# AASHTO SDMS Collector
## Getting Started Manual

**American Association of State Highway and Transportation Officials**
**444 North Capitol Street N.W., Suite 249**
**Washington, D.C.  20001**

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Release 3.4

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# Introduction to SDMS Collector

## Welcome to SDMS Collector

SDMS Collector is the field data collection and stake out software component of the AASHTO Survey Data Management System (SDMS). SDMS Collector has been designed to provide flexible and device independent field survey data recording and stake out software. SDMS Collector supports data collection for commonly used horizontal and vertical survey tasks, including:

- Topographic Surveys
- Establishing Control Networks
- Setting Control Points for Photogrammetric Control Surveys
- Traverses
- Resections
- Radial And Standard (SOR) Cross Sections
- Single-Wire Leveling
- Three-Wire Leveling
- Construction Stakeout

## What Is SDMS?

SDMS is actually two things. First, and most important, it is a detailed data structure which has been defined, documented, and adopted by the American Association of State Highway and Transportation Officials (AASHTO) for recording field survey information. This data structure is defined in the AASHTO publication SDMS Technical Data Guide 2000. This technical data guide can be obtained off the AASHTO Web Site or by writing or calling AASHTO at:

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The goal of AASHTO in defining this data structure is to establish a national standard for recording and exchanging survey data. With electronic measuring equipment and computers being applied to every facet of surveying, civil design, plans production, and construction, the need for a defined standard for recording and exchanging survey information has become critical. The current situation of each brand and model of data collector having a unique data format is a huge impediment to the automation of these processes.

Second, SDMS Collector is a "Year 2000" (Y2K) compliant survey data collection software system that can be used for common surveying tasks, and which complies with the AASHTO SDMS standard data structure. It currently runs on DOS based computers, laptops, and hand-held PC's, and it communicates with a variety of total station instruments. It can also be used as a generic, alphanumeric data collector when no measuring device is interfaced. It is a menu driven system that is easy to learn and easy to use while being flexible and comprehensive at the same time.

One of the hallmarks of SDMS Collector is that within the confines of the SDMS data structure, the software is almost completely user definable. A user can configure the system to prompt for a particular set of data items in any order that makes sense and is convenient for them. SDMS Collector allows the user to define lists of responses to many of the prompts and displays them as pick lists. This reduces the amount of hand entry of data required in the field.

# About This Manual

This manual is intended as only an introduction and orientation to SDMS Collector. Its purpose is to describe and demonstrate the more commonly used features of SDMS, but it does not attempt to discuss every possible option in every possible activity. Many of the topics discussed here are described in greater detail in the SDMS Collector User's Guide.

In writing this manual, it was assumed that the user is reasonably computer-literate, is familiar with operating computers in the MS-DOS environment and is familiar with common procedures in survey data collection and field stakeout. This guide is only intended to help the user get a basic understanding of SDMS Collector. To become most proficient, the user should consult the SDMS Collector User's Guide.

# Standards and Conventions Used

Characters to be entered from the keyboard are shown with bold, italicized characters. Some examples are:

- F1 - indicates the Function 1 key. On some models of Husky PC's, function keys are accessed by holding the "paw" key and then pressing the appropriate number. Thus, F1 is entered as "Paw" -1.
- ? - indicates the question mark character. This is used in SDMS as a help key.
- Esc - indicates that the Esc (escape) key is to be pressed.
- Ctrl-F10 - indicates that the CTRL key is held down while pressing the F10 key.
- Alt-F10 - indicates that the Alt key is to be held down while pressing the F10 key.
- ↵ -or <Enter> - indicates that the Enter or Return key is to be pressed. It usually appears after a string of characters to be entered from the keyboard. For example, MONUMENT↵ indicates that the word "MONUMENT" is to be typed in, followed by pressing the Enter key.

The names of data tags, activities, and task names, as well as prompts and messages displayed by SDMS Collector appear like this:

- TK:TRA - the traverse task.
- AC:OS - the occupied station activity.
- PN: - the point number data tag.
- Choose a Command - a system prompt.

Filenames and filename extensions are shown using characters like these:

- NEWPRJ.SEQ - name of a file

- .PRJ - a filename extension.

Variables, such as a value or filename, are shown in italic characters, like this:

- path\filename.ext
- XC:xxxxxx.xxx

Example and Sample files include a line number as a reference in the document, but are not part of the actual data files. For example,

Variables, such as a value or filename, are shown in italic characters, like this:

| | | |
|---|---|---|
| **1.** | PR:3WREXAM.PRJ | - project header can be the project file name |
| **2.** | TK:3WR | - type of task (3 wire level) |
| **3.** | AC:OS | - begin activity Occupied Station |

The numbers indicate the reference line number only.

# Hardware Supported by SDMS Collector

SDMS Collector is an MS-DOS based program that requires at least an 8 line by 40 column display. It can run on 80286, 80386, 80486, and Pentium based machines. It is designed for use on hand-held PC's in the field but can also be used on desktop and laptop computers, and other data recorders that support MS-DOS. Specific data recorders that meet criteria include:

- Husky Hunter 16 (2Mb minimum)
- Husky FS/2 (2Mb minimum)
- Husky FS/3 (2Mb minimum)
- Husky FSGS (2Mb minimum)
- Husky MP2500 (2Mb minimum)
- HP100LX (2Mb minimum)
- HP200LX (2Mb minimum)
- PC and Laptop Computers that support MS DOS.

To record information measured by total station instruments, there must be an RS232C serial connection between the total station and the data recorder. Total stations supported by SDMS Collector include:

- Geodimeter System (400/500/600)
- Leica T1010/1610
- LIECA TCR303
- LEICA TCA1103
- Lietz Set Series (3 and 3B)
- Nikon DTM Series 400 - 800
- Pentax PTS-III
- Sokkia Set Series (2, 2B, 3, 3B, XL, & 100 Series)
- Topcon GTS Series (4 and 300/500/700)
- Topcon GTS AF Series (601-603 ,605)
- Topcon GPT Series (1001, 1002, 1003)
- Trimble TTS Series (300 and 500)
- Wild 2000 & T2002
- Zeiss Elta Series (3/4D)

For information on supporting other brands and models of total stations, contact:

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SDMS Collector may be also be used as a survey data recording system without being connected to a measuring device. In every case where a measurement is called for, the user has the option of manually entering the values through the keyboard, or polling the connected total station for the measurement values.

# Examples and Tutorials

This guide includes numerous examples and tutorials. Each tutorial and example is given in a three-column table, in which the first column gives the step number, the second instructs you on what to do next, and the third describes the response of the SDMS Collector software once you perform the given instruction. An example of this format is the installation instructions presented in the next section.

All of the examples use manual entry of data to simulate field measurements, so having your computer connected to a total station instrument is not necessary. For working the examples, it is suggested that the user install and run SDMS on a desktop or laptop computer. Getting Started With SDMS Collector is designed to teach a user about the SDMS data structure and how the software works, without getting involved in the peculiarities of the different models of hand-held PC's that SDMS Collector is actually used on in the field.

# Installing SDMS Collector

| Step | User Input | System Response |
|---|---|---|
| 1. | Boot the machine to the DOS prompt. Make the disk drive where SDMS Collector will be installed the active drive by entering the drive letter followed by a colon. For example, if SDMS is to be installed on drive C:, enter C:↵ | Makes the installation drive the active drive. |
| 2. | Enter CD \↵ | Changes the current directory to the root directory. |
| 3. | Enter MD SDMS↵ | Creates the directory C:\SDMS |
| 4. | Enter CD SDMS↵ | Makes C:\SDMS the current directory |
| 5. | Enter MD PRJ↵ | Creates subdirectory C:\SDMS\PRJ, which is used for storing data files. |
| 6. | Enter MD SEQ↵ | Creates subdirectory C:\SDMS\SEQ, which is used for storing user defined sequences. |
| 7. | Insert the SDMS program diskette into the floppy drive (these instructions assume that your floppy drive is drive A:) then enter COPY A:*.* ↵ | Copies the SDMS system onto directory C:\SDMS |
| 8. | Enter COPY NEWPR.SEQ SEQ↵ | Copies the sequence file NEWPR.SEQ to subdirectory C:\SDMS\SEQ , then |
| 9. | Enter DEL NEWPR.SEQ↵ | Delete NEWPR.SEQ from the C:\SDMS directory. |
| 10. | Remove the SDMS installation disk and store it in a safe place. | |

If the data recorder being used does not have a floppy drive, serial communications software or other types of storage media (PCMCIA cards, for example) can be used in place of Step 3 above. Otherwise, follow the same procedure.

To execute SDMS Collector once it has been installed, use the following steps.

| Step | User Input | System Response |
|---|---|---|
| 1. | At the DOS prompt, enter CD C:\SDMS↵. If SDMS Collector is installed to a different directory in steps 2 and 3 of the installation procedure, use the name of that directory instead. | Changes the current directory to the SDMS directory. |
| 2. | Enter SDMS↵ | Executes SDMS Collector and displays the main menu. |
| 3. | To exit from the SDMS main menu back to DOS, Press the Esc key. | Displays the prompt: OK to exit to DOS? Yes No |
| 4. | Press the Y key. | Exits SDMS and returns to the DOS command prompt. |

# SDMS Concepts and Terminology

## The SDMS Data Structure

SDMS Collector uses a hierarchical data structure for storing survey information. SDMS data for a project is stored in an ASCII text file, called the Project File. The project data file is the file produced by the SDMS software that conforms to the standards defined in the AASHTO publication *SDMS Technical Data Guide 2000*. It is the end result of using SDMS to collect field data. Most other files used or produced by SDMS are specific to the data collection software, not to the defined data standard.

To begin our understanding of the data structure, let's study the definitions below.

- **Data Item** - a single piece of information, such as a vertical angle, slope distance, or point description. Each data item occupies one line in the project file.
- **Data Tag** - a two character alphanumeric code that describes the type of data item being recorded. Each line in the SDMS project file begins with a data tag followed by a colon. There are a finite number of supported data tags.

**Note**: Data tags and Data Items are always recorded using upper case characters.

- **Activity** - a group of data items that define the needed information for a surveying activity. There are a finite number of supported activities. Examples of activities include Occupied Station, Backsight, Foresight, Sideshot, and Station Resection. In the project file, each activity begins with the AC: data tag, followed by a colon and a two character activity code. Activities may contain up to 20 different data items, and for each activity you can specify which data items to prompt for, and the order in which they are prompted for.
- **Task** - the type of surveying job the data in an SDMS project file defines. The task defines the type of project. Each project represents one surveying task, such as radial topography, cross section, traverse, etc. It is designated by the TK: data tag followed by a colon and a three letter task name (TK:TRA) indicates the Traverse task). There are a finite number of supported tasks. A project file can not contain more than one task, but certain tasks combine different operations like traverses, sideshots, and radial topography. There is a limit of 20 different activities for any one task.
- **Prompt Sequence** - for each activity, a list of sequential data items to prompt for. This lets you define the data items and the order in which they will be used. Different prompt sequences can be defined for the same activity in different tasks.

- **Shot Sequence** - a user defined list of sequential activities to be run for a particular type of recurring operation and the data items to be prompted for in each activity. Data tag responses may be pre-defined in the shot sequence. For example, to survey cross section points across a simple two-lane road, you could set up a shot sequence to run the activities to record the left edge-of-pavement, crown of road, and right edge-of-pavement, and assign the correct feature codes to these points automatically.

Thus, in the SDMS data structure, each project file contains one task. The task consists of one or more activities, and each activity is defined by a particular set of data items. The type of data item that is recorded on each line is designated by the two character data tag. The prompt sequence can be defined to prompt for a particular set of data items for each activity, and shot sequences can be defined to automatically prompt for a particular set of activities to handle recurring situations. Shot sequences and prompt sequences are features of the SDMS Collector software, not of the SDMS data structure.

Each task, activity, and data tag supported by SDMS is briefly described in the Appendix to this guide. A review of these descriptions indicates the wealth of information that can be recorded with SDMS Collector, and the versatility of the data structure. By selecting specific data items, SDMS can be customized for boundary/land surveying, topographic data collection, construction stakeout, GIS data collection, aerial photogrammetry control, inventory surveying, and many other surveying applications. Figure 1 shows a portion of a typical SDMS project file, with descriptions of each data item.

```
1.      PR:3WREXAM.PRJ    - project header can be the project file name
2.      TK:3WR            - type of task (3 wire level)
3.      CR:No             - curvature and refraction setting
4.      RT:Y              - rod type is Yards
5.      W3:333.333300     - three-wire stadia constant
6.      CF:1.000000       - combination factor
7.      UL:F              - units of length are feet
8.      UA:D              - units of angle are degrees
9.      UT:F              - units of temperature are Fahrenheit
10.     UP:I              - units of barometric pressure are inches Hg
11.     VR:SDMS Ver# 3.2  - SDMS software version is 3.2
12.     AC:OS             - begin activity Occupied Station
13.     PN:1              - point id number
14.     ZC:1016.723       - known elevation at the BS
15.     AC:BS             - begin activity BackSight
16.     R1:2.928          - upper wire reading
17.     R2:2.815          - middle wire reading
18.     R3:0              - lower wire reading
19.     . . . .
```

*Figure 1. Sample SDMS Project File.*

As seen in Figure 1, each line of the project file begins with a two character data tag. The first two lines always define the project name and task. The first activity is setting up the instrument on point number 1 as the occupied station. Since this project is a 3 wire leveling task, only the elevation of point 1 is defined. The rest of the file is a sequence of activities. Each activity begins with the AC: data tag, and has certain data items associated with it.

There is normally only one occurrence of a particular data tag within an activity. If there is more than one occurrence, only the last one is used. Thus, if an error is made while entering a data item, it can be corrected while still in that activity by re-entering the data tag and the data item response. Two common exceptions to this are the tags PD: and CM:. See the *SDMS Collector User's Guide* for additional exceptions to this rule.

# SDMS Collector File Types

SDMS Collector uses and creates a number of different files for system setup, configurations, control point definitions, and other purposes. Each particular type of file has a unique three-character filename extension. The list below briefly describes each file type.

Files normally located in the SDMS Collector program directory (C, or other drive letter :\SDMS\) are:

- **Configuration Files** (.CFG) - a set of files containing configuration information used by SDMS.
- **Help Files** (.HLP) - for specific data tags, describes the data item, defines the size of the response input field, defines the type of response expected (alpha-numeric, numeric, or Yes/No), and in some cases lists allowable responses.
- **Macro Files** (.MAC) - stores a sequence of keystrokes. Stored keystrokes may include function keys, data item input, the Esc key, and so on. Executing a macro will read the keystrokes and enter them into SDMS automatically.
- **Task Tags File** (.TGS) - defines the default prompt sequences used by the various tasks.

Files normally located in the user defined project directory (normally C:\SDMS\PRJ):

- **Project Files** (.PRJ) - stores field survey measurements and point descriptions for a project, as described in section 0. This file conforms to the SDMS data standard defined in the *SDMS Technical Data Guide 2000*.
- **Edit Files** (.EDI) - temporary copies of the file being edited with the SDMS editor.
- **Calculated Data Files** (.CAL) - .CAL files are produced by reducing the raw measurements in a .PRJ file to calculated coordinates. The .CAL file retains all of the measurement and descriptive information recorded in the .PRJ file, but adds the calculated coordinates using the XX:, YY:, and ZZ: data tags, and averaged measurement reductions using double characters such as HH:, VV:, DD:, OO:, SS:, etc. This file also conforms to the SDMS data standards defined in the *SDMS Technical Data Guide 2000*.
- **Control Files** (.CTL) - files containing known or previously determined coordinates for points. Attributes of each point can also be listed. These are used for defining control points, benchmark points, and calculated points to be staked out.
- **Horizontal Alignment Files** (.ALI) - defines the geometry for an alignment. This information is used by SDMS for conversions between X and Y coordinates and the station-offset values.
- **Vertical Alignment File** (.PRO) – defines the geometry of the profile for the named horizontal alignment. This information is used by SDMS to compute elevations (ZZ:) along that alignment.
- **Superelevation File** (.SUP) – defines the cross slopes to be used at a given station. This information is used to compute the elevation of a point at a particular station and offset based on the horizontal and vertical alignment data.

Files normally found in the Sequence directory (C:\SDMS\SEQ\):

- **Sequence Files** (.SEQ) - stores a sequence of activities and data items. If you run the sequence, you will be prompted for the activities and data items in the order defined in the sequence. Default responses to data items can be provided in the sequence file.

Files normally located in the user defined temporary directory (normally C:\SDMS\TEMP or C:\SDMS)

- **Temporary Files** (.TMP) - these are general purpose temporary data files produced internally by the SDMS software.

# The SDMS Collector User Interface

SDMS Collector is a function key driven menu system. The main menu screen shown in Figure 2 displays the SDMS Collector version being run, the release date, the machine date and time, and the amount of available disk space remaining. Sub-menus can be activated for various operations by selecting one of the main menu options listed across the bottom of the screen. A menu item is selected by pressing the appropriate function key.

All other operations use a similar screen layout. Menu and sub-menu options are always listed across the bottom of the display and are selected with function keys. The Esc key is used to exit from a presently displayed menu to the previous menu. Pressing Esc while the main menu is displayed will exit from SDMS back to DOS. The user confirms they want to do this by pressing Y (Yes) or N (No).

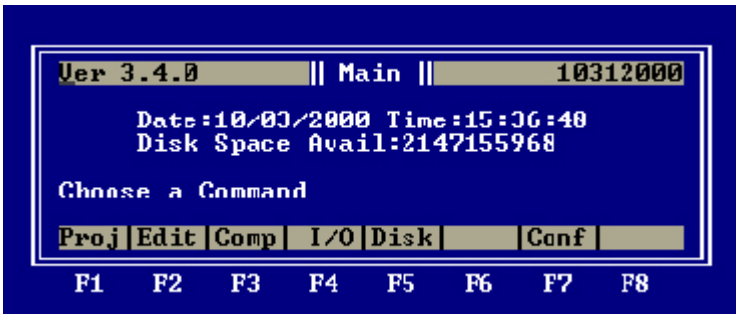


*Figure 2. SDMS Main Menu Screen*

Recording data in a project is accomplished by responding to a sequence of data prompts, where each prompt is a two character data tag. The screen displayed in Figure 3 shows an example of this. The data lines beginning with ZN:, AC:, PN:, FE:, and PD: are data tag prompts that have already been displayed and accepted. The current item being prompted for is the IH: data item (instrument height). The response 4.86 has been typed in, but not yet entered. When the Enter key is pressed, all of the prompts will scroll upward one line, and the next prompt will be displayed.

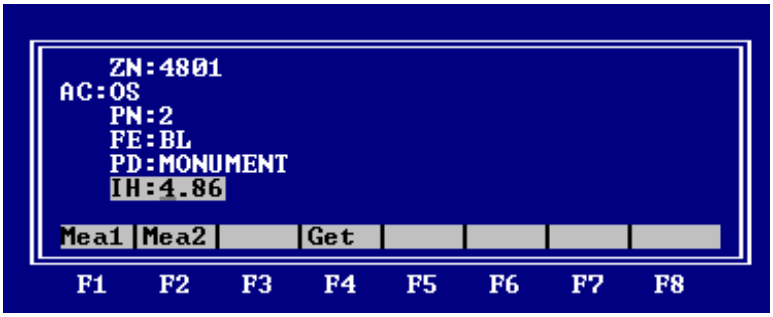


*Figure 3. Example Project Display Screen*

The configuration and setup files determine which data items are displayed, and the order in which they are prompted. However, at any time, the user can insert a new data item by backspacing over the current data tag and entering a different one. After the response has been entered, the previously displayed data item will be redisplayed.

Help is available at any time by pressing the ? key. This accesses the help files to display a description of the data item. If the help file includes a list of the allowable responses for that data item, this list is also displayed. A response can be selected from the list by using the up-arrow and down-arrow keys to highlight a particular response, and select the one currently highlighted by pressing the Enter key. The example in Figure 4 shows the Help screen displayed when the ? is pressed while being prompted for a new activity. The allowable activity codes and their definitions will be listed. If the cursor is left of the colon, SDMS Collector will display the data tag with it's definition from the TAGS.HLP file. If the cursor is to the right of the colon, SDMS Collector will display the data tag responses from TAGS.HLP.

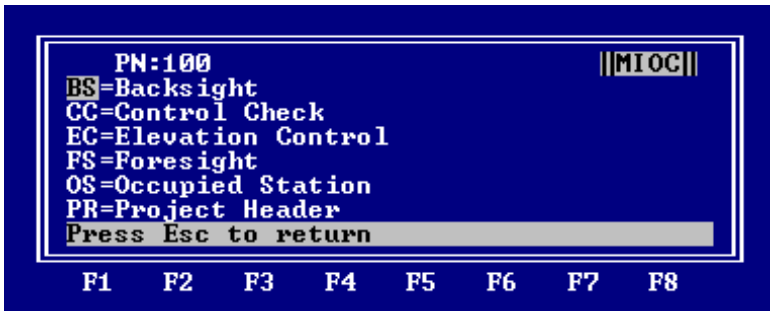


*Figure 4. Example Help Screen*

Error messages from SDMS are displayed across the top line of the screen. These will stay visible for several seconds, then disappear. As long as they are visible, SDMS does not accept any other input or perform any other actions.

# The SDMS Collector Set-up and Configuration

A number of different files play a part in setting up and configuring SDMS Collector. While these may at first seem confusing, the set-up and configuration method is designed to provide maximum flexibility. SDMS Collector is installed with default configuration and setup files, which are printed in the Appendix. It is suggested that these defaults for operating SDMS Collector be used until the user better understands how the setup and configuration files work.

