Instrument Manual

Interface to Topcon TopSurv

LSS™

TOPCON

TopSURV

Contents

Introduction

As modern surveying equipment and methods have evolved, LSS has also developed much more functionality in order to make the most of the techniques available. This is especially true when it comes to data acquisition, field coding and transfer from survey instruments. McCarthy Taylor Systems Ltd has strived to ensure that LSS surveyors are able to make the most of the options available.

This manual has been prepared to help with the configuration of both the survey instrument hardware and LSS software.

Chapter 1

1.1 Install LSS and Testdata

Note: The LSS v10 install procedure provides most of the necessary installation files for the Topcon, but some Installs may be required on the PC in order to connect LSS to Topcon Magnet Field.

It is best to complete all installation steps in one go especially if administrator rights are required.

LSS will automatically initialise the registry when any of the Trimble options are invoked for the first time.

Select 'Install LSS &

Test Data';

For a new install use 'Full LSS Install Incl Dongle Drivers'

Also choose

'Install Enhanced Test Data',

which includes examples of Point Cloud data and the files we use in our specialist training courses

1.2 Survey Instrument and Machine Control Support Files

Return to the Install Home Page;

Select

'**Survey & Machine Control**',

and access the files/documents for your instrument type-

For Topcon instruments and loggers select

'**Topcon survey and machine control**'
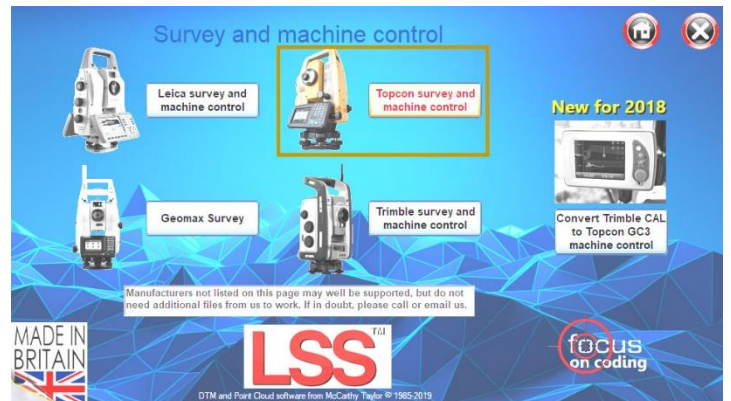
The various Topcon Documents can be accessed.

'The Code Library'

'Browse the Topcon

Support files folder'

(on the installation flash drive):

Note: All the LSS media files shown here are also available for downloading from the LSS website '**www.dtmsoftware.com /Support-Home/Download/Survey-Equipment-Machine-Control-Support-Files**'

Copying the Feature Code Library
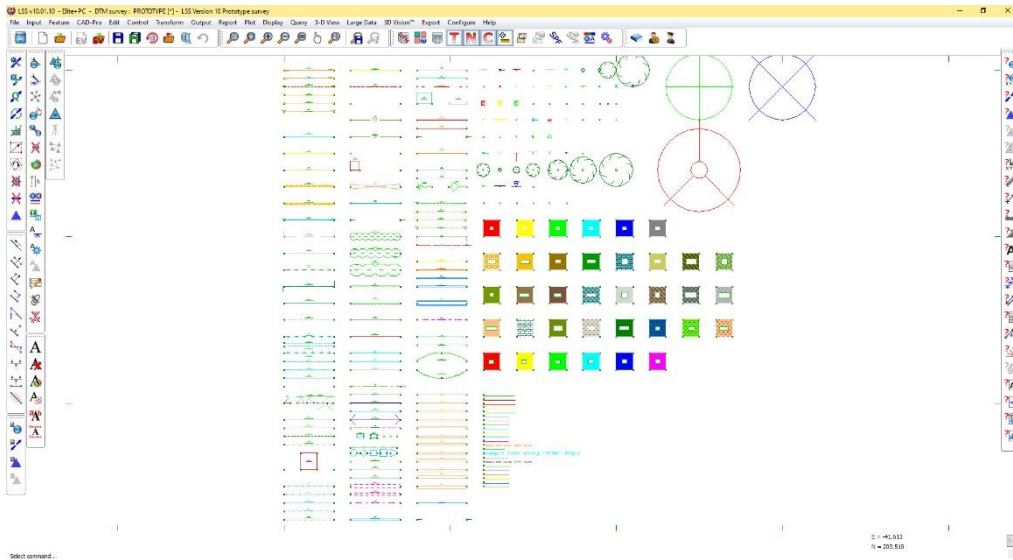
It is recommended that a feature library is copied to the instrument using the option 'Export / Survey Instrument / Codelist'.

