Appendix A

ASCII (Text) Input/Output Files *(updated Sept 06, 2009)*

This section describes the various keywords that can be used to build an ASCII (Text) input data file for COLUMBUS. All COLUMBUS data types (Datums, Stations and Observations) can be defined in the ASCII (Text) file. All keyword definitions are optional within the ASCII (Text) file.

Within a COLUMBUS ASCII (Text) file, there are no column alignment restrictions. To insert comments into the file, use the "!" character at the beginning of the line or use the $BEG_SKIP and $END_SKIP keywords to comment multiple lines in the file.

Datums ($DATUM keyword) should always be defined before the stations and observations that will be associated with the datum. If a datum is not defined prior to stations and/or observations (in the file), these stations and/or observations will be associated with the active datum (within COLUMBUS), when the file is loaded.

The units ($UNITS) are usually defined after the datum, but in practice they can be assigned any number of times in the file. COLUMBUS will assume all linear and angular entries (after a $UNITS keyword) are defined in the specified units.

Stations (e.g., $GEO_COMPACT, $XYZ_COMPACT, etc.) may be defined next (or not at all.)

Observations (e.g., $AZ_COMPACT, $HOR_COMPACT, etc.) are generally defined after stations.

The sequence Datum, Units, Stations, Observations can be repeated any number of times within the file, but the sequence need not be strictly followed.

For additional examples of data files (not found in this Appendix), please see the *.txt data files shipped with COLUMBUS. They can be found in the COLUMBUS installation folder.

If you want to create your own sample files, you can do the following: Open a new project (FILE - NEW), enter the applicable data in the Data input dialogs, then save the newly entered data using the FILE - SAVE AS command. Examine the newly created file.

We occasionally replace old keyword formats with a newer formats. When this is done, we usually continue to support the old format (when a file is loaded), but no longer document that format. For example: replacing the **$CENTER_HORANGSET_SD** format with the **$CENTERING_HORANGSET_SD** format.

Include File Keyword

$INCLUDE_FILE

Use this keyword in your file to include other files into the loading process. When you load file **A.txt** which includes file **B.txt**, both file **A.txt** and file **B.txt** will be loaded automatically. The previous method for performing this operation was to Open file **A.txt** then Append file **B.txt** and append all subsequent files (if any.) For large projects, with dozens of input files, this process could be cumbersome. Now you can simplify the process using the $INCLUDE_FILE keyword.

Example:
You project consists of five files (file **A.txt**, **B.txt**, **C.txt**, **D.txt**, and **E.txt**) and you want to open them automatically by selecting only one file from the FILE - OPEN command.

Solution:
There are a number of solutions, but perhaps the easiest to consider is the following:

Create a file **Z.txt** and include the five files within this file (as shown below).

! Put this at the top of file **Z.txt,** which is located in the path **c:\stations**
! **$INCLUDE_FILE; filename**
$INCLUDE_FILE; A.txt
$INCLUDE_FILE; obs\B.txt
$INCLUDE_FILE; obs\C.txt
$INCLUDE_FILE; obs\D.txt
$INCLUDE_FILE; c:\gps\obs\E.txt
! Bottom of file **Z.txt**

To open all these files, invoke the FILE - OPEN command and select file **Z.txt**.

NOTES:
1) If the included file name is a relative file name (does not contain a full path), COLUMBUS will append the relative path provided to the path of file **Z.txt** to obtain the search path for this file. In the example shown above, the search path for file **A.txt** will become c:\stations\A.txt.

For the next three files, the search path will become c:\stations\obs\B.txt, etc. The **E.txt** file will be searched for in fully qualified path c:\gps\obs\E.txt

2) Files that are included in the current file being loaded, will not be loaded until the current file is completely loaded. The file **Z.txt** will be completely loaded, before file **A.txt.** File **A.txt** will be completely loaded before file **B.txt**, etc.

A good practice is to load stations, before loading observations (that reference these stations). Be sure to structure your file loading accordingly.

Whether you are using the FILE - APPEND command or the $INCLUDE_FILE keyword, matching coordinate type data found in files 2..n will overwrite similar coordinate type data from files 1..n-1. Suppose the first file loaded contains State Plane coordinate data for station **BBB** and the third file loaded also

contains State Plane coordinate data for station **BBB**. When the third file is loaded, its data for State Plane station **BBB** will replace the data loaded from the first file (for State Plane station **BBB**). **With this in mind, structure your loading process so that the last files loaded contain your known good coordinate data.**

Block Commenting Keywords

$BEG_SKIP and $END_SKIP
You can comment out large sections of your input file quickly and easily using the comment block keywords. Formerly, you were required to comment out each line using the exclamation point (!). This technique continues to be supported.

To comment out a section of your input file, begin the section with the keyword **$BEG_SKIP** and end it with the keyword **$END_SKIP**.

$BEG_SKIP
Lines to be skipped
Lines to be skipped
Lines to be skipped
Lines to be skipped
$END_SKIP

You can quickly uncomment this section by placing the exclamation point in front of these two new commands.
! $BEG_SKIP
These lines will now be parsed
These lines will now be parsed
These lines will now be parsed
These lines will now be parsed
! $END_SKIP

You can also Nest your comment blocks using these two keywords.
$BEG_SKIP
Lines to be skipped
Lines to be skipped
Lines to be skipped
Lines to be skipped

$BEG_SKIP
Lines to be skipped
Lines to be skipped
Lines to be skipped
Lines to be skipped
$END_SKIP

Lines to be skipped
Lines to be skipped
$END_SKIP

Be sure you have an equal number of **$BEG_SKIP** and **$END_SKIP** keywords.

Options Settings Keywords

All Options settings can be defined within the COLUMBUS ASCII (Text) input file. You can supply one or more of these keywords in your input file. Those not supplied, will be set to the values contained within the current Option Set (set up in the Options Library Manager.)

By adding these keywords, you can customize your input files so that when they are loaded, the working environment is ready with the options settings you prefer.

For a complete sample of the new Option keywords, see the demo file BIGBASIN_NET.TXT in the COLUMBUS installation folder.