## The TASK.TGS File

The TASK.TGS file defines the default prompt sequences. It lists the data tags to be displayed for each activity in each task. The default TASK.TGS file is listed in the Appendix. A portion of the TASK.TGS file is shown in Figure 5. The first line is the Task data tag, with task name TRA. Each activity that is to be allowed in the traverse task must be listed. Under each activity, the data tags that are to be prompted for are listed in the desired order. Therefore, the default prompts for the Occupied Station activity in a Traverse task (TK:TRA) are PN:, PD:, IH:, SH:, YC:, XC:, and ZC:. Once all of the activities for a task have been defined, a new TK: data item begins the activity definitions for a new task.

```
1.      . . .
2.      TK:TRA
3.      AC:OS
4.      PN:
5.      PD:
6.      IH:
7.      SH:
8.      YC:
9.      XC:
```

```
10.     ZC:
11.     AC:BS
12.     PN:
13.     PD:
14.     HZ:
15.     VT:
16.     DS:
```

*Figure 5. Extract from TASK.TGS File*

## The TAGS.HLP File

The TAGS.HLP file provides a description of each data tag; defines the length and type (0=alphanumeric, 1=numeric, 2=Yes/No) of the response field; and may also list allowable responses to certain data tags. Figure 6 shows a portion of this file. The default TAGS.HLP file is listed in the Appendix.

```
1.      AA 9 1 Area Computed,
2.      AC 2 0 Activity,
3.      ;BS=Backsight
4.      ;CC=Control Check
5.      ;CH=Chain
6.      ;CK=Check Shot
7.      ;EC=Elevation Control
8.      ;FG=Figure
9.      ;FS=Foresight
10.     ;OS=Occupied Station
11.     ;PR=Project Header
12.     ;SI=Sideshot Intersect
13.     ;SR=Station Resection
14.     ;SS=Sideshot
15.     ;ST=Stationing
16.     ;TA=Taping
17.     ;TP=Turn Point
18.     ;TS=Tie Sequence
19.     ;TX=Text Block
20.     ;UE=Utility Elevation
21.     AD 9 0 Angle Distance List,
22.     AR 9 1 Area,
23.     . . .
```

*Figure 6. Extract from TAGS.HLP File*

The AA: data tag is described as being the “Area Computed”. This text will appear if the ? key is pressed when the flashing cursor is on this tag. The response can be up to 9 characters, and must be numeric (type code 1). The AC: data item is described as “Activity”, and it may be responded to with up to 2 characters of alphanumeric input. The lines beginning with a semicolon list the allowable responses to the data tag prompt. These will be listed on the screen for scrolling and selection if the ? key is pressed when the cursor is on the data field. If a response is entered that is not in the list, an error message will be displayed and the response will not be accepted. Compare the list of allowable activity names to the help screen in Figure 4.

In the listing of the full default TAGS.HLP file in the Appendix, look at the list of allowable responses to the FE: (feature code) data tag. The TAGS.HLP file can be customized to include the list of standard feature codes and descriptions developed by the user or for use by a particular CADD system or data collector task. This way, the surveyor can select the correct feature code from the prepared list and any responses not in that list will not be accepted. See the *SDMS Collector User's Guide* for information on setting up the file so responses not in the list will be accepted.

## Configuration Files

SDMS Collector uses five different configuration files to define various settings, global values, and tolerances. Configuration files have a similar format to SDMS Collector project files. Each line begins with a two character data tag, followed by a colon and a data item response or value. The data tags used in configuration files often have the same name as data items used in SDMS Collector project files, even though the definition is entirely different. For example, the AD: data item in a project file defines a list of taped measurements in the taping activity. When used in the configuration file SYS.CFG, it designates when and if automatic date-and-time stamping is done to the project file. Both project and configuration data tags are described in the data tags table in the Appendix of this guide, but the ones used for configuration files are clearly marked as such.

Configuration files can be accessed and modified through CONF (F7) on the SDMS main menu. This displays the Configuration's menu shown in Figure 7. Each of the five configuration files can be selected using the appropriate function key.

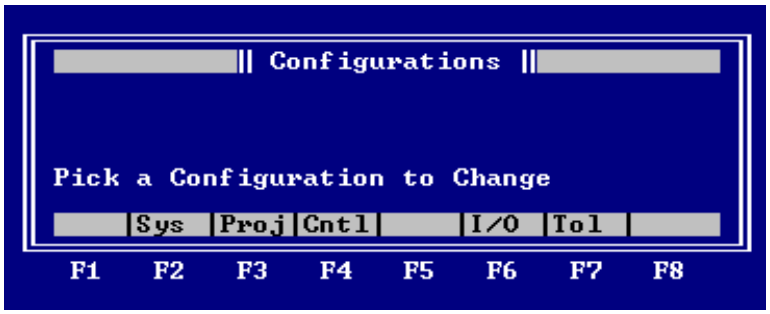


*Figure 7. SDMS Configuration Menu*

Below are brief descriptions of the configuration files. Configuration options are described in more detail in the Customizing SDMS Collector section.

- CNTL.CFG - defines the names of a primary and secondary control point file; the primary and secondary stake out point files; an output or write control point file; the horizontal alignment file; the vertical alignment file; and the superelevation file.
- IO.CFG - defines input/output configuration settings such as the default directory path names to be used for different types of files, the name of the serial I/O device and its communication parameters, the name of the printer output device, and some page layout settings for report generation.
- PROJECT.CFG - defines default responses to typical project header data tags, such as the 3-wire stadia constant, units of length measurements, and units of angle measurements. It also allows the user to specify the name of one sequence file to be executed when resuming work on an existing project, and another for starting a new project.
- SYS.CFG - defines global system settings such as turning on or off logging to the printer, automatic date/time stamping, and file overwrite and removal protection.
- TOL.CFG - defines default tolerances of various types and certain project database limits. For example, the configuration settings in TOL.CFG include the maximum number of stations in a traverse, the 3-wire stadia difference, and the resection tolerance distance.

To obtain help in responding to these prompts, each .CFG file has a corresponding .HLP file. For example, the HELP file for SYS.CFG is SYS.HLP. These help files have the same structure as the TAGS.HLP file described earlier. They provide a description of each tag, the size of the response input field, a code for the type of

response, and in some cases a list of allowable responses. Pressing the ? key at one of the prompts, displays the help file information for that particular configuration file. If the data item has a list of allowable responses, the desired response can be selected from the list.

# The SDMS Collector Menu System

## The Main Menu

The main menu, shown in Figure 2 is the first menu to appear. The options on this menu are:

- **Proj** (F1) - creates a new project or reopens an existing one, then activates the project mode operations.
- **Edit** (F2) - activates the SDMS Collector editor for viewing and modifying a data file. This is a simple text editor designed especially for editing SDMS data files on an 8 line by 40 column display screen.
- **Comp** (F3) - activates the menu for performing batch computations on an SDMS project (.PRJ) file to create a calculated (.CAL) file.
- **I/O** (F4) - activates a menu for sending, receiving, and printing files using the communication ports.
- **Disk** (F5) - activates a menu for performing disk and directory operations, such as listing directories, and copying, renaming, and deleting files.
- **Conf** (F7) - activates the Configurations menu, shown in Figure # 7, that is used for viewing and editing the system configuration files.

Press the Esc key at the Main Menu to exit from SDMS Collector to the DOS command prompt.

## Project Mode Operation Menus

Project mode operations refer to the operations for taking measurements and adding data to the project. There are three different contexts for being in project mode, and each has a slightly different set of menu options. These contexts are:

- **Project Mode in an Activity** - this is the mode used when an activity has been started, and the user is responding to the prompt sequence of data items for that activity.
- **Project Mode in a User Shot Sequence** - this is the mode used when a user shot sequence is being executed, and the user is responding to the activity and data tag prompts defined in that sequence.
- **Project Mode at MIOC** - MIOC stands for More Input or Command. This is the mode used when SDMS is waiting for the user to tell it what to do next (start a new activity, call a user shot sequence, perform live computations, etc.).

Figure 8 shows the menu displayed for Project Mode in an activity. The menu options are described below.

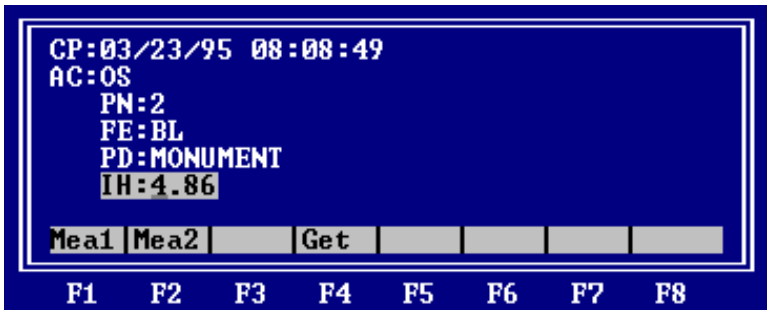


*Figure 8. Menu for Project Mode in an Activity*

- **Mea1** (F1) - activates and/or downloads the horizontal angle, vertical angle, and slope distance from the connected total station instrument and uses these values to respond to the HZ:, VT:, and DS: data tags in the current activity.
- **Mea2** (F2) - activates and/or downloads only the horizontal angle and vertical angle from the connected total station instrument and uses these values to respond to the HZ:, and VT: data tags in the current activity.
- **Get** (F4) – is used in an activity to extract the coordinates of a known point located in one of the active control point files and inserts their values after the appropriate XC:, YC:, and ZC: data tags in the current activity.

Figure 9 shows the display screen for project mode in a user shot sequence. This adds one additional menu option to those described above. It also adds a sequence status line just above the menu line.

- **SavS** (F3) - updates a constant (pre-defined response) in the sequence file. For example, if the sequence already has a PD: (point description) response defined, a new entry can be made and saved to the sequence file.

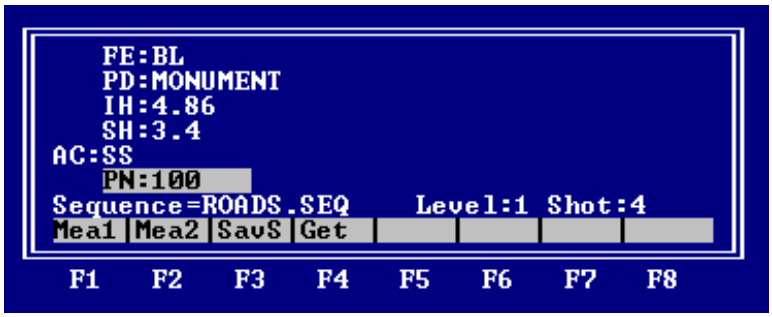


*Figure 9. Menu for Project Mode in a Sequence*

The project mode menu at MIOC is shown in Figure 10. The MIOC mode displays when the current prompt is the AC: data tag. As soon as an activity response is entered, SDMS will switch to the "project mode in an activity" set of operations, as shown in Figure 8.

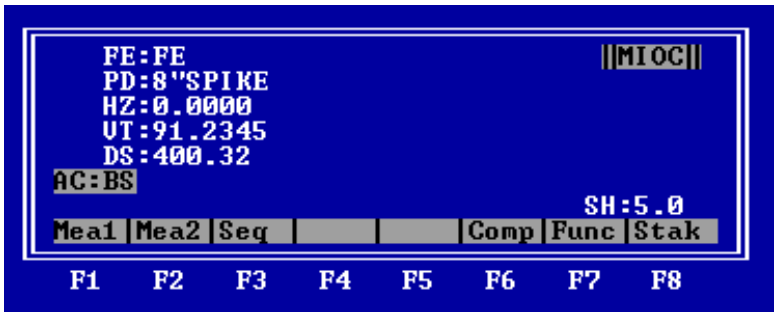

*Figure 10. Menu for Project Mode at MIOC*

The new options shown in this menu are:

- **Seq** (F3)- prompts for the name of a user shot sequence to execute. This puts the system into the project mode in a sequence context.
- **Comp** (F6) - activates the Live Computations menu.
- **Func** (F7) - activates a menu with options to activate the Edit, Comp, I/O, Disk, and Conf menus.
- **Stak** (F8) - activates a menu to perform certain field calculations, such as inversing, stake out, and computing stations and offsets.

## The Edit Menu

The Edit menu is accessed by pressing Edit (F2) at the Main Menu. In project mode, the edit functions are accessed using Func (F7), Edit (F2), as shown in Figure 11. The SDMS Collector editor is a text editor used to make manual modifications to an SDMS file. The arrow keys, Page Up, Page Down, Home, and End keys are used to move around in the file being edited. There are also special edit functions such as inserting a line (Ctrl-N), deleting a line (Ctrl-D), erasing to the end of a line (Ctrl-L), moving to the top of the data file (Ctrl-T) and moving to the bottom of the edit file (Ctrl-B). The Edit menu options are:

- **Srch** (F2) – Search allows the user to do searches for text strings.
- **Recl** (F3) – Recalls deleted lines from a buffer and re-enters those lines in the file being edited.
- **Prnt** (F4) – allows the user to print the file in record format.
- **File** (F5) – Accesses the Read, Write, and Save file functions. These functions are described in detail in the *SDMS Collector User's Guide*.
- **Undo** (F6) – Reinserts a line of data that has been deleted.

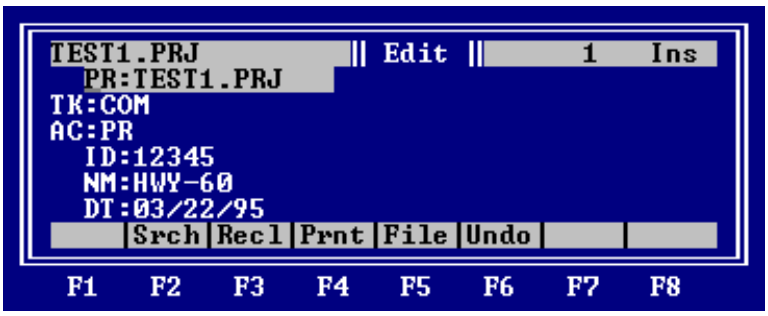


*Figure 11. The SDMS Edit Menu*

## The I/O Menu

The I/O menu, shown in Figure 12, controls file and printer communications through the serial ports (data collectors and PCs) and parallel ports (currently PCs only). It is accessed directly from the main menu using I/O (F4). In the project mode, it is accessed using Func (F7), I/O (F4). Currently, this function only allows printing of files.

The I/O options are:

- **Recv** (F1) - receives a file through the serial port. This option is shown only if the I/O menu is accessed directly from the main menu. File transfers can not take place while in the project mode.

- **Send** (F2) - sends a file through the serial port. This option is shown only if the I/O menu is accessed directly from the main menu. File transfers can not take place while in the project mode.
- **Prnt** (F3) - Prints a file to the configured printer port. Do not use this option unless a printer is on-line, or the system may hang up trying to write to a device that is not there.

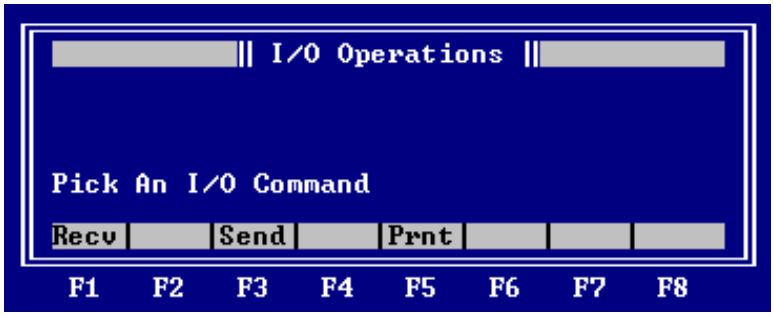


*Figure 12. The I/O Menu*

## The Disk Operations Menu

The Disk Operations menu, shown in Figure 13, is used for common file operations. It is accessed directly from the main menu using Disk (F5). In the project mode, it is accessed using Func (F7), Disk (F5). Standard DOS wildcards may be used with all of these functions. The options on this menu are:

- **Dir** (F1) - displays a listing of files in a directory.
- **Copy** (F2) - copies a file to a different name and/or a different directory.
- **Renm** (F3) - renames a file.
- **Del** (F4) - deletes a file.

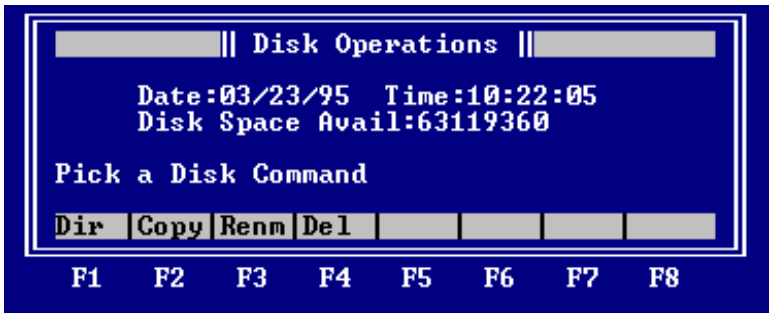


*Figure 13. The Disk Operations Menu*

## The Configurations Menu

The Configurations menu is shown in Figure 14. Each of the menu options shown accesses one of the five SDMS Collector configuration files. The options are:

- **Sys** (F2) – Displays and allows editing of the system configuration settings file (SYS.CFG).
- **Proj** (F3) – Displays and allows editing of the project configuration settings file (PROJECT.CFG).
- **Cntl** (F4) – Displays and allows editing of the control configuration settings file (CNTL.CFG).
- **I/O** (F6) – Displays and allows editing of the input and output configuration settings file (IO.CFG) for file paths and communications

- **Tol** (F7) – Displays and allows editing of the tolerance settings file (TOL.CFG) for a project.

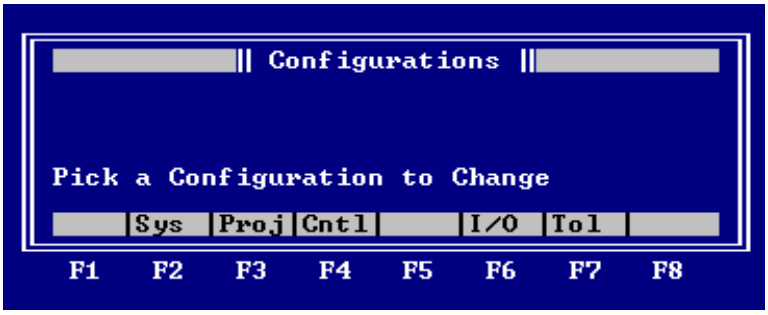


*Figure 14. SDMS Configuration Menu*

Each of the items is described in more detail in the Customizing SDMS Collector section.

# Compatibility with Post-Processing Software

SDMS Collector was designed to provide field survey information for use by office CADD and GIS systems. These systems may use the data to produce topographic maps, plat sheets, legal descriptions, digital terrain models, and to store information in a GIS database. What the data is to be used for has a strong influence on the type of information collected and the methods used to collect it. These office systems may read the data from either the SDMS Collector .PRJ file or the SDMS .CAL file. The project (.PRJ) file contains only raw measurements, which must be processed further before the data will be of much use for CADD and GIS systems. The .CAL file has already had the measurements reduced to coordinate values.

SDMS Collector batch computation functions can produce an SDMS .CAL file, but it does not contain very sophisticated processing algorithms or reporting options. Generally it is better to use the SDMS Processor PC application to convert an SDMS .PRJ file to an SDMS calculated .CAL file. In addition, some third party CADD programs can also process SDMS .PRJ files to produce an SDMS .CAL file. However, these third party systems may interpret some of the information in the .PRJ file differently than SDMS Processor. Therefore, it is essential to understand how a post-processing program interprets the SDMS .PRJ data before it can be properly collected. See the *SDMS Processor User's Guide* for details on using that PC application.

# Using SDMS Collector

## Overview

At this point the user should have a basic understanding of the SDMS data structure and the SDMS Collector menu system. In this section an SDMS project will be developed. It is recommended that SDMS Collector be installed on a desktop or laptop computer for working through the tutorials.

The sample project used in the first tutorial is a single wire leveling task. Since this is the first actual SDMS project to be explained, extra detail will be added to each step to make sure what is happening inside the system is understood. In later tutorials, the System Response column of the tutorial tables will look at only the more visible actions of the software.

