modification is required.

The GTS/ET1/ET2 setting is used for any of the following: GTS-3B, GTS-4, GTS-6 and ITS-1. The GST-3000 applies to the GTS-300 series.

A.2.7 Wild Instruments

The SDR supports the following Wild (Leica) instruments:

T1000	T2000	TC/TCM series
T1000+DI	T2000+DI	T1600+DI
T1600	T1010/1610	T1010/1610+DI

The DI selections support either an external EDM or integrated Total Station (TC series). For example, the T1000+DI supports either a T1000 with DI connected or a TC1000. A special cable (Sokkia Product No. 5306-12) is required.

A.2.8 Zeiss

The SDR provides software to interface with the Zeiss Elta 2, Elta 3, Elta 46R, Elta RL, Elta 50 and DiNi 10/20. A special connector (Sokkia product No. 5306-30) is required to connect the SDR.

Glossary

<%> and <1:>

These softkeys can be used to specify whether the grade is entered and displayed as a percentage or a ratio. If the format is percentage, the grade value specifies the slope to the next template point as a percentage. For example, 3% means that the template will rise 0.300 over a distance of 10.0. If the format is ratio, the grade value specifies the slope as a ratio. For example, 1:30 means that the template will rise 0.333 over a distance of 10.0.

ΔChordarc

This field displays the maximum chord-to-arc separation that applies for the specified *Len incr*. This is useful for checking that the points to be set out around the arc will be spaced closely enough. Entering a required maximum chord-to-arc separation will result in the appropriate length increment being computed, such that this separation is achieved.

ΔEast

Represents the east distance to the desired point from your current position.

ΔElev

This field displays the elevation coordinates.

ΔNorth

Represents the north distance to the desired point from your current position.

ΔOffset

This field displays the distance to the centerline.

ΔSta

This field displays the distance to or from the nearest station.

dist rdgs

This field controls how many distance observations are made during each observational sighting. Enter a value between 0 and 9.

of epochs

This field establishes the criteria to complete an observation. The name of this field and the values entered are dependent on the entry in the *End obsvsn* field (**Epoch**, **Time**, **RMS**, or **Manual**).

123...123

The SDR prompts for the second face of a set in exactly the same order as it prompted the first face. For example, if you select **123...123...**

and preenter points A, B, C, and D, you are prompted to observe points in the following order:

A,F1→B,F1→C,F1→D,F1→
A,F2→B,F2→C,F2→D,F2

123...321

The SDR prompts for the second face of a set be prompted in reverse order:

A,F1→B,F1→C,F1→D,F1→
D,F2→C,F2→B,F2→A,F2

123.321

The SDR prompts for the second face of a set be prompted in reverse order:

A,F1>B,F1>C,F1>D,F1>D,F2>C,F2>B,
F2> A,F2

3DRMS (m)

The RMS (root mean square) of observation residuals indicates the divergence of observed values. This field displays a total RMS value from receiver for the residual of all the components (three-dimensional). Enter the 3DRMS value in meters.

Accept float sol

This field determines if a warning is displayed when attempting to read while in a float solution and whether the end observation criteria includes the requirement of a fixed solution. Select **Yes** or **No** in this field to accept or reject the float solution.

Adj Selector

This field toggles between Yes and No. If Yes is displayed, you may select the adjustment method.

Adjustments

This shows the subsequent adjustments made to the coordinates of the initial position. Adjustments for both procedures are given as well as the initial coordinates.

Aim H. obs

This field shows the horizontal angles required to point to the target.

Aim V. obs

This field shows the vertical angles required to point to the target with a matching code will be included in the list.

Alignment road

This is composed of the horizontal and vertical element definitions, cross-sections, templates, super elevation and widening. These elements can be entered manually or uploaded from a computer system.

ALL level

This displays general information about the collected sets, including the number of sets, the station point ID and the collected points.

Almanac

Message transmitted by each satellite which gives the approximate location of all GPS satellites. The almanac is provided so that the signals for individual satellites can be acquired rapidly. It is also a tool for predicting satellite conditions for planning purposes.

Alpha

The point names may contain 14 characters, both letters and digits. **Job size (k)** This field displays the size of the job, in kilobytes, currently occupied in memory.

Amb fix mode

Select from 1 through 8. This field sets the confidence ratio of the solution between 1 (95.0% confidence) and 5 (99.9% confidence). Higher confidence levels take a longer time to solve the integer ambiguity, but increase reliability. This ratio is fixed if you are using the Radian receiver. Available on some receivers.

Ambiguity

definition: The uncertainty inherent to an initial measurement which biases all measurements.

field: This field displays whether the solved position is **Fixed** or **Float**.

Amb status

The ambiguity status of the current solution from the rover receiver. The options are **Fixed** or **Float**. The current northing value of the receiver's position in the calibrated coordinate system displays.

Angle

Angle units apply to all horizontal and vertical angle measurements and azimuths. Units can be **degrees**, **quadrant bearings**, **gons**, or **mils**. The SDR assumes horizontal angles and azimuths are always measured turning to the right. Selecting quadrant bearing units only affects the display of bearings (30° displays as N30°E); the underlying units are still degrees.

Angular

Select your angular type. Your choices are **Weighted**, **Linear**, or **None**.

Ansermet < 2 No Redundancy caution

The determination for this warning message is the least squares ansermet. When the ansermet is equal to zero, there is no real redundancy in the adjustment. Error detection is not possible and all corrections become zero. If the ansermet is 1, error detection is not theoretically possible, but some corrections are made. It can be an indication to the user that a particular situation could produce unreliable results. In the case of ansermet = 0 or the case of ansermet = 1 with a blunder detected, it should be verified that the geometry of the target point constellation is stable.

<ANT>

This softkey accesses the **Antenna Setup** screen.

Ant Elev

This field indicates the elevation including the antenna height.

Antenna height

The distance between the position of the observed point and the antenna.

Antenna type

This field identifies the antenna type to be used. The options are **User** and several predefined types.

Ant meas method

This field allows selection of the measurement method for antenna height, which is to be directly input. The options are **Vertical** or **Slant**.

Apply Super

This field specifies whether or not the element will be affected by the application of superelevation. Select Yes or No.

Apply Widen

This field specifies whether or not the element will be affected by the application of widening. Select Yes or No.

Arc len

This field specifies the value used to define the distance along the **arc Atmos crn** (*Applies only to total station measurements*). If atmospheric correction is set to **Yes**, the SDR applies an atmospheric correction to observations based on the current temperature and pressure values.

Atmos crn

If atmospheric correction is set to **Yes**, the SDR applies an atmospheric correction to observations based on the current temperature and pressure values (applies only to total station measurements).