Linear unit fields must always be specified in meters. Angular unit fields must be specified in DD.MMSSssss or SS.sss (seconds) where applicable.

```
!Datum Name; Semi-Major Axis; 1/f
$OP_DATUM;    WGS 84;             6378137.000000;    298.257223563
$OP_DATUM;    Airy;               6377563.396000;    299.324960000
$OP_DATUM;    Australian N;       6378160.000000;    298.250000000
$OP_DATUM;    Bessel;             6377397.155000;    299.152812800
$OP_DATUM;    Bessel 1841;        6377397.155000;    299.152812800
$OP_DATUM;    Clarke 1866;        6378206.400000;    294.978698200
$OP_DATUM;    Clarke 1880;        6378249.145000;    293.465000000
$OP_DATUM;    Everest;            6377276.345000;    300.801700000
$OP_DATUM;    Fischer 1960;       6378166.000000;    298.300000000
$OP_DATUM;    Fischer 1968;       6378150.000000;    298.300000000
$OP_DATUM;    GRS 1967;           6378160.000000;    298.247167427
$OP_DATUM;    GRS 1980;           6378137.000000;    298.257222101
$OP_DATUM;    Hayford;            6378388.000000;    297.000000000
$OP_DATUM;    Helmert 1906;       6378200.000000;    298.300000000
$OP_DATUM;    Hough;              6378270.000000;    297.000000000
$OP_DATUM;    International;      6378388.000000;    297.000000000
$OP_DATUM;    Krassovsky;         6378245.000000;    298.300000000
$OP_DATUM;    Mod Everest;        6377304.063000;    300.801700000
$OP_DATUM;    Mod Fischer 60;     6378155.000000;    298.300000000
$OP_DATUM;    Modified Airy;      6377340.189000;    299.324964600
$OP_DATUM;    NAD 27;             6378206.400000;    294.978698214
$OP_DATUM;    NAD 83;             6378137.000000;    298.257222101
$OP_DATUM;    S American 69;      6378160.000000;    298.250000000
$OP_DATUM;    WGS 60;             6378165.000000;    298.300000000
$OP_DATUM;    WGS 66;             6378145.000000;    298.250000000
$OP_DATUM;    WGS 72;             6378135.000000;    298.260000000
$OP_DATUM;    WGS 84;             6378137.000000;    298.257223563

!Current Zone: COLORADO,S,0503,L2
$OP_STATE_PLANE_ZONE_IDX;               29                 ! 0 to 148

$OP_LAMBERT_1_SP;                       32.30000000000     ! -90.0 to 90.0
$OP_LAMBERT_1_SF;                       0.998786408        ! 0.5 to 1.5
$OP_LAMBERT_1_CM;                       68.00000000000     ! -180.0 to 180.0
$OP_LAMBERT_1_EAST;                     2743196.40000      ! -15000000. to 15000000.
$OP_LAMBERT_1_NORTH;                    914398.80000       ! -15000000. to 15000000.

$OP_LAMBERT_2_SP1;                      38.27000000000     ! -90.0 to 90.0
```

```
$OP_LAMBERT_2_SP2;                    39.45000000000      ! -90.0 to 90.0
$OP_LAMBERT_2_CM;                     -105.30000000000    ! -180.0 to 180.0
$OP_LAMBERT_2_CP;                     37.50000000000      ! -90.0 to 90.0
$OP_LAMBERT_2_EAST;                   914401.82890        ! -15000000. to 15000000.
$OP_LAMBERT_2_NORTH;                  304800.60960        ! -15000000. to 15000000.

$OP_TRANSVERSE_CM;                    6.10000000000       ! -180.0 to 180.0
$OP_TRANSVERSE_CP;                    49.50000000000      ! -90.0 to 90.0
$OP_TRANSVERSE_SF;                    1.000000000         ! 0.5 to 1.5
$OP_TRANSVERSE_EAST;                  80000.00000         ! -15000000. to 15000000.
$OP_TRANSVERSE_NORTH;                 100000.00000        ! -15000000. to 15000000.

$OP_AZIMUTH_EQUIDISTANT_CM;           134.27016015000     ! -180.0 to 180.0
$OP_AZIMUTH_EQUIDISTANT_CP;           7.21043996000       ! -90.0 to 90.0
$OP_AZIMUTH_EQUIDISTANT_EAST;         50000.00000         ! -15000000. to 15000000.
$OP_AZIMUTH_EQUIDISTANT_NORTH;        150000.00000        ! -15000000. to 15000000.

$OP_UTM_CM;                           -105.00000000000    ! -180.0 to 180.0
$OP_UTM_SF;                           0.999600000         ! 0.5 to 1.5
$OP_UTM_EAST;                         500000.00000        ! -15000000. to 15000000.
$OP_UTM_NORTH;                        0.00000             ! -15000000. to 15000000.

$OP_LINUNIT;                          0                   ! 0 to 3
$OP_ANGULAR_UNIT;                     0                   ! 0 to 1
$OP_DMS_FORMAT;                       0                   ! 0 to 1

$OP_KEEP_PROMPT;                      N
$OP_MAX_ITERATIONS;                   4                   ! 1 to 99
$OP_CONVERGENCE_CRITERIA;             0.0010000           ! 0.0000001 to 30.0000000
$OP_CONFIDENCE_LEVEL;                 0.95000             ! 0.00001 to 0.99999
$OP_ZENITH_REFRACTION;                0.00000             ! -10.00000 to 10.00000
$OP_APPROX_DEFLECTION_NS;             0.000               ! -59.999 to 59.999
$OP_APPROX_DEFLECTION_EW;             0.000               ! -59.999 to 59.999
$OP_APPROX_LAT;                       45.0000000000       ! -90.0 to 90.0
$OP_APPROX_GEOID;                     0.000               ! -499999.0 to 499999.0
$OP_GEOIDMODEL_CORRECTION;            0.0000              ! -999.0000 to 999.0000
$OP_2D_PROJECT_HGT;                   0.000000            ! -500000.0 to 500000.0
$OP_3D_GEODETIC_HGT_TYPE;             1                   ! 0 to 1

$OP_1D_WEIGHT_MODEL;                  2                   ! 0 to 2
$OP_GPS_SCALE;                        Y
$OP_GPS_ROTATION_NORTH;               Y
$OP_GPS_ROTATION_EAST;                Y
$OP_GPS_ROTATION_UP;                  Y
$OP_USE_APOST_VARIANCE;               Y
$OP_USE_FULL_GPS_COVARIANCE;          Y
$OP_ROTATE_BEARINGS;                  N
$OP_VIEW_APPROX_COORDS;               N
$OP_USE_KNOWN_APPROX_COORDS;          N
$OP_USE_DEFLEC_OF_VERTICAL;           Y
$OP_DISABLE_WARN_MESSAGES;            Y

$OP_STAN_RESIDUAL_CUTOFF;             0.00000             ! 0.00000 to 30.00000
$OP_RESIDUAL_APRIORI_SD_CUTOFF;       5.00000             ! 0.00000 to 30.00000
$OP_AZIMUTH_SD_CUTOFF;                10.00000            ! 0.00000 to 9999.99900
$OP_DIRECTION_SD_CUTOFF;              10.00000            ! 0.00000 to 9999.99900
```

```
$OP_BEARING_SD_CUTOFF;                  10.00000          ! 0.00000 to 9999.99900
$OP_HORANG_SD_CUTOFF;                   10.00000          ! 0.00000 to 9999.99900
$OP_ZENITH_SD_CUTOFF;                   10.00000          ! 0.00000 to 9999.99900
$OP_CHORD_SD_CUTOFF;                    1.0000000         ! 0.0000000 to 30.0000000
$OP_HORDIST_SD_CUTOFF;                  1.0000000         ! 0.0000000 to 30.0000000
$OP_GEODESIC_SD_CUTOFF;                 1.0000000         ! 0.0000000 to 30.0000000
$OP_GEOCHORD_SD_CUTOFF;                 1.0000000         ! 0.0000000 to 30.0000000
$OP_HGTDIFF_SD_CUTOFF;                  1.0000000         ! 0.0000000 to 30.0000000
$OP_DEL_X_SD_CUTOFF;                    1.0000000         ! 0.0000000 to 30.0000000
$OP_DEL_Y_SD_CUTOFF;                    1.0000000         ! 0.0000000 to 30.0000000
$OP_DEL_Z_SD_CUTOFF;                    1.0000000         ! 0.0000000 to 30.0000000
$OP_DEL_NORTH_SD_CUTOFF;                1.0000000         ! 0.0000000 to 30.0000000
$OP_DEL_EAST_SD_CUTOFF;                 1.0000000         ! 0.0000000 to 30.0000000
$OP_DEL_UP_SD_CUTOFF;                   1.0000000         ! 0.0000000 to 30.0000000
$OP_LAT_SD_CUTOFF;                      1.0000000         ! 0.0000000 to 30.0000000
$OP_LON_SD_CUTOFF;                      1.0000000         ! 0.0000000 to 30.0000000
$OP_HGT_SD_CUTOFF;                      1.0000000         ! 0.0000000 to 30.0000000

$OP_DEFAULT_AZIMUTH_SD;                 0.00000           ! 0.00000 to 9999.99900
$OP_DEFAULT_DIRECTION_SD;               0.00000           ! 0.00000 to 9999.99900
$OP_DEFAULT_BEARING_SD;                 0.00000           ! 0.00000 to 9999.99900
$OP_DEFAULT_HORANG_SD;                  0.00000           ! 0.00000 to 9999.99900
$OP_DEFAULT_ZENITH_SD;                  0.00000           ! 0.00000 to 9999.99900
$OP_DEFAULT_CHORD_SD;                   0.0000000         ! 0.0000000 to 30.0000000
$OP_DEFAULT_HORDIST_SD;                 0.0000000         ! 0.0000000 to 30.0000000
$OP_DEFAULT_GEODESIC_SD;                0.0000000         ! 0.0000000 to 30.0000000
$OP_DEFAULT_GEOCHORD_SD;                0.0000000         ! 0.0000000 to 30.0000000
$OP_DEFAULT_HGTDIFF_SD;                 0.0000000         ! 0.0000000 to 30.0000000
$OP_DEFAULT_DEL_X_SD;                   0.0000000         ! 0.0000000 to 30.0000000
$OP_DEFAULT_DEL_Y_SD;                   0.0000000         ! 0.0000000 to 30.0000000
$OP_DEFAULT_DEL_Z_SD;                   0.0000000         ! 0.0000000 to 30.0000000
$OP_DEFAULT_DEL_NORTH_SD;               0.0000000         ! 0.0000000 to 30.0000000
$OP_DEFAULT_DEL_EAST_SD;                0.0000000         ! 0.0000000 to 30.0000000
$OP_DEFAULT_DEL_UP_SD;                  0.0000000         ! 0.0000000 to 30.0000000
$OP_DEFAULT_LAT_SD;                     0.0000000         ! 0.0000000 to 30.0000000
$OP_DEFAULT_LON_SD;                     0.0000000         ! 0.0000000 to 30.0000000
$OP_DEFAULT_HGT_SD;                     0.0000000         ! 0.0000000 to 30.0000000

$OP_AZIMUTH_SET_CENTERING_HOR;          0.0000000         ! 0.0000000 to 30.0000000
$OP_AZIMUTH_SET_CENTERING_VERT;         0.0000000         ! 0.0000000 to 30.0000000
$OP_DIRECTION_SET_CENTERING_HOR;        0.0000000         ! 0.0000000 to 30.0000000
$OP_DIRECTION_SET_CENTERING_VERT;       0.0000000         ! 0.0000000 to 30.0000000
$OP_HORANG_SET_CENTERING_HOR;           0.0000000         ! 0.0000000 to 30.0000000
$OP_HORANG_SET_CENTERING_VERT;          0.0000000         ! 0.0000000 to 30.0000000
$OP_NEU_SET_CENTERING_HOR;              0.0000000         ! 0.0000000 to 30.0000000
$OP_NEU_SET_CENTERING_VERT;             0.0000000         ! 0.0000000 to 30.0000000
$OP_GPS_SET_CENTERING_HOR;              0.0000000         ! 0.0000000 to 30.0000000
$OP_GPS_SET_CENTERING_VERT;             0.0000000         ! 0.0000000 to 30.0000000
$OP_BEARING_SET_CENTERING_HOR;          0.0000000         ! 0.0000000 to 30.0000000
$OP_HGTDIFF_SET_CENTERING_VERT;         0.0000000         ! 0.0000000 to 30.0000000

$OP_PPM_CHORD;                          0.0000000000      ! 0.0 to 9999.999
$OP_PPM_HORDIST;                        0.0000000000      ! 0.0 to 9999.999

$OP_APRIORI_VARIANCE_SCALER;            1.00000           ! 0.00001 to 99999.99900
$OP_CHORD_SCALER;                       1.000000000       ! 0.500000 to 1.500000
$OP_HORDIST_SCALER;                     1.000000000       ! 0.500000 to 1.500000
```

```
$OP_GEODESIC_SCALER;                    1.000000000         ! 0.500000 to 1.500000
$OP_GEOCHORD_SCALER;                    1.000000000         ! 0.500000 to 1.500000
$OP_HGTDIFF_SCALER;                     1.000000000         ! 0.500000 to 1.500000
$OP_DEL_X_SCALER;                       1.000000000         ! 0.500000 to 1.500000
$OP_DEL_Y_SCALER;                       1.000000000         ! 0.500000 to 1.500000
$OP_DEL_Z_SCALER;                       1.000000000         ! 0.500000 to 1.500000
$OP_DEL_NORTH_SCALER;                   1.000000000         ! 0.500000 to 1.500000
$OP_DEL_EAST_SCALER;                    1.000000000         ! 0.500000 to 1.500000
$OP_DEL_UP_SCALER;                      1.000000000         ! 0.500000 to 1.500000

$OP_REPORT_SUMMARY;                     Y
$OP_REPORT_COORD_AND_SD;                N
$OP_REPORT_COORD_AND_COVAR;             N
$OP_REPORT_COORD_XYZ_AND_SD;            N
$OP_REPORT_COORD_XYZ_AND_COVAR;         N

$OP_REPORT_COORD_STATEPLANE;            N
$OP_REPORT_COORD_UTM;                   N
$OP_REPORT_COORD_DIFFERENCES;           N
$OP_REPORT_OBS_BY_SET;                  N
$OP_REPORT_OBS_BY_TYPE;                 N
$OP_REPORT_OBS_GPS_NEU_RESIDUALS;       N
$OP_REPORT_OBS_NOCHECK;                 N
$OP_REPORT_OBS_OUTLIERS;                N
$OP_REPORT_OBS_RESIDUAL_DISTRIBUTION;   N

$OP_REPORT_INV_1D_CONNECTED;            N
$OP_REPORT_INV_2D_GEO_CONNECTED;        N
$OP_REPORT_INV_2D_BEARING_CONNECTED;    N
$OP_REPORT_INV_2D_STATE_PLANE_CONNECTED; N
$OP_REPORT_INV_2D_UTM_CONNECTED;        N
$OP_REPORT_INV_3D_NEU_CONNECTED;        N
$OP_REPORT_INV_3D_XYZ_CONNECTED;        N
$OP_REPORT_INV_3D_ASTRO_CONNECTED;      N

$OP_REPORT_INV_1D_ALLPAIR;              N
$OP_REPORT_INV_2D_GEO_ALLPAIR;          N
$OP_REPORT_INV_2D_BEARING_ALLPAIR;      N
$OP_REPORT_INV_2D_STATE_PLANE_ALLPAIR;  N
$OP_REPORT_INV_2D_UTM_ALLPAIR;          N
$OP_REPORT_INV_3D_NEU_ALLPAIR;          N
$OP_REPORT_INV_3D_XYZ_ALLPAIR;          N
$OP_REPORT_INV_3D_ASTRO_ALLPAIR;        N

$OP_REPORT_HEIGHT_ERR_STATION;          N