## Starting SDMS Collector

In this section, an SDMS project will be started and some of the setup and configuration information will be reviewed before actually working through the project. The instructions assume SDMS Collector is installed on the C: drive. If not, make the appropriate drive letter substitution when following the steps.

| Step | User Input | System Response |
|---|---|---|
| 1. | Change to the default directory where SDMS Collector was installed by entering CD \SDMS↵ | Sets C:\SDMS as the current directory. |
| 2. | Enter SDMS↵ | Executes the SDMS Collector software and displays the main menu screen. SDMS opens and reads the information in the configuration files. These files, .CFG and .HLP are located in the SDMS directory. |
| 3. | Press the F7 key. | Activates the Configurations menu, and prompts: Pick a Configuration to Change |
| 4. | Press the F6 key. | Selects the I/O configuration to be edited. SDMS reads the IO.CFG file and loads it into the SDMS editor. It also reads the IO.HLP file to see what the allowable data items and responses are for this configuration file. |

| Step | User Input | System Response |
|---|---|---|
| 5. | Press the ? key. | Displays the description of each data item in the configuration file. These descriptions are read from the IO.HLP file. |
| 6. | Press the Esc key. | Returns to the edit menu. |
| 7. | The first five lines in this file define the directory paths for various files created or used by SDMS Collector. If SDMS Collector is installed to a drive or directory other than C:\SDMS, change these lines to reflect the correct disk location. For example, if SDMS is installed on the D: drive, substitute D:\ for C:\ in these lines. Move around the file using the arrow keys and the Page Up and Page Down keys. The Ins key toggles the editor between character overwrite and character insert modes. | |
| 8. | Press the F5 key. | Exits from editing the I/O configuration file and displays a menu with options for saving changes or quitting without saving. |
| 9. | If any changes were made to the configuration, press the F1 key to save the changes. Otherwise, press F2 | Returns to the Configurations menu. |
| 10. | Press the F3 key. | Selects the Project configuration for editing. SDMS reads the PROJ.CFG and PROJ.HLP files and loads them into the SDMS editor. |
| 11. | Scroll down the list of data items. Note that Curvature and Refraction is turned on (CR:YES), that the units of length are feet (UL:F), the units of angles are degrees-minutes-seconds (UA:D), and the units of temperature are degrees Fahrenheit (UT:F). For the purposes of this tutorial, do not change any of these settings. | |
| 12. | Note the data item NS:NEWPR toward the bottom of the list. This data item defines sequence file NEWPR.SEQ as the default sequence of data items to be prompted for when beginning a new project. The I/O configuration defined the directory path for sequence files to be C:\SDMS\SEQ. Thus, each time a new project is started, SDMS will automatically use the sequence file C:\SDMS\SEQ\NEWPR.SEQ . | |
| 13. | Press the Esc key to exit the editor. | Displays the prompt: OK to Lose Edits? Yes No |
| 14. | Press the Y key. Choosing Y will exit without saving any inadvertent changes. | Returns to the Configurations menu. |

| Step | User Input | System Response |
|---|---|---|
| 15. | Press the Esc key. | Returns to the Main menu |
| 16. | Either exit SDMS by pressing the Esc key, or remain at the main menu to continue the next tutorial session. | |

# Working a Project

Now that the setup and configuration has been checked and verified, an SDMS project will be developed. For the first example, the data for a simple single wire level run between two USGS benchmarks will be entered manually. This project will be named GSLEVEL.

| Step | User Input | System Response |
|---|---|---|
| 1. | If SDMS Collector is at the Main menu screen, skip to step 4. | |
| 2. | Change to the default directory where SDMS was installed by entering CD \SDMS↵ | Sets C:\SDMS as the current directory. |
| 3. | Enter SDMS↵ | Executes the SDMS Collector software and displays the main menu. SDMS opens and reads the information in the configuration files. |
| 4. | To make sure a new project is started, first use the Disk utilities to delete any existing files with the name GSLEVEL. Press the F5 key (Disk command). | Activates the Disk Operations menu. |
| 5. | Press the F4 key (Del command). | Displays the prompt Delete C:\SDMS*.* with the cursor underneath the first asterisk. |
| 6. | Modify the file specification to read C:\SDMS\PRJ\GSLEVEL.* and press the ↵ key | Displays the prompt: Delete n Files Yes No? where n is the number of files found with that root name. |
| 7. | Press the Y key. | Deletes all files on directory C:\SDMS\PRJ whose root name is GSLEVEL, then returns to the Disk Operations menu. |
| 8. | Press the Esc key. | Returns to the Main menu. |
| 9. | Press the F1 key (Proj command). | Displays the prompt: Project Name > *.PRJC:\SDMS\PRJ\.PRJwith the cursor underneath the “.” |
| 10. | Type GSLEVEL↵ | Displays the message:<br>New Project<br>Enter Task<br>TK:<br>This is the beginning of the data collection for the level run. Prompts will be displayed for information with a series of data tags. |
| 11. | Type the 3 letter task name for single wire level, as shown. LEV↵ | Defines the project as a single-wire level task. The next set of prompts are the data items defined in the new project sequence |

| Step | User Input | System Response |
|---|---|---|
| | | file, NEWPR.SEQ. |
| 12. | For this set of prompts, enter the responses shown below.<br>AC:PR↵<br>ID:GSLEVEL↵<br>NM:3 WIRE LEVEL↵<br>DT: ↵<br>WE:FAIR↵<br>TE:63↵<br>BP:30↵<br>IT:MANUAL↵<br>SN:↵<br>OB:your initials↵<br>RE:your initials↵ | Defines an ID and name for the project, stores the weather conditions, sets the instrument type as MANUAL (keyboard entry of measurements) and saves the initials of the observer and recorder. Then displays the prompt AC:OS.<br>All of these data items are optional except the instrument type (IT:).This must be specified for SDMS to know where the measurements will be coming from. For reading from an actual instrument, it must load the correct software drivers for the selected brand and model. |
| 13. | Press the ↵ key to start the Occupied Station activity. | SDMS reads the TASK.TGS file to see what the data items are for the occupied station activity in the LEV task. |
| 14. | For the AC:OS data item prompts, enter the responses shown below.<br>PN:1↵<br>FE:BM↵<br>PD:USGS 31D 1957↵<br>ZC:835.61↵ | Stores the information associated with the occupied station on benchmark point 1 in the GSLEVEL project file, then displays the prompt AC:BS |
| 15. | Press the ↵ key to start the Backsight activity. | SDMS reads the TASK.TGS file to see what the data items are for the backsight activity in the LEV task, then displays the RR prompt. |
| 16. | Enter the rod reading value 6.29↵ | Stores the rod reading for the backsight, then displays the AC:BS prompt again. |
| 17. | Type TP over the BS activity response and press ↵. | Begins the TP: (turning point) activity. SDMS reads the TASK.TGS file to see what the data item prompts are for this activity, then displays the RR: prompt. |
| 18. | Enter the rod reading value 1.36↵ | Stores the rod reading for the turning point, then displays the AC:TP prompt. |
| 19. | Type BS (over TP) ↵ | Starts the backsight activity, and displays the RR: prompt. |
| 20. | Enter the value 8.94↵ for the observed rod reading for the backsight on the turning point. | Stores the backsight rod reading, and displays the AC:BS prompt. (This entry is a deliberate error that will be corrected in the next step). |
| 21. | To correct the rod reading entry, backspace over the AC:BS prompt and type RR:7.94↵ in its place. The colon will be displayed automatically; do not type it. | Stores a second rod reading value for the last BS activity. When more than one entry of the same data item is made within a single activity, the last one is considered correct. SDMS now re-displays the AC:BS prompt. |
| 22. | Type FS (over BS) ↵ | Starts the FS: (Foresight) activity. SDMS reads the TASK.TGS file to see what the data item prompts are for this activity in the level task. Displays the PN: prompt. |
| 23. | For the foresight activity prompts, | Stores the foresight shot information, then |

| Step | User Input | System Response |
|---|---|---|
| | enter the responses shown below.<br>PN:2↵<br>FE:BM↵<br>PD:USGS 31E 1957↵<br>RR:9.37↵<br>ZC:839.123↵ | displays the AC:FS prompt. |
| 24. | Press the Esc key to exit from data collection. | Displays the prompt Close or Suspend |
| 25. | Press the C key to close the project. | Returns to the main menu |
| 26. | Either exit SDMS by pressing the Esc key, or remain at the main menu to continue in the next tutorial session. | |

# Discussion of the Tutorial

The level run just completed is a typical example of how SDMS Collector can be used to collect and store survey data. By setting the task type to be LEV, SDMS Collector read the TASK.TGS file to see what activities are allowed in that task. For each activity listed, SDMS Collector displayed the default data tag prompts for that activity. Thus, the BS: and TP: activities prompted only for the rod reading data tag since TASK.TGS defined that as being the only data tag needed. The OS: and FS: activities required a point number and elevation, but also prompted for an optional point description and feature code. The FS: activity also required a rod reading to close the level run.

Each time the AC: data tag prompt was displayed, there was a default activity type present. Once the project header data had been entered, the first default activity was AC:OS. Thereafter, the default activity was the same as the activity just completed. As this example demonstrated, the activity to be initiated can be changed by typing over the default activity type with a different one. The data tag displayed can be changed by backspacing over the data tag name and typing in the name of the data tag desired. After the new data tag was accepted, SDMS then redisplayed the tag originally displayed. This function was used in step 17 to change the AC:BS to TP:.

SDMS Collector does not change to the default sequence for the activity currently displayed until the user presses <ENTER> on that new AC:. Therefore, nothing in the just completed Activity is stored to the project file until the new Activity is accepted. This feature allows the user to modify items in the just completed Activity without having to go to Edit mode. This also allows the user to move the cursor over the currently displayed Activity and type in any valid data tag. The data tag and response will be added to the bottom of the previous activity. SDMS will then redisplay the next Activity prompt. This was demonstrated in Step 21 of the sample project above. This procedure allows the user to either add an item to an activity that is not in the default prompts for an activity listed in the TASK.TGS file, or to change an already entered item in the activity by entering the same data tag and a new response.

The same procedure is used to change or repeat data tag prompts within an activity. The data tag displayed can be changed by backspacing over the tag name and typing in the name of the data tag desired. After the new data tag is accepted, SDMS then redisplays the tag originally displayed. This function was used in step 21 to correct an erroneous entry of a rod reading value. Remember SDMS processing will always

use the last occurrence of a data item within an activity. The only exceptions are AD:, CH:, CM:, PD:, and PL:.

Notice that whenever the current prompt was the AC: data tag, the letters MIOC (More Input or Command) appeared in the upper right corner of the screen. At this point the user could input more data, use one of the function keys to execute a menu command, or press the Esc key to close or suspend the project to return to the main menu. Once the Enter key was pressed to start an activity, the MIOC message disappeared until the next time the AC: data tag was reached.

# Performing Batch Computations

In the following tutorial session, the SDMS Collector batch computations utility will be used to analyze and reduce the data stored in the previous session. The batch computations use the stored data to compute coordinates or elevations, or both (depending on the type of task) for measured points. In the case of the leveling task, it will calculate the vertical error of closure on the level run from the beginning benchmark point to the ending one, and adjust the elevation measurements to force closure. Since leveling does not involve any horizontal measurements, only elevations are calculated.

The batch computations command reads the project .PRJ file and produces a .CAL file with the same root name. The .CAL file has all of the data originally read from the .PRJ file and adds the calculated coordinates and/or elevations using the XX:, YY: , and ZZ: data tags. There is also an option for storing the points as control points in a .CTL file. The control point file to which calculated points are written to is referred to as the Write Control file. This file can be used by SDMS to read coordinates and elevations of control points into later activities in the same project or into any activity in a new project.

| Step | User Input | System Response |
|---|---|---|
| 1. | If SDMS Collector is at the Main menu, skip to step 4. | |
| 2. | Change to the default directory where SDMS was installed by entering<br>CD \SDMS↵ | Sets C:\SDMS as the current directory. |
| 3. | Enter SDMS↵ | Executes the SDMS Collector software and displays the main menu. SDMS opens and reads the information in the configuration files. |
| 4. | Press the F3 key (Comp command). | Displays the prompt<br>Compute File ->\<br>C:\SDMS\PRJ\.PRJ |
| 5. | Press the F1 key (Dir command) | Displays the prompt<br>Choose Directory Path<br>C:\SDMS\PRJ*.PRJ |
| 6. | Press the ↵ key. | Lists all .PRJ files found in the directory. |
| 7. | Use the ↓ key to highlight file GSLEVEL.PRJ; then press the ↵ key. | Displays the following information and prompt message.<br>Batch Computations<br>Input File: C:\SDMS\PRJ\GSLEVEL.PRJ |

| Step | User Input | System Response |
|---|---|---|
| | | Read Control:<br>Write Control: C:\SDMS\PRJ\GSLEVEL.CTL<br>Hz-Alignment:<br>OK to Continue? Y/N<br>This indicates that the GSLEVEL.PRJ project data file created in the previous session will be used as input for the computations and that there is no file of existing control points from which to read. The calculated points resulting from the batch computations will be written to control file GSLEVEL.CTL. If a CTL file is defined in the configuration file, that file name will be used. No horizontal alignment geometry is needed or defined. |
| 8. | Press the Y key to continue. | Displays the following information.<br>Single Wire Level Unadjusted<br>Total Elev. Diff. = 3.50000<br>Error of Closure = -0.01300 |
| 9. | Press the ↵ key. | Displays the message<br>CREATE CAL FILE? Yes No |
| 10. | Press the Y key. | Displays the message<br>PRINT REPORT? Yes No |
| 11. | Press the N key. (If you have a printer attached, you may opt to answer Y, instead) | Adjusts the measurements to force vertical closure, calculates the level run point elevations, creates the .CAL and .CTL files, and returns to the main menu. |
| 12. | Exit SDMS by pressing the Esc key, or remain at the main menu to continue in the next session. | |

# Using the SDMS Collector Editor

The SDMS Collector editor is a text file editor specifically designed for viewing and modifying the various types of SDMS files on a small screen display. It is restricted to editing files with the extensions .PRJ, .SEQ, .CTL, .ALI, .CAL, .EDI, and .TGS. Figure 15 shows the SDMS Collector Edit menu. To edit any other SDMS file (such as TAGS.HLP), an ASCII text editor program must be used.

The top line is the Status line that shows the name of the file being edited, the screen title (“Edit”), and the line number in the file that is currently highlighted. If the word “Ins” is also showing, the character insert mode is active. If not, the character overwrite mode is active. Below this, the editor displays up to six lines of the text file.

*Figure 15. SDMS Editor Menu*

The highlighted line shows which line the cursor is currently on. The blinking underbar cursor shows which character is active on that line. The maximum allowable length for any field is highlighted as blank characters when a field is selected. The SDMS editor uses most of the normal PC editing keys in the usual way. Some of most used keys are described below. A complete list can be found in the *SDMS Collector User's Guide*.

| Editor Key | Function |
|---|---|
| ← and → | Moves the cursor left or right one character. |
| ↑ and ↓ | Moves up or down one line in the file. |
| Pg-Up and Pg-Down | Moves up or down one full screen (6 lines) in the file. |
| Home | Moves to the first line currently showing on the display. |
| End | Moves to the last line currently showing on the display. |
| Ins | Toggles between Insert mode and Overwrite mode. |
| Del | Deletes the character the cursor is currently under. |
| ^B | Moves the cursor to the bottom of the file. |
| ^D | Deletes a line |
| ^L | Deletes from cursor location to the end of a field |
| ^N | Inserts a line |
| ^T | Moves the cursor to the top of the file. |
| ? | Help |

One characteristic of the editor is that it is expecting to create or modify lines that begin with a two-character data tag followed by a colon. It automatically places a colon as the third character on each line. The cursor will jump from the second to the fourth column (and vice versa) when moving the cursor across a line in the file.

The next tutorial session uses the editor simply to view the contents of the files created in the previous sample project. No modifications to the file will be made at this time.

| Step | User Input | System Response |
|---|---|---|
| 1. | If SDMS Collector is at the main menu, skip to step 4. | |
| 2. | Change the default directory to where SDMS Collector was installed by entering<br>CD \SDMS↵ | Sets C:\SDMS as the current directory. |
| 3. | Enter SDMS↵ | Executes the SDMS Collector software and displays the main menu. SDMS opens and |

| Step | User Input | System Response |
|---|---|---|
| | | reads the information in the configuration files. |
| 4. | Press the F2 key (Edit command). | Displays the prompt<br>Load File -><br>C:\SDMS\PRJ\.PRJ |
| 5. | Press the F1 key (Dir command) | Displays the prompt<br>Choose Directory Path<br>C:\SDMS\PRJ*.PRJ |
| 6. | Change the file specification to read<br>C:\SDMS\PRJ*.*<br>and press the ↵ key. | Lists all files found in the directory C:\SDMS\PRJ. |
| 7. | Use the ↓ key to highlight file GSLEVEL.PRJ, then press the ↵ key. | Loads the GSLEVEL project file into the editor, displaying the first 6 lines. |
| 8. | Use the Pg-Down and Pg-Up keys to scroll through the file. Compare the data items stored in the project file to the steps performed in the tutorial in Section 3.2. There may be extra lines displayed, such as CP: and a date and time. These items are automatically placed in the file by SDMS when the file is closed. | |
| 9. | See the SDMS Collector User's Guide to experiment with some of the edit operations described there. | |
| 10. | Press the F5 key (File command), then press F5 again (Quit command) | Exits the editor without saving any changes.<br>OK To Lose Edits? Yes No will be displayed. If N is pressed, SDMS will not exit the file. Respond with Y if it is okay to exit.<br>The system returns to the Main menu. |
| 11. | Repeat steps 4 through 7, but this time select file GSLEVEL.CAL to edit. | Loads file GSLEVEL.CAL into the editor. This file was produced by SDMS Collector doing the batch computations. |
| 12. | Scroll through the .CAL file. Notice that the intermediate BS: and TP: points now have the calculated elevation values stored using the ZZ: data tags. | |
| 13. | Exit this file by pressing F5 twice. | Returns to the Main menu screen. |
| 14. | Repeat steps 4 through 7 and select file GSLEVEL.CTL. | Loads file GSLEVEL.CTL into the editor. This is the control point file created with the batch computations. |
| 15. | Scroll through the control point file and observe the structure. Notice that each point has data tags for XY coordinates (XC: and YC:), but that these items are blank. ZC: values should be filled | |

| Step | User Input | System Response |
|---|---|---|
| | in. | |
| 16. | Leave this file loaded in the SDMS Editor during the discussion of Control Files in the following section. Later, exit the editor by pressing the F5 key twice. | |

# Control Point Files

A control point file (.CTL) is used to store information about points with known XY coordinates, elevations (Z), and attributes. The primary purpose of a control point file is to allow SDMS Collector to read known point data and insert that data into the current project. For example, when using the OS: activity to set up the instrument on a known point to begin a traverse, the Get (F4) function is used to read the data for a control point from the control file.

A control file uses the basic SDMS format, in which each line begins with a two-character data tag. The following is an example of the basic structure for a control file. See the *SDMS Collector User's Guide* for other data tags that may also be included.

AC:xx (Any activity name may be used, but OS or SS are most common)
PN:point number
YC:northing coordinate
XC:easting coordinate
ZC:elevation
PD:point description

The point number must be provided, as well as either the XY coordinates, the elevation, or both. All other valid data items are optional. One way of creating a control point file is with the SDMS Collector Editor. Other coordinate geometry and CADD systems also have utilities for creating SDMS control point files. Control point filenames must use the .CTL extension.

When data is being collected for a project, any or all of the data for a control point data can be extracted from the control file to fill in the data tag fields for activities like OS:, BS:, FS:, and TP:. For example, at the PN: prompt in an Occupied Station activity, press the F4 key to get all of the data that is stored in the control file for a point and insert that data to the matching data items. Pressing F4 displays the prompt Get PN:+. This lets the user specify the point number to be read, get the next unread control point, or get the previously read control point. Specific data items for a control point can also be selected. For example, if the current data tag prompt is either YC:, XC:, ZC:, or PD:, pressing the F4 key will pull just that data item from the control file.

SDMS Collector can have up to five different control files active at a time. Each has an associated data tag, as described below. In addition to these, the horizontal and vertical alignment files and the superelevation file are necessary for the stake out functions to operate properly. The data tags for these files are listed following the control file data tags.

- L1: - The Primary Read Control file. This is the first file searched when you use the F4 key to get information from a control file.
- L2: - The Secondary Read Control file. If the specified point is not found in the L1: control file, this file is searched next.

- S1: - The Primary Staking Control file. This file stores information for points that are being staked out.
- S2: - The Secondary Staking Control file. This file is searched if a point being staked out is not found in the S1: file.
- WC: - The Write Control file. When using batch computations, SDMS writes the data for known and calculated points to this file.

The names of the default control files are defined using the CNTL option under the CONF menu. The file names can be changed during a data collection session, at MIOC, by accessing the Control Configuration (Func (F7), Conf (F7), Cntl (F4)). Highlight the appropriate data tag (L1:, S1:, etc.). Then tab over to the right of the colon and type in a different control point file name and the appropriate file extension.

# Alignment Files

## Horizontal Alignments

A horizontal alignment file defines the geometry for a horizontal alignment or baseline. It is used for computations involving station-offset values. Horizontal alignments are defined in SDMS based on the PI definition. The horizontal alignment file is used to compute point positions that are based on station and offset in 3D stakeout.

Horizontal alignments files use the extension .ALI. The TY: data item in the header of an alignment file is used to define the type of alignment is being used. Therefore, the response will be PI (TY:PI). The Cntl option under the configuration menu is used to name the horizontal alignment file that will be used for the project. In the Control configuration file, it is specified with the HA: data tag. The structure of the horizontal alignment file is described in detail in the *SDMS Collector User's Guide*.

## Vertical Alignment (Profile)

A vertical alignment file defines the VPI points specified by station and elevation. This information is used by SDMS Collector to compute the profile grade line elevation at any station along the alignment during the 3D stake out functions. Symmetrical and asymmetrical vertical curves are specified by defining the length(s) of the parabolic curves along the profile at a VPI. The first and last VPI can not have vertical curves. PRO is used as the file extension for Vertical Alignment files.

## Superelevation Files

A superelevation file defines the slopes to be used at a station and elevation. This information is used by SDMS Collector to determine the left and right side slopes of the design sections at any station along the alignment using the 3D stake-out function. SUP is used as the file extension for superelevation files.

## Alignment File Configuration

The names of the alignment files are defined using the Cntl option under the configuration menu. The file names can be changed during a data collection session, at MIOC, by accessing the Control Configuration (Func (F7), Conf (F7), Cntl (F4)).

The following tags relate to files needed for stake out functions to operate properly:

- HA: - The horizontal alignment file. This file defines the horizontal alignment geometry needed for the calculations used in 2D and 3D stake out functions.
- VA: - The vertical alignment file. This file defines the vertical profile geometry needed for the calculations used in 3D stake out functions.
- SF: - The superelevation file. This file defines the station cross slopes for the sub-grade or pavement calculations used in 3D stake out functions.

**Note**: Horizontal alignment files can stand by themselves when needed for SDMS Collector computations. However, the vertical alignment and superelevation files are only valid when associated with their associated horizontal alignment file and must be present and named for the 3D staking functions.

# Customizing SDMS Collector

## Overview

One of the greatest strengths of SDMS Collector is that it allows the user to customize it. This can be done in a number of different areas, including:

- Changing default configuration settings.
- Modifying TAGS.HLP to change the size of the input fields for data items; to provide lists of allowable responses to certain data items; and, to change the descriptions of data tags.
- Modifying TASK.TGS to specify the default data tag prompts for each activity in each task.
- Defining user shot sequences of activities and data tag prompts for commonly occurring situations.
- Storing macros (a sequence of keystrokes).

## Changing Default Configuration Settings

The five SDMS Collector configuration files were described in the pervious sections. Configuration settings are changed through the Configurations menu. The options on this menu are for editing the SYS.CFG, PROJECT.CFG, CNTL.CFG, IO.CFG, and TOL.CFG files. Each of these has a corresponding help file that specifies the type and size of the input fields for each configuration item and the allowable responses.

A closer look will be taken at the items defined in each configuration file. When editing the configuration files, use the ? key to get help information on any data item. The default configuration files and their help files are listed in the Appendix.

### Configuration File SYS.CFG

SYS.CFG defines some general system settings. These settings include:

LP: If the **log to printer** toggle is turned on, all entered data is automatically logged to the named, connected print device (the device named under the PD: data tag in the I/O configuration). If this toggle is turned off, no automatic printer logging occurs during data collection. Yes turns this toggle on; No turns it off. The default is No.

**Note**: If the computer on which SDMS is running is connected to a total station and the PD: is COM1, logging to the printer can't occur and is automatically turned off.