The format to use for Topcon Magnet is .XML and there is available a pre-prepared code list that has been exported from the standard LSS Prototype Survey File - **PROTOTYPE.LSS** ;

The command Query List will list the features in the Prototype Legend;
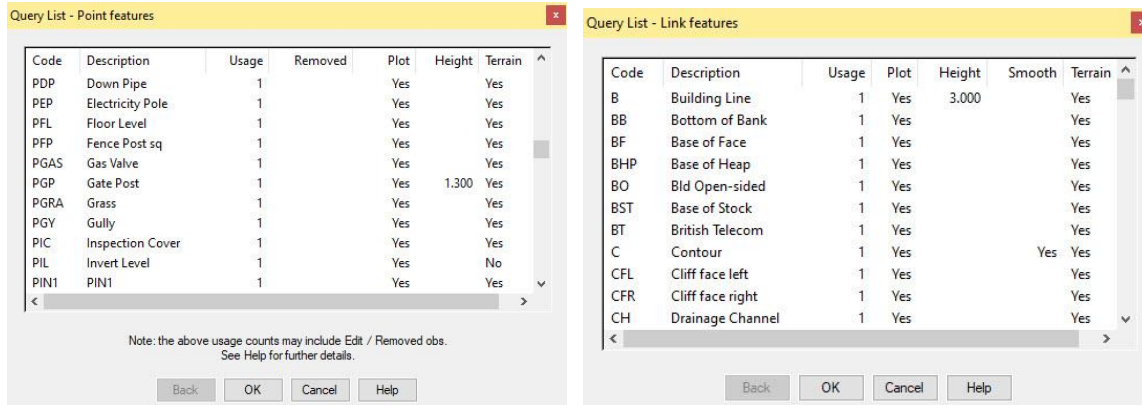
The command **Export Survey Instrument – Code List** has been used and the resultant file, LSSv10_Magnet.XML, found on the LSS media under **Support_Files\Topcon\Code\LSSv10.XML** initially should be copied onto the Topcon - Magnet Logger's IEFiles folder;

When starting a new job on the logger, it can be configured to include this code list.

Copy the LSS example XML file from the LSS media 'Support_Files\Topcon\TopSurv\Code' folder to the 'TopSurv\IEFiles' folder on the TopSURV logger via Active Sync.
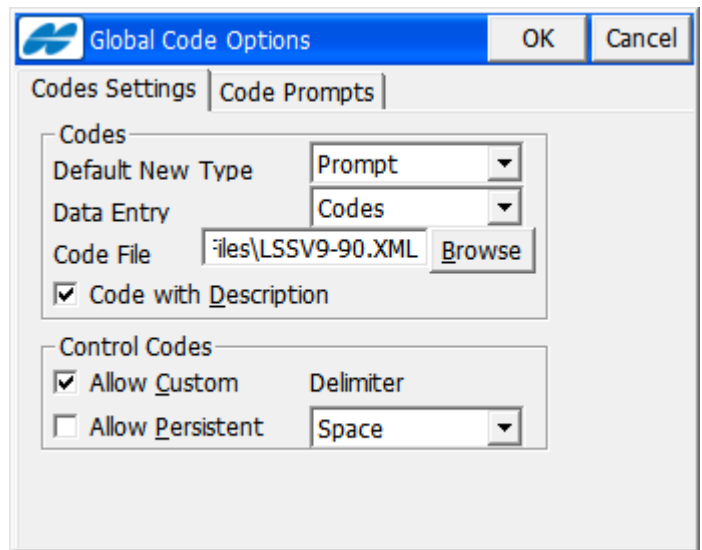
Select *'Configure / Codes' or 'Job Config Global'*

Browse the XML code file. Once set this becomes the default code library used every time a Job is created.

Set 'Code with Description' on.

In Control Codes set 'Allow Custom' on.

Note: The 'Allow Custom' option allows non-TopSurv control codes to be entered in the '**Ctrl Code**' input box during detailing. The LSS ones are described below.

LSS preset control codes;

        '**.A**' - start string,

        '**.J**' or '**JP**' - join to previous point,

        '**.T**' - end string and

        '**.P**' or '**CLOSE**' - closed loop.

Although LSS supports the use of the control codes in general TopSurv does not use these graphically. Therefore, although it allows more choice of coding options you will not see the affects of these control codes on the TopSurv Map.