$OP_REPORT_HEIGHT_ERR_CONNECTED;        N

$OP_REPORT_DISTANCE_ERR_CONNECTED;      N
$OP_REPORT_DISTANCE_ERR_ALLPAIR;        N

$OP_REPORT_ERROR_CIRCLE_STATION;        N
$OP_REPORT_ERROR_CIRCLE_CONNECTED;      N
$OP_REPORT_ERROR_CIRCLE_ALLPAIR;        N

$OP_REPORT_ERROR_ELLIPSE_STATION;       N
$OP_REPORT_ERROR_ELLIPSE_CONNECTED;     N
$OP_REPORT_ERROR_ELLIPSE_ALLPAIR;       N
```

```
$OP_REPORT_ERROR_ELLIPSOID_STATION;      N
$OP_REPORT_ERROR_ELLIPSOID_CONNECTED;    N
$OP_REPORT_ERROR_ELLIPSOID_ALLPAIR;      N

$OP_REPORT_ALTA_ELLIPSE_CONNECTED;       N
$OP_REPORT_ALTA_ELLIPSE_ALLPAIR;         N
$OP_REPORT_ALTA_DISTANCE_ERR_CONNECTED;  N
$OP_REPORT_ALTA_DISTANCE_ERR_ALLPAIR;    N

$OP_REPORT_SORT_OUTLIER_BY;              0                  ! 0 to 3

$OP_ALTA_FIXED_UNCERTAINTY;              0.02134            ! 0.00000 to 30.00000
$OP_ALTA_PPM_UNCERTAINTY;                50                 ! 0 to 10000

$OP_IMPORT_LATLON_FORMAT;                0                  ! 0 to 3
$OP_IMPORT_QUAD_SIGN;                    0                  ! 0 to 3
$OP_IMPORT_DELIMITER;                    *

$OP_IMPORT_ORDER_NAME;                   0                  ! 0 to 99
$OP_IMPORT_ORDER_DESC;                   0                  ! 0 to 99
$OP_IMPORT_ORDER_LAT;                    0                  ! 0 to 99
$OP_IMPORT_ORDER_LON;                    0                  ! 0 to 99
$OP_IMPORT_ORDER_ORTHO;                  0                  ! 0 to 99
$OP_IMPORT_ORDER_GEOID;                  0                  ! 0 to 99
$OP_IMPORT_ORDER_ELLIP;                  0                  ! 0 to 99
$OP_IMPORT_ORDER_DEFLNS;                 0                  ! 0 to 99
$OP_IMPORT_ORDER_DEFLEW;                 0                  ! 0 to 99

$OP_IMPORT_ORDER_LAT_SD;                 0                  ! 0 to 99
$OP_IMPORT_ORDER_LON_SD;                 0                  ! 0 to 99
$OP_IMPORT_ORDER_ORTHO_SD;               0                  ! 0 to 99
$OP_IMPORT_ORDER_GEOID_SD;               0                  ! 0 to 99
$OP_IMPORT_ORDER_ELLIP_SD;               0                  ! 0 to 99
$OP_IMPORT_ORDER_DEFLNS_SD;              0                  ! 0 to 99
$OP_IMPORT_ORDER_DEFLEW_SD;              0                  ! 0 to 99

$OP_IMPORT_ORDER_X;                      0                  ! 0 to 99
$OP_IMPORT_ORDER_Y;                      0                  ! 0 to 99
$OP_IMPORT_ORDER_Z;                      0                  ! 0 to 99
$OP_IMPORT_ORDER_X_SD;                   0                  ! 0 to 99
$OP_IMPORT_ORDER_Y_SD;                   0                  ! 0 to 99
$OP_IMPORT_ORDER_Z_SD;                   0                  ! 0 to 99

$OP_IMPORT_ORDER_SP_NORTH;               0                  ! 0 to 99
$OP_IMPORT_ORDER_SP_EAST;                0                  ! 0 to 99
$OP_IMPORT_ORDER_SP_ORTHO;               0                  ! 0 to 99
$OP_IMPORT_ORDER_UTM_NORTH;              0                  ! 0 to 99
$OP_IMPORT_ORDER_UTM_EAST;               0                  ! 0 to 99
$OP_IMPORT_ORDER_UTM_ORTHO;              0                  ! 0 to 99

$OP_IMPORT_ORDER_LOC_NORTH;              0                  ! 0 to 99
$OP_IMPORT_ORDER_LOC_EAST;               0                  ! 0 to 99
$OP_IMPORT_ORDER_LOC_UP;                 0                  ! 0 to 99
$OP_IMPORT_ORDER_LOC_ORTHO;              0                  ! 0 to 99
$OP_IMPORT_ORDER_HGT;                    0                  ! 0 to 99
$OP_IMPORT_ORDER_HGTSD;                  0                  ! 0 to 99
```

```
$OP_EXPORT_LINK;                        N
$OP_EXPORT_LATLON_FORMAT;               0                   ! 0 to 3
$OP_EXPORT_QUAD_SIGN;                   0                   ! 0 to 3
$OP_EXPORT_CORRELATIONS;                N
$OP_EXPORT_LATLON_DECIMAL;              10                  ! 4 to 12
$OP_EXPORT_OTHER_DECIMAL;               4                   ! 0 to 7
$OP_EXPORT_DELIMITER;                   *
$OP_EXPORT_HEADERS;                     N

$OP_EXPORT_ORDER_NAME;                  0                   ! 0 to 99
$OP_EXPORT_ORDER_DESC;                  0                   ! 0 to 99
$OP_EXPORT_ORDER_LAT;                   0                   ! 0 to 99
$OP_EXPORT_ORDER_LON;                   0                   ! 0 to 99
$OP_EXPORT_ORDER_ORTHO;                 0                   ! 0 to 99
$OP_EXPORT_ORDER_GEOID;                 0                   ! 0 to 99
$OP_EXPORT_ORDER_ELLIP;                 0                   ! 0 to 99
$OP_EXPORT_ORDER_DEFLNS;                0                   ! 0 to 99
$OP_EXPORT_ORDER_DEFLEW;                0                   ! 0 to 99

$OP_EXPORT_ORDER_LAT_SD;                0                   ! 0 to 99
$OP_EXPORT_ORDER_LON_SD;                0                   ! 0 to 99
$OP_EXPORT_ORDER_ORTHO_SD;              0                   ! 0 to 99
$OP_EXPORT_ORDER_GEOID_SD;              0                   ! 0 to 99
$OP_EXPORT_ORDER_ELLIP_SD;              0                   ! 0 to 99
$OP_EXPORT_ORDER_DEFLNS_SD;             0                   ! 0 to 99
$OP_EXPORT_ORDER_DEFLEW_SD;             0                   ! 0 to 99

$OP_EXPORT_ORDER_GEO_NN;                1                   ! 0 to 99
$OP_EXPORT_ORDER_GEO_EE;                2                   ! 0 to 99
$OP_EXPORT_ORDER_GEO_UU;                0                   ! 0 to 99
$OP_EXPORT_ORDER_GEO_NE;                3                   ! 0 to 99
$OP_EXPORT_ORDER_GEO_NU;                0                   ! 0 to 99
$OP_EXPORT_ORDER_GEO_EU;                4                   ! 0 to 99

$OP_EXPORT_ORDER_X;                     0                   ! 0 to 99
$OP_EXPORT_ORDER_Y;                     0                   ! 0 to 99
$OP_EXPORT_ORDER_Z;                     0                   ! 0 to 99
$OP_EXPORT_ORDER_X_SD;                  0                   ! 0 to 99
$OP_EXPORT_ORDER_Y_SD;                  0                   ! 0 to 99
$OP_EXPORT_ORDER_Z_SD;                  0                   ! 0 to 99

$OP_EXPORT_ORDER_ECEF_XX;               0                   ! 0 to 99
$OP_EXPORT_ORDER_ECEF_YY;               0                   ! 0 to 99
$OP_EXPORT_ORDER_ECEF_ZZ;               0                   ! 0 to 99
$OP_EXPORT_ORDER_ECEF_XY;               0                   ! 0 to 99
$OP_EXPORT_ORDER_ECEF_XZ;               0                   ! 0 to 99
$OP_EXPORT_ORDER_ECEF_YZ;               0                   ! 0 to 99

$OP_EXPORT_ORDER_SP_NORTH;              0                   ! 0 to 99
$OP_EXPORT_ORDER_SP_EAST;               0                   ! 0 to 99
$OP_EXPORT_ORDER_SP_ORTHO;              0                   ! 0 to 99
$OP_EXPORT_ORDER_SP_GRID_SCALE;         0                   ! 0 to 99
$OP_EXPORT_ORDER_SP_HEIGHT_SCALE;       0                   ! 0 to 99
$OP_EXPORT_ORDER_SP_COMBINED_SCALE;     0                   ! 0 to 99
$OP_EXPORT_ORDER_SP_MAP_ANGLE;          0                   ! 0 to 99
```

```
$OP_EXPORT_ORDER_UTM_NORTH;             0                   ! 0 to 99
$OP_EXPORT_ORDER_UTM_EAST;              0                   ! 0 to 99
$OP_EXPORT_ORDER_UTM_ORTHO;             0                   ! 0 to 99
$OP_EXPORT_ORDER_UTM_GRID_SCALE;        0                   ! 0 to 99
$OP_EXPORT_ORDER_UTM_HEIGHT_SCALE;      0                   ! 0 to 99
$OP_EXPORT_ORDER_UTM_COMBINED_SCALE;    0                   ! 0 to 99
$OP_EXPORT_ORDER_UTM_MAP_ANGLE;         0                   ! 0 to 99

$OP_EXPORT_ORDER_LOC_NORTH;             0                   ! 0 to 99
$OP_EXPORT_ORDER_LOC_EAST;              0                   ! 0 to 99
$OP_EXPORT_ORDER_LOC_UP;                0                   ! 0 to 99
$OP_EXPORT_ORDER_LOC_ORTHO;             0                   ! 0 to 99
$OP_EXPORT_ORDER_HGT;                   0                   ! 0 to 99
$OP_EXPORT_ORDER_HGTSD;                 0                   ! 0 to 99

$OP_DXF_AZIMUTH_LAYER;                  N
$OP_DXF_DIRECTION_LAYER;                N
$OP_DXF_BEARING_LAYER;                  N
$OP_DXF_HORANG_BS_LAYER;                N
$OP_DXF_HORANG_FS_LAYER;                N
$OP_DXF_ZENITH_LAYER;                   N
$OP_DXF_DISTANCES_LAYER;                N
$OP_DXF_HGTDIFF_LAYER;                  N
$OP_DXF_DXYZ_LAYER;                     N
$OP_DXF_DNEU_LAYER;                     N
$OP_DXF_UNIQUE_LINES_LAYER;             Y
$OP_DXF_STATION_NAME_LAYER;             Y
$OP_DXF_STATION_SYMBOL_LAYER;           Y
$OP_DXF_STATION_ELLIPSE_LAYER;          N
$OP_DXF_RELATIVE_ELLIPSE_LAYER;         N

!DXF Color Codes (7=white)
$OP_DXF_AZIMUTH_COLOR;                  7                   ! 1 to 8
$OP_DXF_DIRECTION_COLOR;                7                   ! 1 to 8
$OP_DXF_BEARING_COLOR;                  7                   ! 1 to 8
$OP_DXF_HORANG_BS_COLOR;                7                   ! 1 to 8
$OP_DXF_HORANG_FS_COLOR;                7                   ! 1 to 8
$OP_DXF_ZENITH_COLOR;                   7                   ! 1 to 8
$OP_DXF_DISTANCES_COLOR;                7                   ! 1 to 8
$OP_DXF_HGTDIFF_COLOR;                  7                   ! 1 to 8
$OP_DXF_DXYZ_COLOR;                     7                   ! 1 to 8
$OP_DXF_DNEU_COLOR;                     7                   ! 1 to 8
$OP_DXF_UNIQUE_COLOR;                   7                   ! 1 to 8
$OP_DXF_STATION_NAME_COLOR;             7                   ! 1 to 8
$OP_DXF_STATION_SYMBOL_COLOR;           7                   ! 1 to 8
$OP_DXF_STATION_ELLIPSE_COLOR;          7                   ! 1 to 8
$OP_DXF_RELATIVE_ELLIPSE_COLOR;         7                   ! 1 to 8

$OP_DXF_1DFIX_SYMBOL;                   5                   ! 0 to 5
$OP_DXF_2DFIX_SYMBOL;                   5                   ! 0 to 5
$OP_DXF_3DFIX_SYMBOL;                   5                   ! 0 to 5
$OP_DXF_1DCONS_SYMBOL;                  5                   ! 0 to 5
$OP_DXF_2DCONS_SYMBOL;                  5                   ! 0 to 5
$OP_DXF_3DCONS_SYMBOL;                  5                   ! 0 to 5
$OP_DXF_FREE_SYMBOL;                    5                   ! 0 to 5
```

```
$OP_DXF_LINEAR_PLOT_UNIT;               2000                ! 1 to 999999
$OP_DXF_ELLIPSE_EXPANDER;               5000                ! 1 to 999999
$OP_DXF_SYMBOL_SIZE;                    0.200               ! 0.000 to 9.999
$OP_DXF_NAME_SIZE;                      0.200               ! 0.000 to 9.999
$OP_DXF_NAME_X_OFFSET;                  0.100               ! 0.000 to 9.999
$OP_DXF_NAME_Y_OFFSET;                  0.100               ! 0.000 to 9.999

$OP_REPORT_HEADING_1;                   COLUMBUS Network Adjustment Software
$OP_REPORT_HEADING_2;                   NOTSET
$OP_REPORT_HEADING_3;                   NOTSET
$OP_GENERATE_CSV_FILE;                  N

!Comment these out so they don't change user Directory Options
!$OP_DATA_PATH;                         C:\
!$OP_THIRD_PARTY_PATH;                  C:\
!$OP_REPORT_PATH;                       C:\
!$OP_WORK_PATH;                         C:\
!$OP_GEOID_FILE;                        NOTSET
!$OP_DEFLECTION_FILE;                   NOTSET

!0=RGB(255,255,255)
!1=RGB(192,192,192)
!2=RGB(255,0,0)
!3=RGB(255,255,0)
!4=RGB(0,255,0)
!5=RGB(0,255,255)
!6=RGB(0,0,255)
!7=RGB(255,0,255)
!8=RGB(0,0,0)
!9=RGB(128,128,128)
!10=RGB(128,0,0)
!11=RGB(128,128,0)
!12=RGB(0,128,0)
!13=RGB(0,128,128)
!14=RGB(0,0,128)
!15=RGB(128,0,128)
$OP_CUSTOM_COLOR_1D_FIX;                4                   ! 0 to 15
$OP_CUSTOM_COLOR_2D_FIX;                5                   ! 0 to 15
$OP_CUSTOM_COLOR_3D_FIX;                2                   ! 0 to 15
$OP_CUSTOM_COLOR_1D_CONS;               12                  ! 0 to 15
$OP_CUSTOM_COLOR_2D_CONS;               13                  ! 0 to 15
$OP_CUSTOM_COLOR_3D_CONS;               10                  ! 0 to 15
$OP_CUSTOM_COLOR_FREE;                  6                   ! 0 to 15
$OP_CUSTOM_COLOR_NAMES;                 14                  ! 0 to 15
$OP_CUSTOM_COLOR_ELLIPSES;              2                   ! 0 to 15
$OP_CUSTOM_COLOR_ALLOBS;                13                  ! 0 to 15
$OP_CUSTOM_COLOR_ROUTE_LINES;           8                   ! 0 to 15
$OP_CUSTOM_COLOR_COORDS_ZERO;           1                   ! 0 to 15
$OP_CUSTOM_COLOR_DISABLED_OBS;          2                   ! 0 to 15
$OP_CUSTOM_COLOR_HISTOGRAM_TEXT;        14                  ! 0 to 15
$OP_CUSTOM_COLOR_HISTOGRAM_LINES;       13                  ! 0 to 15
$OP_CUSTOM_COLOR_HISTOGRAM_BARS;        2                   ! 0 to 15

$OP_SAVE_OPTIONS_IN_PROJECT;            N
$OP_SAVE_DATA_COMPACT;                  Y
```