AD: This data item controls the **automatic date and time stamping** feature. The default is OFF. The choices are:

- PROJ=The system date and time are inserted (stamped) at the beginning of each project.
- STAT= The system date and time are inserted (stamped) at the beginning of each occupied station activity, immediately following the AC:OS data item.
- SHOT= The system date and time are inserted (stamped) at the beginning of each activity immediately following the AC:XX data item (where XX means any valid shot activity).
- OFF= No automatic date/time stamps are made.

OP: If the **overwrite protection** toggle is turned on, a source file cannot be overwritten with an edited file. Edits must be saved in a new file. If this toggle is turned off, a source file may be overwritten with an edited file. Yes turns this toggle on; No turns it off. The default is No.

RP: If the **file removal protection** lock is turned on, files cannot be deleted using the SDMS file deletion feature. If this lock is turned off, files can be deleted within SDMS. Yes turns this toggle on; No turns it off. The default is No.

MP: The **macro pause** setting determines the length of time, in seconds, that SDMS pauses between steps in a macro before continuing to the next step. The default is 0 (no pause).

AS: The **automatic save** setting determines if each data item is saved as it is recorded. If this toggle is turned on, data is saved to the file automatically after each shot. If this toggle is turned off, the user is asked if the data should be saved. Yes turns this toggle on; No turns it off. The default is Yes.

OA: The **overwrite data** setting determines if control point data computed during batch processing is written to the control file, overwriting all existing information in the file, or if the new control point data is appended, or added to the existing data in the file. If this toggle is turned on by choosing A, the computed data is appended. If this toggle is turned off by choosing O, the existing data is overwritten. The default is O.

## Configuration File PROJECT.CFG

The project configuration can be edited only when the configurations are accessed from the main menu. That is, once in project mode (data collection), the user cannot change the project configuration until the project is closed or suspended and SDMS returns to the main menu.

---

**Note**: SDMS automatically inserts certain information from the project configuration file directly into the project file as explained in the *SDMS Collector User's Guide*.

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CR: The **curvature and refraction** indicates with a Yes or No whether the project data should be corrected for the earth's curvature and atmospheric refraction. The default is Yes. This tells the post processing software to apply a correction to the slope distance (DS) when computing the horizontal distance (DH).

W3: The **three wire stadia constant** is used to record the 3 wire stadia constant value. This value should be consistent with the selected instrument type. The default is 333.3333.

CF: The **combination factor constant** is used to reduce ground distances to grid distances, and vice versa. The default is 1.00 (no adjustment).

UL: The **units of length** data item documents in which units length data items are recorded. Choose F (US Survey foot), M metric (kilometer stations), M2 metric (100 meter stations) and M3 metric (kilometer stationing). The default is F.

UA: The **units of angle** data item documents in which units angular data items are recorded . Choose D (degrees), R (radians) or G (gons). The default is D. The FORMAT for angles in SDMS is DDD.MMSSS and this is not decimal degrees. SDMS only uses D (degrees) in computations.

UT: The **units of temperature** data item documents in which units temperature data items are recorded. Choose F (Fahrenheit) or C (Celsius). The default is F.

UP: The **units of pressure** data item documents in which units barometric pressure data items are recorded. Choose B (millibars) or I (inches of mercury). The default is I.

OS: This is the **old project - opening sequence** file that SDMS automatically calls when a suspended or closed project file is reopened. Any sequence file can be named here. The default is blank (no opening sequence for old projects).

NS: This is the **new project - opening sequence** file that SDMS automatically calls when a new project is opened. Any sequence file can be used here. The default is NEWPR.SEQ (A sample is supplied with the program).

RT: The **rod type** data item specifies the type of rod used during a three-wire leveling task. If a yard rod is specified, readings are reduced to feet. If a foot or meter rod is specified, no conversion is made. Choose from F (foot), Y (yard) or M (meter). The default is F.

MM: The **minimum memory** data item specifies the value at which SDMS will automatically notify the user at every AC:OS that the remaining available memory is below this value. This value is given in bytes (with each byte being approximately equal to one keystroke). The default is 1000 bytes.

## Configuration File CNTL.CFG

This configuration file specifies the names of the default control point and alignment files. SDMS inserts active control file names in the project file after the project configuration's automatic entries. This documents the control files active during the project mode. See the *SDMS Collector User's Guide* for details.

## Configuration File IO.CFG

The I/O configuration controls the flow of data and how SDMS interacts with other devices.

DP: The **data path** tells SDMS where to store and recall alignment, superelevation, and control files. The path entered here is used as a default only, and is suggested by SDMS for a file location. This default may be overridden or changed anytime.

PP: The **project path** tells SDMS where to store and recall project files. The path entered here is used as a default only, and is suggested by SDMS for a file location. This default may be overridden or changed anytime.

QP: The **sequence path** tells SDMS where to store and recall sequence files. The path entered here is used as a default only, and is suggested by SDMS for a file location. This default may be overridden or changed anytime.

FP: The **format path** tells SDMS where to store and recall file format definitions to reformat files to the SDMS format. The path entered here is used as a default only, and is suggested by SDMS whenever the user makes a file selection for third-party

files. This default may be overridden or changed anytime. This tag is reserved but not implemented.

TP: The **temporary path** tells SDMS where to place temporary files during computations.

SP: The **screen pause** controls how long the screen pauses when files or reports are printed to the screen. Enter the pause in 1/18 seconds (18 = 1 second). The default is 18.

## *I/O Communication Devices*

CD: The **communication send/receive** device names the port to use when communicating between SDMS and total stations. The default is COM1 (RS-232 communications).

## *I/O Communication Parameters*

The following I/O configuration data tags control communication parameters between SDMS and other peripheral devices. Both the computer and the device must use the correct corresponding parameters for successful data transfer. The default communication parameters are for an IBM-PC. Note that all communication parameters related to the total station are hard coded with the instrument driver IT and do not utilize these settings.

B1: This tag sets the **baud rate**. Choose from 300, 1200, 2400, 4800 or 9600. The default is 9600.

P1: This tag sets the **parity**. Choose from ODD, EVEN or NONE. The default is NONE.

PR: This tag sets the data **transfer protocol**. Choose XON/XOFF or NONE. The default is NONE.

D1: This tag sets the **data bits**. Choose 7 or 8. The default is 8.

S1: This tag sets the **stop bits**. Choose 1 or 2. The default is 1.

## *I/O Printing Controls*

These I/O data tags control printing conditions:

PD: **Print device** names the printer connected to SDMS. The default is LPT1. The possible choices are:

| Port Name | Port Description |
|---|---|
| COM1 | Serial printer on the COM1 serial port |
| COM2 | Serial printer on the COM2 serial port |
| LPT1 | Parallel printer on the first parallel port |
| LPT2 | Parallel printer on the second parallel port |
| CON | Screen display (console) |

PH: The **print header** data tag lets the user enter a 37-character (or less) alphanumeric page header for reports. Leave this field blank if no header is needed on the reports. The default is blank (no header entered).

PF: The **print footer** data tag lets the user enter a 37-character (or less) alphanumeric page footer for your reports. Leave this field blank if no footer is needed on the reports. The default is blank (no footer entered).

PL: The **page length** data tag controls the intervals at which the printer is to start a new page. Enter the number of lines per page (standard spacing is 6 lines per inch). The default is 60 lines. Set this field to 8 if the PC or data collector screen display (PD:CON) is used as the print device.

PW: The **page width** data tag tells SDMS how wide to print the reports and files. Enter the number of characters per line. The default is 80 characters. Set this field between 10 and 40 if the data collector or PC screen display (PD:CON) is used as the "printer".

PG: This data tag turns **automatic page numbering** on or off. Yes turns the toggle on; No turns it off. The default is No.

TS: This data tag turns **automatic time stamping** on or off for printed reports. Yes turns this toggle on; No turns it off. The default is No.

DT: This data tag turns **automatic date stamping** on or off for printed reports. Yes turns this toggle on; No turns it off. The default is No.

## Tolerance Configuration File TOL.CFG

TOL.CFG defines settings for such things as minimum closures, instrument precision specifications, error radii, and standard deviations. SDMS issues a warning if any of the default tolerance values are exceeded during computations. Most of the default values are based on values establish by NGS for third order surveys and are in units of feet. To be able to switch more easily between metric and English, the user may want to establish a TOLE.CFG for English projects and a TOLM.CFG for metric projects and then activate the appropriate one by copying it to TOL.CFG.

VT: This data tag is the **maximum occupied stations tolerance** for vertical tasks. It specifies the maximum number of occupied stations allowed per loop during processing. The default is 25.

W1: This data tag is the **single-wire level closure tolerance** and is used with the single-wire level task. It specifies the allowable difference between the given elevation and the elevation as computed for the survey. The default is 0.05.

ST: This data tag is the **three-wire stadia difference tolerance**. It specifies the maximum difference between the upper and lower stadia intervals. The default value for this data tag is .011 feet. The tolerance is computed as:

The value of the top (R1:) rod reading, plus the value of the bottom (R3:) rod reading, less twice the value of the middle (R2:) rod reading, or

R1: + R3: - (2 x R2:) = three-wire stadia difference

W3: This data tag is the **three-wire level closure tolerance**. It specifies, for three-wire level tasks, the maximum the difference between the given elevation and the elevation as computed for the survey. The default value is 0.03.

XC: The **profile/cross-section closure tolerance** specifies, for vertical tasks, the difference between the given elevation of the closing point, and the elevation as computed through the survey. The default value is 0.1.

SD: The **deviation from nominal stationing tolerance** specifies, for cross-section tasks, the difference between nominal stationing and the stationing as computed through the survey. The default value is 5.

RT: The **resection tolerance** specifies the maximum standard deviation of the computed coordinates. The default value is 0.3.

ER: The **radial topography error radius tolerance** specifies the radial distance of standard deviation of the Northing and Easting for sideshot intersects located from three or more occupied stations. The default value is 0.25.

MS: The **double/multi stub tolerance** specifies the maximum allowable radial difference between coordinates computed for a point from two or more occupied stations. The default value is 0.25.

VI: The **vertical intersects tolerance** specifies the standard deviation of elevations computed for sideshot intersects. The default value is 0.25.

RP: The **ratio of precision tolerance** specifies the ratio of closing distance error to the length of the traverse. The value entered is the whole number to the right of the colon when the precision is expressed as a ration of precision. 1:#####. For example, a ratio of 1:20000 would be recorded as RP:20000. The default value is 10000.

TT: **Maximum number of occupied stations in a traverse task**. It specifies the maximum number of occupied stations allowed per traverse. A warning will be given during processing that the number has been exceeded. The maximum and default value is 25. SDMS will not process the file if it contains more than 25 Occupied Stations.

TA: The **traverse horizontal angle closure tolerance** specifies the difference between the given closing azimuth, and the azimuth computed through the traverse, divided by the number of occupied stations. The default value is 3.

TE: The **traverse elevation closure tolerance** specifies the maximum difference between the given elevation of the closing point, and the elevation as computed through the survey. The default value is 0.5.

HA: The **set horizontal angle tolerance** specifies the standard deviation of measured horizontal circle readings. The default value is 5.

VA: The **set vertical angle tolerance** specifies the standard deviation of measured vertical readings. The default value is 20.

DS: The **set distances tolerance** specifies the standard deviation of measured distance readings recorded in sets. The default value is 0.05.

# Customizing the TAGS.HLP File

The ability to modify the TAGS.HLP file is one of the most powerful tools for customizing SDMS Collector. There are a number of basic items that can be customized by editing the TAGS.HLP file. These are:

- The description of each data tag that is displayed when you use the ? key for help.
- The width of the input field for each data tag.
- The list of allowable responses, and the description of each response, for any data tag.
- The response type, such as alpha, numeric, or alphanumeric.

Data tags cannot be changed or removed, but the responses for most tags can be changed. See the *SDMS Collector User's Guide* for information on this function.

TAGS.HLP cannot be changed with the SDMS Collector editor. An ASCII text editor must be used. Be very careful when modifying this file. If it has formatting errors it may cause SDMS Collector to function incorrectly. Data tags must be in alphabetic order, and the information provided is in a very specific format. Look at the AA: data tag as an example.

AA 9 1 Area Computed,

The first two characters are the data tag name. The second item, separated by one space, is the width of the input field. When the AA: data tag is being prompted for, a response of up to 9 characters may be given. Any characters entered past the ninth are truncated. The input field is highlighted on most displays. After the response field width, separated by one space, is a numeric code indicating the type of response. Code 1 specifies that the response must be a numeric value. Following this code is the data tag description that is displayed when the ? key is pressed for help. This description is always terminated by a comma.

The following is an example that includes some of the allowable responses for the SI: data tag.

SI 3 0 Shot ID,
;BL=begin LOC shots
;EL=end LOC shots
;PC=point of curve
;PI=point of intersection

The first line has the format just described. The response field is 3 characters; an alphanumeric response is expected, and the description of the tag is “Shot ID”. Since the lines immediately following have a semicolon in the first column, SDMS knows that these are the allowable responses to this data tag. The characters between the ; and the = are the allowed responses and there should be no spaces in this area. The text to the right of the = is the description of the response. This description should begin in the column immediately after the = character. The first line that does not begin with a semicolon terminates the list and starts a new data tag description. Remember that the responses to AC: and TK: cannot be changed.

Some of the tags for which the user will most likely want to change the listed allowable responses are:

- CF: - combination factors for different regions in your area
- CO: - list of counties in your area
- FE: - list of point feature codes and their descriptions
- OW: - list of owners of items such as utilities
- TY: - list of point or feature types
- ZN: - coordinate zone number (e.g. state plane, or county coordinate systems)

The feature code list in particular is one that deserves a great deal of attention. If the user already has their own set of standard feature codes, these can be substituted in TAGS.HLP. Often these feature names translate to CADD cell names.

# Customizing TASK.TGS

TASK.TGS defines the default prompt sequence for each activity in each task. It also defines which activities are allowed in each task. This file can be modified with the SDMS Collector editor or any DOS based text editor. The default TASK.TGS file follows the standard SDMS file format. Each line begins with a two-character data tag followed by a colon. An extract is shown in Figure 16.

```
1.      TK:TRA
2.      AC:OS
3.      PN:
4.      PD:
5.      IH:
6.      SH:
7.      YC:
8.      XC:
9.      ZC:
```

```
10.     AC:BS
11.     PN:
12.     PD:
13.     HZ:
14.     VT:
15.     DS:
16.     AC:FS
17.     PN:
18.     . . .
```

*Figure 16. Extract from TASK.TGS*

The first line specifies a task name (TRA in this sample). The following line gives the name of an activity that may be used in that task. Subsequent lines list the data items that SDMS Collector will prompt for in an activity for this task. Thus, the OS: activity in the TRA task will prompt for PN:, PD:, IH:, SH:, YC:, XC:, and ZC:, in that order. Any activities that are not given before the next TK: data tag will not be allowed in this task. Note that 20 different data tags is the maximum number allowable within any one activity.

For customizing purposes, the order of data tags can be changed, added, or removed from any activity in any task. It is the responsibility of the user to make sure that meaningful data is being stored for each activity. For example, the horizontal angle and distance data tags could be removed from the backsight and foresight activities in a traverse, but the results would be useless for computations.

To some extent, which activities are allowed in a given task can be changed. Usually, it is safe to remove activities from a task, but SDMS will not necessarily allow activities to be added that are not already in the default file. For example, SDMS will not process sideshots in a traverse task (TK:TRA), no matter what is added to TASK.TGS.

# Setting Up Sequences

Two types of sequences, prompt sequences and user shot sequences, were defined in previous sections. Prompt sequences are those defined in the TASK.TGS file, as described in the preceding section. A user shot sequence file is a file that contains a sequence of activity tags and names, with each activity followed by a list of data items to prompt for. Sequences, how they are built and how they operate, are described in detail in the *SDMS Collector User's Guide*. This section provides a brief overview of sequences.

A sequence can be started while at the MIOC-Project mode by pressing the F3 key (Seq command), then giving the name of the sequence file to run. One sequence file already introduced is called NEWPR.SEQ. In the project configuration file, this sequence is specified as the one to be automatically invoked each time a new project is created. The prompts in this sequence file are:

AC:PR
ID:
NM:
DT:
WE:
TE:
BP:
IT:
SN:
OB:
RE:

This sequence was used at the beginning of the GSLEVEL project in the previous section. Responses had to be given to a set of data item prompts. This is a simple example of a sequence. There are two ways to change the startup sequence. The NEWPR.SEQ file can be modified, or a new sequence file can be created. If a new sequence file is created, be sure to change the name of the startup sequence file in the NS: data item in the Project configuration file to that of the new sequence file created.

There can be any number of activities within a sequence, and sequences can be nested within each other. There are also special tags to use to indicate that you want to use the standard prompts (from TASK.TGS) for an activity within a sequence.

The example below is a sequence to measure around a building with the taping activity. Taping must have two previously measured points to establish a reference line along one side of the building. This sequence first uses two sideshot activities to establish the reference line, then uses activity TA: to record the taped measurements. The special tag "--:" indicates that the standard prompts for an activity are to be used.

```
AC:SS
--:
AC:SS
--:
AC:TA
--:
```

If this sequence is stored in a file called TAPE.SEQ and called up during data collection, the user will be prompted twice for a sideshot activity with its standard data tags, then be prompted for a taping activity with its standard data tags. Any time a sequence is being run, the name of the sequence file shows at the bottom of the display (see Figure 2.5.2).

Sequence files can also contain preset responses. These responses are set as default responses until a different response is given. The given response will then become the default. Some responses, such as PN:, will automatically increment each time they are used.

# Setting Up Macros

An SDMS Collector macro file is simply a file with a stored sequence of keystrokes. If the same keystroke sequence is being repeated over and over, a macro can be stored and subsequently activated when the situation warrants. When running a macro, SDMS Collector reads the keystrokes from the macro file just as though they were being typed in at the keyboard. Be careful that a macro is activated in the correct context. Details on creating and executing macros are described in the *SDMS Collector User's Guide*.

# Example Problems

## Overview

This section provides more practice running SDMS Collector by working more example problems. These examples include creating a control file, creating and using a sequence, and entering and adjusting a horizontal traverse.

All of the examples in this section have to do with the traverse problem shown in Figure 18.

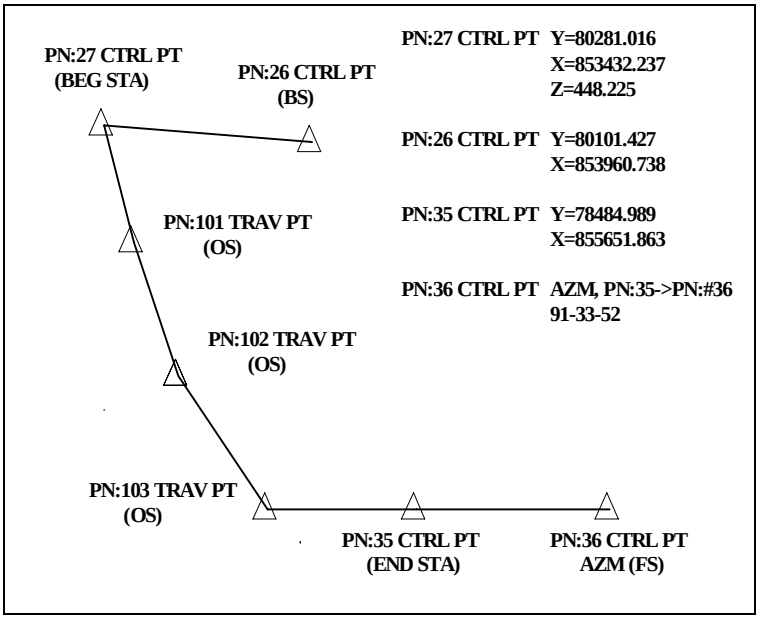


*Figure 18. Sample Traverse*

A control point file (.CTL) is created using the SDMS Collector editor. The horizontal traverse problem in Figure 18 uses three horizontal control points (X, Y or X, Y, Z known) and one azimuth control point (direction only known). It begins at point 27, backsights to point 26, and ends at point 35 with a final foresight to point 36. Before recording the traverse data, a control point file will be created containing the three horizontal control points.

| Step | User Input | System Response |
|---|---|---|
| 1. | If SDMS is at the main menu screen, skip to step 4. | |
| 2. | Change the default directory to where SDMS.EXE was installed by entering | Sets C:\SDMS as the current directory. |

| Step | User Input | System Response |
|---|---|---|
| | CD \SDMS↵ | |
| 3. | Enter SDMS↵ | Executes the SDMS Collector software and displays the main menu screen<br>SDMS opens and reads the information in the configuration files. |
| 4. | Press the F2 key (Edit command). | Displays the prompt<br>Load File --> <br>C:\SDMS\PRJ\.PRJ |
| 5. | Change the filename specification to read<br>C:\SDMS\PRJ\GSCNTL.CTL<br>and press the ↵ key. | Displays the prompt message<br>C:\SDMS\PRJ\GSCNTL.CTL<br>Not Found OK to Create? Yes No |
| 6. | Press the Y key. | Activates the SDMS Collector editor and initializes the file GSCNTL.CTL. |
| 7. | Enter the following set of tags and data items. Remember that the editor will automatically place the colon after the data tag.<br>AC:SS↵<br>PN:26↵<br>YC:80101.427↵<br>XC:853960.738↵<br>ZC: ↵<br>PD:CONTROL POINT↵ | Stores the data for control point number 26 to the file. |
| 8. | Enter the following set of tags and data items.<br>AC:SS↵<br>PN:27↵<br>YC:80281.016↵<br>XC:853432.237↵<br>ZC:448.225↵<br>PD:CONTROL POINT↵ | Stores the data for point number 27. |
| 11. | Enter the following set of tags and data items.<br>AC:SS↵<br>PN:35↵<br>YC:78484.989↵<br>XC:855651.863↵<br>ZC: ↵<br>PD:CONTROL POINT↵ | Stores the data for point number 35 |
| 12. | Press the F5 key (File command). | Activates the exit editor menu. |
| 13. | Press the F4 key (Exit command). | Saves the file, exits the editor, and returns to the Main menu. |
| 14. | Exit SDMS by pressing the Esc key, or remain at the main menu to continue in the next session. | |

# Creating A Sequence

Running a traverse involves a number of occupied station activities. Most of these are on intermediate traverse points, and require that we record the point number, point description, instrument height, and staff height. However, the first occupied station also requires the known coordinates and elevation of the POB (point of beginning), and is usually followed by a backsight shot to a known point for which known coordinates are available.