Chapter 2

2.1 Instrument Data Capture

2.1.1 Creating a New TopSURV Job

Having started up TopSURV select *New* from the *Open Job* screen, or select *Job New* from the menu...
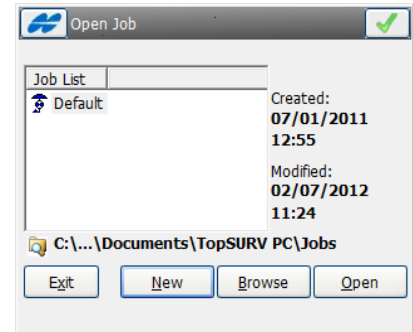
enter appropriate name and details ...

Press *Next*
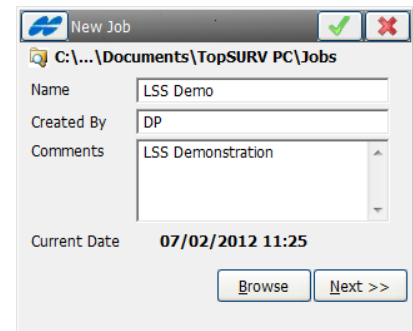
and select the appropriate total station configuration set, for instance: *My Conventional*

Press *Next*

review the *Coordinate System* settings. For total station based jobs, these can be left as shown, or various options are available for GPS jobs.

Press *Next*

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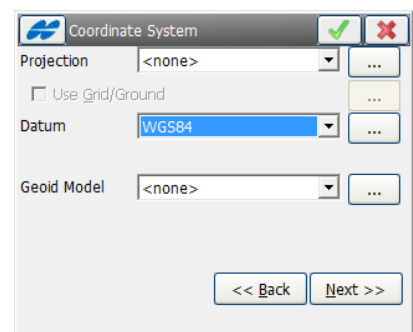
check that you have the appropriate units set for the job

Press *Next*
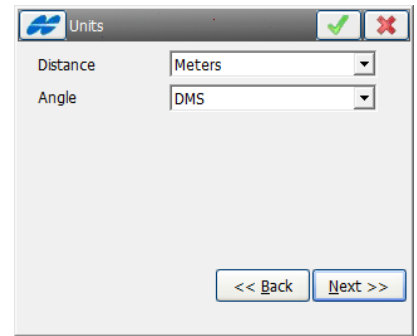
ensure that your *Coord Order* is as shown below...

Press *Next*
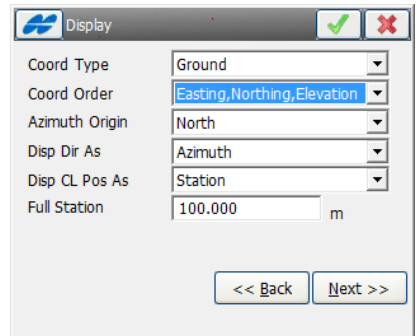
The last dialog shows the notification alarms which can be left as they are.
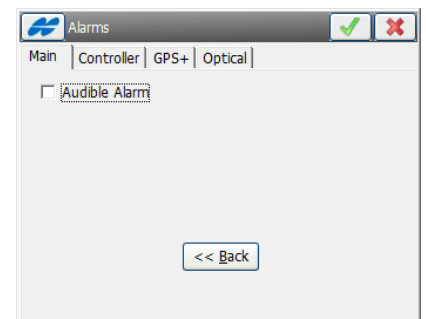
Finally, pressing *Finish* to get back to the main TopSURV screen within the newly created job.

2.1.2 Station Set-Up

Select *Survey / Backsight* from the menu...

Enter the Occ Point (Set on station).

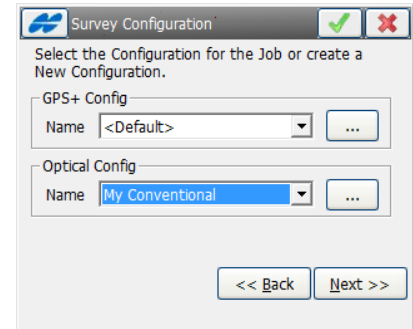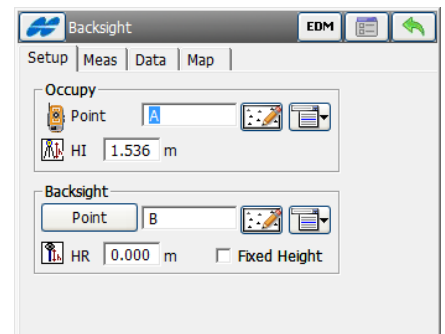Enter the BS Azimuth value (Backsight station azimuth). If the button reads 'BS Point' then clicking on this will toggle to BS Azimuth.

If the check box 'Measure distance to BS' is not ticked then the Backsight station in LSS will be created 500m away unless a control obs to the backsight is taken immediately after the setup.