DATUM and UNITS keyword

```
! $DATUM
! Datum Name (15 chars max)
! Semi Major Axis (always meters)
! 1 / f, where f = flattening (unitless)
$DATUM
  WGS 84
  6378137.000000
  298.257223563



! $UNITS
! Linear units (M - meters, I - intl foot, U - US foot, C - chains)
! Angular units (D - dms, G - grads)
! DMS Format (1 - DD.MMSSssss, 2 - DDMMSS.sssss)
$UNITS
  M
  D
  1
```

All linear and angular entries (that follow the $UNITS section), are assumed to be in the units defined in that $UNITS section. You can repeat the $UNITS section as often as needed in the file in order to accomodate data of differing units.

Internal to COLUMBUS, all linear units are stored as meters, while all angular units are stored as radians.

Station Keywords

Station Names can be a maximum of 15 characters in length. Latitude is positive North. Longitude is positive East.

! **Geodetic station definition**
! **$GEO**
! Station Name
! Lat Lat SD
! Long Long SD
! Ortho Hgt Ortho Hgt SD
! Geoid Hgt Geoid Hgt SD
! Ellip Hgt Ellip Hgt SD
! Defl NS Defl NS SD
! Defl EW Defl EW SD
$GEO
5010
39.3 0
-89.50 0
1131.591 0
-32.127 0
1099.464 0
-1.000 0
1.000 0

! **$GEO_COMPACT**
! Single line version of $GEO.
! Station Name; Lat; Lat SD; Long; Long SD; Ortho Hgt; Ortho Hgt SD; Geoid Hgt; Geoid Hgt SD;
! Ellip Hgt; Ellip Hgt SD; Defl NS; Defl NS SD; Defl EW; Defl EW SD
$GEO_COMPACT; 5010; 39.3; 0; -89.50; 0; 1131.59100; 0; -32.127; 0; 1099.464; 0; -1.0; 0; 1.0; 0

! **ECEF Cartesian station definition**
! **$CART**
! Station Name
! ecef X ecef X SD
! ecef Y ecef Y SD
! ecef Z ecef Z SD
$CART
101
-1564904.932 0.006
-4847446.011 0.020
3830606.048 0.013

! **$CART_COMPACT**
! Single line version of $CART.
! Station Name; ecef X; ecef X SD; ecef Y; ecef Y SD; ecef Z; ecef Z SD
$CART_COMPACT; 101; -1564904.932; 0.006; -4847446.011; 0.020; 3830606.048; 0.013

! **State Plane station definition**
! **$STATE**
! Station Name
! North
! East
$STATE
  101
   358797.743
   701892.673

! **$STATE_COMPACT**
! Single line version of $STATE.
! Station Name; North; East
$STATE_COMPACT; 101; 358797.743; 701892.673

! **$STATE_ELEV_COMPACT**
! Station Name; North; East; Elev
$STATE_ELEV_COMPACT; BB; 358797.74; 701892.67; 170.32

! **UTM station definition**
! **$UTM**
! Station Name
! North
! East
$UTM
  101
   4113062.203
   243114.217

! **$UTM_COMPACT**
! Single line version of $UTM.
! Station Name; North; East
$UTM_COMPACT; 101; 4113062.203; 243114.217

! **$UTM_ELEV_COMPACT**
! Station Name; North; East; Elev
$UTM_ELEV_COMPACT; CC; 4113062.20; 243114.21; 210.05

! **Local NEU Elevation station definition**
! **$LOCAL_NEUE**
! Station Name
! local horizon North
! local horizon East
! local horizon UP
! Elevation
$LOCAL_NEUE
  12
  101357.089
   99967.554
    4803.765
    2072.089

! **$LOCAL_NEUE_COMPACT**
! Single line version of $LOCAL_NEUE.
! Station Name; local horizon North; local horizon East; local horizon UP
$LOCAL_NEUE_COMPACT; 12; 101357.089; 99967.554; 4803.765; 2072.089

! **Height station definition**
! **$HEIGHT**
! Station Name
! Height   Height SD
$HEIGHT
  101
  3010.885   0.181

! **$HEIGHT_COMPACT**
! Single line version of $HEIGHT.
! Station Name; Height; Height SD
$HEIGHT_COMPACT; 101; 3010.885; 0.181

! Station description definition
! $STA_DESC

To add a station description (feature code) to a station, use the $STA_DESC keyword. The station description can be up to 60 characters in length and **it must be defined somewhere (in the file) after the station has been defined by one of the station keywords described above.**
Example for station Apple:

$HEIGHT_COMPACT; Apple; 4000.0; 0.200
$STA_DESC; Apple; Sits high on a ridge - good visibility

Defining Network Station Keywords

To define stations in the input file that you want pre-selected for network adjustment/pre-analysis, use the keywords shown below. You can always make different selections (within COLUMBUS) after you have loaded the file. This gives you a convenient way to identify a sub network (from a larger set of data in the file) that will be ready to adjust, once you load the file. **These can be defined anywhere after the $DATUM section.**

These same keywords are also used by COLUMBUS when invoking the NETWORK - SAVE NETWORK command after a network adjustment.

The following keywords are available:

$NET_1DFIX
$NET_2DFIX
$NET_3DFIX
$NET_1DCONS
$NET_2DCONS
$NET_3DCONS
$NET_IN_NET

Suppose you have a data file with the following stations: **A, B, C, D, E, F, G.**

For the current adjustment, you want to pre-select all stations to be in the network adjustment, except station **F** and **G**. Also, you want station **A** to be fixed in 3D and station **C** to be constrained in 1D.
In your data file you would set up the following list

```
$NET_3DFIX;      A
$NET_1DCONS;   C
$NET_IN_NET;    B
$NET_IN_NET;    D
$NET_IN_NET;    E
```

These declarations can be placed anywhere in the file. Putting them near the top of the file makes them easier to find. Once you have designated a station as fixed or constrained, you need not define them to be in the network - it is assumed.

Defining Hidden Station Keyword (introduced in version 3.6.1.22)

To tell COLUMBUS the stations you want hidden from view, use the keywords described below. Hiding stations from view can also be set up from within the VIEW - HIDE STATION(S) dialog. **These can be defined anywhere after the $DATUM section.**

To hide stations in the Main Graphical View use the following keywords and syntax.

! **$START_HIDDEN_STATION**
! Add each station on a separate line between these two key words
! **$END_HIDDEN_STATION**

$START_HIDDEN_STATION
Mt. Princeton
Mt. Elbert
Mt. Massive
Mt. Harvard
Mt. Yale
$END_HIDDEN_STATION

To hide stations in the Network Adjustment/Pre-Analysis Graphical View use the following keywords and syntax.

! **$START_NET_HIDDEN_STATION**
! Add each station on a separate line between these two key words
! **$END_NET_HIDDEN_STATION**

$START_NET_HIDDEN_STATION
Mt. Elbert
Mt. Massive
$END_NET_HIDDEN_STATION

Defining Multiple Station Routes Keyword (introduced in version 3.6.1.22)

To set up one or more station routes, use the keywords described below. Station routes are normally set up in COLUMBUS by right clicking on successive stations or from within the VIEW - SETUP COGO/DESIGN ROUTE dialog.

Routes are used for traversing, inversing, areas computations, and/or network design. You can predefine routes within your data file that are ready to utilize after you file is loaded into COLUMBUS. **These routes can be defined anywhere in the data file.**

! **$START_ROUTE**
! The first line is the route name that you assign (up to 60 characters)
! Each additional line is the next station in the order of the route (up to 15 characters)
! **$END_ROUTE**

Suppose you have a route that begins at station **A**, then to station **B**, then to station **C**, and finally back to station **A**. The route name is **Traverse along ridge line**. Within the data file, define the route as shown below.

$START_ROUTE
Traverse along ridge line
A
B
C
A
$END_ROUTE

! You can also define additional routes
$START_ROUTE
Traverse down and back up the ruby canyon using stations A, J, K, L, M
A
J
K
L
M
A
$END_ROUTE

After loading this data file into COLUMBUS, the desired route can be selected within the VIEW - SETUP COGO/DESIGN ROUTE dialog. You can also create additional routes or edit existing routes from within this dialog.

Observation Station Type Keyword

$STATION_TYPE_FOR_OBS

This keyword allows you to tell COLUMBUS what type of station to create when the station type is not found in the file. If an observation (defined in the file) references a station name that has not been defined (by a $GEO_COMPACT record, or $GEO record, or $LOCAL_NEUE**,** etc.) before the observation, then COLUMBUS will create this station type when the file is loaded. A station type created in this way will be assigned coordinates of ZERO.

This keyword replaces the former **$NETTYP** keyword. The $NETTYP keyword continues to be supported, however.

Possible values include:

1D_VERT
2D_GEO
3D_GEO
3D_ECEF
2D_STATE
3D_STATE
2D_UTM
3D_UTM
2D_NE
3D_NEU

! Example Format:
$STATION_TYPE_FOR_OBS
3D_NEU

If the $STATION_TYPE_FOR_OBS is used in the file and stations of the type specified are loaded (or created) when the file is loaded, then that station type will also become the active view after the file is loaded (i.e., 1D Vertical, 2D Geodetic, 3D Geodetic, 3D Cartesian XYZ, 2D State Plane, 3D State Plane, 2D UTM, 3D UTM, 2D Local NE, 3D Local NEU.)

This keyword can be repeated as often as needed in the file. All demo files shipped with COLUMBUS (*.txt extension) now have this keyword embedded before the observation data.

Observation Keywords

Observation data can be grouped by observation set or individually. When using observations sets (e.g., $AZ_COMPACT) you may occasionally find it necessary to tell COLUMBUS to ignore one of the observation fields. For example, the $AZ_COMPACT record contains three observations; an azimuth, a zenith angle, and a chord (slope) distance. If you did not actually measure the chord distance, but still want to use the $AZ_COMPACT record, you can place the **NOOBS** text in the position of the chord distance field. COLUMBUS will then ignore the chord distance field when the record is loaded.

$AZ_COMPACT; BENTLY; 5010; 149.4905; 1.0; 89.5540; 0.5; **NOOBS**; 0.0; 1.66; 1.22

In the above scenario, you may wonder what is the advantage of using the $AZ_COMPACT record vs. simply using individual records (e.g., $AZIMUTH_ONLY and $ZENITH_ONLY) for the azimuth and zenith angle? By using the $AZ_COMPACT record, you need only enter the instrument and target heights once for both observations. Also, both observations can then be edited together as a group (within COLUMBUS).

Azimuth, zenith angle, chord distance observation set definition.

```
! $AZ
! AT Station Name
! TO Station Name
! Azimuth      Azimuth SD
! Zenith       Zenith SD
! Chord        Chord SD
! Instr Hgt
! Targ Hgt
$AZ
BENTLY
5010
     149.49170000        1.000
      89.55325000        0.500
      42784.35000        0.40000
         0.00000
         0.00000

! $AZ_COMPACT
! Single line version of $AZ.
! AT Station Name; TO Station Name; Azimuth; Azimuth SD; Zenith; Zenith SD; Chord; Chord SD;
! Instr Hgt; Targ Hgt
$AZ_COMPACT; BENTLY; 5010; 149.4917; 1.0; 89.55325000; 0.5; 42784.35; 0.4; 1.7; 1.2
```

Direction, zenith angle, chord distance observation set definition.

```
! $DIR
! AT Station Name
! TO Station Name
! DirSetNum      Instr Hgt      Targ Hgt
! Direction      Direction SD
! Zenith         Zenith SD
! Chord          Chord SD
$DIR
BARNS
NOBLE
   1             1.415       1.652
  27.0011         10.0
  89.4739         20.0
 114.839          0.005
```

```
! $DIR_COMPACT
! Single line version of $DIR.
! AT Station Name; TO Station Name; Direction; Direction SD; Zenith; Zenith SD; Chord; Chord SD;
! Instr Hgt;  Targ Hgt; DirSetNum
$DIR_COMPACT; BARNS; NOBLE; 27.0011; 10.0; 89.4739; 20.0; 114.839; 0.005; 1.415; 1.652; 1
```

Note: The direction set number must be an integer, where its value is (0 < setNum <= 999999). There can be a maximum of 100 direction sets at each station. Each direction set can have up to 100 direction measurements. **For COLUMBUS version 3.7.1.48 and earlier, the direction set number must be an integer, where its value is (0 < setNum <= 25).**

Bearing, horizontal distance observation set definition.

```
! $BEAR
! AT Station Name
! TO Station Name
! QUADRANT (NE, SE, SW, or NW)
! Bearing            Bearing SD
! Horizontal Dist    Horizontal Dist SD
$BEAR
1
2
NE
    0.24       15.0
  810.10        0.20
```

```
$BEAR_COMPACT
! Single line version of $BEAR.
! AT Station Name; TO Station Name; Bearing; Bearing SD; Quadrant; Hor Dist; Hor Dist SD
$BEAR_COMPACT; 1; 2; 0.24; 15.0; NE; 810.10; 0.20
```

Horizontal angle right, zenith angle, chord distance observation set definition.

```
! $HOR
! AT Station Name
! TO Station Name
! BS Station Name
! Hor Ang      Hor Ang SD
! Zenith       Zenith SD
! Chord        Chord SD
! Instr Hgt
! Targ Hgt
$HOR
5010
BENTLY
MACK
     7.2913            1.7
    90.2738            0.5
    42784.15           0.05
         1.6
         1.2

! $HOR_COMPACT
! Single line version of $HOR.
! AT Name; TO Name; BS Name; HorAng; HorAng SD; Zen; Zen SD; Chord; Chord SD; Instr Hgt; Targ Hgt
$HOR_COMPACT; 5010; BENTLY; MACK; 7.2913; 1.7; 90.2738; 0.5; 42784.15; 0.05; 1.6; 1.2
```

Horizontal angle left, zenith angle, chord distance observation set definition (becomes angle right when loaded.)

```
! $HORLEFT
! AT Station Name
! TO Station Name
! BS Station Name
! Hor Ang      Hor Ang SD
! Zenith       Zenith SD
! Chord        Chord SD
! Instr Hgt
! Targ Hgt
$HOR
5010
FRED
MACK
     10.3012           1.65
    91.1332            2.0
    15123.151          0.025
         1.65
         1.25

! $HORLEFT_COMPACT
! Single line version of $HORLEFT.
```

```
! AT Name; TO Name; BS Name; HorAng; HorAng SD; Zen; Zen SD; Chord; Chord SD; Instr Hgt; Targ Hgt
$HORLEFT_COMPACT; 5010; FRED; MACK; 10.3012; 1.65; 91.1332; 2.0; 15123.151; 0.025; 1.65; 1.25
```

GPS dX, dY, dZ observation set definition (fields have been rounded for display only.)

```
! $GPS
! AT Station Name
! TO Station Name
! dX      XX     XY     XZ
! dY             YY    YZ
! dZ                   ZZ
$GPS
12
14
  -3761.27     0.004     -0.001      -0.002
    1417.52                0.003       0.001
      446.34                            0.005

! $GPS_COMPACT
! Single line version of $GPS.
! AT Station Name; TO Station Name; dX; dY; dZ; XX; XY; YY; XZ; YZ; ZZ (upper diag column order)
$GPS_COMPACT; 12; 14; -3761.27; 1417.52; 446.34; 0.004; -0.001; 0.003; -0.002; 0.001; 0.005
```

Local Horizon dN, dE, dUP observation set definition.

```
! $NEU
! AT Station Name
! TO Station Name
! dNorth         dNorth SD
! dEast          dEast  SD
! dUP            dUP SD
$NEU
MONTANA
JUPITER
  2000.0     0.01
   150.0     0.005
    -25.0     0.008

! $NEU_COMPACT
! Single line version of $NEU.
!  AT Station; TO Station; Delta North; Stan Dev; Delta East; Stan Dev; Delta Up; Stan Dev
$NEU_COMPACT; MONTANA; JUPITER; 2000.0; 0.01; 150.0; 0.005; -25.0; 0.008
```

Height Difference observation set definition.
! **$HGTDIFF**
! AT Station
! TO Station
! Hgt Diff Hgt Diff SD (can also be Distance or Num Setups)
$HGTDIFF
BOB
CINDY
2.5692 0.002

! **$HGTDIFF_COMPACT**
! Single line version of $HGTDIFF
! AT Station Name; TO Station Name; Hgt Diff; Hgt Diff SD
$HGTDIFF_COMPACT; BOB; CINDY; 2.5692; 0.002

Geodetic azimuth and geodesic observation set definition.
! **$SURF**
! AT Station
! TO Station
! Geodetic Az Geodetic Az SD
! Geodesic Geodesic SD
$SURF
CONRAD
DELANY
  175.12201 0.50
22501.056 0.001

! $SURF_COMPACT
! Single line version of $SURF.
! AT Station; TO Station; Geodetic Azimuth; Stan Dev; Geodesic; Stan Dev
$SURF_COMPACT; CONRAD; DELANY; 175.12201; 0.5; 22501.056; 0.001

Geodetic azimuth and geo chord observation set definition.
! **$SURFCRD**
! AT Station
! TO Station
! Geodetic Az Geodetic Az SD
! Geodesic Geo Chord SD
$SURFCRD
CONRAD
SPENCER
  185.10205 3.0
14501.512 0.001

$SURFCRD_COMPACT
! Single line version of $SURFCRD.
! AT Station; TO Station; Geodetic Azimuth; Stan Dev; Geo Chord; Stan Dev
$SURFCRD_COMPACT; CONRAD; SPENCER; 185.10205; 3.0; 14501.5; 0.001

Individual Observations

Below are the new single line, single observation formats for Azimiths, Directions, Bearings, Horizontal Angles, Zenith Angles, Horizontal Distances, Chord (slope) distances, and Height Difference observations. The Height Difference observation has always been supported in this format.