Attributes

This field is used for user-defined attributes.

Auto pt ID

If you do not enter a point designator, this is the next designator that SDR automatically suggests. Once a point designator has been suggested and accepted, the SDR automatically increments to determine the next value. For example, point 1000 is followed by 1001, and PIPE8 is followed by PIPE9 and then PIPF0. HELLO is followed by HELLP. The sequence continues until HELLZ, which is followed by HELMA.

Az

This field displays the azimuth value of the indicated satellite.

Azimuth

definition: A horizontal angle measured clockwise from a reference source. The reference, typically north, is defined as zero.

horz point: Azimuth at the end of the previous element.

traverse orientation: Enter the back-sight azimuth.

horz arc: Azimuth at the end of the previous element, which is used as the azimuth for the start of the spiral.

horiz straight: The direction of the straight. It defaults to the azimuth at the end of the previous element. If the straight is the first element in the alignment, it defaults to the starting azimuth of the centerline. Generally, you will not need to change this value. It is acceptable to do so, but the alignment will not be smooth; a sudden change of direction will occur.

B (base)

The associated satellite is tracked by the base receiver.

Back tan

This field specifies the value used to define the back tangent direction.

Base Elev Mask (Base receiver only)

The elevation mask limits the base receiver to use only satellites above this angle from the horizon. Values between 0° and 90° can be used.

Baud rate

This field specifies the speed that characters are sent along the serial line. The baud rate is the number of bits sent per second; there are typically 10 bits transmitted for each byte or character. For example, 9,600 baud means 960 bytes per second. Available baud rates are: 300; 600; 1,200; 2,400; 4,800; 9,600; 19,200 and 38,400.

Beep on epoch

This field will turn the data collector beep on or off.

BLAVE

This option performs a BLAVE adjustment.

Blunder detection

Because blunders have an adverse affect on Least Squares adjustments and are helpful in explaining the status of other indicators, it is important for the user to be made aware of their presence. A target point observation, bearing or distance, is marked as a blunder if the corresponding correction exceeds the apriori standard error of the observation multiplied by ten. The apriori standard error of the observation are the observation tolerances set in the Tolerance screen in the **Func** menu.

BPS age (s)

This field displays the time interval for broadcasting the base positional information.

BPS warn

This field displays the base position signal's from the base receiver. The messages displays as follows:

No refcoord: base station coordinates contain all zeros

No ref ant: antenna offsets were not entered in the base receiver

No ref raw: raw position was not computed at base

Bad ref pos: computed raw position differs from the entered base coordinates by 500 meters or more

No ref L2: L2 measurements are not available at base

BS pt

Enter the backsight point ID.

C (common)

The associated satellite is tracked by both base and rover receivers (receiver specific).

C/A (Course/Acquisition) code

Standard GPS code transmitted on the L1 frequency. The sequence contains 1023 modulations per signal at a rate of 1.023 MHz. The code reiterates every millisecond.

Calculate resection

This option calculates the station by performing a least squares adjustment.

Cd

This field allows a code to be attached to the point that this element defines.

Center

This field is used to define the center of the arc.

Chord In

This field specifies the value used to define the straight line distance between the arc's *From* and *To* points.

Close code

Select this code to be the line end code.

Circular VC

Define the vertical intersection point (**VIP**) and radius for a circular curve in this screen. The direction of the curve is determined by the relative position of the previous and following **VIPs**.

Code

A code can be specified in the **Cd** field; only points with a matching code will be included in the list.

Code Fields On?

If this option is selected, your codes will be split into subfields.

Code list active

When this field is set to **Yes**, any code field will use the feature code list for quick entry of codes. When this field is set to **No**, use normal entry of alphanumeric data in the code field.

Collect more sets

Select this option to collect more observation sets.

Combine F1/F2

When this field is selected **Yes**, the topography program prompts you for two observations, one from each face of the instrument.

Cogo

This menu allows you to perform coordinate geometry calculations and setting out field work.

Com sat

This field indicates the number of satellites common to both the current rover and base receiver. The warning will indicate if the number of satellites is equal to or less than number provided.

<CNFG>

This softkey accesses the **Configure Reading** screen.

Const Adj

This field displays the constant height shift for all points based on the difference.

Cont reading

This field determines the data collection method of observations. **Yes** - Continuous Reading. **No** - Single reading.

Cont. readings

Use this method to collect continuous observations by specifying time and distance parameters. This method is not available during **Type**. The available fields in the **Configure Reading** screen vary depending on the instrument type selected. You can establish the configuration for any instrument whether it is currently connected or not. The options are **Total Stn** or **GPS RTK**.

Cont record rate

This field determines how often (in seconds) a position is stored during continuous reading.

Coord

Coordinate units do not refer to the coordinate values, but to the order in which they are displayed. Your choices are **N-E-Elev** (north, east elevation) or **E-N-Elv** (east, north elevation).

Corrections

This gives the bearing and distance corrections which were applied by each adjustment procedure. The BLAVE corrections will indicate certain observations with an asterisk next to the appropriate bearing or distance. The asterisk indicates that the corresponding correction exceeds the a prior standard error of the observation (observation tolerances as set in the **Tolerance** screen) multiplied by ten.

Cut

This grade will be applied to meet existing terrain when the template is in a cut situation.

Cut/Fill

This field shows the cut/fill determined by the current point

Cut or Fill

This field indicates the vertical distance above or below the desired elevation. If the field is **Cut**, the elevation is below. If the field is **Fill**, the elevation is above.

Cut o/s

This field is normally zero. However, if the design point is underground, you may want to enter a **Cut o/s** value of 1.000, for example, to accurately stake an above ground mark. (To set out a fill offset, enter a negative value in the **Cut o/s** field.) The vertical angle in the **V.obs** field changes to reflect the new desired position. If you observe this vertical angle, the actual Cut value in the first field changes to 1.000.

Date and Time

Displays the date and time the job was last accessed; therefore, the date and time displayed will not necessarily relate to the last time data was saved in the job. For example, the process of selecting a job as the current job will access the job files and therefore update the date and time.

D.ang

Angular closure error.

Data

This field controls which observational measurements will be collected together. The options are as follows:

HVD: All measurements are collected in each set of observations.

H,VD: The horizontal angles are collected during one observation. The vertical angle and distance are collected on the next observation.

H,V,D: The horizontal angle, vertical angle, and slope distance are collected in separate observations.

Where: **H** = horizontal angle, **V** = vertical angle, and **D** = slope distance.

Date

The date the feature code list was created.

<DATUM>

This view displays the point datum latitude, longitude, and height.

Datum And Ellipsoid

The simplest type of datum transformation; it allows a conversion between ellipsoids.