If the Occ Point does not exist click the down arrow icon to the right and select Properties, then Yes to 'No Point to display! Create One?'

Add the coordinate values and '-ST' for the code so that LSS will know this is a station value.
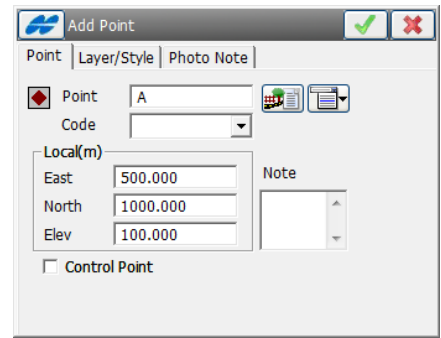
Click OK

Click the 'Meas BS' button or 'HC set'.

Note: If this is the first set-up and the coordinates are typed in for the Backsight station then add a code '-ST'. This allows LSS to recognise the coordinate as a station in SDR33 format.

Note: If this is not the first set-up for an arbitrary coordinate system then use 'BS Point' for the backsight as there should now be other known stations.

Click Close to end the set-up recording.

2.2 LSS and TopSURV Feature Coding

Select Survey / Topo to enter the detailing section.
Control observation - set the Code to '-ST' to 'tell' LSS that it is a control obs.

Note: The PointID is set to the station name.
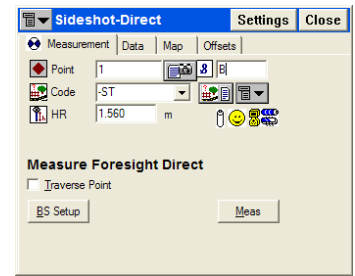
Select Note to add General Text.

Note: A Note will disappear once the shot has been measured.
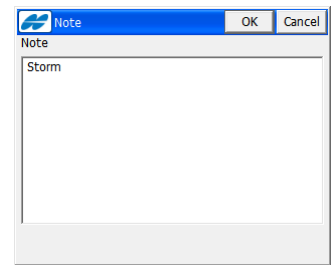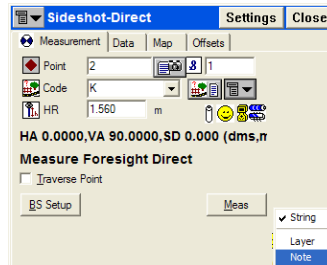
To create multiple coding click on the icon to the right of the Code field. Click 'Multiple Codes' then Add and select the Code and String.
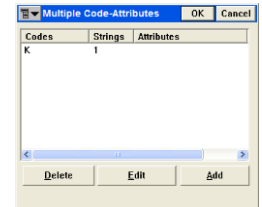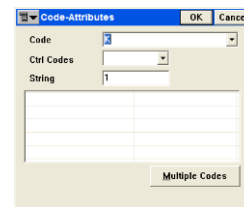
Note: Multi codes apply for one shot only. Once it has been taken the Code reverts to its main value.
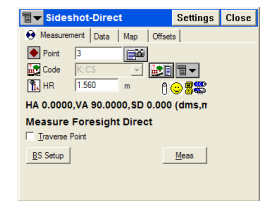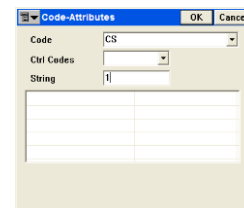
If a Note is required on 2 lines use ',@' for each new text line.

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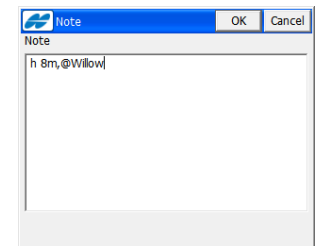
Chapter 3

3.1 Exporting EDM and GPS Data from TopSURV for LSS

Select *Export / To File / Raw Data / Sokkia SDR33*.

The configuration of the export option (below) only needs to be set once and from then on skip to the **Export** paragraph.
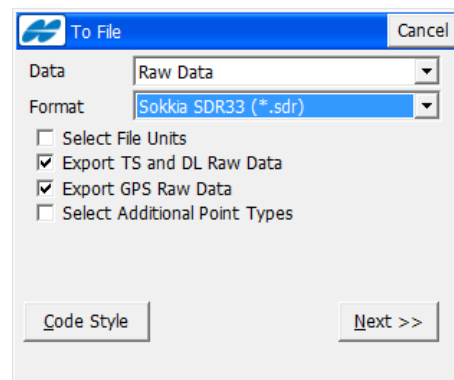
3.1.1 Configure the Export SDR33 Format