Additional samples of these formats can be found at the bottom of some of the demo *.txt input files shipped with COLUMBUS.

Azimuth observation definition.
! **$AZIMUTH_ONLY**
! AT Station Name; TO Station Name; Azimuth; Azimuth SD; Instr Hgt; Targ Hgt
$AZIMUTH_ONLY; BENTLY; 5010; 149.49170000; 1.000; 1.60; 1.25

Direction observation definition.
! **$DIRECTION_ONLY**
! AT Station Name; TO Station Name; Direction; Direction SD; Instr Hgt; Targ Hgt; Set Num
$DIRECTION_ONLY; BENTLY; 5555; 163.2032; 2.000; 1.60; 1.20; 3

Horizontal angle right observation definition.
! $HORIZ_ANGLE_ONLY
! AT Station Name; TO Station Name; BS Station Name; Hor Angle; Hor Angle SD; Instr Hgt; Targ Hgt
$HORIZ_ANGLE_ONLY; 101; 102; 27; 208.09010000; 2.000; 1.75; 1.24

Horizontal angle left observation definition (converted to angle right when loaded).
! $HORIZ_ANGLELEFT_ONLY
! AT Station Name; TO Station Name; BS Station Name; Hor Angle; Hor Angle SD; Instr Hgt; Targ Hgt
$HORIZ_ANGLELEFT_ONLY; 101; 102; 99; 120.1020; 3.000; 1.67; 1.29

Bearing observation definition.
! **$BEARING_ONLY**
! AT Station Name; TO Station Name; Bearing; Bearing SD; Quadrant
$BEARING_ONLY; 1; 2; 0.2400; 10.000; NE

Zenith angle observation definition.
! $ZENITH_ONLY
! AT Station Name; TO Station Name; Zenith; Zenith SD; Instr Hgt; Targ Hgt
$ZENITH_ONLY; 5010; TIN CUP; 89.36158000; 2.5; 1.80; 1.10

Chord (slope) distance observation definition.
! $CHORD_ONLY
! AT Station Name; TO Station Name; Chord (Slope Dist); Chord SD; Instr Hgt; Targ Hgt
$CHORD_ONLY; 5010; TIN CUP; 39879.305; 0.003; 1.850; 0.995

Horizontal distance observation definition.
! $HORIZ_DIST_ONLY
! AT Station Name; TO Station Name; Hor Dist; Hor Dist SD
$HORIZ_DIST_ONLY; 1; 2; 810.11; 0.03

! Observation description definition
$OBS_DESC

Use the $OBS_DESC keyword to add observation descriptions (feature coding) to your observation data.

Observation descriptions allow you to uniquely identify observations. Simply place the keyword (with description) **just before** the observation (or observation set) in the input file. Observation descriptions can be up to 60 characters in length.

Example 1:

$OBS_DESC; Bearing taken from plat 43, 1947
! Now for the observation or observation set
$BEARING_ONLY; 1; 2; 0.24000000; 15.000; NE

Example 2:
$OBS_DESC; Azimuth determined by polaris at station 5040
! Now for the observation set
$AZ_COMPACT; 5040; TINCUP; 120.3041; 5.0; 89.3616; 0.5; 3879.3; 0.3; 0.0; 0.0

Coordinate Observations

Geodetic coordinate observations are defined next. Their are two slightly different input formats that can be used in the COLUMBUS ASCII Text input file. We provided both formats so that you don't mentally need to convert NEU to ENU - simply use the ENU format. Simplified numeric values shown below.

Covariance Matrix In NEU (north, east, up covariance) format.
! **$GEO_COORD_NEUCOV**
! Station Name; Lat; Lon; Hgt; NN; NE; EE; NU; EU; UU
$GEO_COORD_NEUCOV; AA; 39.49; -90.04; 900.53; 0.01; 0.002; 0.03; 0.004; 0.005; 0.06

Covariance Matrix In ENU (east, north, up covariance) format.
! **$GEO_COORD_ENUCOV**
! Station Name; Lat; Lon; Hgt; EE; EN; NN; EU; NU; UU
$GEO_COORD_ENUCOV; AA; 39.49; -90.04; 900.53; 0.03; 0.002; 0.01; 0.005; 0.004; 0.06

Disabling Observations Keyword

Use the keywords shown below to identify any observations you want disabled when the file is loaded.

Disabled observations are loaded into COLUMBUS (they are not ignored). However, they are tagged as disabled and are not usable in the Network Adjustment/Pre-Analysis or COGO tools until they have been enabled again. You have access to them (if you want it), but they will not get in your way until you enable them.

To enable any disabled observation(s) interactively within COLUMBUS, enter the DATA - DISABLE OBSERVATIONS dialog and uncheck any disabled observations.

To change the color of the line representing a disabled observation, enter the OPTIONS - COLORS dialog, select the **Disabled Observations** list item, then select the color. Click OK to close the dialog.

$DISABLE_OBS_POS_1
$DISABLE_OBS_POS_2
$DISABLE_OBS_POS_3
$DISABLE_OBS_SET

To disable an individual observation, use one of the first three keywords.

To disable the first observation in an observation set, use **$DISABLE_OBS_POS_1**.

To disable the second observation in an observation set, use **$DISABLE_OBS_POS_2**.

To disable the third (if applicable) observation in an observation set, use **$DISABLE_OBS_POS_3.**

Example:
To disable the Zenith Angle and Chord Distance from the Azimuth observation set, place the **$DISABLE_OBS_POS_2** and **$DISABLE_OBS_POS_3** keywords, before the observation set.

```
$DISABLE_OBS_POS_2
$DISABLE_OBS_POS_3
! AT Sta Name; TO Sta Name; Az; Az SD; Zen; Zen SD; Chord; Chord SD; Instr Hgt; Targ Hgt
$AZ_COMPACT; 5010; TIN CUP; NOOBS; NOOBS; 89.36158; 0.5; 39879.3; 0.3; 0.0; 0.0
```

To disable an entire observation set place the **$DISABLE_OBS_SET** keyword before the observation set.

For single observations records, use **$DISABLE_OBS_POS_1** or **$DISABLE_OBS_SET** keyword before the observation definition.

Observation Scalers

The following section describes scalers which can be used to scale observations when they are loaded into COLUMBUS. These scalers can be repeated any number of times in the input file. To apply a scale change, assign the applicable scale variable a value other than 1.0. To turn it off, set the same variable back to 1.0 at the appropriate place within the file. Most scalers can range from 0.90 to 1.10.

! **$S_CRD -** Scaler for chord distance observations.
$S_CRD
0.9999999
!
! **Define some chord distance observations here (or observation sets with chord distance.)**

! **Then change scale back to 1.0 or some other value.**
$S_CRD
1.0000
!
! **Define some additional chord distance observations here that are not to be scaled.**

! **Repeat this technique as often as needed for each Observation Scaler type.**

! **$S_HD -** Scaler for horizontal distance observations.
$S_HD
1.00001

! **$S_HGTDIFF -** Scaler for height difference observations.
$S_HGTDIFF
0.9999999

! **$S_X -** Scaler for GPS dX observations.
$S_X
0.9999999

! **$S_Y -** Scaler for GPS dY observations.
$S_Y
0.9999999

! **$S_Z** - Scaler for GPS dZ observations.
$S_Z
0.9999999

! **$S_N** - Scaler for Local North observations.
$S_N
0.9999999

! **$S_E -** Scaler for Local East observations.
$S_E
0.9999999

! **$S_UP -** Scaler for Local Up observations.
$S_UP
0.9999999

! **$S_GEODESIC -** Scaler for geodesic (distance) observations.
$S_GEODESIC
0.9999999

! **$S_GEOCRD -** Scaler for geo chord distance observations.
$S_GEOCRD
0.9999999

Observation Standard Deviation (and Covariance) Scalers

The following section describes scalers which can be used to scale observations standard deviations when they are loaded into COLUMBUS. These scalers can be repeated any number of times in the input file. To apply a scale change, assign the applicable scale variable a value other than 1.0. To turn it off, set the same variable back to 1.0 at the appropriate place within the file. Most scalers can range from 0.001 to 99999.999.

! **$S_XYZ_COV -** Scaler for GPS dX, dY, dZ covariance matrix for each baseline.
$S_XYZ_COV
5.525
!
! **Define some GPS observations here**

! **Then change scale back to 1.0 or some other value.**
$S_XYZ_COV
1.0000
!
! **Define some additional GPS observations here that are not to be scaled.**

! **Repeat this technique as often as needed for each Observation SD/Covar Scaler type.**

! **$S_GEO_COV -** Scaler for Geodetic coordinate covariance matrix.
$S_GEO_COV
4.500

! **$S_AZ_SD -** Scaler for Azimuth Standard Deviation.
$S_AZ_SD
4.500

! **$S_DIR_SD -** Scaler for Direction Standard Deviation.
$S_DIR_SD
4.500

! **$S_BEAR_SD -** Scaler for Bearing Standard Deviation.
$S_BEAR_SD
4.500

! **$S_HOR_SD -** Scaler for Horizontal Angle Standard Deviation.
$S_HOR_SD
4.500

! **$S_ZEN_SD -** Scaler for Zenith Angle Standard Deviation.
$S_ZEN_SD
4.500

! **$S_CRD_SD -** Scaler for Chord Distance Standard Deviation.
$S_CRD_SD
4.500

! **$S_HD_SD -** Scaler for Horizontal Distance Standard Deviation.
$S_HD_SD
4.500

! **$S_HGTDIFF_SD -** Scaler for Height Difference Standard Deviation.
$S_HGTDIFF_SD
4.500

! **$S_N_SD -** Scaler for Delta North Standard Deviation.
$S_N_SD
4.500

! **$S_E_SD -** Scaler for Delta East Standard Deviation.
$S_E_SD
4.500

! **$S_UP_SD -** Scaler for Delta Up Standard Deviation.
$S_UP_SD
4.500

! **$S_GEODESIC_SD -** Scaler for Geodesic Standard Deviation.
$S_GEODESIC_SD
4.500

! **$S_GEOCRD_SD -** Scaler for Geo Chord Standard Deviation.
$S_GEOCRD_SD
4.500

Observation Standard Deviation Defaults

The following section describes observation standard deviation defaults that can be used to set observation types to a specific value when they are loaded into COLUMBUS. These keywords can be repeated any number of times in the input file. To turn a global default on, assign the applicable global variable a value > 0.0. To turn it off, set the same variable to a value of 0.0 at the appropriate place within the file.

Angular observation standard deviations should be entered in seconds (degree or gons). Linear unit observations should be entered in the active linear units. The active loading units can be defined in the file with the $UNITS keyword (before the data it is applicable to in the file), otherwise the active unit settings in COLUMBUS will be assumed.