Datum Shift

Allows conversion between ellipsoids that have different origins.

Datum Shift Rotate

Convert further between ellipsoids whose Cartesian systems are rotated with respect to each other.

Datum Transformation

Ellipsoidal to ellipsoidal.

DBEN latency

This field displays the time interval for a message from the base receiver to the rover receiver.

D.Dist

Horizontal closure distance.

D.East

Closure distances for the north coordinates.

Dec shown

see *Decimals Shown*.

Decimals Shown

This field controls how many decimal places are shown. The options are **2**, **3**, and **4**. The number will be rounded at the specified decimal place.

Define horizontal

This option allows you to enter a variety of horizontal elements to your alignment road definition.

Define super

This option allows you to specify superelevation and widening to your road definition.

Define vertical

This option allows you to enter a variety of vertical elements to your alignment road definition.

Define Xsection

This option allows you to attach a roading template to use instead of defining individual elements.

D.Elev

This field shows the closure distances for the north coordinates. This field can also be used for specifying a known difference in elevation, from the interpolated height along the baseline to the point being set out. A

negative difference in elevation value indicates the point to be set out is below the interpolated elevation along the baseline.

Description

This field displays a description of the transformation type selected in the Transformation field. Up to 16 characters can be entered.

Design Elev

This field displays the elevation of the point being staked out.

Design slope

This field displays the design grade of the slope being staked out.

Dest.N

Enter the North destination value.

Dest.E

Enter the East destination value.

Dest.El

Enter the elevation destination value.

Direction

calculate position/set collection: Observe several points using the same instrument orientation.

arc: This field specifies whether the arc being defined turns toward the right (clockwise) or left (counterclockwise) when viewed from the From point. This field toggles between **Right** and **Left** when the ← or → keys are pressed.

receiver: This field displays the current direction of the receiver based on azimuth.

cross-section: This field specifies the survey direction of the cross-section. Choose from Left->Right, Right->Left, Left, or Right using the <<-> and <-> arrow keys.

Dist

units: The unit chosen applies to all distances, lengths and coordinates. The conversion factor used is 1 International foot = 1.000002 US feet = 0.3048 meters. For distances in land surveying, the difference between the International foot and the U.S. Survey foot is less significant than the error inherent in EDM instruments. However, take this factor into account in certain situations such as using state plane coordinate system values. Distance units can be **meters, (International) feet, or US feet**

baseline to point: This field indicates the set out distance from the baseline to the point to be set out. A negative distance value indicates that the point to be set out is in the opposite direction to that of the baseline (the point is "behind" the From point).

loop distance: This field displays the loop distance.

Distance

template: This field specifies the horizontal distance of the new template point from the previous template point. It may not be negative; the template shape may not double back on itself. If the grade is specified as

either **Up** or **Down** then the distance is taken to be vertical with the horizontal distance being zero.

horizontal straight: The length of the straight section.

radius: If a distance value is entered into the **Radius** field, only points within that area (radius) from the current station will be included in the list.

Distance range

If a distance value is entered into the **Radius** field, only points within that distance (radius) from the current GStn will be included in the list.

Dist exclusion

A position will not be stored based on the continuous reading setting if the point is within the specified distance of the previous point.

D.North

Closure distances for the north coordinates.

<DSGN>

Use this softkey to store a RPOS record containing the design coordinates, station, and offset from a selected part of the road design.

Dynamics

This field defines changes in velocity during observations. The setting filters out measurements that do not fit expected motion. Select an option best suited to movement (aircraft, vehicle, etc.) expected during the survey.

E

In this field, the east coordinate value will be displayed or must be defined.

East

The current easting value of the base receiver's position in the calibrated coordinate system.

<EDIT>

This softkey initiates an edit mode in which you can modify the *Cd* field of the current record.

EDM desc

This field is used to log EDM descriptions.

EDM S/N

A six digit numeric field for the EDM serial number. It is transmitted as part of the instrument record.

Edm tol (mm)

SDM fixed tolerance in millimeters specifies the SDM error that is independent of the length of line measured.

Edm tol (ppm)

(parts per million) Specifies the EDM error that is proportional to the length of the line measured.

EI

This field displays the calculated elevation value of the indicated object. In some screens you will must enter the elevation point in this field.

Elev

GPS Stn Position: The current elevation value of the base receiver's position in the calibrated coordinate system.

Adjustment Options: Select **Weighted**, **Linear**, or **None**.

Elev mask

Values from 0° to 90° can be entered to exclude satellites below the rover receiver's elevation mask from being used in the observation.

End obsvn

The observation will end when the specified conditions are met. The selection in this field will affect the observation in the *Taking Reading* screens. The options are **Epoch**, **Time**, **RMS**, and **Manual**.

End stn

The end station for this application.

End vert algmt

This option will end the vertical alignment definition.

Epoch rate (s)

This field allows you to enter the rate at which measurement epochs on the receiver are taken. An epoch is a point in time based on the rate in seconds set in this field. Each observation is a number of epochs.

Face order

This field controls the switching between F1 and F2 during the collection of single as well as multiple sets. Select from the following options:

F1 only F1F2/F1F2 F2F1/F2F1

F2 only F1F2/F2F1 F2F1/F1F2

Some selections show two sets, separated by a slash, indicating that both faces will be used. For example, F1F2/F2F1 specifies that, in the first set, observations will be made to points in the set beginning with Face 1 and then Face 2 of your instrument, and in the second set, you will reobserve the same points beginning with Face 2 and then Face 1 of the instrument.

If you wish to observe only one set, taking first Face 1 then Face 2, you should choose either F1F2/F1F2 or F1F2/F2F1. (Since you are only collecting one set, ignore the second set specification.)

Fast Solution

The **Fast Solution** option will produce calculated estimates to your next point when you are in motion during a survey. This can be used when continuous readings are necessary when navigating between points in set out routines. Select **Yes** (default) or **No** in this field (Available on some receivers).

Feature Code

Specify a feature code in the **Cd** field; only points **Right/Left**. This field shows you the distance to move

either left or right to get on line. The direction is from the instrument operator's point of view.

File

This option copies the job to the SDR memory and will not send data through the com ports. The stored data can then be used by user programs.

File Size (k)

This field displays the size of the feature code list in kilobytes.

Fill

This field shows you the amount of cut or fill the currently observed position represents relative to the design point. Remember the currently observed point is the physical point at the bottom of the prism pole.

template: This grade will be applied to meet existing terrain when the template is in a fill situation.