The first time this option is used on the logger you will need to click the *Code Style* button to configure the export.
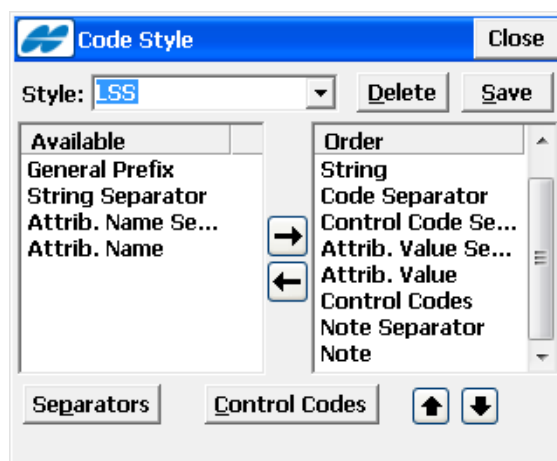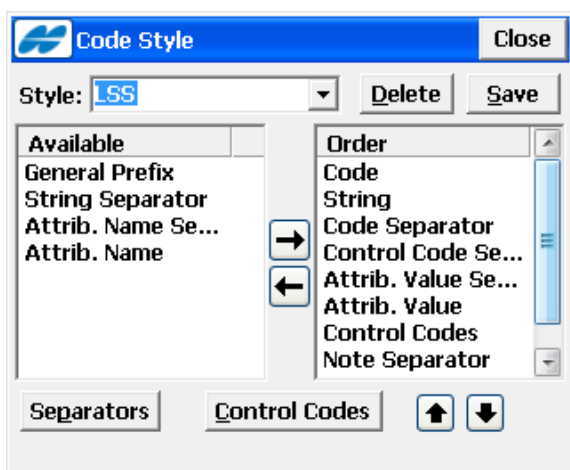
Populate the right hand list as per the dialogs above (they are the same one with the second picture showing the RHS scrolled to the bottom of the list).

Then click the *Separators* button

Use the space bar to create the dot symbol in the input boxes as shown.

Add an ampersand '&' to the Notes input box.

Click OK
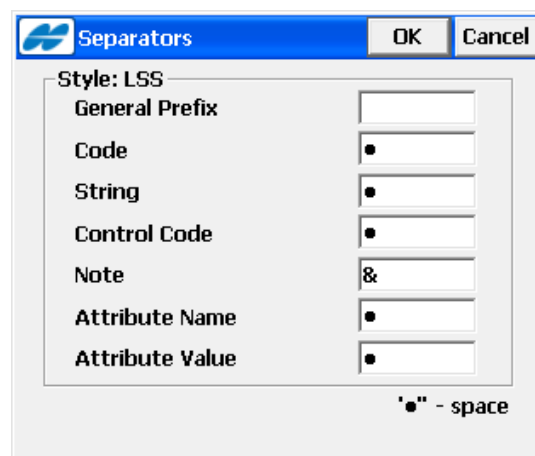
The LSS custom control codes ('.A' start string, '.J' join to previous point, '.T' end string and '.P' closed loop) do not need to be set here.

Make sure the 'Line Start' and 'Line End' settings are blank.

Click OK.
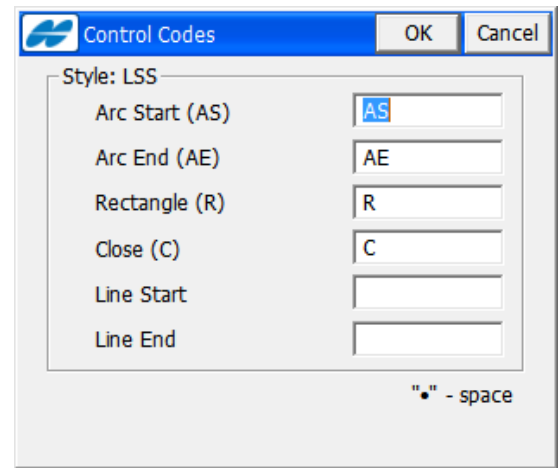
To get TopSURV to remember these values type LSS as the Style and click the Save button.
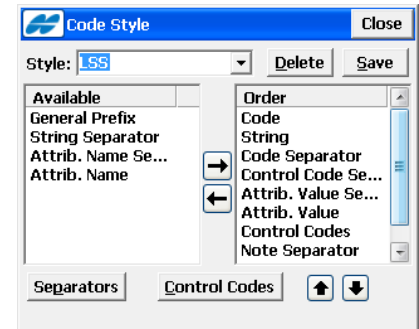
The LSS code styles will only need to be reselected if another Code style is used at any point.