Since this is a commonly occurring situation, a sequence called POB.SEQ will be created that will prompt for the necessary information for the initial occupied station and backsight in a traverse.

| Step | User Input | System Response |
|---|---|---|
| 1. | If SDMS Collector is at the main menu, skip to step 4. | |
| 2. | Change to SDMS directory by entering<br>CD \SDMS↵ | Sets `C:\SDMS` as the current directory. |
| 3. | Enter<br>SDMS↵ | Executes the SDMS software and displays the main menu<br>SDMS opens and reads the information in the configuration files. |
| 4. | Press the F2 key (Edit command). | Displays the prompt<br>Load File -->\<br>C:\SDMS\PRJ\.PRJ |
| 5. | Change the filename specification to read<br>C:\SDMS\SEQ\POB.SEQ<br>and press the ↵ key. | Displays the prompt message<br>C:\SDMS\SEQ\POB.SEQ<br>Not Found OK to Create? Yes No |
| 6. | Press the Y key. | Initializes the file and starts the SDMS Collector editor. |

| Step | User Input | System Response |
|---|---|---|
| 7. | Use the editor to enter the sequence of activities and tags as shown below:<br>AC:OS<br>PN:<br>PD:<br>IH:<br>YC:<br>XC:<br>ZC:<br>AC:BS<br>PN:<br>SH:<br>PD:<br>HZ:<br>VT:<br>DS:<br>YC:<br>XC: | |
| 8. | Press the F5 key (File command). | Activates the editor exit menu. |
| 9. | Press the F4 key (Exit command). | Saves the file, exits the editor, and returns to the Main menu. |
| 10. | Exit SDMS by pressing the Esc key, or remain at the main menu to continue in the next session. | |

# 5.3 Horizontal Traverse Example

The traverse task in SDMS (**TK:TRA**) is used to record a series of occupied stations, backsights, and foresights. Closed traverses (ones for which an error of closure can be computed) are those that either begin and end at the same point with known coordinates, or begin at one point and end at another point with both points having known coordinates. The traverse task allows multiple singe-thread traverse loops, but it does not permit sideshots or traverse networks.

This example uses the control file and sequence file that were created in the previous two sections.

| Step | User Input | System Response |
|---|---|---|
| 1. | If SDMS Collector is at the main menu, skip to step 4. | |
| 2. | Change to the default directory where SDMS was installed by entering<br>CD \SDMS | Sets C:\SDMS as the current directory. |
| 3. | Enter SDMS | Executes the SDMS software and displays the main menu<br>SDMS opens and reads the information in |

| Step | User Input | System Response |
|---|---|---|
| | | the configuration files. |
| 4. | Press the F7 key (Conf command). | Activates the Configurations menu. |
| 5. | Press the F4 key (Cntl command). | Edits the configuration file CNTL.CFG. |
| 6. | On the line with the L1: data tag, enter the filename GSCNTL.CTL. | Sets the name of the active control point file. |
| 7. | Press the F5 key to exit the configuration editor, and press F1 to save the file. Then press Esc to return to the Main menu screen. | |
| 8. | To start a new project, a project of the same name cannot already exist. For this example, if a file called GSTRAV already exists, it must be deleted<br>Press the F5 key (Disk command). | Activates the Disk Operations menu. |
| 9. | Press the F4 key (Del command). | Displays the prompt<br>Delete<br>C:\SDMS*.*<br>with the cursor underneath the first asterisk. |
| 10. | Modify the file specification to read<br>C:\SDMS\PRJ\GSTRAV.*<br>and press the ↵ key. | Displays the prompt<br>Delete n Files? Yes No<br>where n is the number of files found with that root name. |
| 11. | Press the Y key. | Deletes all files on directory C:\SDMS\PRJ whose root name is GSTRAV, then returns to the Disk Operations menu. |
| 12. | Press the Esc key. | Returns to the Main menu screen. |
| 13. | Press the F1 key (Proj command). | Displays the prompt<br>Project Name > *.PRJ<br>C:\SDMS\PRJ\.PRJ |
| 14. | Change the filename specification to read<br>C:\SDMS\PRJ\GSTRAV.PRJ<br>and press the ↵ key. | Displays the message and prompt<br>New Project<br>Enter Task<br>TK: |
| 15. | Enter<br>TRA↵ | Defines the project as a traverse task, and activates the new project sequence NEWPR.SEQ. |
| 16. | For this set of prompts, enter the responses shown below.<br>AC:PR↵<br>ID:GSTRAV↵<br>NM:TRAVERSE↵<br>DT: ↵<br>WE: ↵<br>TE: ↵<br>BP: ↵<br>IT:MANUAL↵ | Records the project setup data, then displays the prompt AC:OS.<br>Any prompt left blank will be deleted from the .PRJ file. |

| Step | User Input | System Response |
|---|---|---|
| | SN: ↵<br>OB: ↵<br>RE: ↵ | |
| 17. | Press the F3 key.<br>This activates the sequence file name menu. | Displays the prompt<br>Enter Seq file name -> *.SEQ<br>C:\SDMS\SEQ\.SEQ |
| 18. | Change the filename specification to read<br>C:\SDMS\SEQ\POB.SEQ<br>and press the ↵ key. | Begins prompting for the data items stored in the sequence file. The first prompt is AC:OS. |
| 19. | Press the ↵ key to begin the OS activity. | Displays the prompt PN:2. |
| 20. | Press the F4 key (Get command). | Displays the prompt Get PN:+. |
| 21. | Type 27↵ over the + character. | Reads the data for point 27 from the active control point file, then displays the IH: prompt. |
| 22. | Enter the instrument height by typing<br>5.2↵ | Displays YC:,XC:, and ZC: data tags with the data read from the control point file. Then displays the prompt AC:BS. |
| 23. | Press the ↵ key to begin the backsight activity. | Displays the prompt PN:1. |
| 24. | Press the F4 key (get command) | Displays the prompt Get PN:1. |
| 25. | Type 26↵ over the + character. | Reads the data for point 26 from the active control point file, then displays the prompt SH:. |
| 26. | Enter the staff height by typing:<br>5.7↵ | Displays the HZ: prompt. |
| 27. | Type 0↵ to zero the backsight. | Displays the prompt VT:. |
| 28. | Enter the measured vertical (zenith) angle of 91°02’00<br>91.0200↵ | Displays the prompt DS:. If a total station instrument is in use, press F1 to take a measurement and read the data from the instrument instead of typing it in manually. |
| 29. | Enter the measured slope distance<br>558.181↵ | Displays the YC and XC: data tags with the data read from the control point file. Now the sequence in POB.SEQ file is finished. SDMS is back to the default prompt sequence and displays AC:PR which was the activity before POB.SEQ. |
| 30. | Begin a foresight activity by typing FS↵ over the PR activity name. | Begins prompting for the foresight shot data items. |
| 31. | Enter the foresight data as shown below.<br>PN:101↵<br>PD:TRAV PT↵<br>HZ:54.4048↵<br>VT:90.2550↵<br>DS:610.061↵ | Stores the data for the foresight shot, and displays the prompt AC:FS. |
| 32. | Type OS↵ over the activity name. | Displays the prompt PN:101. |
| 33. | Enter the occupied station data as | Stores the data for the occupied station at |

| Step | User Input | System Response |
|---|---|---|
| | shown below.<br>PN:101↵<br>PD:TRAV PT↵<br>IH:5.2↵<br>SH:4.9↵ | point number 101, and displays the prompt AC:BS. |
| 34. | Press↵ to accept the BS activity. | Begins the backsight activity and displays the prompt PN:27. Now you are doing a backsight shot to the last occupied station. |
| 35. | Enter the backsight data as shown below.<br>PN:27↵<br>PD:Ctrl PT↵<br>HZ:0.0000↵<br>VT:89.3510↵<br>DS:610.061↵ | Stores the data for the backsight shot and displays the prompt AC:BS. The staff height has changed, so it must be entered before beginning the next shot. |
| 36. | Backspace over the AC data tag and type SH.<br>For the staff height value, enter 5.3↵ | Resets the staff height, and re-displays the prompt AC:BS. Now the instrument is moved to point 102. |
| 37. | Type FS:↵ over the BS activity name. | Begins the foresight activity and displays the prompt PN:102. |
| 38. | Enter the foresight data as shown below.<br>PN:102↵<br>PD:TRAV PT↵<br>HZ:173.3938↵<br>VT:87.3846↵<br>DS:98.496↵ | Stores the data for the foresight shot, and displays the prompt AC:FS> |
| 39. | Type OS↵ over the FS data tag. Then enter the occupied station data as shown below:<br>PN:102↵<br>PD:TRAV PT ↵<br>IH:5.2↵<br>SH:5.3↵ | Stores the data for the occupied station at point 102, and displays the prompt AC:BS. The next activity is a backsight on point 101. |
| 40. | Press↵ to accept the BS data tag. Enter the<br>backsight data as shown below:<br>PN:101↵<br>PD:TRAV PT↵<br>HZ:0.0000↵<br>VT:92.2214↵<br>DS:698.496↵ | Stores the data for backsight shot and displays the prompt AC:BS. The next activity is a foresight shot on point 103. The staff height must be changed again before recording the next shot. |
| 41. | Backspace over the AC data tag and type SH. For the staff height, enter 5.1↵. | Resets the staff height, and re-displays the prompt AC:BS. The next activity is to move the instrument to foresight point 103. |
| 42. | Type OS↵ over the FS activity name, then enter the data as shown below.<br>PN:103↵<br>PD:TRAV PT↵<br>HZ:159.2402↵<br>VT:90.5815↵ | Stores the data for the foresight on point 103, and displays the prompt AC:BS. |

| Step | User Input | System Response |
|---|---|---|
| | DS:793.877↵ | |
| 43. | Type OS↵ over the FS activity name, then<br>enter the data as shown below.<br>PN:103↵<br>PD:TRAV PT↵<br>IH:5.45↵<br>SH:5.1↵ | Stores the data for the occupied station at point 103, then displays the prompt AC:BS. The next activity is a backsight shot on point 102. |
| 44. | Press↵ to accept the BS data tag and enter the backsight data as shown below.<br>PN:102↵<br>PD:TRAV PT↵<br>HZ:0.0000↵<br>VT:89.0245↵<br>DS:793.877↵ | Stores the data for the backsight shot and displays the prompt AC:BS. The next activity is a foresight shot to control point 35. |
| 45. | Type FS↵ over the BS activity name. | Displays the prompt PN:104. |
| 46. | Press the F4 key (Get command). | Displays the prompt Get PN:+. |
| 47. | Type 35↵ over the + character. | Reads the data for point 35 from the control point file, then displays the prompt HZ:. |
| 48. | Enter the foresight measurement data as shown below.<br>HZ:133.0802↵<br>VT:91.1010↵<br>DS:1228.112↵ | Stores the foresight information and displays the prompt AC:FS. The next activity is to move the instrument to occupy the closing control point. |
| 49. | Enter OS↵ over the activity name FS. | Displays the prompt PN:35. |
| 50. | Press the F4 key (Get command). | Displays the prompt Get PN:+. |
| 51. | Type 35↵ over the + character. | Reads the point description from the control point file, and displays the prompt IH:5.45. |
| 52. | Enter the nstrument and staff heights as shown below. Note that the instrument height has changed.<br>IH:4.9↵<br>SH:4.84↵ | Stores the staff and instrument heights, and displays the prompt AC:BS. Before moving to the next activity, the coordinates of the closing point must be recorded. |
| 53. | Backspace over the AC data tag and type YC. | Reads the Y coordnate of point 35 from the control point file, and re-displays the prompt AC:BS. |
| 54. | Backspace over the AC data tag and type XC. | Reads the X coordinate from the control point file, and re-displays the prompt AC:BS. The next activity is a backsight on point 103. |
| 55. | Press↵ to accept the BS data tag and Enter the backsight shot data as shown below.<br>PN:103↵<br>PD:TRAV PT↵<br>HZ:0.0000↵ | Stores the backshot data and displays the prompt AC:BS. The next activity is a foresight shot to control point 36. |

| Step | User Input | System Response |
|---|---|---|
| | VT:88.5050↵<br>DS:1228.112↵ | |
| 56. | Type FS↵ over the BS activity name. For the foresight, enter the data as shown below.<br>PN:36↵<br>PD:CONTROL POINT↵<br>HZ:181.5540↵<br>VT:90.3020↵<br>DS:835.533↵ | Stores the foresight shot information and displays the prompt AC:FS. Once again we need to change the staff height. |
| 57. | Backspace over the AC data tag and type SH.<br>Enter the staff height value 5.1↵ | Resets the staff height and re-displays the prompt AC:FS. Before finishing the traverse the known azimuth from point 35 to 36 must be recorded in order to calculate the angular error of closure. |
| 58. | Backspace over the AC data tag and type AZ. For the azimuth value, enter 91.3352↵ | Records the closing azimuth and re-displays the prompt AC:FS. |
| 59. | Press the Esc key to end the project. | Displays the prompt<br>Close or Suspend ? |
| 60. | Type C to close the project and return to the Main menu screen. | |
| 61. | Press the F3 key (Comp command) | Displays the prompt<br>Compute File -><br>C:\SDMS\PRJ\.PRJ |
| 62. | Change the filename specification to read<br>C:\SDMS\PRJ\GSTRAV.PRJ<br>and press the ↵key. | Displays the Batch Computations screen, and lists the names of the input file, read control file, and write control file. Displays the prompt<br>OK to Continue ? Yes No |
| 63. | Press the Y key. | Displays the traverse computations (number of setups, total length, and various closure errors). This information stays on the screen until the ↵key is pressed. |
| 64. | Press the ↵key. | Displays more traverse closure information. |
| 65. | Press the ↵key. | Displays the prompt<br>Continue to Adjust ? Yes No |
| 66. | Press the Y key. | Displays the prompt<br>Create Cal File ? Yes No |
| 67. | Press the Y key. | Displays the prompt<br>Print Report ? Yes No |
| 68. | Press the N key (unless you have a printer attached). | Adjusts the traverse and writes the results to GSTRAV.CAL, and returns to the Main menu. |
| 69. | The SDMS editor can be used to look at the results of adjusting the traverse in file GSTRAV.CAL. | |

| Step | User Input | System Response |
|---|---|---|
| 70. | Exit SDMS by pressing the Esc key, or remain at the main menu to continue in the next session. | |

An older version of the example can be found in the *SDMS Collector User's Guide*. That version did not utilize a control point file or a sequence. Compare the steps on the first occupied station and backsight in the example and the one in the *SDMS Collector User's Guide*. That same section also has other example projects for radial topography, cross sections, three-wire leveling, and a profile.

# Processing SDMS Collector Data

## Overview

The primary purpose of SDMS Collector is to record field survey information, but it is also useful to be able to perform some computations while in the field. For example, computing the error of closure for a traverse while still on-site can insure that no serious errors exist before returning to the office. Being able to perform basic coordinate geometry calculations, such as resections, inverses between points, and station-offset calculations can also be useful.

SDMS Collector includes a number of computation utilities, which include live computations and batch computations. Live computations can be performed during data collection through special function keys. This function can be used to monitor set reductions, resections, and other intermediate checks. Spreadsheet computations can be accessed during data collection that allow the user to check inverses, station offsets, as well as coordinate and azimuth computations.

The batch computations can be used on a project file to display the results of traverse closure, leveling adjustment, and sideshot measurements. Computations can be saved in the calculated (CAL) file format and in the control (CTL) file format for future use.

## Live Computations

Each time the AC: data tag is displayed during data collection, the system SDMS Collector goes into the MIOC (More Input Or Command) mode which activates certain options on the menu bar. One of these, corresponding to function key F6, is the Comp command. Pressing F6 at this point displays the Live Comps menu, shown in Figure 20.

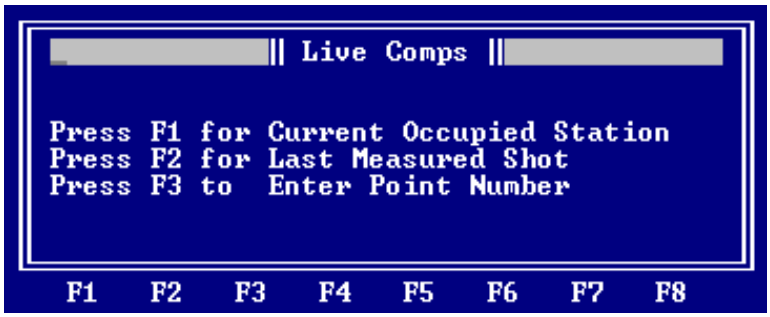

Figure 20. The Live Comps Screen

This menu has three options. Function key F1 displays the point number and calculated 3D coordinates of the current occupied station. F2 displays the same information for the most recently measured shot, and F3 displays the 3D coordinates for any point that has already been measured in the current project. Live computations do not adjust for closure errors. Therefore, live computations coordinates will be unadjusted. After each live computations display, press the ↵ key to return to the Live Comps menu. Pressing the Esc key returns to the MIOC-Project mode menu.

Performing live computations does not alter or change the recorded data in any way. Their main purpose is to provide a quick check on a position or an intermediate computation in the field. Once computations are completed, the user can return to the MIOC-Project screen, and continue data collection for the next activity.

# The 2D and 3D Computations and Stake Out Functions

Another option accessible from the MIOC-Project mode menu is the 3D Stake out and computations functions command Stak (function key F8). This option activates the 2D and 3D computation functions available on the data collector. The computation functions provided are:

- Calculate the azimuth, bearing, and horizontal distance between two points.
- Locate a point at a given azimuth, bearing, distance, and elevation from a known point.
- Calculate X, Y, and Z coordinates and station-offset values relative to the active horizontal alignment, vertical alignment, and specified superelevation. This can be done by using point numbers, station-offset, or station-feature from a control file, or, by hand entering the data.
- Set slope stakes based on a known or computed hinge point and catch point.
- Set points based on a slope ratio.

The first screen that appears is the Orientation screen, shown in Figure 21. This screen is used to:

- Input the data necessary to orient the instrument for stake out.
- Input point numbers or coordinates to compute the inverse horizontal distance and azimuth/bearing between two points.

The two functions listed above will be described in this section. A detailed description of all of the 2D and 3D computation and stake out functions available on the data collector can be found in the SDMS Collector User's Guide

The left side of the screen, labeled OS PN:, is used to input data for the point number of the occupied station for instrument orientation. The right side, labeled BS PN:, is used to input data for the backsight point. Type in the point number of the control point desired and press Enter. If a point number entered in these fields resides in the named Location Control File, the coordinate information will be displayed in the coordinate fields for that point. The coordinates can also be hand entered if no control file is available on the data collector. If the user wishes to stake out 3D points, the instrument height (IH:) and staff height (SH:) should be entered on this screen.

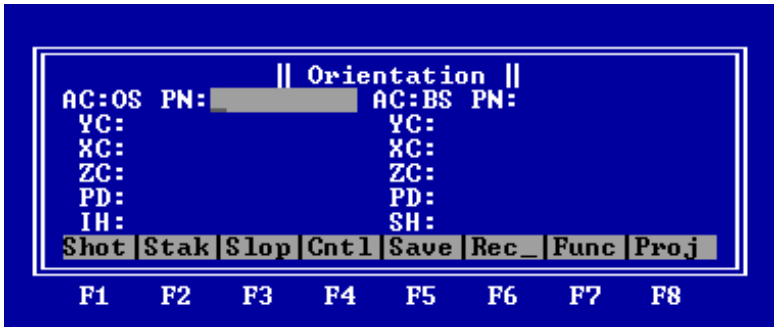


*Figure 21. The Orientation Screen*

To complete the orientation of the instrument, press F1 Shot. This will bring up the Shot/Inverse screen shown in Figure 22. The azimuth (AZ:) and bearing, and the computed horizontal distance (DD:) between the occupied station and the backsight will be displayed. If the data collector is hooked to an instrument, pressing the F1 Measure key will trigger the instrument to measure the horizontal distance (DH:) and horizontal angle (HZ:) between the occupied station and backsight. The computed elevation difference (DZ:) between the known elevation of the backsight and the computed elevation, based on the current measurement will also be displayed.

Coordinates based on a state plane coordinate system can be used for staking out points. The combination adjustment factor (CF:) saved in the project configuration file (PROJECT.CFG) will be displayed and used for computations. At times the wrong value for CF: has been saved in the project configuration file. The user can change the combination adjustment factor to the correct value on the Shot/Inverse screen. Be sure to press Enter after making a change. The value entered will automatically be saved as the updated project combination adjustment factor in the project configuration file.

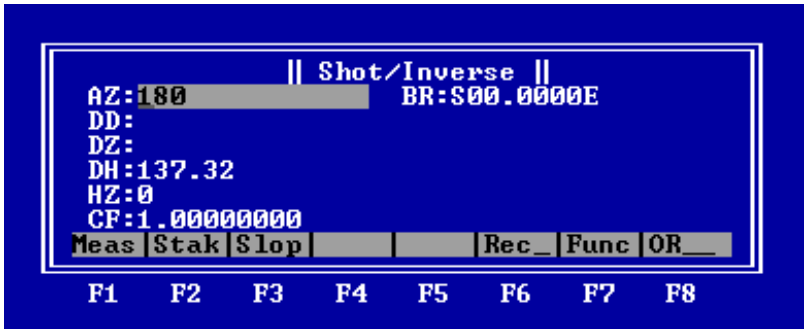


*Figure 22. The Shot/Inverse Screen*

The user can also enter the measurement information manually if an instrument is not hooked to the data collector. When no instrument is attached or activated, the user must set the data collector to IT:MANUAL. Pressing F1 Meas will then bring up the HVD screen, shown in Figure 23. This allows the manual entry of the necessary measurement data. Pressing F1 Save will then return the user to the Shot/Inverse screen with the DH:, HZ, and DZ data tags updated based on the data that was entered on the HVD screen.