! **$G_AZ_SD** - Global azimuth standard deviation of 10 seconds.
$G_AZ_SD
10.000

! **Define some azimuth observations here (or observation sets with azimuths.)**

! **Then change global standard deviation back to 0.0 (OFF) or some other value.**
$G_AZ_SD
0.0

! **Define some azimuth observations here (or observation sets with azimuths.)**

! **Repeat this technique as often as needed for each Observation type.**

! **$G_DIR_SD** - Global direction standard deviation.
$G_DIR_SD
10.000

! **$G_BEAR_SD** - Global bearing standard deviation.
$G_BEAR_SD
10.000

! **$G_HOR_SD** - Global horizontal angle standard deviation.
$G_HOR_SD
0.000

! **$G_ZEN_SD** - Global zenith angle standard deviation.
$G_ZEN_SD
10.000

! **$G_CRD_SD** - Global chord distance standard deviation.
$G_CRD_SD
0.005

! **$G_GEODESIC_SD** - Global geodesic distance standard deviation.
$G_GEODESIC_SD
0.005

! **$G_GEOCRD_SD** - Global geo chord distance standard deviation.
$G_GEOCRD_SD
0.005

! **$G_HD_SD** - Global horizontal distance standard deviation.
$G_HD_SD
0.005

! **$G_HGTDIFF_SD** - Global height difference standard deviation.
$G_HGTDIFF_SD
0.005

! **$G_N_SD** - Global Local North standard deviation.
$G_N_SD
0.005

! **$G_E_SD** - Global Local East standard deviation.
$G_E_SD
0.005

! **$G_UP_SD** - Global Local Up standard deviation.
$G_UP_SD
0.005

! **$G_X_VAR** - Global GPS dX **variance**.
$G_X_VAR
0.000025

! **$G_Y_VAR** - Global GPS dY **variance**.
$G_Y_VAR
0.000025

! **$G_Z_VAR** - Global GPS dZ **variance**.
$G_Z_VAR
0.000025

! **$G_X_SD -** Global GPS dX standard deviation
$G_X_SD
0.005

! **$G_Y_SD -** Global GPS dY standard deviation
$G_Y_SD
0.005

! **$G_Z_SD -** Global GPS dZ standard deviation
$G_Z_SD
0.005

! **$G_LAT_VAR -** Global Geo Coord Lat variance
$G_LAT_VAR
0.000025

! **$G_LON_VAR -** Global Geo Coord Lon variance
$G_LON_VAR
0.000025

! **$G_HGT_VAR -** Global Geo Coord Hgt variance
$G_HGT_VAR
0.000025

! **$G_LAT_SD -** Global Geo Coord Lat standard deviation
$G_LAT_SD
0.005

! **$G_LON_SD -** Global Geo Coord Lon standard deviation
$G_LON_SD
0.005

! **$G_HGT_SD -** Global Geo Coord Hgt standard deviation
$G_HGT_SD
0.005

Ensuring Ortho, Geoidal, and Ellipsoidal Height Consistency

When using the $GEO or $GEO_COMPACT record type, three height components are called for in the record: orthometric (elevation) height, geoidal height, and ellipsoidal height. By declaring the **$HGT_UPDATE** keyword, you can instruct COLUMBUS to calculate one of these values from the remaining two values. That way your height values are always consistent with each other when a $GEO or $GEO_COMPACT record is loaded into COLUMBUS.

By default the $HGT_UPDATE setting is internally set to **H** (see below.)

To modify the orthometric height field from the geoidal and ellipsoidal height fields, use the following before the applicable $GEO or $GEO_COMPACT station records (use the capital letter 'O', not zero):
$HGT_UPDATE
O

The orthometric height will then be determined by: Orthometric Hgt = Ellipsoidal Hgt - Geoidal Hgt

To modify the geoidal height field from the orthometric and ellipsoidal height fields, use the following before the applicable $GEO or $GEO_COMPACT station records:
$HGT_UPDATE
G

The geoidal height will then be determined by: Geoidal Hgt = Ellipsoidal Hgt - Orthometric Hgt

To modify the ellipsoidal height field from the orthometric and geoidal height fields, use the following before the applicable $GEO or $GEO_COMPACT station records.
$HGT_UPDATE
H

The ellipsoidal height will then be determined by: Ellipsoidal Hgt = Orthometric Hgt + Geoidal Hgt

The $HGT_UPDATE record can be changed as often as you like within the file.

Instrument/Target Centering Error keywords

Use the following keywords before the observation sets (or individual observations) they reference. The variables can be changed as often as needed or turned off by setting them to zero. All observation sets (or individual observations) following these settings, in the file, will be given the defined values.

Enter values in the active linear units. The format shown below must have each field separated by a semicolon.

! **$CENTERING_HORANGSET_SD**
! Horizontal angle set centering errors occur in the order: AT Horizontal, AT Vertical, TO Horizontal,
! TO Vertical, BS Horizontal
$CENTERING_HORANGSET_SD; 0.001; 0.001; 0.001; 0.001; 0.001

! **$CENTERING_AZSET_SD**
! Azimuth set centering errors occur in the order: AT Horizontal, AT Vertical, TO Horizontal, TO Vertical.
$CENTERING_AZSET_SD; 0.002; 0.002; 0.002; 0.002

! **$CENTERING_DIRSET_SD**
! Direction set centering errors occur in the order: AT Horizontal, AT Vertical, TO Horizontal, TO Vertical.
$CENTERING_DIRSET_SD; 0.003; 0.003; 0.003; 0.003

! **$CENTERING_BEARSET_SD**
! Bearing set centering errors occur in the order: AT Horizontal, TO Horizontal
$CENTERING_BEARSET_SD; 0.003; 0.003

! **$CENTERING_NEUSET_SD**
! Local NEUE set centering errors occur in the order: AT Horizontal, AT Vertical, TO Horizontal,
! TO Vertical.
$CENTERING_NEUSET_SD; 0.001; 0.001; 0.001; 0.001

! **$CENTERING_GPSSET_SD**
! GPS XYZ set centering errors occur in the order: AT Horizontal, AT Vertical, TO Horizontal, TO Vertical.
$CENTERING_GPSSET_SD; 0.002; 0.002; 0.002; 0.002

! **$CENTERING_HGTDIFFSET_SD**
! Height Difference set centering errors occur in the order: AT Vertical, TO Vertical.
$CENTERING_HGTDIFFSET_SD; 0.004; 0.004

PPM Correction keywords

Use the following keywords before the observation sets (or individual observations) they reference. The variables can be changed as often a needed or turned off by setting them to zero. All observation sets (or individual observations) following these settings, in the file, will be given the defined values.

PPM corrections should be entered as a PPM value. A PPM of 6.5 should be entered as 6.5. COLUMBUS will automatically divide this value by one million (1000000.0) before calculating the actual distance standard deviation correction.

Standard deviation correction due to PPM = (PPM / 1000000) * distance

! **$PPM_CHORDDIST**
! Chord (Slope) Distance PPM correction with sample format.
$PPM_CHORDDIST; 5.0

! **$PPM_HORIZDIST**
! Horizontal Distance PPM correction with sample format.
$PPM_HORIZDIST; 8.0

Some Sample Formats

On the next several pages, there are file samples that use many of the keywords described earlier in this Appendix. For additional samples (with some overlap here), please see the following sample (*.txt) input files shipped with COLUMBUS:

BEAR2D.TXT

BIGBASIN.TXT

BIGBASIN_NET.TXT

GEO.TXT

GEO_TRAV.TXT

GPSONLY.TXT

MIXED.TXT

NEE.TXT

NEE_TRAV.TXT

STATEPLANE.TXT

STATEPLANE_TRAV.TXT

TERRONLY.TXT

TRIGLEVEL.TXT

UTM.TXT

UTM_TRAV.TXT

VERTICAL.TXT

Example One

```
$BEG_SKIP


********************************************************************************
Comments can be embedded into the ASCII (Text) data file by either beginning
each comment line with an exclamation point (!) or by wrapping one or more
comment lines between the $BEG_SKIP and $END_SKIP keywords as is done here.

! Example of a single line comment

ALL file keywords begin with the dollar sign ($) and are uppercase
********************************************************************************


This sample is a small 1D vertical differential leveling network.

$END_SKIP



! The $DATUM record is not required if you make the datum active in COLUMBUS
! prior to loading the file. The active datum is set within the Options - Datums
! dialog.

! For 1D Vertical networks, the datum is not relevant to the adjustment. However,
! COLUMBUS expects all data to be associated with a datum for internal organizational
! purposes.

!  Datum Record
!  Name
!  Major Axis (Meters)
!  1 / Flattening

$DATUM
  NAD 83
  6378137.000000
  298.257222101


! The $UNITS record is not required if you make the units (units used in this
! file) active in COLUMBUS prior to loading the file. The active units are set
! within the Options - Units dialog. If these are the units you usually use, you may
! not need to change them again. If the data within this file occurs in different units
! (both meters and feet), you must define this record immediately prior to each set of
! data that is described in those units.

!  Units Record
!  Linear       (M = Meters, U = US Foot, I = Intl Foot, C = Chains)
!  Angular      (D = Degrees, G = Grads)
!  DMS Format   (1 = DD.MMSSssssss, 2 = DDMMSS.sssss)

$UNITS
  M
  D
  1


! The $STATION_TYPE_FOR_OBS record is new beginning with version 3.5.1.135.
! It allows you to tell COLUMBUS what type of station to create when the
! station type is not found in the file. If an observation (in the file below)
! references a station name that is not defined (by its type, e.g., height
! type, geodetic type, utm type, etc.), then COLUMBUS will create this station
! type when the file is loaded. A station type created in this way will be
! assigned coordinates of ZERO. In this file, we do not actually need the
! $STATION_TYPE_FOR_OBS, because we have defined all the required station
! types with the $HEIGHT_COMPACT records.
$STATION_TYPE_FOR_OBS
1D_VERT

! Station Names can be a maximum of 15 characters in length
! Station Name; Height; Height SD
$HEIGHT_COMPACT; BOB; 260.04050; 0.00000
```

```
$HEIGHT_COMPACT; CINDY; 262.61200; 0.00000

$HEIGHT_COMPACT; DEBRA; 267.71765; 0.00000

$HEIGHT_COMPACT; ED; 263.88720; 0.00000

$HEIGHT_COMPACT; FAYE; 260.61770; 0.00000

$HEIGHT_COMPACT; GABE; 259.59200; 0.00000


!  This section contains HEIGHT DIFFERENCE observations. Each observation record is
!  defined by a station pair and the Height Difference between the stations. The DIST/SETUPS/SD
!  field is used to weight the observation in the adjustment. In this network we are weighting each
!  observation by the distance between stations. The distance units (Km, Miles, etc.) are not
!  important. These entries are just a number to COLUMBUS. COLUMBUS does not know how to interpret
!  the DIST/SETUPS/SD number, until you select the vertical network type in the OPTIONS module
!  (vertical network weighted by distances, setups, OR standard deviations).
!
! AT Station Name; TO Station Name; Hgt Diff; Hgt Diff Distance (in any linear unit)
$HGTDIFF_COMPACT; BOB; CINDY; 2.56916; 0.38710

$HGTDIFF_COMPACT; BOB; GABE; -0.44714; 0.34138

$HGTDIFF_COMPACT; CINDY; DEBRA; 5.09749; 0.40234

$HGTDIFF_COMPACT; CINDY; FAYE; -1.98974; 0.31394

$HGTDIFF_COMPACT; DEBRA; ED; -3.82921; 0.29261

$HGTDIFF_COMPACT; ED; FAYE; -3.26777; 0.39319

$HGTDIFF_COMPACT; FAYE; GABE; -1.02169; 0.42062
```