From

transformation: Enter the beginning point ID of the point whose azimuth you wish to rotate and the point you wish the SDR to use to calculate the azimuth.

define baseline: Enter a point; this field plus one of the other point fields (*To pt*, *Center* or *Intersect pt*) must be entered.

arc: Enter a point from which the arc initiates in the direction defined.

loop: This field indicates the starting point ID of the level loop.

FS pt

Enter the closing foresight point ID.

Func

This menu is used to set up or start survey jobs, determine job and configuration parameters, remove jobs and communicate between the SDR and other devices as well as starting the calculator, setting up feature code lists and upgrading SDR software and languages.

<Func>+<⏏>

This key combination turns off the SDR.

<Func>+<Bksp (Del)>

This key combination deletes the character under the cursor.

<Func>+<C>

This key combination pops up the calculator.

<Func>+<L>

This key combination turns the SDR's backlight screen on or off.

<Func>+<M>

This key combination accesses configuration manager, enabling you to select whether a particular menu or a specific menu option is displayed.

<Func>+<O>

This key combination displays all the options available for a field.

<Func>+<SP (Ins)>

This key combination turns insert/overwrite mode on or off.

General Statistics

This provides general information about the points which were observed.

Gnd Elev

This field displays the elevation minus the antenna height.

<GOBS>

see *GOBS*.

GOBS

(GPS observation) The azimuth, vertical angle, and slope distance from the base antenna to the rover antenna. The **GOBS** view shows the observation from the base receiver antenna to the rover receiver antenna.

GOBS/OBS

This searches for last **OBS** or **GBOS** record in database.

<GPOS>

(GPS position) The **GPOS** view shows you the observation reduced to coordinates relative to the station from which it was calculated. It also searches for last **GPOS** record in database.

GPOS view

GPS position uncalibrated/uncorrected view.

GPS Coord system

Selecting Unknown requires all Stns and GStns to have connectivity. This connectivity (or homogeneity) requires all points to be connected by observations. A selection of Known allows the use of disjointed Stns and Gstns.

GPS view stored

The GPS observations are stored in the indicated view. Choices: GOBS, GRED, GPOS or POS.

Grade

This field displays the grade of the slope being staked out. You can edit this field if desired.

<GRED>

see *GRED view*.

GRED

The horizontal distance and the vertical distance from point A to point B.

GRED/RED

This searches for last **RED** or **GRED** record in database.

GRED view

(GPS reduced) The **GRED** view shows you the observation adjusted for base and rover antenna height reduced to its horizontal and vertical components.

H

A letter "H" displays if the associated satellite is healthy.

HDOP

This field displays a value of the two-dimensional Horizontal Dilution of Precision.

Height

Enter a height value in this field.

Horz

One or more points required for this calibration. Points must have at least Northing and Easting coordinate values.

Horizontal

This option performs a horizontal calibration.

Horizontal/Vertical

This option performs both a horizontal and a vertical calibration.

HRMS (m)

This field displays a HRMS value from receiver for the residuals of the horizontal component. Enter horizontal RMS value in meters.

H sets

This field controls how many sets of horizontal angles are collected.

HtDiff

This field specifies the vertical height difference of the point from the centerline. A positive height difference means the point is above the centerline.

Hz/Vt

One point or three or more points are required for this calibration. Points must have Northing, Easting and Elevation coordinate values.

ID

Road Statistics: Name of the current road. You can enter a new ID here if necessary.

Stats: This field displays the name of the feature code list.

Info Blocks

This field will split your note records into specific fields that contain different types of data.

In/Out

This field shows you the distance to move either in (toward the instrument) or out (away from the instrument) to get the prism on to the target point.

Intersect pt

The point field used to define the intersection of the tangents.

Job

This field holds the name of a new job. Enter a name with any combination of letters and numbers, up to 16 characters long. Do not use a period (.) within a job name.

Job size (k)

Size of the road file, in kilobytes.

Join

This field determines whether points with this code are joined together as line work if the points are plotted.

Latitude

Enter a value in this field for latitude (positive north and negative south). For example, to enter 37°25'42.0000N, type **37 + <. > + 25 + <FUNC> + <. > + 42.**

Least Squares

This option calculates the unknown station using a least squares adjustment.

Least Squares statistical data

used to determine, independently, the validity of the Least Squares result. This can be particularly helpful in the event that the LS and BLAVE results do not coincide.

Left template

This field indicates the name of the template to be inserted on the left side of the centerline.

Len incr

This field specifies distance increments along the set out line at which you want to set out points. For example, if you wish to set out points every 20 feet (or meters) along the set out line, enter 20 into this field.

Level

This menu accesses routines for differential leveling.

Level Desc

Enter the type of level you are using; this information is stored as part of the instrument record for documentation.

Level S/N

Enter the serial number of the level; this information is stored as part of the instrument record for documentation.

Linear

Any angular closure is distributed evenly among the angles of the traverse route.

Line len

This field defines the distance along the specified baseline from the selected **From** point to the set out point. You can enter into the **Line len** field the appropriate distance to the point to be set out or you can use the other fields on the screen to determine the distance.

Line work

Draw lines between points.

List Name

This field indicates the Feature Code List name (up to 16 characters).

Local coords

This field controls the coordinate system to which the computed coordinates are referenced.

Local Datum View

View local datum in latitude and longitude height.

Longitude

Enter a value in this field for longitude (positive east and negative west).

Low Wire

This field displays the low wire reading.

L super

The superelevation to apply to the template on the left side of the road.

<HORIZ>

applies horizontal superelevation to the left side of the road.

<|:> converts a superelevation value to a ratio format (1:300).

<%> converts the superelevation value to a percentage.

LS vs. BLAVE

The same tolerance is applied to the horizontal distance between the determined unknown station position of both adjustment procedures (times two). It informs the user when the results of the two procedures deviate from each other. This would be expected in the presence of blunders which typically, and incorrectly, alter a Least Squares position.

L widen

This field specifies the amount of widening to add on to the elements of the template on the left hand side of the road.

Manual Method

This selection field can be toggled between 1-wire and 3-wire. Select 1-wire if you are reading only the center cross hairs. Choose 3-wire if you are recording top, center, and bottom cross hairs.

MC view

Measure corrected observation view.

Memory (kB)

This field provides information on remaining instrument memory in kilobytes.

Method

Adjustment Options: Select the **Compass** or **Transit** coordinate adjustment method.

Set Collection: This field indicates the sets collection method:

Direction-observing several points using the same instrument orientation.

Repetition-observing a single angle between two points several times using different instrument orientations.

Method Selector

This field toggles between Weighted and Linear.

Mid Wire

This field displays the mid wire reading.

Model

This field provides the model of instrument based on the selected type; the information is stored as part of the instrument record.