3.1.2 Export

This sequence can be used repeatedly once the Code Styles have initially been configured.

Click the Code Style button to
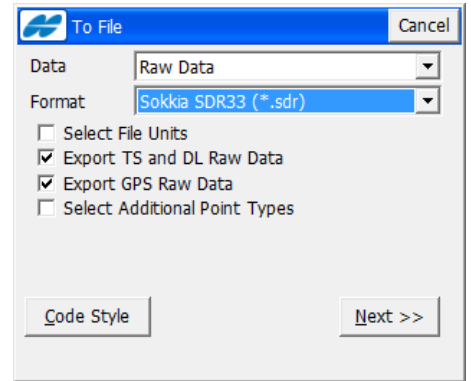
Check that the Style is still set to LSS

Click Close

At the previous dialog click Next
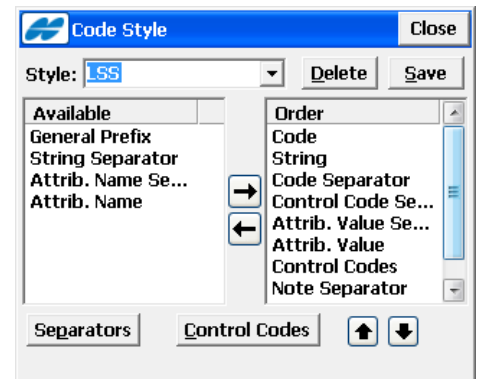
Enter a file name

Click OK
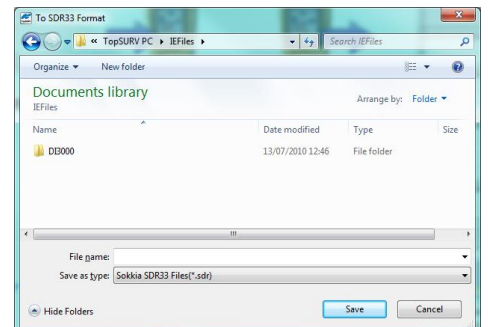
The file will be created.

Click 'Close'

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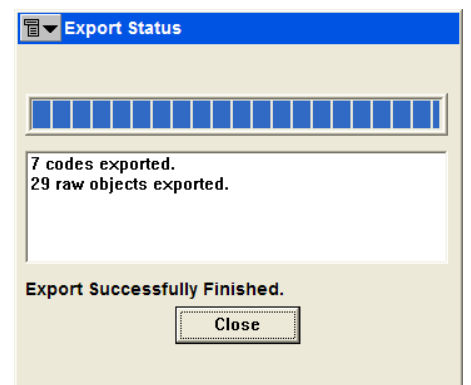
3.2 Data Processing in LSS– Converting Data

This option will download and convert survey data from TopSurv / TopSURV logger.

Selecting **Input Download / Convert** will invoke the Download data window, the variant shown on the right being displayed if we have not already configured a logger which prompts us to do so by clicking 'New' and following the dialog boxes:
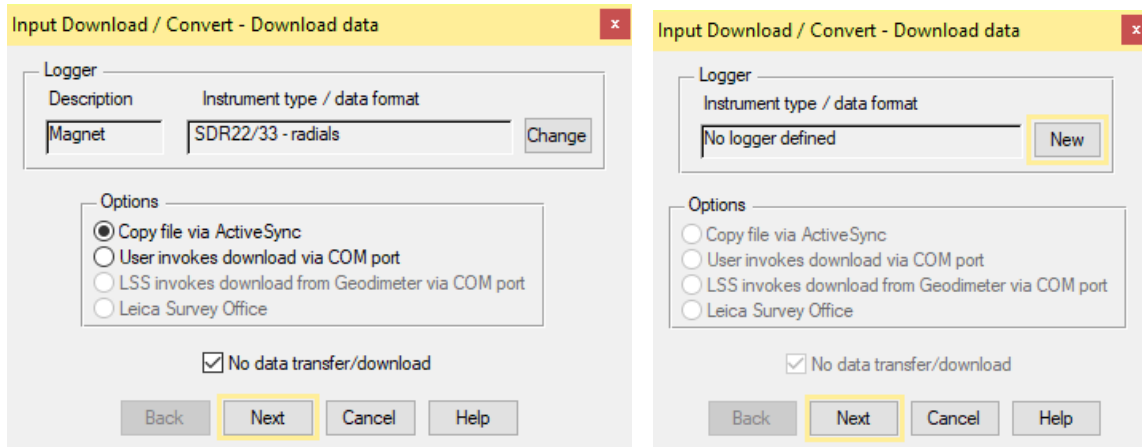
Either way we will need to save the logger configuration settings in the system registry.