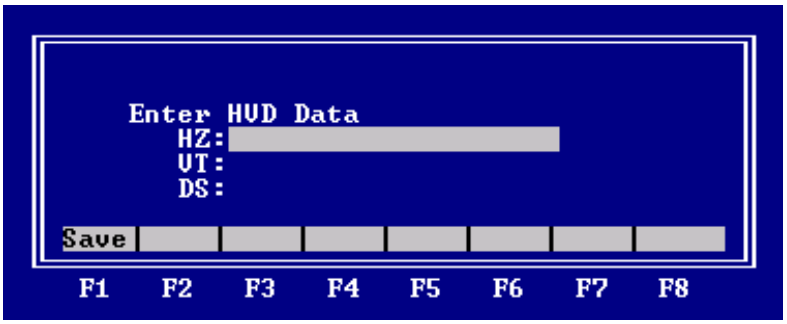


*Figure 23. The HVD (Manual Entry) Screen*

The Orientation and Shot/Inverse screens can also be used to compute the inverse horizontal distance and azimuth/bearing for points other than the occupied station and backsight. This is done by entering the point numbers or coordinate values of the points desired on the left and right sides of the Orientation screen (Figure 21). Press F1 Shot to view the computed information for the azimuth (AZ:), bearing (BR:) and the horizontal distance (DH:) between the two points on the Shot/Inverse screen (Figure 23).

# Batch Computations in SDMS Collector

The batch computation function takes the data in a closed or suspended project and performs calculations to reduce that data. The type of computations performed depends on the project task. For example, leveling adjustments are performed for the LEV and 3WR tasks, and traverse adjustments (compass rule) are performed for the TRA and COM tasks. Sideshot calculations are done for tasks RTO and COM. The batch computation function has already been used in the Leveling example and in the Traverse example in the previous sections.

The results of the batch computations can be written to a calculated (CAL) file and/or a control (CTL) file. The CAL file contains all of the measurements and descriptive information recorded in the project (PRJ) file in addition to the calculated coordinates and/or elevations. The control file will contain only the PN:, YC:, XC:, ZC:, and PD: values for all of the points in the file being computed. The XC:, YC:, and ZC: values are the same as the computed values (XX:, YY:, ZZ) for each point in the calculated file. The option for printing reports is also made available during the batch computations process.

# Processing SDMS Collector data with SDMS Processor

SDMS Collector was designed to provide field survey information for use by office CADD and GIS systems. These systems may use the data to produce topographic maps, plat sheets, legal descriptions, digital terrain models, and to store information in a GIS database. What the data is to be used for has a strong influence on the type of information collected and the methods used to collect it. These office systems may read the data from either the SDMS Collector .PRJ file or the SDMS .CAL file. The .PRJ file contains only raw measurements, which must processed further before the data is very useful to the office CADD and GIS systems. The .CAL file has already had the measurements reduced to coordinate values.

SDMS Collector batch computation functions can produce an SDMS .CAL file, but it does not contain very sophisticated processing algorithms or reporting options.

Generally, it is better to use the SDMS Processor PC application to convert an SDMS .PRJ file to an SDMS calculated (CAL file. In addition, some third party CADD programs can also process SDMS .PRJ files to produce an SDMS (CAL) file. However, these third party systems may interpret some of the information in the .PRJ file differently than SDMS Processor. Therefore, it is essential to understand how a post-processing program interprets the SDMS .PRJ data before it can be properly collected. See the *SDMS Processor User's Guide* for details on using that PC application.

# Defining Chains With SDMS

## Overview

Defining connectivity refers to the method used to indicate which surveyed points should be connected together to form linear and curvilinear features such as centerlines, edges of pavements, break lines, fences, and so on. The word chains will be used to refer to the figures formed by connecting points. The definition of chains is vital to producing good maps and accurate digital terrain model surfaces. While obtaining accurate measurements is the first priority, just knowing the positions of the points is not very helpful if one does not also know what the points represent and how they are connected to one another. The decision on which connectivity method is used has an enormous impact on the procedures used by the field crew.

SDMS Collector, like nearly all data collection systems, records data in the same order the measurements were taken in the field. It would be fairly easy to define point connectivity if, for each chain, the field crew was forced to collect points along a chain from one end to the other, without taking other shots that are not part of that chain. However, this is simply not an efficient way for the crew to operate. The more natural way to operate is to move the instrument along a corridor or to different spots around a site, and to take as many measurements from each instrument set up position as possible. This method results in a file where the points on any given chain are scattered throughout the file, and in which several chains may be in progress simultaneously.

Connecting the points to define chains is actually the job of the post-processing software, such as SDMS Processor, that interprets the SDMS connectivity data. But the field data collection procedure needs to provide the post-processing system the intelligence to do that correctly. SDMS has several different ways of tagging points for chain definition. The methods for creating chains with SDMS include:

Connectivity By Figure Number
Connectivity By Origin-Destination
Connectivity With The Chain Activity
Connectivity By Feature Code
Connectivity By Taping

Each method has its advantages and the selection is to some extent a matter of personal preference. The simplest method is to define a chain by figure number.

The Figure Number data tag (FG) offers a simple way of defining connectivity. In this method, each chain is assigned a unique figure number, and every measured point that is part of a chain is tagged with the figure number of that chain. The survey of a simple roadway is an example. The left edge-of-pavement is designated

as Figure 1 and the right edge-of-pavement as Figure 22. Every point measured on the left pavement edge must include the data item FG:1, and those measured on the right edge FG:2. The post-processing software should then form a chain for the left edge by connecting all of the points tagged with FG:1, in the order they were numbered or measured in the field. The right edge chain connects all points tagged with FG:2.

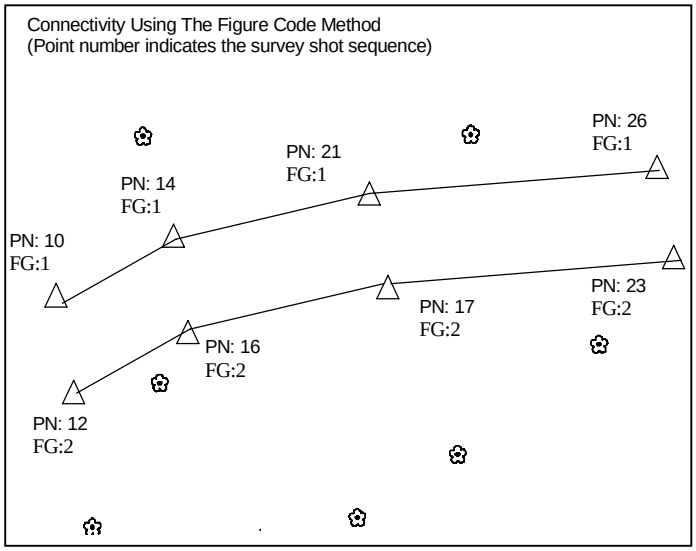


*Figure 22 Connectivity by Figure Code*

This method does impose the restriction that the points on a given chain must be measured in order working from one end of the chain towards the other, but not necessarily in sequential shots. It does allow any number of chains to be in progress simultaneously. The field crew must keep track of the figure numbers used for each chain figure. The other chain attributes, such as feature code, topographic type, etc., are usually defined as data items on the first point of each chain. In Figure 22, each point is labeled with its point number and figure number. The point numbers correspond to the shot sequence used in the field.

It is important to remember that the method used for tagging connectivity and assigning attributes to chain figures must be compatible with SDMS Processor, or other post-processing software that processes the SDMS Collector data file. An explanation of all the methods for creating chains can be found in the *AASHTO SDMS Technical Data Guide 2000* and in the appendix of the *SDMS Collector User's Guide*.

# Appendix

## Overview

The Appendix gives quick reference to various parts of SDMS Collector:

- Set up of total stations
- The SDMS Collector file naming conventions
- The SDMS Collector program files
- Tasks
- Activities
- Data tags
- Default task and activity definitions
- Default help file listings
- Default of configuration file listings
- The file structure of control files
- The file structure of alignment files

## Set Up of Total Stations

The total station must be correctly set up to communicate with SDMS. These communication parameters are currently hard coded into the SDMS program based on manufacturer default settings when each model was first added to SDMS support. Since then, some manufactures have changed the defaults on newer instruments. The communication parameters for all the supported total stations are as follows:

| Driver | Baud | Data Bit | Parity | Stop Bit |
|---|---|---|---|---|
| GEODIMETER System (400/500/600) | 4800 | 7 | Odd | 1 |
| LIECA T1010 & 1610 | 2400 | 7 | Even | 1 |
| LIECA TCR303 | 9600 | 7 | Even | 1 |
| LEICA TCA1103 | 9600 | 7 | Even | 1 |
| LIETZ SET (3 & 3B) | 1200 | 8 | None | 1 |
| NIKON DTM Series (400-800) | 1200 | 8 | None | 1 |
| PENTAX PTSIII | 1200 | 8 | None | 1 |
| SOKKIA SET Series (2, 2B, 3, 3B, XL, & 100 Series | 1200 | 8 | None | 1 |
| TOPCON (Coarse and Fine Modes) | 1200 | 7 | Even | 1 |

| Driver | Baud | Data Bit | Parity | Stop Bit |
|---|---|---|---|---|
| GTS Series (4 & 300/500/700)<br>GTS AF Series (601-603 ,605)<br>GPT Series (1001, 1002, 1003) | | | | |
| TRIMBLE TTS (300 and 500) | 38400 | 8 | none | 1 |
| WILD T2000 & T2002 | 2400 | 7 | Even | 1 |
| ZEISS Elta Series 3 & 4D | 1200 | 7 | Odd | 2 |

# SDMS Collector File Naming Conventions

The name for SDMS files must observe DOS file naming conventions. The SDMS file name extensions conventions are listed below:

| File Extension | File Description |
|---|---|
| ALI | Horizontal Alignment files |
| CAL | Calculated files |
| CFG | Configuration files |
| CTL | Control files |
| EDI | Edited files |
| EXE | Executable program files |
| HLP | Help files |
| MAC | Macro files |
| PRJ | Project files |
| PRO | Vertical Alignment files |
| SEQ | User shot sequence files |
| SUP | Superelevation files |
| TGS | Default prompt sequence |
| TMP | Temporary files |

# The SDMS Collector Program Files

SDMS Collector program files include the executable file, the configuration files, the help files and the default prompt sequence file TASK.TGS. All of these files must be located in the same directory named as the default (DP:) in the I/O configuration file.

| File Name | Purpose | Edit in SDMS |
|---|---|---|
| CNTL.CFG | Names control and alignment files | Yes or use DOS editor |
| CNTL.HLP | Control file configuration help | No use DOS editor |
| HALIGN.TMP | Temporary file used to compile current horizontal alignment file | No use DOS editor |
| IO.CFG | Names I/O devices and default paths | Yes or use DOS editor |
| IO.HLP | I/O configuration help | No use DOS editor |
| NEWPR.SEQ | Default sequence for opening new jobs | Yes |
| PROJECT.CFG | Sets controls in the project configuration | Yes or use DOS editor |

| File Name | Purpose | Edit in SDMS |
|---|---|---|
| PROJECT.HLP | Project configuration help | No use DOS editor |
| SYS.CFG | Sets options in the system configuration | Yes or use DOS editor |
| SYS.HLP | System configuration help | No use DOS editor |
| SDMS.EXE | Runs the SDMS program | No |
| TAGS.HLP | Lists data tags and allowed responses | No use DOS editor |
| TASK.TGS | Defines activities and data items, by task | Yes |
| TOL.CFG | Sets survey tolerances for data collection | Yes or use DOS editor |
| TOL.HLP | Tolerance help | No use DOS editor |

# Tasks

Tasks appear in the project file with the task data tag (TK:). Tasks are always three letter combinations. The following table shows the horizontal tasks with its data item.

| Horizontal Task | Task ID | Description |
|---|---|---|
| Combined | COM | To combine one or more single thread traverses and radial topography measurements in one project |
| Control network | CON | To establish a control network of traverses. This allows least squares adjustment of the traverses by the post processing software. Sideshots are not allowed |
| Photo control | PHO | To establish photo control points |
| Radial topography | RTO | To be used for radial topography measurements, both for data collection and stakeout. |
| Terrain model | TMO | Terrain model measurements |
| Traverse | TRA | One or more single thread traverses. Sideshots are not allowed. |

The following table shows the vertical tasks with its data item.

| Vertical Task | Task ID | Description |
|---|---|---|
| Cross-section | XSE | Cross section measurements done with a level |
| Level run | LEV | single wire level run |
| Profile | PRO | To measure points along a profile |
| Three-wire level | 3WR | Three wire leveling run |

# Activities

Activities appear in the project file with the activity data tag (AC:). The following table shows each activity with its data item:

| Activity | Activity ID | Description |
|---|---|---|
| Backsight | BS | Backsight shot to a defined point |
| Control check | CC | Used to shoot from the current station to a point with known X,Y,Z coordinates as a check on the |

| Activity | Activity ID | Description |
|---|---|---|
| | | current position and elevation. |
| Chain | CH | To define a chain by giving a list of previously defined points and chains, regardless of any connectivity methods used |
| Check shot | CK | Used to suspend prompted operations to allow the user to work interactively with SDMS, then continue the operation. |
| Elevation control | EC | Used with tasks that use an electronic total station instrument to shoot from the current occupied station to a point with known elevation to compute the elevation of that occupied station. |
| Equation Point | EQ | Used to define a station equation in an alignment file. |
| Figure | FG | Used to record critical points from which standard figures (such as an inlet) can be extrapolated. |
| Foresight | FS | Used to make a foresight shot from the current station. |
| Occupied station | OS | Used to set up the instrument on a known or previously measured point. |
| Project header | PR | To define the project name, the task, and global settings for a project |
| Sideshot intersect | SI | Used to measure a horizontal angle from the current station to a sideshot point. A sideshot intersect to the same point from at least two different stations will allow the sideshot point coordinates to be computed. |
| Station resection | SR | Used to measure distances and angles from the current station to points with known coordinates. Resection measurements from an occupied station to two or more different known points will allow the occupied station coordinates to be computed. |
| Sideshot | SS | Used to make a sideshot from the current station. |
| Stationing | ST | Used to define a station on a baseline or alignment for cross sectioning. |
| Taping | TA | Used to define a chain by collecting taped measurements along figures (such as a building perimeter). |
| Tie sequence | TS | Used to reference a control point using azimuths and distances |
| Turning point | TP | Used for a turning point (foresight) in the level or 3-wire level task |
| Text | TX | Used to define a text block which allows multi-line comments or point descriptions |
| Utility elevation | UE | Used to measure an elevation on a utility point, above or below the level of the sideshot. |

# Data Tags

Data tags identify pieces of data. Data tags have two alphanumeric characters and a colon. The table below describes the SDMS data tags. The data tags are listed alphabetically and may not be in the same order as found in the TAGS.HLP file.

**Note**: A number of the tags in the list are either used only in the various configuration files, or have a completely different definition in a configuration file than the same tag name does in an SDMS project file. In the latter case, the tag name is defined in the list twice; an example of this is the AD data tag. Tags that are used for configuration file data items are marked with the word (config) underneath.

| Data Tag | Description |
|---|---|
| --: | Standard Shot - used in building sequences to indicate that you want to use the standard prompts for an activity. Place the -- data tag immediately following the activity data item. |
| //: | Nested Sequence - used to nest one user-defined sequence inside of another. If //:file name is found in a sequence, the sequence in the given file is invoked. Once the nested sequence is completed, the original sequence continues. |
| A0 - A9: | Attribute fields 0 through 9. Used to record special attribute data for which there is not already a data tag. For example, a street address may be recorded using these data items. |
| AA: | Area-Computed - used to record the computed area of a stored figure. No user response required. |
| AC: | Activity - begins a new activity. The activity name must be one of the two character codes listed in section 8.3. |
| AD: | Angle Distance List - used to record a list of angles and horizontal and vertical distances measured by tape in the taping activity (AC:TA). |
| AD: (config) | Auto Date/Time Stamp - when used in the SYS.CFG file, designates when or if to automatically date and time stamp the project file. Responses include OFF, PROJ (in project header only), STAT (at each OS activity), and SHOT (at each activity). |
| AH: | Accuracy Horizontal - used in a project file to designate the horizontal precision of a point if recorded with that point, or for all the points in a file if recorded in the project header. Examples - AH:A (could be equivalent to NGS Order A of 0.1 PPM); AH:F (could be equivalent to NGS First Order of 10.0 PPM) |
| AR: | Area – defines the known or designed area of a closed chain or figure. |
| AS: (config) | Auto Save - when used in the SYS.CFG file, Yes indicates that files will be automatically saved. No indicates that the user will prompted whether or not to save files. |
| AV: | Accuracy Vertical - used in a project file to designate the vertical precision of a point if recorded with that point, or for all the points in a file if recorded in the project header. Examples - AV:F1 (could be equivalent to NGS First Order, Class 1); AV:T (could be equivalent to NGS Third Order) |
| AZ: | Azimuth - used to record an azimuth from the current station to either a backsight or foresight point. |
| B1: (config) | Baud Rate - when used in the IO.CFG file, designates the communications device baud rate (B1:9600 = 9600 baud). Does |

| Data Tag | Description |
|---|---|
| | not apply to the measuring device. |
| BG: | Begin Group - Used in the SDMS calculated file (CAL) to indicate the beginning of the list of chains generated by SDMS Processor from the shot attribute information listed in that file |
| BP: | Barometric Pressure - used to record the barometric pressure in the units designated by the UP: data item. |
| BR: | Bearing – used to record or display the bearing measured or computed between two points. The format is (N or S)DD.MMSSS(E or W). |
| BS: | Backsight Point Number - used with the Taping Activity (AC:TA) to list the point number to use as the back sight to initiate the taping routine. |
| CD: | Chain Description - used to record descriptive information for a survey or geometry chain (figure). This data item will normally be used with AC:SS and AC:CH |
| CD:(config) | Communication Device - when used in the IO.CFG file, designates the name of the serial communications device port (COM1, COM2 etc.) |
| CE: | Collimation Error - used to record the angular horizontal collimation error as determined by the surveyor when testing the collimation of the instrument. |
| CF: | Combination Factor - used to specify the combination factor used in converting between grid and ground distances. |
| CH: | Chain Number - used in the chain activity (AC:CH) to include a list of previously defined chains in the chain being defined. |
| CI: | City - used to record the city where the survey took place. |
| CL: | Class - used to record a classification code of some sort. Some post processing and CADD systems interpret this as a topography attribute tag, while other post-processing and CADD may interpret it as a soil classifications. |
| CM: | Comment - used to record a comment about a point or observation. |
| CN: | Condition - used to record the condition of surveyed objects, such as inlets, pipes, bridges, etc. This data item is often used in inspection surveys. |
| CO: | County - used to record the county where the survey took place. |
| CP: | Close Project - closes a project and indicates that it is finished. Any user response may be given. It is used to indicate the user's intent that the project is complete and is not to be continued. |
| CR: | Curvature and Refraction - indicates with a Y or N whether the project data should be corrected for the Earth's curvature and atmospheric refraction. |
| CS: | Coordinate System - used in a project or control file to indicate the coordinate system used as the basis of the point coordinates found in that file. Examples State Plane Coordinate systems; County Coordinate systems; local coordinate systems. |
| D1: (config) | Data Word Length - when used in the IO.CFG file, designates the serial communications word length in bits (7 or 8). |
| DA: | Deflection Angle - used to record deflection angles at PI points for computation of a horizontal alignment. The deflection angle is defined by extending the back tangent direction ahead of the PI and measuring the subtended angle and recording this angle in |

| Data Tag | Description |
|---|---|
| | DDD.MMSSSS format. An angle left is indicated by preceding the angle with a negative (-) sign in front of the (-DDD.MMSSSS). An angle right is positive and no sign is required.<br>NOTE: In the current release of SDMS Collector and SDMS Processor, DA: is used for information purposes only. |
| DC: | Degree of Curvature - used in the Horizontal Alignment file to define a curve's degree of curvature. It may also be used in a project file to document a degree of curvature for a curve. |
| DD: | Distance-Computed - where multiple observations are made of a point from the same station, this data item records the averaged distance. |
| DH: | Distance Horizontal - used to record a measured horizontal distance. |
| DI: | Diameter - records the diameter of a surveyed object, such as a culvert pipe or a tree. |
| DL: | Delete Shot/Station - used to delete a single shot (DL:SH), or delete a station and all of its related shots (DL:ST). Deleted items are not actually removed from the project file, only marked as deleted. |
| DO: | Direction of Offset - used to record whether offsets to the prism in an activity are horizontal (DO:H) or vertical (DO:V). |
| DP: | Depth - used to record the depth of cover of a surveyed object. |
| DP: (config) | Data Path - when used in the IO.CFG file, it designates the default directory path for SDMS project files. |
| DS: | Distance Slope - used to record a slope distance measurement. Usually used in conjunction with a vertical angle (VT:) and horizontal angle (HZ:) data item |
| DS: (config) | Distance Tolerance Sets - When used in the TOL.CFG file to specify the standard deviation of a measured distance from the mean. |
| DT: | Date - records the date. |
| DT: (config) | Date Stamp - when used in the IO.CFG file, Yes or No indicates whether or not to stamp the date on each page of SDMS reports and printouts. |
| DV: | Distance Vertical – used to record or display the vertical distance between two known or computed points. |
| DX: | Delta X - used in live and batch computations to record the algebraic difference between the known X Coordinate (XC:) of a point and the computed X Coordinate (XX:) of a point based on the shots taken to that point in a project file. |
| DY: | Delta Y - used in live and batch computations to record the algebraic difference between the known Y Coordinate (YC:) of a point and the computed Y Coordinate (YY:) of a point based on the shots taken to that point in a project file. |
| DZ: | Delta Z - used in live and batch computations to record the algebraic difference between the known Z Coordinate (ZC:) of a point and the computed Z Coordinate (ZZ:) of a point based on the shots taken to that point in a project file. |
| E1: | Left Side Slope - used in the superelevation file (.SUP) for the stake out functions to define the left side slope rate at a transition station. This slope is expressed in feet/feet, meter/meter, or percent |