Modem

If you are using a modem, set this field to **Yes**. This field can also specify the modem used. An extra screen appears whenever any communications are initiated.

Mount

In this field you may choose a type of EDM mounting method. Your choices are:

Not applic-EDM and theodolite are coaxial

Standards-EDM is standard mounted on the theodolite case

Telescope-EDM is mounted on the theodolite telescope and consequently moves as the vertical angle changes

N

This field displays the calculated north coordinate value. In some screens you must enter the north coordinate value in the corresponding field.

N1

This field displays the Signal to Noise ratio for the L1 frequency.

New Azim

Enter the new azimuth.

<NEXT>

This softkey moves you to the next occurrence of the record type you have currently highlighted.

None

No elevation adjustment is carried out.

North

The current northing value of the base receiver's position in the calibrated coordinate system.

North, East, Elevation

These three fields show the point's coordinates.

No RTK warn

This field, if set to **Yes**, provides a warning if no RTK solution is available. The options are **Yes and No**.

Number H Sets

This field controls how many sets of horizontal angles are collected.

Number of V Sets

This field appears only if the data being collected is **H,VD** or **H,V,D**; this field indicates how many sets of vertical angles are collected.

Numeric

Numeric point names, which contain four digits, that are compatible with the SDR20 series of data collectors.

OBS MC

This searches for last **OBS MC** record in database.

Obs order

This field specifies the order in which the SDR prompts you to observe points when collecting individual sets.

OBS view

Observation view.

Offset

roads: This field specifies the distance of the point from the centerline. This offset must not be less than the offsets of any previous points in the template (A template may not fold back on itself with an overhang). You can enter an offset the same as the previous point; this results in a vertical portion of the template. However, only two consecutive template points may have the same offset; you may not have three points one above the other. This field can also be used to define a parallel offset from the originally defined curve. A negative value indicates an offset to the left illustrates an offset arc to the right.

antenna: Represents the current offset of the antenna position.

store results: This field displays the calculated offset of the observed position.

arc: This field displays the perpendicular distance from the baseline or arc.

<OK>

This key accepts and stores all fields displayed on a screen form. (A form is a group of data fields displayed together).

<OPTNS>

This softkey accesses the options menu related to the active screen.

Org.N

Enter the origin North value.

Org.E

Enter the origin East value.

Org.El

Enter the origin elevation.

Other grades

This grade unit will be applied to all crossfall occurrences including the definition of the actual templates in ROADING (with the exception of the sideslope grades as discussed below). The options are: **Ratio** (1:10) or **Percent** (10%).

Output delay

This is designed primarily to give support for serial printers with little or no buffering. When this field is non-zero, it causes any output to pause for the number of milliseconds specified before sending each byte.

Paper

Paper size

Parabolic VC

Define the vertical intersection point (**VIP**) and length for a parabolic curve in this screen. The direction of the curve is determined by the relative position of the previous and following **VIPs**.

Parity

This field specifies the type of parity bit added to each character during sending. It also refers to the parity bit that is checked when a character is received. Your options are **Not set**, **Odd**, and **Even**. The parity bit is sent in addition to the specified number of data bits.

P.C. mm

The prism constant (in millimeters) is the optical distance from the plumb line to the reflexive surface of the prism. Apply the prism constant in either the SDR L5 or the instrument, but not both. The screen allows you to specify the receiver and where the GPS raw data should be stored.

PDOP

This field displays a value for the three dimensional Positional Dilution of Precision. PDOP is related to the volume of the geometric figure whose convergent point is the receiver and whose sides are defined by the vectors from the receiver to each of the satellites being tracked.

Permanent Installation

Load transformation (XFM) files to the SDR's non-volatile memory (NVM).

<PGDN>

This softkey moves you down a full screen (8 lines).

<PGUP>

This softkey moves you up a full screen (8 lines).

Pivot

This field specifies whether the center, left or right part on the cross-section is to be held at constant elevation during the application of superelevation and widening.

Plan form

Vertical, horizontal, or 3-D plan form.

Point ID

The first range criteria consists of a simple numeric range of points from the point name specified in the **From** field to the point name specified in the **To pt** field (inclusive). Any point names in the range that do not already exist are ignored.

POINTS level

This displays specific information about a point. Also, this level displays the average of all observations made to a point from each set in the station.

Point count

Displays the number of points currently stored. A new road will have a point count of 0.

Point range

The first selection method is a simple numeric range of points from the point name specified in the **From** field to the point name specified in the **To pt** field (inclusive). Any point names in the range that do not already exist are ignored.

Port

This field specifies the SDR port the serial cable is plugged into. Your choices are COM1 (top) and COM2 (bottom).

Position

This compares the coordinates calculated by both adjustment procedures.

<POS>

(position) The **POS** view shows the observation relative to the station from which it was calculated. If the record is a GPS observation, the transformation determined from the most recent calibration will be applied, if available.

POS

Configure Reading: The coordinate at position C with the transformation determined from the most recent calibration applied, if available.

SDR database: Search for last **POS** record in database.

POS view

Positional view.

Precision

Precision of the traverse as a ratio of the total horizontal distance traversed to the closure distance.

Preenter points

This field determines if you enter a list of points that you will observe, prior to observing any points in the set. The SDR will use the list's order, in conjunction with the **Obs order** field, to prompt you for the next point to observe.

If this field is **Yes**, the SDR allows you to enter a list of points that you will observe, prior to observing any points in the set.

If this field is set to **No**, you will not be asked for the point names prior to observing the points. The SDR will, however, intelligently guess which point you are observing based on the observations taken, and assist you by supplying the point name, code and target height, if required. This feature is active only for sets collected by direction.

Pressure

Pressure units apply to the atmospheric pressure values. Units can be millimeters of mercury (**mm Hg**), inches of mercury (**Inch Hg**) or **millibars**. Conversion factors used are 1 Inch Hg = 25.4 mm Hg and 1,000 mbar = 750 mm Hg.

<PREV>

This softkey moves you to the previous occurrence of the currently highlighted record type. For example, if a station (STN) record is highlighted,

pressing <PREV> moves the highlight bar to the previous station in the database.

Projection

Ellipsoidal to rectangular

Pt

String Road definition: This field indicates the current road station point ID.

Translation Transformation: Enter the starting point ID.

Pt 1

This field indicates the first point name to define the building face plane. Both *Pt 1* and *Pt 2* must have horizontal coordinates to properly define the building face.

Pt 2

This field indicates the second point name to define the building face plane. Both *Pt 1* and *Pt 2* must have horizontal coordinates to properly define the building face.

Pt 3

This field indicates the third point name to define the plane. If you are surveying a vertical plane, or building face, the *Pt 3* field should be left blank.