Note: The 'No data transfer/download tick box can be selected if the survey data has already been copied from the TopSurv OR Magnet \ IEFiles e.g. via memory card, to the hard drive of the computer.
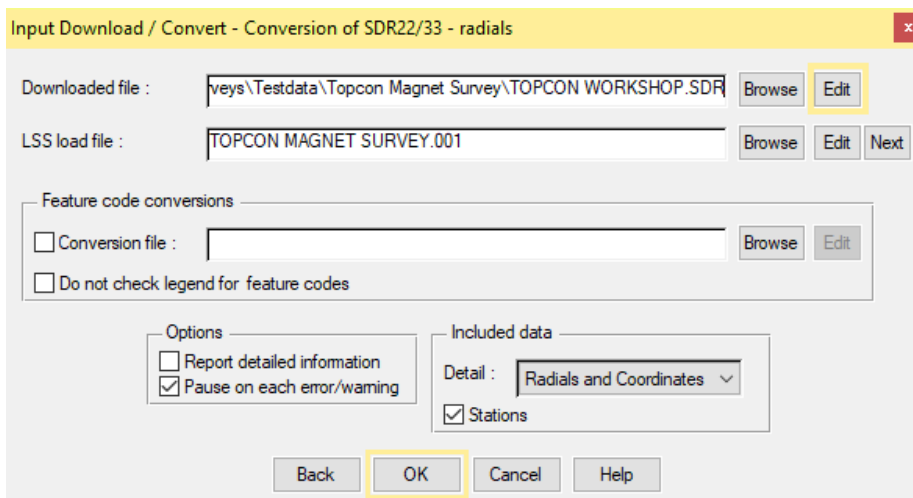
If the tick box is not selected then the download method *e.g.* ActiveSync, allows direct access to the TopSurv OR Magnet \ IEFiles

On the conversion dialog we Browse for the Topcon Workshop data file

Click 'Next' when the load file box is empty for the next available load file for the current survey

Leave the other settings as per default. Click 'OK' for LSS to convert the SDR33 file into a new LSS 'Load file',

The .SDR file can be opened using the 'Edit' button (see screenshot below):

Note: For GPS surveys, the HRMS and VRMS are reported as min/max values or individually if they exceed the error tolerance. The Lat/Longs are converted as comments in the load file.

If during the conversion LSS detects a feature code that it does not recognise in the legend of the current survey a 'Feature conversion' dialog is displayed, to allow the feature to be converted;

'Select' will open up the lists for point or link features accordingly to allow a conversion.

Unless we can see a feature code in the

'Select' list to replace, we can simply set

'OK' to maintain the current code and

'No more feature code conversion requests will ignore all future unrecognised codes.

If conversion requests have been reacted to, then LSS will prompt the creation of a code conversion file .CNV.
Or we can hit 'No Save'.

Once all the requests have been responded to or 'No more feature conversion requests' the conversion will complete with LSS displaying the relevant information.

```
Input Download / Convert

Start of conversion...

0, LSS load file converted from SDR22/33 - radials file :
0, C:\SURVEYS\TESTDATA\TOPCON MAGNET SURVEY\TOPCON MAGNET SURVEY.SDR
0, Created by LSS v10.01.10 : 2019.11.13 15:32
0
0
0
0, Conversion information from SDR22/33 - radials data.
0
0, Stations            :     2
0
0, Set-ups             :     1
0
0, Converted radial obs.  :    44
0

Conversion completed.

"OK" to save LSS load file, or
Cancel to terminate.
```

Pause   Continue   Back   OK   Cancel

Click 'OK'

and we will be given the options for the newly created load file;

'Save and LOAD file'
'Save'
'Delete'
Choose the first item – 'OK'-
The **Input Load** command will automatically be invoked.

```
Input Download / Convert - File Close

Output file  C:...TESTDATA\TOPCON MAGNET SURVEY\TOPCON MAGNET SURVEY.001

┌ Options ──────────────┐
│  ◉ Save and LOAD file │
│                       │
│  ○ Save               │
│  ○ Delete             │
└───────────────────────┘

   Back     OK     Cancel    Help
```
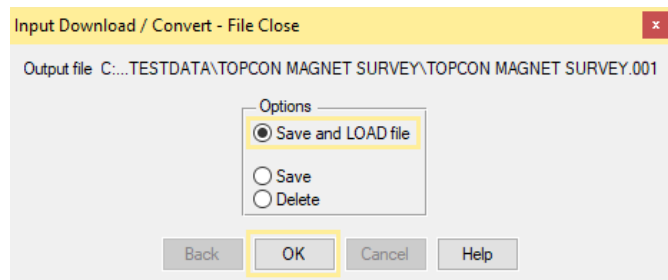
Note: If the Load file name is for a survey that does not exist then the 'Save and LOAD file' will prompt **File New** to create a new survey prior to loading the data.