Example Two

```
$BEG_SKIP

*******************************************************************************
Comments can be embedded into the ASCII (Text) data file by either beginning
each comment line with an exclamation point (!) or by wrapping one or more
comment lines between the $BEG_SKIP and $END_SKIP keywords as is done here.

!Example of a single line comment

ALL file keywords begin with the dollar sign ($) and are uppercase
*******************************************************************************



This file contains a small 3D geodetic network consisting of terrestrial
and GPS observation measurements. With careful field procedures, you can
combine both GPS and conventional observations and achieve excellent results.
Usually all that is required is that you carefully measure your instrument
and target heights accurately for your conventional measurements.

$END_SKIP



! The $DATUM record is not required if you make the datum active in COLUMBUS
! prior to loading the file. The active datum is set within the Options - Datums
! dialog. If this is the datum you usually use, you may not need to change it
! again.
$DATUM
  NAD 83
  6378137.000000
  298.257222101


! The $UNITS record is not required if you make the units (units used in this
! file) active in COLUMBUS prior to loading the file. The active units are set
! within the Options - Units dialog. If these are the units you usually use,
! you may not need to change them again. If the data within this file occurs
! in different units (both meters and feet), you must define this record
! immediately prior to each set of data that is described in those units.
$UNITS
  M
  D
  1


! The $STATION_TYPE_FOR_OBS record is new beginning with version 3.5.1.135.
! It allows you to tell COLUMBUS what type of station to create when the
! station type is not found in the file. If an observation (in the file below)
! references a station name that is not defined (by its type, e.g., height
! type, geodetic type, utm type, etc.), then COLUMBUS will create this station
! type when the file is loaded. A station type created in this way will be
! assigned coordinates of ZERO. In this file, we actually do not need the
! $STATION_TYPE_FOR_OBS, because we have defined all the required station
! types with the $GEO_COMPACT records.
$STATION_TYPE_FOR_OBS
3D_GEO


! Station Names can be a maximum of 15 characters in length
! Station Name; Lat; Lat SD; Long; Long SD; Ortho Hgt; Ortho Hgt SD; Geoid Hgt; Geoid Hgt SD; Ellip Hgt;
! Ellip Hgt SD; Defl NS; Defl NS SD; Defl EW; Defl EW SD
$GEO_COMPACT; 5010; 39.3; 0.0; -89.50; 0.0; 1131.59100; 0.0; -32.127; 0.0; 1099.464; 0.0; -1.0; 0.0; 1.0; 0.0

$GEO_COMPACT; BEND; 39.0; 0.0; -90.0; 0.0; 531.5304; 0.0; -31.5304; 0.0; 500.0; 0.0; -3.5; 0.0; -1.0; 0.0

$GEO_COMPACT; BENTLY; 39.50; 0.0; -90.0460; 0.0; 933.2545; 0.0; -32.7175; 0.0; 900.537; 0.0; 3.0; 0.0; -2.0; 0.0

$GEO_COMPACT; MACK; 40.0; 0.0; -90.20; 0.0; 1033.0759; 0.0; -33.0759; 0.0; 1000.0; 0.0; 2.0; 0.0; -2.5; 0.0

$GEO_COMPACT; TEMPE; 39.25; 0.0; -90.30; 0.0; 732.187; 0.0; -32.474; 0.0; 699.713; 0.0; 2.0; 0.0; -2.0; 0.0
```

```
$GEO_COMPACT; TIN CUP; 39.45; 0.0; -89.3; 0.0; 1532.509; 0.0; -32.509; 0.0; 1500.0; 0.0; 2.0; 0.0; -3.0; 0.

! AT Station Name; TO Station Name; Azimuth; Azimuth SD; Zenith; Zenith SD; Chord (Slope Dist); Chord SD;
! Instr Hgt; Targ Hgt
$AZ_COMPACT; 5010; TIN CUP; NOOBS; NOOBS; 89.36158000; 0.500; 39879.30000; 0.30000; 0.00000; 0.00000

$AZ_COMPACT; BEND; TEMPE; NOOBS; NOOBS; 90.06146000; 1.000; 63289.70000; 0.40000; 0.00000; 0.00000

$AZ_COMPACT; BENTLY; 5010; 149.49170000; 1.000; 89.55325000; 0.500; 42784.35000; 0.40000; 0.00000; 0.00000

$AZ_COMPACT; TEMPE; 5010; 80.37400000; 0.500; 89.52008000; 0.600; 58127.00000; 0.30000; 0.00000; 0.00000

$AZ_COMPACT; TEMPE; MACK; NOOBS; NOOBS; 90.02210000; 0.600; 66334.10000; 0.30000; 0.00000; 0.00000

$AZ_COMPACT; TIN CUP; 5010; NOOBS; NOOBS; 90.45130000; 1.000; 39878.90000; 0.50000; 0.00000; 0.00000

! AT Station Name; TO Station Name; BS Station Name; Hor Angle; Hor Angle SD; Zenith; Zenith SD;
! Chord (Slope Dist); Chord SD; Instr Hgt; Targ Hgt
$HOR_COMPACT; 5010; BEND; TIN CUP; 148.48430000; 1.700; NOOBS; NOOBS; NOOBS; NOOBS; 0.00000; 0.00000

$HOR_COMPACT; 5010; BENTLY; MACK; 7.29130000; 1.700; 90.27387000; 0.500; 42784.15000; 0.30000; 0.00000; 0.00000

$HOR_COMPACT; 5010; MACK; TEMPE; 61.26360000; 1.700; 90.23510000; 0.500; 70141.30000; 0.30000; 0.00000; 0.00000

$HOR_COMPACT; 5010; TEMPE; BEND; 66.28080000; 1.700; 90.39183000; 0.500; 58126.60000; 0.30000; 0.00000; 0.00000

$HOR_COMPACT; BEND; 5010; TEMPE; 57.21070000; 1.200; 89.39370000; 1.000; 57354.00000; 0.40000; 0.00000; 0.00000

$HOR_COMPACT; BEND; TIN CUP; 5010; 12.43210000; 1.200; NOOBS; NOOBS; NOOBS; NOOBS; 0.00000; 0.00000

$HOR_COMPACT; BENTLY; MACK; TEMPE; 93.07020000; 1.500; NOOBS; NOOBS; NOOBS; NOOBS; 0.00000; 0.00000

$HOR_COMPACT; BENTLY; TEMPE; 5010; 68.01340000; 1.500; NOOBS; NOOBS; NOOBS; NOOBS; 0.00000; 0.00000

$HOR_COMPACT; MACK; 5010; BENTLY; 11.22120000; 1.000; NOOBS; NOOBS; NOOBS; NOOBS; 0.00000; 0.00000

$HOR_COMPACT; MACK; BENTLY; TIN CUP; 19.47540000; 1.000; 90.19495000; 1.000; 28276.75000; 0.50000; 0.0; 0.0

$HOR_COMPACT; MACK; TEMPE; 5010; 50.19210000; 1.000; 90.33290000; 1.000; 66334.00000; 0.50000; 0.0; 0.0

$HOR_COMPACT; TEMPE; 5010; BENTLY; 43.02440000; 0.500; NOOBS; NOOBS; NOOBS; NOOBS; 0.00000; 0.00000

$HOR_COMPACT; TEMPE; BEND; 5010; 56.10520000; 0.500; NOOBS; NOOBS; NOOBS; NOOBS; 0.00000; 0.00000

$HOR_COMPACT; TEMPE; BENTLY; MACK; 25.11280000; 0.500; 90.04010000; 0.600; 58487.20000; 0.30000; 0.0; 0.0

! AT Station Name; TO Station Name; Hgt Diff; Hgt Diff SD
$HGTDIFF_COMPACT; BEND; BENTLY; 399.63000; 0.03000

$HGTDIFF_COMPACT; BENTLY; TEMPE; -199.90000; 0.05000

$HGTDIFF_COMPACT; TEMPE; MACK; 299.94000; 0.02000

$HGTDIFF_COMPACT; TIN CUP; 5010; -400.09000; 0.04000

! AT Station Name; TO Station Name; dx; dy; dz; xx; xy; yy; xz; yz; zz (upper diag column order)
$GPS_COMPACT; 5010; TIN CUP; 28524.00000; 17563.70000; 21638.55000; 0.32; 0.0; 0.245; 0.0; 0.0; 0.18

$GPS_COMPACT; BENTLY; 5010; 21472.25000; -23765.60000; -28365.25000; 0.02; 0.0; 0.045; 0.0; 0.0; 0.08

$GPS_COMPACT; BENTLY; TIN CUP; 49995.70000; -6202.00000; -6726.70000; 0.18; 0.0; 0.245; 0.0; 0.0; 0.32

$GPS_COMPACT; MACK; 5010; 42807.35000; -35643.35000; -42625.70000; 0.045; 0.0; 0.08; 0.0; 0.0; 0.1225

$GPS_COMPACT; MACK; BENTLY; 21334.70000; -11877.05000; -14259.75000; 0.02; 0.0; 0.045; 0.0; 0.0; 0.08

$GPS_COMPACT; MACK; TIN CUP; 71330.00000; -18079.20000; -20986.60000; 0.1225; 0.0; 0.18; 0.0; 0.0; 0.245

$BEG_SKIP

! Many of the above observation set records can also be expressed as individual
```

```
! observations. Below is how it would be done. GPS are always in observation set form

! AT Station Name; TO Station Name; Azimuth; Azimuth SD; Instr Hgt; Targ Hgt
$AZIMUTH_ONLY; BENTLY; 5010; 149.49170000; 1.000; 0.00000; 0.00000

$AZIMUTH_ONLY; TEMPE; 5010; 80.37400000; 0.500; 0.00000; 0.00000


! AT Station Name; TO Station Name; BS Station Name; Hor Angle; Hor Angle SD; Instr Hgt; Targ Hgt
$HORIZ_ANGLE_ONLY; 5010; BEND; TIN CUP; 148.48430000; 1.700; 0.00000; 0.00000

$HORIZ_ANGLE_ONLY; 5010; BENTLY; MACK; 7.29130000; 1.700; 0.00000; 0.00000

$HORIZ_ANGLE_ONLY; 5010; MACK; TEMPE; 61.26360000; 1.700; 0.00000; 0.00000

$HORIZ_ANGLE_ONLY; 5010; TEMPE; BEND; 66.28080000; 1.700; 0.00000; 0.00000

$HORIZ_ANGLE_ONLY; BEND; 5010; TEMPE; 57.21070000; 1.200; 0.00000; 0.00000

$HORIZ_ANGLE_ONLY; BEND; TIN CUP; 5010; 12.43210000; 1.200; 0.00000; 0.00000

$HORIZ_ANGLE_ONLY; BENTLY; MACK; TEMPE; 93.07020000; 1.500; 0.00000; 0.00000

$HORIZ_ANGLE_ONLY; BENTLY; TEMPE; 5010; 68.01340000; 1.500; 0.00000; 0.00000

$HORIZ_ANGLE_ONLY; MACK; 5010; BENTLY; 11.22120000; 1.000; 0.00000; 0.00000

$HORIZ_ANGLE_ONLY; MACK; BENTLY; TIN CUP; 19.47540000; 1.000; 0.00000; 0.00000

$HORIZ_ANGLE_ONLY; MACK; TEMPE; 5010; 50.19210000; 1.000; 0.00000; 0.00000

$HORIZ_ANGLE_ONLY; TEMPE; 5010; BENTLY; 43.02440000; 0.500; 0.00000; 0.00000

$HORIZ_ANGLE_ONLY; TEMPE; BEND; 5010; 56.10520000; 0.500; 0.00000; 0.00000

$HORIZ_ANGLE_ONLY; TEMPE; BENTLY; MACK; 25.11280000; 0.500; 0.00000; 0.00000


! AT Station Name; TO Station Name; Zenith; Zenith SD; Instr Hgt; Targ Hgt
$ZENITH_ONLY; 5010; TIN CUP; 89.36158000; 0.500; 0.00000; 0.00000

$ZENITH_ONLY; BEND; TEMPE; 90.06146000; 1.000; 0.00000; 0.00000

$ZENITH_ONLY; BENTLY; 5010; 89.55325000; 0.500; 0.00000; 0.00000

$ZENITH_ONLY; TEMPE; 5010; 89.52008000; 0.600; 0.00000; 0.00000

$ZENITH_ONLY; TEMPE; MACK; 90.02210000; 0.600; 0.00000; 0.00000

$ZENITH_ONLY; TIN CUP; 5010; 90.45130000; 1.000; 0.00000; 0.00000

$ZENITH_ONLY; 5010; BENTLY; 90.27387000; 0.500; 0.00000; 0.00000

$ZENITH_ONLY; 5010; MACK; 90.23510000; 0.500; 0.00000; 0.00000

$ZENITH_ONLY; 5010; TEMPE; 90.39183000; 0.500; 0.00000; 0.00000

$ZENITH_ONLY; BEND; 5010; 89.39370000; 1.000; 0.00000; 0.00000

$ZENITH_ONLY; MACK; BENTLY; 90.19495000; 1.000; 0.00000; 0.00000

$ZENITH_ONLY; MACK; TEMPE; 90.33290000; 1.000; 0.00000; 0.00000

$ZENITH_ONLY; TEMPE; BENTLY; 90.04010000; 0.600; 0.00000; 0.00000


! AT Station Name; TO Station Name; Chord (Slope Dist); Chord SD; Instr Hgt; Targ Hgt
$CHORD_ONLY; 5010; TIN CUP; 39879.30000; 0.30000; 0.00000; 0.00000

$CHORD_ONLY; BEND; TEMPE; 63289.70000; 0.40000; 0.00000; 0.00000

$CHORD_ONLY; BENTLY; 5010; 42784.35000; 0.40000; 0.00000; 0.00000

$CHORD_ONLY; TEMPE; 5010; 58127.00000; 0.30000; 0.00000; 0.00000

$CHORD_ONLY; TEMPE; MACK; 66334.10000; 0.30000; 0.00000; 0.00000
```

```
$CHORD_ONLY; TIN CUP; 5010; 39878.90000; 0.50000; 0.00000; 0.00000

$CHORD_ONLY; 5010; BENTLY; 42784.15000; 0.30000; 0.00000; 0.00000

$CHORD_ONLY; 5010; MACK; 70141.30000; 0.30000; 0.00000; 0.00000

$CHORD_ONLY; 5010; TEMPE; 58126.60000; 0.30000; 0.00000; 0.00000

$CHORD_ONLY; BEND; 5010; 57354.00000; 0.40000; 0.00000; 0.00000

$CHORD_ONLY; MACK; BENTLY; 28276.75000; 0.50000; 0.00000; 0.00000

$CHORD_ONLY; MACK; TEMPE; 66334.00000; 0.50000; 0.00000; 0.00000

$CHORD_ONLY; TEMPE; BENTLY; 58487.20000; 0.30000; 0.00000; 0.00000

! AT Station Name; TO Station Name; Hgt Diff; Hgt Diff SD
$HGTDIFF_COMPACT; BEND; BENTLY; 399.63000; 0.03000

$HGTDIFF_COMPACT; BENTLY; TEMPE; -199.90000; 0.05000

$HGTDIFF_COMPACT; TEMPE; MACK; 299.94000; 0.02000

$HGTDIFF_COMPACT; TIN CUP; 5010; -400.09000; 0.04000

! AT Station Name; TO Station Name; dx; dy; dz; xx; xy; yy; xz; yz; zz (upper diag column order)
$GPS_COMPACT; 5010; TIN CUP; 28524.0; 17563.7; 21638.55; 0.320; 0.000; 0.245; 0.000; 0.000; 0.180

$GPS_COMPACT; BENTLY; 5010; 21472.25; -23765.60; -28365.25; 0.020; 0.000; 0.045; 0.000; 0.000; 0.080

$GPS_COMPACT; BENTLY; TIN CUP; 49995.70; -6202.00; -6726.70; 0.180; 0.000; 0.245; 0.000; 0.000; 0.32

$GPS_COMPACT; MACK; 5010; 42807.35000; -35643.35; -42625.70; 0.045; 0.000; 0.080; 0.000; 0.000; 0.1225

$GPS_COMPACT; MACK; BENTLY; 21334.700; -11877.05; -14259.75; 0.020; 0.000; 0.045; 0.000; 0.000; 0.080

$GPS_COMPACT; MACK; TIN CUP; 71330.00; -18079.20; -20986.60; 0.1225; 0.000; 0.180; 0.000; 0.000; 0.245

$END_SKIP
```