Pt an orient

Point annotation orient.

Pt an pen

Point annotation pen.

Pt an size

Point annotation size.

Pt code

Point code.

Pt elev

Point elevation.

Pt num

Point number.

R (rover)

The associated satellite is tracked by rover receiver.

Radio link warn

This field, if set to **Yes**, provides a warning if the radio link is lost. The options are **Yes and No**.

Radius

spiral: Smallest radius of the spiral.

arc: Radius of the arc.

Radius (mm)

Antenna Settings: This radius of the antenna is entered in millimeters.

This field displays only if **Ant meas method** is set to **Slant** and is editable if **Antenna type** field is set to **User**.

<RCHK>

This softkey stores a RCHK record and a note record of the observation.

Rcv

This field indicates in some receivers which receiver(s) is tracking this satellite. The available options are as follows:

B-Base

R-Rover

C-Common

Rcvr batt (%)

This field provides your remaining battery power by percent.

<READ>

This key records measurement readings from your instrument.

Recip Calc

Choose whether to perform reciprocal calculation. The options are **Prompted, Always, and Never**.

Recs used

(**Road Statistics** screen) The approximate number of records (point positions, observations, notes, etc.) currently stored in the road.

Recs Used

(**Stats** screen) This field displays how many records occur in the feature code list.

Recvr mode

The receiver mode identifies which receiver is currently connected and being set up. The options are **Base and Rover**.

RED view

Reduced view.

Report angle adjust

Select **Yes** or **No** to specify whether or not to display the updated closure and traverse precision details after the angular adjustment, but before the coordinate adjustment. The displayed angular closure after the angular adjustment is always zero.

Resection

This method uses least squares adjustment techniques to determine the coordinates of an unknown point.

Return sight

This field specifies whether you wish to sight again on the first observed point in a set when the end of the set is reached. For example, if points 1, 2 and 3 are observed and a return sight is selected, then the physical observations made would be 1, 2, 3, 1. Any error found in the return sighting is distributed between the other observations. This field displays only when the set collection method is **direction**.

Review existing sets

Select this option to review the collected observation sets.

Right template

This field indicates the name of the template to be inserted on the right side of the centerline.

RMS

The root mean square of the least squares calibration procedure.

Road

menu: This menu contains programs for road survey, definition and set out.

field: This field indicates the name of the road where you are taking cross-sections in the field. Specifying a different road name in the *Road* field after observing some sections allows you to take cross-sections of subsequent roads.

Rotation

Enter a rotation value.

Rot Pt

Enter a point ID to use as the rotation point. All coordinates will be rotated around this point.

<RPOS>

This softkey stores an RPOS record and a Note of the observation to the SDR database.

<RPT>

This softkey accesses the *Slope Staking Report* to insert staking notes in the SDR database.

RSTN Station

This field specifies the station point name.

R super

This field specifies the superelevation to apply to the template on the right side of the road. Highlighting the **R super** field displays the same three softkeys presented for the **L super** field:

<**HORIZ**> applies horizontal superelevation to the right side of the road

<|:> converts a superelevation value to a ratio format (1:300)

<%> converts the superelevation value to a percentage

R widen

This field specifies the amount of widening to add on to the elements of the template on the right hand side of the road.

Sat

This field displays the tracked satellite's PRN.

Scale

Horiz Parameter: The scale factor is a uniform scale in all directions that relates the GPS coordinate system to the local defined system.

Linear Transformation: Horizontal scale factor.

Scale Factor

see *S.F.*

SDR search rules

Rule 1:Observations in POS view are treated as a POS record.

Rule 2:The SDR uses POS, GSTN, STN and POS view records before using GOBS/OBS records even if the GOBS/OBS record is more recent.

Rule 3:If there are no applicable POS, GSTN, STN, or POS view records, the SDR will use the most recent GOBS, OBS, GPOS, MC, GRED or RED record. The record's view is no longer significant.

Rule 4:If no such record can be found, the search fails.

Rule 5:Coordinate searching is iterative.

Segments

This field displays only if both the **From** and **To** points were specified for the baseline. This field interacts with the **Len incr** field, because it displays the number of segments of the length specified in the **Len incr** field that fit in the defined baseline. Therefore, if you want to split the baseline into a specific number of evenly sized segments, enter the required number of segments into the **Segments** field. The **Len incr** field will then display the computed length of each segment. The <**RNDUP**> softkey, when selected, will round the value in the **Segments** field up to the next whole number. Again the <**RNDUP**> softkey is available only when both the **From** and **To** points are specified for the baseline.

Select XFM

This field determines whether coordinate systems will be calibrated or applied during the survey process.

Send all as LELEV

Send all as level record (point defined only by elevation)

Send all as POS

Send all as a positional view

Send GPS as POS

Send GPS record as a positional view

Send partial job

Send a partial job

Serial no

This field displays the automatic number assigned to your project.

SETS level

The initial Set review screen indicates all of the points observed during the collection of set number 1 from the station to its left.

SETS-POINTS level

This displays all the observations to a point in a specific set. The fields in this level display the following information:

Third and fourth line-list the horizontal angles of each observation made to B in Set 1.

Fifth line-the average (represented as an **F1** observation) of the horizontal observations made to the point B in Set 1.

Sixth line-the maximum difference between the average and the individual horizontal observations.

Seventh line-the difference between the average from the fifth line and the average over all sets (Sets 1 and 2).

It should be emphasized that return sights are displayed independently of initial sights to the reference point.

SETS-POINTS-FACES level

This displays the raw observation data about a highlighted point.

Shift Rotate Scale

The most general type of datum transformation, is similar to Datum Shift Rotate, but also provides a scale factor for converting between the Cartesian coordinate systems.

S.F. (Scale Factor)

This field holds the plane scale factor of the job. If your job is using a transverse mercator projection you will need to calculate a suitable scale factor for your work area.

The scale factor is applied whenever non-GPS observations are reduced to generate coordinates. It is also applied in reverse to generate set out measurements.

<Shift>

This key alternates between lowercase to uppercase.

Sideslope at

This field displays the horizontal distance from the beginning of the sideslope to the current antenna location.

Sideslope grade

The sideslope is the crossfall which joins the edge of a roading template and the existing terrain at a catch point. It can be set independently of other grades with this unit. Options: **Ratio** (:) or **Percent** (%).

Single observations

Use this method to collect individual observations by pressing the **<Read>** key when the antenna is at the appropriate position.

Slope E

This field indicates the slope along the east axis, which indicates how the geoid changes in the northerly direction. Since it is a slope (or ratio), it has no units.

Slope N

This field indicates the slope along the north axis, which indicates how the geoid changes in the easterly direction. Since it is a slope (or ratio), it has no units.