| Data Tag | Description |
|---|---|
| | (E.g., 0.02). |
| E2: | Right Side Slope - used in the superelevation file (.SUP) for the stake out functions to define the tight side slope rate at a transition station. This slope is expressed in feet/feet, meter/meter, or percent (E.g., 0.02). |
| ED: | Error Distance - used to record the standard deviation in the mean of multiple distance measurements. |
| EG: | End Group (List) - Used in the SDMS calculated file (CAL) to indicate the end of the list of chains generated by SDMS Processor from the shot attribute information listed in that file. |
| EH: | Error Horizontal Angle - used to record the standard deviation from the mean of multiple horizontal angle measurements. |
| EQ: | Equation Number - used to the point number of a station equation in an alignment. |
| ER: (config) | Error Radial Topography Radius - when used in the TOL.CFG file, defines the radial topography error radius tolerance value. |
| ES: | Ending Station - identifies the ending station of a survey loop. |
| EV: | Error Vertical Angle - used to record the standard deviation in the mean of multiple vertical angle measurements. |
| EX: | External Distance Horizontal Curve - used with a horizontal alignment (PI Definition) to record the distance from the PI to the midpoint of the arc defined between the PC and PT to the PI |
| FC: | Face Number - used to record which face of the instrument was used for each shot when recording a set of repeated shots to a point from the same station. FC:1 indicates direct; FC:2 indicates reverse. This must always be used in conjunction with the set (SE) data item. |
| FE: | Feature Code - used to record an alpha, numeric, or alpha-numeric feature code for a point or chain. |
| FG: | Figure Code - used to assign a common figure number to all points that are part of the same figure or chain. Points with the same figure number should be connected together by the post-processing software in the order recorded to form a chain. |
| FP: (config) | Format Path - when used in the IO.CFG file, designates the default directory path for predefined output formats. |
| GM: | Geometry Type - used to tag the geometric type of a point in a chain. For example, if GM:C (curve) is used, the chain should have a smooth curve going through the point. If GM:P (Point) is used, the chain should have a straight line between points. Verify how these data items are used by the post-processing software to define chains. |
| GR: | Group - used to group sets of surveyed object together in the post-processing software database. Items with the same group tag should be placed on the same level, layer, zone etc. |
| H1: | Help - displays on-line help text during data collection. Does not record any information to the project file. |
| HA: | Horizontal Alignment File Name- gives the name of the file that defines the geometry of the horizontal alignment. The alignment geometry is used for station-offset calculations. |
| HA: (config) | Horizontal Angle Set Difference - used in TOL.CFG to set the tolerance allowed between an individual horizontal angle measured in sets and the mean horizontal angle computed from the |

| Data Tag | Description |
|---|---|
| | sets. Horizontal angles that exceed the difference will be omitted from final computations |
| HD: | Horizontal Datum - records the user-specified name of the horizontal datum, such as NAD27 or NAD83. This information can be used by the post-processing software for conversions between X,Y and Latitude, Longitude. SDMS will accept any response; be sure that the name you use is compatible with the post-processing software. |
| HE: | Height Ellipsoid –used to record the distance, measured along the normal to the ellipsoid, between a point on the ground and the surface of the ellipsoid as defined in geodesy and used with the Global Positioning System (GPS). Also known as ellipsoid height and height above the ellipsoid. |
| HG: | Height Geoid – used to record the distance between the geoid and ellipsoid at a given point as defined in geodesy and used with the Global Positioning System (GPS). The geoid can be above or below the ellipsoid defined. |
| HH: | Horizontal Angle-Computed - computes the average horizontal angle from repeated observations to a point from the same station. |
| HT: | Height - records the user-specified height of a surveyed object, such as a tree or fence. |
| HY: | Highway - used to record the name of a highway or road. |
| HZ: | Horizontal Angle - used to record a horizontal angle measurement. The format used is DDD.MMSSS. |
| I0 - I9: | Information Field 0 (through) Information Field 9 - used to record user-defined information fields. These tags may have specific usage defined by the post-processing software. |
| ID: | Project Identification - records the name or identification number of the project in the project header. |
| IH: | Instrument Height - used to record the vertical distance from the occupied survey point to the vertical index of the instrument. |
| IT: | Instrument Type - used to record the type of instrument used. This information tells SDMS which device driver to use. IT:NONE indicates that all measurements will be entered manually. |
| L1: (config) | Location 1 Control File Name – used in CNTL.CFG to name the primary control point file. By default, referenced control points are searched for in this file first, and in the Location 2 file second. |
| L1: | Length First Curve - used with a vertical alignment (PRO) to record the length of vertical curve for symmetrical curves or the curve length from the VPC to VPI for unsymmetrical curves. |
| L2: (config) | Location 2 Control File Name– used in CNTL.CFG to name the secondary control point file. |
| L2: | Length Second Curve - used with a vertical alignment (PRO) to record the length of vertical curve from the VPI to VPT for unsymmetrical curves. |
| LC: | Long Chord - used with a horizontal alignment (PI Definition) to record the distance represented by a straight line between the PC and PT of a curve. |
| LG: | Longitude - used to record the longitude of a point. |
| LN: | Length - used to record the length of a surveyed object.<br>Used with a horizontal alignment (PI Definition) to record the |

| Data Tag | Description |
|---|---|
| | length of a circular curve. |
| LO: | Length Offset - used when the target can not be placed directly on the point being measured, but is placed in front or in back of the point. A negative value is used if the target is in front of the point. |
| LP: (config) | Log to Printer - when used in the SYS.CFG file, Yes or No indicates whether or not to log any screen reports to the printer automatically. |
| LS: | Length of Spiral - used to specify the length of a spiral in the PC/PT defined horizontal alignment file. |
| LT: | Latitude - records the latitude of a point. |
| MM: (config) | Memory Cache - when used in the PROJECT.CFG file, designates the amount of hard disk space below which the user is warned. |
| MO: | Mid Ordinate Circular Curve - used with a horizontal alignment (PI Definition) to record the distance from the center of a curve to the midpoint of the long chord for that curve. |
| MP: (config) | Macro Pause - when used in the SYS.CFG file, designates the step delay time for macro execution in 1/18th second increments (MP:2 designates 2/18th seconds pause time). |
| MS: (config) | Multi-Stub - when used in the TOL.CFG file, defines the error radius allowed on multi-stub intersections. |
| NM: | Name - used as a general purpose Name field. It could be used to record project names, point and chain names, name of a building, etc. |
| NS: | Number of Shots - can be used by the post-processing software to indicate the number of shots that have been taken on a point from the same station. |
| NS: (config) | New Project Sequence - when used in the PROJECT.CFG file, designates the name of the sequence file to automatically execute when starting a new project. |
| OA: (config) | Overwrite/Append - when used in the SYS.CFG file, “O” indicates that current data overwrites existing files, and “A” indicates that current data is appended to existing files. |
| OB: | Observer - used to record the name or initials of the observer on the survey crew. |
| OD: | Origin/Destination Point Number - provides a method of defining chain connectivity. When shooting points on a chain, it defines the identification number of the next point to be connected to in that chain. |
| OF: | Offset - used when the target can not be placed directly on the point being measured, but is placed to the left or right of the point. A perpendicular offset to the left of the point (in the line of sight when facing the point from the instrument) is entered as a negative value.<br>Used in the profile and cross section tasks and in stake out computations to define the distance right of left of the specified alignment a shot represents. |
| OO: | Offset-Computed - used to record the computed offset of a point relative to an alignment when the point was measured by radial setup. |
| OP: (config) | Overwrite Protection - when used in the SYS.CFG file, YES designates protection is on (files may not be overwritten). |

| Data Tag | Description |
|---|---|
| OS: | Occupied Station Point Number - used with the Taping Activity (AC:TA) to list the point number to use as the occupied station to initiate the taping routine. |
| OS: (config) | Old Project Sequence - when used in the PROJECT.CFG file, designates the name of the sequence file to execute when starting SDMS to continue with an existing project. |
| OW: | Owner - used to record the name of an owner of some object defined by the survey. For example, it may be used to specify the owner of a parcel defined by a chain, or of a utility feature defined by a point. |
| P1: (config) | Parity - when used in the IO.CFG file, designates the type of parity used for serial communications (NONE, ODD, or EVEN). |
| PC: | Prism Correction - used to correct the measured slope distance for the difference between the optical center of the prism and the axis of the prism housing. Entered as a length value in the project units. |
| PD: | Point Description - used to record point description information. It may also be used to record descriptive information for a chain or other objects. |
| PD: (config) | Print Device - when used in the IO.CFG file, designates the name of the printer device port (LPT1, LPT2, COM1, COM2, or CON). |
| PF: (config) | Print Footer - when used in the IO.CFG file, defines a line of text to be used as a footer in SDMS reports and printouts. |
| PG: (config) | Page Numbering - when used in the IO.CFG file, Yes or No indicates whether or not to number pages in SDMS reports and printouts. |
| PH: | Physical Characteristic - used to record encoded physical characteristic information for a point. This is used by some post-processing software to assign graphical attributes such as level and cell/symbol name. |
| PH: (config) | Print Header - when used in the IO.CFG file, defines a line of text to be used as a header in SDMS reports and printouts. |
| PL: | Point List - used in the chain activity (AC:CH) to define a list of point numbers to be included in that chain. |
| PL: (config) | Page Length - when used in the IO.CFG file, designates the number of lines per page for SDMS reports and printouts. |
| PM: | PPM Factor - records a parts-per-million factor usually associated with total station measuring devices. |
| PN: | Point Number - identifies the point number for an activity. Depending on which activity it is used in, it may be referring to a previously defined point, or assigning a point number to a new point. For example, the backsight activity (AC:BS) must give the number of a previously defined point that is being observed. A sideshot activity (AC:SS) assigns a point number to a new point. |
| PO: | Prism Offset - used to record the distance from the desired point to a prism placed on the point. It is used in conjunction with the offset direction data item (DO:), which indicates if the prism is set in a horizontal or vertical offset orientation. If, when facing the point, the prism offset is to the right, enter a negative offset value. |
| PP: (config) | Project Path - when used in the IO.CFG file, it designates the default directory path for creating and editing projects files. |
| PR: | Project Name - identifies the file name of the file used to collect the survey. Only one PR data item may be used per project file. |

| Data Tag | Description |
|---|---|
| | The project name may be up to 8 characters. It is ALWAYS the first data item in a project file. |
| PR: (config) | Protocol - when used in the IO.CFG file, designates the communications protocol (NONE or XON/XOFF). |
| PW: (config) | Page Width - when used in the IO.CFG file, designates the width of the page in characters for SDMS reports and printouts. Defaults to PW:40 for screen output, and PW:80 for printer output. SDMS assumes that a constant width character font is being used. |
| QP: (config) | Sequence Path - when used in the IO.CFG file, designates the default path for finding sequence files. |
| R1: (TK:3WR) | Rod Reading-Top Wire - for three wire leveling (3WR), used to record the upper wire reading. |
| R1: | Radius First Curve - used with a horizontal alignment (HA:) to record the radius of the first circular curve of a compound curve or compound reverse curve and also defines the beginning radius to use for a connecting spiral between compound curves. |
| R2: (TK:3WR) | Rod Reading-Middle Wire - for three wire leveling (3WR), used to record the middle wire reading. |
| R2: | Radius Second Curve - used with a horizontal alignment (HA:) to record the radius of the second circular curve of a compound curve or compound reverse curve and also defines the ending radius to use for a connecting spiral between compound curves. |
| R3: (TK:3WR) | Rod Reading-Bottom Wire - for three wire leveling (3WR), used to record the bottom wire reading. |
| RA: | Radius - records the radius of a curve. The radius for a curve to the left is entered as a negative value. |
| RD: | Ring Description - a special tag used in tunneling operations to describe the current ring. |
| RE: | Recorder - records the name or initials of the note taker or recorder on the survey crew. |
| RN: | Ring Number - a special tag used in tunneling operations to identify the current ring. |
| RO: | Right Angle Offset – used to record the angular offset left or right of the line of sight to an object. Not presently used in SDMS Collector live or batch computations. |
| RP: (config) | Removal Protection - when used in the SYS.CFG file, YES indicates the removal protection is on (files may not be deleted). |
| RP: (config) | Ratio of Precision - when used in the TOL.CFG file, defines the position closure tolerance in traverses. A warning is issued if the computed closure is worse. |
| RR: | Rod Reading - used to record the rod measurement in vertical tasks and in activities such as utility elevation (AC:UE) in horizontal tasks. In vertical tasks, all rod readings are positive unless the rod is inverted. In horizontal tasks, positive readings are used to record depth values. |
| RS: | Ring Style - special data tag for tunneling operations that indicates the type of ring being observed. RS:CIRC, RS:BOX, and RS:ARCH indicate circular, rectangular, or arched ring styles, respectively. |
| RT: | Rod Type - used to specify the units of graduation of the rod being used. Valid responses are YARD, FOOT, and METER. Yard measurements are automatically converted into feet. |

| Data Tag | Description |
|---|---|
| RT: (config) | Resection Tolerance - when used in the TOL.CFG file, defines the resection tolerance value in UL. |
| S1: (config) | Stop Bit Length - when used in the IO.CFG file, designates the number of stop bits for serial communications (1 or 2).<br>Staking 1 Control File Name– used in CNTL.CFG to name the primary staking point file. This file defines coordinates for points to be staked out in the field. |
| S1: | Entry Spiral Length - used with a horizontal alignment to record the spiral length to use at the beginning (TS) of a spiral curve. |
| S2: (config) | Staking 2 Control File Name – used in CNTL.CFG to name the secondary staking point file. |
| S2: | Exit Spiral Length - used with a horizontal alignment to record the spiral length to use at the end (SC) of a spiral curve. |
| S3: | Connecting Spiral Length - used with a horizontal alignment to record the spiral length to use between compound circular curves. |
| SB: | Station Back - used to indicate the stationing to be used for an alignment (HA & VA) from a specific SI back along the alignment. |
| SD: | Station Direction - used to indicate whether shots are currently being taken looking up-station (SD:UP; increasing stations) or down-station (SD:DOWN; decreasing stations). This is normally used only in tunneling operations. |
| SD: (config) | Nominal Station Deviation - when used in the TOL.CFG file, defines the station deviation tolerance value. |
| SE: | Set Number - used to identify a point as part of a set of repeated measurements to a point from the same station. Sets are used to calculate averaged distances and angles. Each shot in the set must contain both the SE: and FC: data items. |
| SF: (config) | Superelevation File Name - used to specify the name of the file where the cross slopes for the sub-grade or pavement based on the horizontal alignment specified are defined. |
| SH: | Staff Height - used to record the height of the staff, target, rod, or prism on a shot. |
| SI: | Shot Identification - identifies a point as being of certain type. Refer to section 5 of the SDMS Technical Data Guide 2000 for detailed information about allowable responses. |
| SN: | Serial Number - used to record the serial number of the instrument being used. |
| SP: | Suspend Project - used to suspend work on a project until a later time or day. Any response may be used and recorded. The SP data item is generated by SDMS, and does not affect computations. |
| SP: (config) | Screen Pause - when used in the IO.CFG file, designates the amount of time for pausing the screen display for scrolling screen reports in 1/18th second increments (SP:2 = 2/18th sec. pause). |
| SS: | Stationing-Computed - computes and records the station relative to an alignment of a point shot radially. |
| ST: | Stationing - used to define the nominal station along an alignment or the stationing to use ahead at an equation. It is also used in the station activity (AC:ST), where it applies to all subsequent shots until a new station activity is begun. The format is based on the units of length (UL:) settings in the project configuration file. |

| Data Tag | Description |
|---|---|
| ST: (config) | Three Wire Stadia Tolerance - when used in the TOL.CFG file, designates the 3 write stadia difference tolerance. |
| SX: | Standard Error Estimate X Coordinate– used with control points to define an error estimate in the X component (Easting) of the coordinate for that control point to be used during the least squares analysis process. The response represents the amount of freedom the user wishes to allow the control point to adjust during processing. The default value in SDMS Processor is 0.001feet (or meters) which is considered fixed. |
| SY: | Standard Error Estimate Y Coordinate – used with control points to define an error estimate in the Y component (Northing) of the coordinate for that control point to be used during the least squares analysis process. The response represents the amount of freedom the user wishes to allow the control point to adjust during processing. The default value in SDMS Processor is 0.001feet (or meters) which is considered fixed. |
| SZ: | Standard Error Estimate Z Coordinate – used with control points to define an error estimate in the Z component (Elevation) of the coordinate for that control point to be used during the least squares analysis process. The response represents the amount of freedom the user wishes to allow the control point to adjust during processing. The default value in SDMS Processor is 0.001feet (or meters) which is considered fixed. |
| TA: (config) | Traverse Horizontal Angle Closure - when used in the TOL.CFG file, defines the angular closure error tolerance value. |
| TD: | Tunnel Direction - records the direction of a tunnel, such as INBOUND or OUTBOUND. |
| TE: | Temperature - used to record the current temperature in the units designated in the UT data item. |
| TE: (config) | Traverse Elevation Closure - when used in the TOL.CFG file, defines the traverse elevation closure tolerance value. |
| TI: | Tunnel Identification - records the name or number of a tunnel. |
| TK: | Task - used to define the type of survey task being conducted. There may be only one TK: data item per project file, and it is normally the second data item in the project. |
| TL: | Tangent Length - used with a horizontal alignment (PI Definition) to indicate the tangent length of a simple curve. |
| TM: | Time - used to record the time. |
| TN: | Traverse Number - used to tag which traverse a point belongs to when multiple traverses are in the same project. |
| TP: (config) | Temporary Path - when used in the IO.CFG file, designates the default directory path for temporary files. |
| TS: | Date/Time Stamp - records the date and time. |
| TS: (config) | Time Stamp - when used in the IO.CFG file, Yes or No indicates whether or not to time stamp each page for SDMS reports and printouts. |
| TT: (config) | Maximum Stations Traverse - when used in the TOL.CFG file, sets the maximum number of occupied stations allowed in a traverse. |
| TY: | Type - used to record a type code for an object. It is used by some post-processing software to assign graphical attributes such as level or color. |

| Data Tag | Description |
|---|---|
| UA: | Units of Angles - specifies the units used in angle measurements. Most systems record degrees, minutes, and seconds (ddd.mmss). |
| UL: | Units of Length - specifies the units used in length and distance measurements, coordinates, station values, etc.. Allowable responses are F (feet) and M (meters with kilometer stationing ##+###.###), M2 (meters with 100 meter stationing ###+##.###), and M3 (same as M). |
| UP: | Units of Pressure - specifies the units used for recording barometric pressure with the BP data item. |
| UT: | Units of Temperature - specifies the units used for recording temperature. Allowable responses are F (Fahrenheit) and C (Celsius). |
| VA: | Vertical Alignment File Name - specifies the name of the file where the control vertical alignment geometry is defined. |
| VA: (config) | Vertical Angle Sets Difference - maximum deviation allowed between and individual vertical angle measured in sets and the mean vertical angle computed form sets. Vertical angles that exceed the difference will not be used in final computations |
| VD: | Vertical Datum - records the user-defined name of the vertical datum being used (VD:NGVD29 or VD: NAVD88 for example). |
| VE: | Vertical Index Error - used to record the angular vertical collimation error as determined by the surveyor when testing the collimation of the instrument. |
| VH: | Vertical/Horizontal Ratio - Used in stake out to specify the slope of a line between two points, expressed as decimal equivalent meter/meter, foot/foot or a percent (EG VH:0.02). |
| VI: (config) | Vertical Intersects Tolerance - when used in the TOL>CFG file, defines the tolerance allowed when comparing computed elevations for a point shot from various occupied stations during a sideshot intersection activity (AC:SI). |
| VO: | Vertical Offset - used in radial topography to record the vertical distance (+/-) from the point shot to a remote shot directly above or below it. |
| VR: | Version Number - used to record the version number of SDMS being used. |
| VT: | Vertical Angle - used to record a vertical angle measurement in the DDD.MMSS format. Vertical angles are measured from the zenith being equal to zero degrees. For example a vertical angle of 90.0000 degrees indicates horizontal line of sight. This angle is equivalent to a zenith angle. |
| VT: (config) | Maximum Vertical Stations - when used in the TOL.CFG file, defines the maximum number of occupied stations that can be recorded in a vertical task between two bench marks. |
| VV: | Vertical Angle-Computed - where multiple observations are made of a point from the same occupied station, this data item records the averaged vertical angle. |
| W1: (config) | Single Wire Level Closure - when used in the TOL.CFG file, defines the single wire leveling closure tolerance. |
| W3: (config) | Three Wire Stadia Constant - used in leveling to record the Three Wire stadia constant value. This value should be consistent with the selected rod type (RT). This data item is also used in the TOL.CFG file. |

| Data Tag | Description |
|---|---|
| WC: | Write Control File Name - a user specified control file used to save point data that has been calculated but not checked for accuracy. Once these points have been verified, they can be moved to the L1:, L2:, S1:, or S2: files. |
| WD: | Width - used to record the width of a surveyed object, such as a box culvert. |
| WE: | Weather - used to record user-defined weather condition description. |
| WI: | Witness Description - used to record information about a witness or accessory points. |
| XC: | X Coordinate-Known - used to record a known X coordinate value for a point. |
| XC: (config) | Cross Section Closure Tolerance - when used in the TOL.CFG file, defines the profile and cross section closure tolerance value. |
| XX: | X Coordinate-Computed - used to record a computed X coordinate value for a point in a calculated project file. |
| YC: | Y Coordinate-Known - used to record a known Y coordinate value for a point. |
| YY: | Y Coordinate-Computed - used to record a computed Y coordinate for a point in a calculated project file. |
| ZC: | Z Coordinate-Known - used to record a known elevation for a point. |
| ZN: | Zone - used to record the projection or state plane zone for the project coordinate system. |
| ZZ: | Z Coordinate-Computed - used to record a computed elevation for a point in a calculated project file. |

# Tasks Default Prompt Sequences

The following tables list the default Activity and Data Items listed in the **TASK.TGS** file provided with SDMS Collector program.