Example Three

```
$BEG_SKIP

********************************************************************************
Comments can be embedded into the ASCII (Text) data file by either beginning
each comment line with an exclamation point (!) or by wrapping one or more
comment lines between the $BEG_SKIP and $END_SKIP keywords as is done here.

!Example of a single line comment

ALL file keywords begin with the dollar sign ($) and are uppercase
********************************************************************************



This file contains a small 2D geodetic network (1/2 section from a township)
consisting of recorded mean bearing and horizontal distance survey data taken
from a plat.

$END_SKIP



! The $DATUM record is not required if you make the datum active in COLUMBUS
! prior to loading the file. The active datum is set within the Options - Datums
! dialog. If this is the datum you usually use, you may not need to change it
! again.
$DATUM
  NAD 27
  6378206.400000
  294.978698214


! The $UNITS record is not required if you make the units (units used in this
! file) active in COLUMBUS prior to loading the file. The active units are set
! within the Options - Units dialog. If these are the units you usually use,
! you may not need to change them again. If the data within this file occurs in
! different units (both meters and feet), you must define this record immediately
! prior to each set of data that is described in those units.
$UNITS
  M
  D
  1


! The $STATION_TYPE_FOR_OBS record is new beginning with version 3.5.1.135.
! It allows you to tell COLUMBUS what type of station to create when the
! station type is not found in the file. If an observation (in the file below)
! references a station name that is not defined (by its type, e.g., height
! type, geodetic type, utm type, etc.), then COLUMBUS will create this station
! type when the file is loaded. A station type created in this way will be
! assigned coordinates of ZERO. In this file, we actually do not need the
! $STATION_TYPE_FOR_OBS, because we have defined all the required station
! types with the $GEO_COMPACT records.
$STATION_TYPE_FOR_OBS
2D_GEO


! Station Names can be a maximum of 15 characters in length
! Station Name; Lat; Lat SD; Long; Long SD; Ortho Hgt; Ortho Hgt SD; Geoid Hgt; Geoid Hgt SD;
! Ellip Hgt; Ellip Hgt SD; Defl NS; Defl NS SD; Defl EW; Defl EW SD
$GEO_COMPACT; 1; 44.26206; 0.0; -105.04579; 0.0; 1828.80; 0.0; 0.0; 0.0; 1828.80; 0.0; 0.0; 0.0; 0.0; 0.0

$GEO_COMPACT; 10; 44.264654; 0.0; -105.0534044; 0.0; 1828.80; 0.0; 0.0; 0.0; 1828.80; 0.0; 0.0; 0.0; 0.0; 0.0

$GEO_COMPACT; 2; 44.2646837; 0.0; -105.04576443; 0.0; 1828.80; 0.0; 0.0; 0.0; 1828.80; 0.0; 0.0; 0.0; 0.0; 0.0

$GEO_COMPACT; 3; 44.27130755; 0.0; -105.045738; 0.0; 1828.80; 0.0; 0.0; 0.0; 1828.80; 0.0; 0.0; 0.0; 0.0; 0.0

$GEO_COMPACT; 92; 44.2620283; 0.0; -105.053408; 0.0; 1828.80; 0.0; 0.0; 0.0; 1828.80; 0.0; 0.0; 0.0; 0.0; 0.0

$GEO_COMPACT; 98; 44.2712800; 0.0; -105.0534007; 0.0; 1828.80; 0.0; 0.0; 0.0; 1828.80; 0.0; 0.0; 0.0; 0.0; 0.0
```

```
!  The $BEAR observation set record consists of a bearing and a horizontal distance. Bearings must be ≥ 0 and
!  ≤ 90.0. If one or more of the observations were not measured, enter the text "NOOBS" for its field and
!  standard deviation.
!
!  This observation set was developed for adjusting cadastral data to obtain good 2D (latitude and longitude)
!  positions from recorded bearings and distances. These networks are adjusted at an average project height.
!
!  For the first observation set record below, the bearing from Station "1" to Station "2" is NE 00-24-00.00
!  degrees with a standard deviation of 15 seconds. The horizontal distance is 810.10 meters with standard
!  deviation of 0.20 meters.

!  When building networks using the bearing observation type, be sure to review the discussion concerning the
!  enabling of bearing rotations in the OPTIONS chapter of this manual.


! AT Station Name; TO Station Name; Bearing; Bearing SD; Quadrant; Hor Dist; Hor Dist SD
$BEAR_COMPACT; 1; 2; 0.24000000; 15.000; NE; 810.10; 0.20

$BEAR_COMPACT; 1; 92; 89.18000000; 15.000; SW; 800.45; 0.20

$BEAR_COMPACT; 10; 98; 0.03100000; 15.000; NE; 810.65; 0.20

$BEAR_COMPACT; 2; 10; 89.21100000; 15.000; SW; 805.16; 0.20

$BEAR_COMPACT; 2; 3; 0.24000000; 15.000; NE; 810.11; 0.20

$BEAR_COMPACT; 3; 98; 89.24000000; 15.000; SW; 809.90; 0.20

$BEAR_COMPACT; 92; 10; 0.03200000; 15.000; NE; 810.75; 0.20



$BEG_SKIP

! The above BEAR_COMPACT observation set records can also be expressed as individual
! observations. Below is how it would be done.

! AT Station Name; TO Station Name; Bearing; Bearing SD; Quadrant
$BEARING_ONLY; 1; 2; 0.24000000; 15.000; NE

$BEARING_ONLY; 1; 92; 89.18000000; 15.000; SW

$BEARING_ONLY; 10; 98; 0.03100000; 15.000; NE

$BEARING_ONLY; 2; 10; 89.21100000; 15.000; SW

$BEARING_ONLY; 2; 3; 0.24000000; 15.000; NE

$BEARING_ONLY; 3; 98; 89.24000000; 15.000; SW

$BEARING_ONLY; 92; 10; 0.03200000; 15.000; NE


! AT Station Name; TO Station Name; Hor Dist; Hor Dist SD
$HORIZ_DIST_ONLY; 1; 2; 810.10; 0.20

$HORIZ_DIST_ONLY; 1; 92; 800.45; 0.20

$HORIZ_DIST_ONLY; 10; 98; 810.65; 0.20

$HORIZ_DIST_ONLY; 2; 10; 805.16; 0.20

$HORIZ_DIST_ONLY; 2; 3; 810.11; 0.20

$HORIZ_DIST_ONLY; 3; 98; 809.90; 0.20

$HORIZ_DIST_ONLY; 92; 10; 810.75; 0.20

$END_SKIP
```

Example Four

```
!  This file contains the ASCII (Text) representation for a datum transformation situation. In this example,
!  NAD 83 geodetic stations will be transformed to NAD 27 geodetic stations. The common stations on each datum
!  are used to determine the transformation parameters. In this file, we use the $DATUM section twice. Once to
!  define each NAD 27 station and then to define each NAD 83 station. When the $DATUM keyword is encountered,
!  the data read next is linked to this datum.

$DATUM
  NAD 27
  6378206.40000
      294.97869821

$UNITS
  M
  D
  1

$GEO_COMPACT; TERRIE; 65.5258606; 0.65; -144.2433224; 0.75; 299.0; 2.065; 0; 0;  299.0; 2.065; 0; 0; 0; 0

$GEO_COMPACT; TOM; 65.2309779; 0.6; -144.1757364; 0.7; 762.2; 2.01; 0; 0; 762.2; 2.01; 0; 0; 0; 0

$GEO_COMPACT; TOOTHACHE; 65.3438715; 0.7; -145.1527366; 0.8; 953.3; 2.121; 0; 0; 953.3; 2.121; 0; 0; 0; 0


$DATUM
  NAD 83
  6378137.00000
      298.25722210

$GEO_COMPACT; TANDY; 65.304521354; 0.1; -145.053212547; 0.2; 632.214; 0.25; 0; 0; 632.214; 0.25; 0; 0; 0; 0

$GEO_COMPACT; TERRIE; 65.525736170; 0.15; -144.24422036; 0.25; 308.12; 0.57; 0; 0; 308.12; 0.57; 0; 0; 0; 0

$GEO_COMPACT; TOM; 65.23085056; 0.1; -144.18060988; 0.2; 772.57; 0.51; 0; 0; 772.57; 0.51; 0; 0; 0; 0

$GEO_COMPACT; TOON; 65.4725156; 0.15; -144.18246542; 0.2; 510.236; 0.4; 0; 0; 510.236; 0.4; 0; 0; 0; 0

$GEO_COMPACT; TOOTHACHE; 65.34373811; 0.2; -145.15362509; 0.3; 963.62; 0.632; 0; 0; 963.62; 0.632; 0; 0; 0; 0

$GEO_COMPACT; TOWER; 65.324565421; 0.2; -144.584532145; 0.1; 723.5465; 0.3; 0; 0; 723.5465; 0.3; 0; 0; 0; 0
```

Example Five

```
!  In this file we have three stations with geodetic and State Plane coordinates.

$DATUM
  NAD 83
  6378137.00000
      298.25722210

$UNITS
  M
  D
  1

$GEO_COMPACT; ADAMS; 42.260273954; 0; -89.032859297; 0; 0; 0; 0; 0; 0; 0; 0; 0; 0

$GEO_COMPACT; ALEX; 42.262798249; 0; -89.033832617; 0; 0; 0; 0; 0; 0; 0; 0; 0; 0

$GEO_COMPACT ASH; 42.321370631; 0; -88.56086875; 0; 0; 0; 0; 0; 0; 0; 0; 0; 0


!  This is the $STATE_COMPACT station type record.
!  State Plane Statio Name; North; East;
$STATE_COMPACT; ADAM; 48663.0672; 677521.5353

$STATE_COMPACT; ALEX; 49439.4624; 677290.2863

$STATE_COMPACT; ASH; 60230.4471;  687430.3819
```

Example Six

```
!  In this file we have two stations with geodetic and UTM coordinates.

$DATUM
  NAD 27
  6378206.40000
      294.97869821

$UNITS
  M
  D
  1

$GEO_COMPACT; RAYMOND; 37.3015425; 0; -96.1523124; 0; 0; 0; 0; 0; 0; 0; 0; 0; 0

$GEO_COMPACT; ROBERT; 34.1534742; 0; -96.0243158; 0; 0; 0; 0; 0; 0; 0; 0; 0; 0



!  This is the $UTM_COMPACT station record type.
!  UTM Station Name; North; East;
$UTM_COMPACT; RAYMOND; 4154148.8916; 742521.2714

$UTM_COMPACT; ROBERT; 3794702.1723; 772075.8124
```

Example Seven

This example illustrates the usage of the Local NEUE (north, east, up, elevation) coordinate record.

Note: The terms "Elevation" and "Orthometric Hgt" are use interchangeably in COLUMBUS.

Before continuing, it is useful to explain the difference between the UP coordinate component and the Elevation coordinate component. **The UP coordinate component represents the distance UP (positive) or DOWN (negative UP) from a plane tangent to the earth's surface at a specific point or collection of points (secant plane.)**

To simplify the discussion, let's assume a plane tangent to just one point on the ground (the point of tangency.) If you were to project a plane surface out from this point you would begin to see the earth curve down and away from this plane as you get farther from the point of tangency. For any given point on the ground (on the same side of earth that the plane is on), there is an UP (+ or -) component that is perpendicular to this plane and ends at the ground point.

As points on the earth's surface get further away from the point of origin of the plane, the North, East, and UP offsets from the origin increase. North and East are directly on the plane, while the UP component is perpendicular to the plane (as state above.)

For short distances from the point of origin (say 1 km) the direction of the UP component closely approximates the direction of gravity. In this scenario, a delta UP value between two stations would be nearly identical to the delta height between two stations.

As one moves further from the point of origin, the direction of the UP component begins to deviate more and more from the direction of gravity. In this scenario, a delta UP between station pairs will not closely match a delta height between the same station pairs.

To visualize this, take a flat piece of cardboard and press the middle of the cardboard up against a basketball. The cardboard is the plane, and the ball is the earth. The cardboard should only touch the ball at one point (the point of tangency.) Notice how the UP component begins to deviate (in direction) from the direction of the radius of the ball as you move away from the point of tangency.

```
!  In this file we have five stations with geodetic and Local NEUE (north, east, up, elevation) coordinates.

$DATUM
  NAD 27
  6378206.40000
      294.97869821

$UNITS
  M
  D
  1

$GEO_COMPACT; WASHINGTON; 37.5515399; 0; -107.3814025; 0; 4065.7; 0; 3.2; 0; 4068.9; 0; 5.3; 0; 13.5; 0

$GEO_COMPACT; WATERSHED; 38.0130088; 0; -107.1746139; 0; 3270.8; 0; 4.6; 0; 3275.4; 0; 1.5; 0; 7.6; 0

$GEO_COMPACT; WESTERN; 38.0112628; 0; -107.371396; 0; 3996.24; 0; 0; 0; 3996.24; 0; 0; 0; 0; 0

$GEO_COMPACT; WONDER; 38.0113087; 0; -107.2225665; 0; 2882.26; 0; 1.4; 0; 2883.66; 0; -2.4; 0; -2.3; 0;

$GEO_COMPACT; WYOMING; 37.5627321; 0; -107.2515973; 0; 4277.57; 0; 0; 0; 4277.57; 0; 0; 0; 0; 0;
```

```
!  This is the $LOCAL_NEUE station type record.
!  Name; North; East; Up; Elev

$LOCAL_NEUE_COMPACT; WASHINGTON; 100000.0; 100000.0; 5000.0; 4065.7

$LOCAL_NEUE; WATERSHED; 111612.9963; 129963.5958; 4125.6465; 3270.8

$LOCAL_NEUE; WESTERN; 111020.9646; 101466.0120; 4917.6281; 3996.24

$LOCAL_NEUE; WONDER; 111065.7614; 123142.5596; 3763.2245; 2882.26

$LOCAL_NEUE; WYOMING; 102240.9781; 119011.2120; 5179.9977; 4277.57
```