S-O Align

This field enables you to select the type of information displayed when using setting out functionality for roading alignments and defined lines in **COGO** functions. The options are **Azmth/Dist**, **Deltas**, **Sta/Direction** and **Sta/Offset** (default).

S-O Points

This field determines the format of information in the when setting out functionality for roading alignments and. The options are **Azimuth** (default) and **Deltas**.

Sort Type

This field indicates the sorting option for feature codes in the list.

Alpha - As feature codes are enter in the list, they are automatically sorted alphanumerically. The Default List is sorted alphanumerically.

User - The user-defined sorting option should be used if you repeatedly will use particular feature codes in the same order, for example a road cross-section with user-sorted feature codes of curb, gutter, center line and curb. As you enter points, the feature code list will always be one code away from the next observation. Additionally, the feature code lists starts from the beginning when it gets to the end.

Speed

This field determines the speed at which the receiver is moving. The options are **KPH**, **MPH** and **knots**.

<SRCH>

This softkey enables you to search backward or forward for a particular point name or feature code.

Sta crn

This field represents the distance you need to move along the centerline in order to find a point.

Stadia

Select the stadia value, **1:100** or **1:300**, when entering 3-wire readings using the **Manual** instrument setting.

Sta incr

The **Sta incr** field indicates the distance between each station.

Sta..ing

Horz straight: The station (chainage) at the start of the straight section.

Horz spiral: Station (chainage) at the start of the spiral.

String Road definition: This field indicates the current stationing value.

Units: This field controls how stationing values are displayed. The options are **10+00**, **1+000** and **1000**.

Define Vertical: Define the point by specifying the station (chainage) to relate the vertical alignment to the horizontal alignment

Define Xsection: This field indicates the station (chainage) at the start of the cross section definition

Horz point: The station (chainage) at the end of the previous element.

Start

Enter a point name in the **Start** field; the point elevation value will display in the **Elev** field. (The point name itself is not actually stored in the vertical definition since the information and survey job are independent).

Start code

Select this code to be the line start code.

Sta crn

This field displays the distance to or from the nearest station.

Start stn

The starting station (chainage) of this application.

<STAT>

The softkey accesses the **GPS Status** screen.

Stationing

This field controls how stationing values are displayed. The options are 10+00, 1+000 and 1000.

Stn

This field displays the starting traverse point ID. You can also enter the ending traverse point ID.

Stn Pos(field)

This field specifies the station point name. If you enter a name known to the SDR, it fills in the coordinate fields with the point's coordinates; otherwise it sets the coordinate fields to **Null**.

Stn pos(warning)

A particular least squares statistic, the standard deviation, is used to determine a **Stn pos** as good or bad. The standard deviation, times two, is compared to a user-supplied tolerance in the **Func** menu under **Tolerances**. If it exceeds it, the **Stn pos** is determined as "bad". This is meant to be an indicator to the user that the LS standard point deviation is large prompting further investigation of the results.

Stop bit

The number of stop bits transmitted after each character. Your options are **1** and **2**.

<STORE>

Transfers the RPOS and NOTE records to the database and returns you to the **Set Out Road** screen.

Store obs

This field determines if raw observables are stored in the receiver's memory. The options are **Yes** or **No**.

Store Obs on

Select where the raw observation data should be stored. The options are **SDR** or **RCVR** (receiver) but depends on the receiver's functionality.

Surv

This menu accesses survey programs frequently used in the field for data collection.

Tan len

The tangent length of define arc.

Temp

see *Temperature*.

Temp-Dist/VDist

This element is used to create consecutive, incremental, joined cross-section lines specified by a distance and vertical distance.

Temp-Grade/Dist

This element is used to create consecutive, incremental, joined cross-section lines. Specify the grade and distance incrementally from the previous station element.

Templ-Offs/Htdiff

This element is used to create lines based off the center line of the road. Specify the offset distance and then the height difference from the desired station.

Templ-Sideslope

This element is used for defining a sideslope and can be only the last component in a template. Specify the cut/fill ratio desired for the sideslope.

Temperature

Temperature units apply to the atmospheric temperature values. Units can be **degrees Fahrenheit** or **degrees Celsius** (Centigrade). The conversion formula used is $^{\circ}\text{C} = (^{\circ}\text{F} - 32)/1.8$.

Temporary Installation

This enables you to send an XFM file directly from Sokkia software packages to the SDR. This process works similar to transferring a job.

Time

The time the feature code list was created.

To

Enter the point you wish the SDR to use to calculate the azimuth.

Tol H.obs

The field displays the horizontal distance measurement.

Tol V.obs

This field displays the vertical distance measurement.

Topo View stored

This field controls the view in which observations are initially displayed using the topography program. Your options are **OBS** (raw observation view), **MC** (measured and corrected view), **RED** (reduced view), **POS** (position view).

To Pt

general: Enter the ending point ID of the point whose azimuth you wish to rotate.

arc: A point field describes the point upon which the arc terminates.

loop: This field indicates the ending point ID of the level loop.

Top Wire

This field displays the top wire reading.

Trans

see *Transformation*

Transformation

Select the type of transformation to be used on the job in this field.

Trans.E

The east shift parameter moves the GPS origin east to coincide with the locally-defined coordinate system.

Trans.N

The north shift parameter moves the GPS origin north to coincide with the locally-defined coordinate system.

Type

This text field addresses the type of instrument you are setting up.

U

A letter "U" displays if the associated satellite is unhealthy.

Unprompted

The SDR will not prompt you at all and observations may be made in any order.

User Datum

This is equivalent to the Datum Shift Rotate Scale, but the ellipsoid parameters are provided by the user.

VDist

This field specifies the vertical height difference of the point from the previous template point. A positive value means the point is above the previous point, a negative value means it is below.

Vertical

This option performs a vertical calibration.

Vertical offset (mm)

The vertical offset is the measurement from the antenna mount to the phase center of the antenna in millimeters. This field is editable if the **Antenna type** field is set to **User**.

VDOP

A value for the elevation Vertical Dilution of Precision. You may enter a value for height precision in this field

V.obs

The **vertical observation** field allows you to select a method to measure a vertical angle.

Zenith-Angles are measured with the upward vertical representing 0 degrees

Horiz -Angles are measured with the horizontal representing 0 degrees

VRMS (m)

This field displays a VRMS value from receiver for the residual of the vertical component. Enter vertical RMS value in meters.

V sets

This field appears only if the data being collected is **H,VD** or **H,V, D**; this field indicates how many sets of vertical angles are collected.

Weighted

Any closure in the elevations is distributed in proportion to the length of the traverse line leading to the point (like the Compass rule used in the coordinate adjustment).