## Traverse Task - TRA

| Activity | Default Data Tags |
|---|---|
| AC:OS | PN: IH: FE: PD: |
| AC:BS | PN: SH: FE: PD: HZ: VT: DS: |
| AC:FS | PN: SH: FE: PD: HZ: VT: DS: |
| AC:EC | PN: SH: FE: PD: ZC: HZ: VT: DS:: |
| AC:CC | PN: SH: FE: PD: YC: XC: ZC: HZ: VT: DS: |
| AC:SI | PN: FE: PD: HZ: |
| AC:TS | PN: FE: HZ: VT: DS: PD: |
| AC:PR | |
| AC:CK | |
| AC:TX | PN: CM: |

## Radial Topography Task - RTO

| Activity | Default Data Tags |
|---|---|
| AC:OS | PN: IH: FE: PD: |
| AC:BS | PN: SH: FE: PD: HZ VT: DS: |
| AC:SS | PN: SH: FE: PD: HZ: VT: DS: |
| AC:EC | PN: SH: FE: PD: ZC: HZ: VT: DS: |
| AC:CC | PN: SH: FE: PD: YC: XC: ZC: HZ: VT: DS: |
| AC:SR | PN: SH: FE: PD: HZ: VT: DS: YC: XC: ZC: |
| AC:SI | PN: FE: PD: HZ: |
| AC:UE | PN: SH: FE: PD: RR: |
| AC:ST | PN: HZ: VT: DS: FE: PD: |
| AC:PR | |
| AC:CK | |
| AC:TX | PN: CM: |
| AC:CH | FE: CD: FG: CH: PL: |
| AC:FG | FE: TY: |
| AC:TA | OS: BS: PN: FE: CD: FG: AD: PL: CM: |

## Combined Task - COM

| Activity | Default Data Tags |
|---|---|
| AC:OS | PN: IH:  FE: PD: |
| AC:BS | PN: SH: FE: PD: HZ VT: DS: |
| AC:FS | PN: SH: FE: PD: HZ: VT: DS: |
| AC:SS | PN: SH: FE: PD: HZ: VT: DS: |
| AC:EC | PN: SH: FE: PD: ZC: HZ: VT: DS: |
| AC:CC | PN: SH: FE: PD: YC: XC: ZC: HZ: VT: DS: |
| AC:SR | PN: SH: FE: PD: HZ: VT: DS: YC: XC: ZC: |
| AC:SI | PN: FE: PD: HZ: |
| AC:UE | PN: SH: FE: PD: RR: |
| AC:TS | PN: HZ: VT: DS: FE: PD: |
| AC:ST | ST: |
| AC:PR | |
| AC:CK | |
| AC:TX | PN: CM: |
| AC:CH | FE: CD: FG: CH: PL: |
| AC:FG | FE: TY: |
| AC:TA | OS: BS: PN: FE: CD: FG: AD: PL: CM: |

## Control Network Task - CON

| Activity | Default Data Tags |
|---|---|

| Activity | Default Data Tags |
|---|---|
| AC:OS | PN: FE: PD: IH: SH: |
| AC:BS | PN: FE: PD: HZ: VT: DS:: |
| AC:FS | PN: FE: PD: HZ: VT: DS:: |
| AC:EC | PN: FE: PD: ZC: HZ: VT: DS: |
| AC:SI | PN: FE: PD: HZ: |
| AC:TS | PN: FE: HZ: VT: DS: PD: |
| AC:PR | |
| AC:CK | |
| AC:TX | PN: CM: |

## Profile Task - PRO

| Activity | Default Data Tags |
|---|---|
| AC:OS | PN: PD: ZC: |
| AC:BS | RR: |
| AC:FS | PN: PD: RR: |
| AC:SS | ST: OF: RR: |
| AC:EC | PN: PD: RR: ZC: |
| AC:CC | PN: PD: RR: ZC: |
| AC:UE | PN: PD: RR: |
| AC:TP | RR: |
| AC:PR | |
| AC:CK | |
| AC:TX | PN: CM: |

## Photo Control Task - PHO

| Activity | Default Data Tags |
|---|---|
| AC:OS | PN: FE PD: IH: |
| AC:BS | PN: SH: FE: PD: HZ: VT: DS: |
| AC:FS | PN: SH: FE: PD: HZ: VT: DS: |
| AC:SS | PN: SH: FE: PD: HZ: VT: DS: |
| AC:EC | PN: SH: FE: PD: ZC: HZ: VT: DS: |
| AC:CC | PN: SH: FE: PD: YC: XC: ZC: HZ: VT: DS: |
| AC:SR | PN: SH: FE: PD: HZ: VT: DS: YC: XC: ZC: |
| AC:SI | PN: FE: PD: HZ: |
| AC:UE | PN: FE: PD: RR: |
| AC:TS | PN: HZ: VT: DS: FE: PD: |
| AC:PR | PN: FE PD: IH: |
| AC:CK | |
| AC:TX | PN: CM: |

## Terrain Model Task - TMO

| Activity | Default Data Tags |
|---|---|
| AC:OS | PN: FE: PD: IH: |
| AC:BS | PN: SH: FE: PD: HZ: VT: DS: |
| AC:FS | PN: SH: FE: PD: HZ: VT: DS: |
| AC:SS | PN: SH: FE: PD: HZ: VT: DS: |
| AC:EC | PN: SH: FE: PD: ZC: HZ: VT: DS: |
| AC:CC | PN: SH: FE: PD: YC: XC: ZC: HZ: VT: DS: |
| AC:SR | PN: SH: FE: PD: HZ: VT: DS: YC: XC: ZC: |
| AC:SI | PN: FE: PD: HZ: |
| AC:UE | PN: FE: PD: RR: |
| AC:TS | PN: HZ: VT: DS: FE: PD: |
| AC:PR | |
| AC:CK | |
| AC:TX | PN: CM: |

## Level Run Task - LEV

| Activity | Default Data Tags |
|---|---|
| AC:OS | PN: FE: PD: ZC: |
| AC:BS | RR: |
| AC:FS | PN: FE: PD: RR: |
| AC:EC | PN: FE: PD: RR: ZC: |
| AC:CC | PN: FE: PD: RR: ZC: |
| AC:TP | RR: PD: |
| AC:SS | PN: FE: PD: RR: |
| AC:PR | |
| AC:CK | |

## Three-Wire Level Task - 3WR

| Activity | Default Data Tags |
|---|---|
| AC:OS | PN: FE: PD: ZC: |
| AC:BS | RR: PN: PD: |
| AC:FS | PN: FE: PD: RR: |
| AC:EC | PN: FE: PD: RR: ZC: |
| AC:CC | PN: FE: PD: RR: ZC: |
| AC:TP | RR: |
| AC:PR | |
| AC:CK | |
| AC:TX | PN: CM: |

## Cross-Section Task - XSE

| Activity | Default Data tags |
|---|---|
| AC:OS | PN: FE: PD: ZC: |
| AC:BS | RR: PN: PD: |
| AC:FS | PN: FE: PD: RR: |
| AC:SS | FE: PD: OF: RR: |
| AC:ST | ST: |
| AC:EC | PN: FE: PD: RR: ZC: |
| AC:CC | PN: FE: PD: RR: ZC: |
| AC:UE | PN: FE: PD: RR: |
| AC:TP | RR: |
| AC:PR | |
| AC:CK | |
| AC:TX | PN: CM: |

# Default Tags Help File TAGS.HLP

```
1.      A0 10 0 Attribute 0,
2.      A1 10 0 Attribute 1,
3.      A2 10 0 Attribute 2,
4.      A3 10 0 Attribute 3,
5.      A4 10 0 Attribute 4,
6.      A5 10 0 Attribute 5,
7.      A6 10 0 Attribute 6,
8.      A7 10 0 Attribute 7,
9.      A8 10 0 Attribute 8,
10.     A9 10 0 Attribute 9,
11.     AA 25 1 Area Computed,
12.     AC 2 0 Activity,
13.     ;BS=Backsight
14.     ;CC=Control Check
15.     ;CH=Chain
16.     ;CK=Check Shot
17.     ;EC=Elevation Control
18.     ;EQ=Equation
19.     ;FG=Figure
20.     ;FS=Foresight
21.     ;OS=Occupied Station
22.     ;PR=Project Header
23.     ;SI=Sideshot Intersect
24.     ;SR=Station Resection
25.     ;SS=Sideshot
26.     ;ST=Stationing
27.     ;TA=Taping
28.     ;TP=Turn Point
29.     ;TS=Tie Sequence
30.     ;TX=Text Block
31.     ;UE=Utility Elevation
32.     AD 25 0 Angle Distance List,
33.     AH 2 0 Accuracy Horizontal,
34.     AR 25 1 Area,
35.     AV 2 0 Accuracy Vertical,
36.     AZ 12 1 Azimuth,
37.     BG 25 0 Begin Group,
38.     BP 10 1 Barometric Pressure,
39.     BR 10 0 Bearing,
40.     BS 7 3.001 Back Sight Point Number,
41.     CD 25 0 Chain Description,
42.     CE 10 1 Collimation Error,
```

```
43.     CF 10 1 Combination Factor,
44.     ;
45.     ;1.0=Default
46.     CH 6 3.001 Chain Number,
47.     CI 25 0 City,
48.     CL 2 0 Class,
49.     ;F=Feature
50.     ;G=Ground
51.     CM 25 0 Comment,
52.     CN 25 0 Condition,
53.     CO 25 0 County,
54.     CP 25 0 Close Project,
55.     CR 3 2 Curvature & Refraction Adjust?,
56.     CS 10 0 Coordinate System,
57.     DA 8 1 Deflection Angle,
58.     DC 8 1 Degree of Curvature,
59.     DD 12 1 Distance Computed,
60.     DH 12 1 Distance Horizontal,
61.     DI 8 0 Diameter,
62.     DL 2 0 Delete Shot/Station,
63.     ;SH=shot
64.     ;ST=station
65.     DO 1 0 Direction of Offset,
66.     ;H=horizontal
67.     ;V=vertical
68.     DP 8 0 Depth,
69.     DS 12 1 Distance Slope,
70.     DT 10 0 Date,
71.     DV 12 1 Distance Vertical,
72.     DX 12 1 Delta X,
73.     DY 12 1 Delta Y,
74.     DZ 12 1 Delta Z,
75.     E1 6 0 Left Side Slope,
76.     E2 6 0 Right Side Slope,
77.     ED 8 1 Error Distance,
78.     EG 25 0 End Group,
79.     EH 8 1 Error Horizontal Angle,
80.     EQ 4 1 Equation Number,
81.     ES 3 2 Ending Station (Y/N)?,YES
82.     ;YES=current OS is ending station
83.     ;NO=current OS is NOT ending station
84.     EV 8 1 Error Vertical Angle,
85.     EX 10 1 External Distance Circular Curve,
86.     FC 1 1 Face Number,
87.     ;1=direct face
88.     ;2=reverse face
89.     FE 5 0 Feature Code,
90.     ;
91.     FG 4 0 Figure Code,
92.     GM 1 0 Geometry Type,
93.     ;C=Curve Point
94.     ;P=Point on Line
95.     GR 4 0 Group,
96.     H1 25 0 Help,
97.     HA 12 0 Horizontal Alignment File Name,
98.     HD 13 0 Horizontal Datum,
99.     HE 9 1 Height Ellipsoid,
100.    HG 9 1 Height Geoid,
101.    HH 9 0 Horizontal Angle Computed,
102.    HT 6 0 Height,
103.    HY 15 0 Highway,
104.    HZ 10 1 Horizontal Angle,
105.    I0 20 0 Information 0,
106.    I1 20 0 Information 1,
107.    I2 20 0 Information 2,
108.    I3 20 0 Information 3,
109.    I4 20 0 Information 4,
110.    I5 20 0 Information 5,
111.    I6 20 0 Information 6,
112.    I7 20 0 Information 7,
113.    I8 20 0 Information 8,
```

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114.    I9 20 0 Information 9,
115.    ID 25 0 Project Identification,
116.    IH 6 1 Instrument Height,
117.    IT 25 0 Instrument Type,
118.    ;GEODIMETER=See Docs for Model #'s
119.    ;LEICA=See Docs for Model #'s
120.    ;MANUAL=data entered by hand
121.    ;NIKON_DTM=See Docs for Model #'s
122.    ;PENTAX_PTSIII=PTS III
123.    ;SOKKIA(LIETZ)=See Docs for Model #'s
124.    ;TOPCON_COARSE=See Docs for Model #'s
125.    ;TOPCON_FINE=See Docs for Model #'s
126.    ;TRIMBLE_TTS=See Docs for Model #'s
127.    ;WILDT2000=See Docs for Model #'s
128.    ;WILDT1010=See Docs for Model #'s
129.    ;ZEISS4D=See Docs for Model #'s
130.    L1 12 0 Loc 1 CTL File Name/Length Curve 1,
131.    L2 12 0 Loc 2 CTL File Name/Length Curve 2,
132.    LC 10 0 Long Chord,
133.    LG 13 0 Longitude,
134.    LN 6 0 Length,
135.    LO 8 1 Length Offset,
136.    LS 10 0 Length of Spiral,
137.    LT 12 0 Latitude,
138.    MO 10 1 Mid Ordinate Distance Circular Curve,
139.    NM 25 0 Name,
140.    NS 2 1 Number of Shots,
141.    OB 15 0 Observer,
142.    OD 7 3.001 Origin/Destination Point Number,
143.    OF 6 1 Offset,
144.    OO 6 1 Offset Computed ,
145.    OS 7 3.001 Occupied Station Point Number,
146.    OW 25 0 Owner,
147.    PC 10 1 Prism Correction,
148.    PD 25 0 Point Description,
149.    PH 4 0 Physical Attribute,
150.    PL 25 0 Point List,
151.    PM 4 0 PPM Factor,
152.    PN 7 3.001 Point Number (Max 32576),
153.    PO 6 1 Prism Offset,
154.    PR 25 0 Project Name,
155.    R1 8 1 Rod Reading Top Wire/Radius 1,
156.    R2 8 1 Rod Reading Middle Wire/Radius 2,
157.    R3 8 1 Rod Reading Bottom Wire,
158.    RA 10 1 Radius,
159.    RD 25 0 Ring Description,
160.    RE 15 0 Recorder,
161.    RN 6 3.001 Ring Number,
162.    RO 8 1 Right Angle Offset,
163.    RR 6 1 Rod Reading,
164.    RS 4 0 Ring Style,
165.    RT 2 0 Rod Type,
166.    ;F=foot rod
167.    ;Y=yard rod
168.    ;M=meter rod
169.    S1 12 1 Stk 1 CTL File Name/Spiral Entry Length,
170.    S2 12 1 Stk 2 CTL File Name/Spiral Exit Length,
171.    S3 12 1 Spiral Connecting Length,
172.    SB 10 1 Station Back,
173.    SD 4 0 Station Direction,
174.    ;UP=shots taken up station
175.    ;DOWN=shots taken down station
176.    SE 2 1 Set Number,
177.    SF 12 0 Superelevation File Name,
178.    SH 6 1 Staff Height,
179.    SI 3 0 Shot ID,
180.    ;BL=begin LOC shots
181.    ;EL=end LOC shots
182.    ;PC=point of curve
183.    ;PI=point of intersection
184.    ;PT=point of tangent
```

```
185.    ;CS=curve to spiral
186.    ;SC=spiral to curve
187.    ;ST=spiral to tangent
188.    ;TA=taping shot
189.    ;TS=tangent to spiral
190.    ;RTO=radial topog shot
191.    ;XSE=cross-section shot
192.    SN 10 0 Serial Number,
193.    SP 25 0 Suspend Project,
194.    SS 10 0 Stationing Computed,
195.    ST 10 0 Stationing,
196.    SX 6 0 Standard Error Estimate X-Coordinate,
197.    SY 6 0 Standard Error Estimate Y-Coordinate,
198.    SZ 6 0 Standard Error Estimate Z-Coordinate,
199.    TD 8 0 Tunnel Direction,
200.    ;INBOUND=
201.    ;OUTBOUND=
202.    TE 3 1 Temperature,
203.    TI 18 0 Tunnel ID,
204.    TK 3 0 Task,
205.    ;COM=Combined
206.    ;CON=Control Network
207.    ;LEV=Level Run
208.    ;PHO=Photo Control
209.    ;PRO=Profiling
210.    ;RTO=Radial Topography
211.    ;3WR=Three-Wire Level
212.    ;TMO=Terrain Model
213.    ;TRA=Traverse
214.    ;XSE=Cross-Section
215.    TL 10 1 Tangent Length,
216.    TM 8 0 Time,
217.    TN 2 1 Traverse Number,
218.    TY 5 0 Type,
219.    UA 1 0 Units of Angles,
220.    UL 2 0 Units of Length,
221.    ;F=Feet or English
222.    ;M=Metric (Kilometer ST)
223.    ;M2=Metric (100 Meter ST)
224.    ;M3=Metric (Kilometer ST)
225.    UP 1 0 Units of Pressure,
226.    ;B=Millibars
227.    ;I=Inches of Mercury
228.    UT 1 0 Units of Temperature,
229.    ;F=Farenheit
230.    ;C=Celsius
231.    VA 12 0 Vertical Alignment File Name,
232.    VD 7 0 Vertical Datum,
233.    VE 10 1 Vertical Index Error,
234.    VH 6 0 Vertical to Horizontal Ratio,
235.    VO 12 1 Vertical Offset,
236.    VR 25 0 Version Number,
237.    VT 9 1 Vertical (Zenith) Angle,
238.    VV 8 1 Vertical Angle Computed,
239.    W3 8 1 Three-Wire Stadia Constant,
240.    WC 12 0 Write Control File Name,
241.    WD 6 0 Width,
242.    WE 10 0 Weather,
243.    WI 25 0 Witness Description,
244.    XC 25 1 X Coordinate Known ,
245.    XX 25 1 X Coordinate Computed,
246.    YC 25 1 Y Coordinate Known,
247.    YY 25 1 Y Coordinate Computed,
248.    ZC 10 1 Z Coordinate/Elevation Known,
249.    ZN 4 1 Datum Projection Zone,
250.    ZZ 10 1 Z Coordinate/Elevation Computed,
251.    -- 0 0 Wild Card (Insert a Standard Shot),
252.    // 12 0 Nested Sequence (Insert a Sequence),
```

# Sample Control File

```
AC:PR                  **(Optional)**
PR:JOB 001234
NM:STATE HWY 1– HWY 71
CM:CONTROL FILE
DT:03/26/1998
HD:NAD83       **( Any SDMS compliant data
VD:NAVD88      ** tags with user defined fields may**
UL:M3          ** follow AC:PR, but none are required)**
ZN:4802
AC:OS
PN:1
YC:207471.554
XC:759409.835
ZC:282.994
FE:CONTROL
PD:5/8 REBAR
AC:OS
PN:2
YC:206635.500
XC:759717.549
ZC:307.162
FE:CONTROL             **( Any SDMS compliant data
PD:REBAR AND CAP       ** tags with user defined fields may**
ST:10+00               ** be used, but none are required)**
OF:50
```

# Sample Horizontal Alignment File (.ALI) – PI Definition

```
AC:PR
PR:STH67
NM:STATE HWY A – HWY B
CM:DESIGN HORIZONTAL ALIGNMENT
DT:03/26/1998
UL:M3
VD:NGVD 29
HD:NAD 83 (1991)
ZN:4802
RE:GENO
DT:03/26/1998
RE:GENO
AC:EQ **(All equations listed immediately following AC:PR)**
PN:1
SB:11+374.836
ST:11+400.000
AC:EQ
PN:2
SB:12+172.297
ST:12+140.000
AC:OS                          ***(Beginning PI)***
ST:10+973.656
YC:206370.369000
XC:759735.757000
AC:OS
SI:PI                          ***(Spiral Curve Spiral)***
YC:206655.052023
XC:759712.393480
S1:30.000000
S2:30.000000
RA:435.000000
AC:OS
SI:PI                          ***(Spiral Curve Spiral)***
YC:206971.980072
XC:759516.707250
S1:50.000000
S2:50.000000
RA:592.379000
```

```
39.     AC:OS
40.     SI:PI                           ***(Simple Curve)***
41.     YC:207400.163795
42.     XC:759447.697336
43.     RA:-435.000000
44.     AC:OS
45.     SI:PI                           ***(Simple Curve)***
46.     YC:207594.266000
47.     XC:759322.394000
48.     RA:-582.126000
49.     AC:OS
50.     SI:PI                           ***(Simple Curve)***
51.     YC:207777.366789
52.     XC:759158.093290
53.     RA:480.000000
54.     AC:OS
55.     SI:PI                   ***(RSR - Radius Spiral Radius)***
56.     YC:208076.928466
57.     XC:759174.304456
58.     R1:300.000000
59.     R2:400.000000
60.     S3:150.000000
61.     AC:OS
62.     SI:PI                           ***(Ending PI)***
63.     YC:208605.886025
64.     XC:759457.507387
```

# Sample Vertical Alignment File (.PRO) - PI Definition

```
1.      AC:PR
2.      PR:STH67.PRO
3.      NM:STATE HWY A – HWY B
4.      CM:DESIGN CENTERLINE PROFILE
5.      DT:03/26/1998
6.      RE:GENO
7.      UL:M3
8.      AC:OS
9.      ST:10+974.000
10.     ZC:299.024000
11.     L1:0.000000
12.     L2:0.000000
13.     AC:OS
14.     ST:11+240.000
15.     ZC:307.998840
16.     L1:225.000000
17.     L2:225.000000
18.     AC:OS
19.     ST:11+725.164
20.     ZC:284.000640
21.     L1:125.000000
22.     L2:125.000000
23.     AC:OS
24.     ST:12+142.867,2         **(Second Occurrence of the Station)**
25.     ZC:284.000640
26.     L1:100.000000
27.     L2:100.000000
28.     AC:OS
29.     ST:12+342.867
30.     ZC:275.500640
31.     L1:100.000000
32.     L2:100.000000
33.     AC:OS
34.     ST:12+494.867
35.     ZC:275.500640
36.     L1:0.000000
37.     L2:0.000000
38.     AC:OS
39.     ST:13+402.462
40.     L1:0.000000
```

# Sample Superelevation File (.SUP) - PI Definition

```
AC:PR
PR:STH67.SUP
NM:STATE HWY A – HWY B
CM:DESIGN SUPERELEVATION FILE THROUGH
CM:THE FIRST CURVE
DT:03/26/1998
UL:M3
VD:NGVD 29
HD:NAD 83 (1991)
ZN:4802
RE:GENO
AC:OS
ST:10+973.656
E1:-0.020000
E2:-0.020000
AC:OS
ST:11+129.667
E1:-0.020000
E2:-0.020000
AC:OS
ST:11+139.836
E1:-0.020000
E2:0.000000
AC:OS
ST:11+169.836
E1:-0.059000
E2:0.059000
AC:OS
ST:11+344.836
E1:-0.059000
E2:0.059000
AC:OS
ST:11+400.000
E1:-0.020000
E2:0.000000
AC:OS
ST:11+410.169
E1:-0.020000
E2:-0.020000
```

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