<WGS84>

This view shows the original GOBS coordinates converted to WGS84 ellipsoidal coordinates. latitude, longitude, and height.

Word length

This field specifies the number of data bits in each character transmitted or received. You may use up to eight characters.

WGS84 LLH view

View coordinates in latitude and longitude height

Xsect crn

This field displays the distance (perpendicular) to the centerline.

Zero azimuth

This field determines which direction is used to define the zero azimuth. The options are **north** (default) and **south**.

Zone

Select the local zone to which the transformation will be applied.

Index

A

- accessing
 - accumulative 16-6
 - record views 23-5
- adding
 - notes 24-14
 - points 6-1
- angle
 - fields 24-10
 - offsets 5-3
- antenna setup 4-1
- arc set out 10-2
- area
 - calculating 22-2
 - subdividing 22-2
- averaging observations 5-7
- azimuth
 - reviewing 3-3
 - zero 4-4

B

- backsight 13-1
- base receiver
 - differential message 3-3
 - setting up instrument 4-1
- basic operations 24-1
- baud rate 25-2
- building face survey 20-1

C

- carrier detect 25-2
- character keys 24-3

COGO

- calculating inverse 22-1
 - menu 24-6
 - options 22-1
 - rotating a fixed point 22-6
 - subdividing areas 22-2
 - subdividing lines 22-8
- ## communications
- hardware 25-1
 - observation formats 25-6
 - parameters 25-1
- ## configuration manager 24-8
- ## coordinate
- searching 23-7
 - search logic 23-7
 - systems 2-2
- ## cross-section
- performing 19-5
 - setting out 16-2
 - survey 19-1
- ## customizing
- instrument selections 24-8
 - menu options 24-8
 - menus 24-7
 - SDR software 24-7

D

- data
 - entering 24-9
 - printing 25-4
- database
 - reviewing records 23-3
 - viewing 23-1

data bit 25-1
defining, unit formats 4-4
deleting
 job 12-6
 points 6-2
 road 15-3
 template 15-10
derivation code 22-4
design coordinates 6-1
document conventions 1-1

E

editing
 codes 23-3
 notes 23-3
elevation
 record 24-9
 remote 14-1
 reviewing 3-3
elevation mask 4-1
epoch rate 4-2

F

fields
 alphanumeric 24-11
 numeric 24-10
 option 24-11
 types 24-10
file format 2-4
fixed points, subdividing 22-6
flow control 25-1
full functionality 2-3
function keys 24-3
functions menu 24-6

G

geometry
 reviewing 3-3
GPS
 azimuth 3-3
 capabilities 1-1
 definition 3-1
 elevation 3-3

instruments 4-3
 observation 23-5
 position 23-5
 reduced 23-5

H

hardware, comms 25-1
HDOP 3-3
HRMS
 instruments 4-3
 reviewing 3-3

I

illegal shape 22-3
incremental 16-5
info. blocks 4-2
initiating observation 5-1
instrument
 GPS 4-3
 selection 2-2
 selections 24-8
 setting up 4-1
intersections 22-10

J

job
 creating 12-2
 current 12-6
 deleting 12-6
 modifying 12-8
 opening 12-3
 renaming 12-4
 reviewing 12-4
 specifying 12-5

K

keyboard, using 24-3

L

latitude and longitude 24-12
leveling

- using the program 21-1
- making reports 21-4

M

- menu options
 - customizing 24-8
 - restoring 24-9
- menus
 - customizing 24-7
 - options 24-9
 - survey 24-6
- menu structure 24-4
- modem
 - using 25-7

N

- notes 24-14

O

- observations
 - angle offset 5-3
 - averaging multiple 5-7
 - initiating 5-1
- offsets, observing 5-2
- output 2-4

P

- parameters
 - communications 25-1
 - RTK surveys 4-2
 - setting 25-2
- parity 25-1
- PDOP
 - establishing 4-3
 - reviewing 3-3
- point
 - adding 6-1
 - deleting 6-2
 - IDs 24-11
 - projecting 9-2
 - searching 23-7
 - setting out 8-1

- staking out 6-3
- point projections 9-1
- printing data 25-4
- project management 2-1

R

- RCHK 16-4
- receiver
 - base 3-3
 - rover 3-2
- receiving data, files 25-6
- records
 - reviewing 23-6
 - views 23-5
- remote elevation 14-1
- RMS 3-1
- renaming
 - job 12-4
 - road 15-3
- restoring
 - instruments 24-9
 - menus 24-9
 - options 24-9
- reviewing
 - azimuth 3-3
 - differential message 3-3
 - elevation 3-3
 - geometry 3-3
 - job statistics 12-4
 - observation records 23-3
 - records 23-6
 - satellite use 3-4
 - template definitions 15-9
 - welcome screens 24-2
- roading 2-3
- road menu 24-7
- roads
 - creating 15-1
 - deleting 15-3
 - renaming 15-3
 - selecting 15-2
- road statistics 15-3
- road topography 18-1
- rotation 11-4
- rover receiver 3-2

RPOS 16-4

RTK solution 3-1

S

satellite use 3-4

scale factor 24-9

SDR database 23-1

searching

by point 23-2

by feature code 23-2

for coordinates 23-7

search logic 23-7

search rules 23-8

selecting road 15-2

sending data to computer 25-5

set out

arc 10-2

cross-section 16-2

line 7-2

list 6-1

road surface 17-1

sideslopes 16-4

setting up

instrument 4-1

road station 15-4

station and backsight 13-1

single-distance offset 5-4

sideslopes 16-4

softkeys 24-4

sorting set out by azimuth 6-3

staking out

arc 10-2

line 7-2

notes 16-5

relative to a line 7-4

station, backsight 13-1

station setup 2-1

status screens, GPS 3-1

stop bits 25-1

subdividing areas 22-2

survey direction 19-2

surveying

left to right 19-2

nonvertical planes 20-4

right to left 19-3

to the left 19-4

to the right 19-4

vertical planes 20-1

survey jobs 12-1

survey menu 24-6

system messages 24-15

T

taking readings 2-2

taping from baseline 8-1

technical support 1-3

temperature 4-4

template

deleting 15-10

point by distance 15-8

point by grade 15-7

point by offset 15-6

reviewing definitions 15-9

sideslope definitions 15-9

topo 2-2

topography, road 18-1

transferring data files 25-5

transformation reduction 23-6

transformations

Helmert 11-1

Linear 11-2

translation 11-3

two-distance observation 5-6

typefaces 1-1

U

unit formats, defining 4-4

units, angles 24-12

V

viewing database 23-1

VRMS 3-3

W

welcome screen 24-2

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