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3.3 Data Processing in LSS– Inputting Data

3.3.1 Introduction

The 'LSS Load Input file' is the format by which all external data is processed into LSS e.g. data from a survey instrument has to first be converted to a load file via the **Input Download & Convert** option.

3.3.2 Loading Data into a Survey Model

The **Input Load** Window appears where there is a load file available to load into the current survey:

The first radial buttons are for choosing where to send a load report - to a printer, to Adobe Acrobat file or (more usually)

A text report file.

A load report file is generated for each load.

We can choose a Conversion file here,

Normally we would 'Report pauses on' 'Errors' and 'Control tolerance warnings'.

We could also select 'All warnings'.

Other options are described below.

We can normally accept the default settings, but if we do need to change any of the settings on a regular basis we can 'Save as Default' as required.

The Defaults [which we will leave the options as per default and click 'Next'] are:

For the 'Pause' options, we will need to select 'Continue' during the processing when any of the errors or warnings are triggered. This will become clearer as LSS processes the survey data.

'Include' 'Crossing Links or 'Stations' – conversely unticking will exclude,

which, for crossing links is an automatic way of removing crossing links where the majority should simply not be there.

'General text settings' will allow field notes and annotations to take the Font and the position of the text from that set in the level text of feature's legend entry.

'Strings restart on' 'New setup' and 'Change of feature' will stop links from joining up across survey instrument set-ups and when a change of link feature is identified

This could reduce the number of 'crossing links' in the survey.

Clicking the 'Advanced' button will give the user access to 'Advanced settings' for redefining the 'Conditioning tolerance' for inputting arcs and circles.

3.3.3 An Explanation of the LSS Load File Format

The Load file can be viewed and edited to address any issues raised during **Input Load**.

A Load File can contain either radial observations, coordinate observations or both:

Each record is assigned a number for LSS to process as described below;

Radial and coordinate record types

0 = Comment line containing information that will not be processed by LSS, such as the surveyors name, date and time of the survey.

1 = Parameters record containing e.g. survey units and angular settings.

2 = Station coordinate record.

20 = Station coordinate control observation used as a check and commonly encountered with GPS survey equipment to verify a survey station position.

6 = An item of general annotation (normally text entered on a survey instrument or logger as a comment or note). Such annotation will be shown in the LSS survey centred on the previously surveyed point.

9 = End of file marker. It is not necessary to have one of these at the end of the file.

Radial only record types

3 = An instrument setup record with set-on station, followed by backsight station, backsight angle, instrument height, vertical angle collimation and station scale factor. Some of the fields may be blank as in this load file as LSS will be getting information from lines which follow.

4 = A control observation where the final field is the station name. If there is a 4 record following a setup record, this will provide any missing information in the setup record. This is identical to a '5,' record with a '-ST' code.

5 = A 'detail' record which contains an observation to a surveyed point with the feature code appearing in the last field. Multiple features may be specified and separated by either a comma or a forward slash. This record type may also be a control observation, where '-ST' is the code, with the station name either following this or being taken from the observation number field.

We may also use the special or Reserved codes, described in detail in the next session.

Coordinate only record types (not shown in this example)

21 = A coordinate record. Instead of collecting radial data it is possible to collect and convert coordinates, e.g. for GPS survey data. These survey data can also use Reserved codes.

As the load file is processed so a report is produced showing all relevant information e.g. comments, setups and control observations. Any warnings or errors found in the data set will cause the processing to pause.

An error will not allow **Input Load** to complete.

The end of the Input Load Report should appear, with a note

*** Warning(s) issued ***recognising that some warnings had been issued.
Any misclosures that exceed the 'warning' parameter are labelled Large differences, and Load will pause. Likewise for any that exceed the 'error' parameter except that here Load will not complete.

If we scroll back up the following report file, we might find 'Warning : Feature does not exist.' and 'Warning : Large Difference.'Warnings have been generated during the **Input Load** process. Otherwise, click 'Continue' to update DTM and 'OK' to close window.

If a loaded feature is not found in the Legend, then the 'Warning : Feature does not exist.' is created. We will also be prompted to save new feature selections to CNV file.

For each control observation, the combined 3D measured 'slope distance' is compared with any stored values and tested against the 'Control Tolerance' warning and error values set in 'Survey Parameters'.
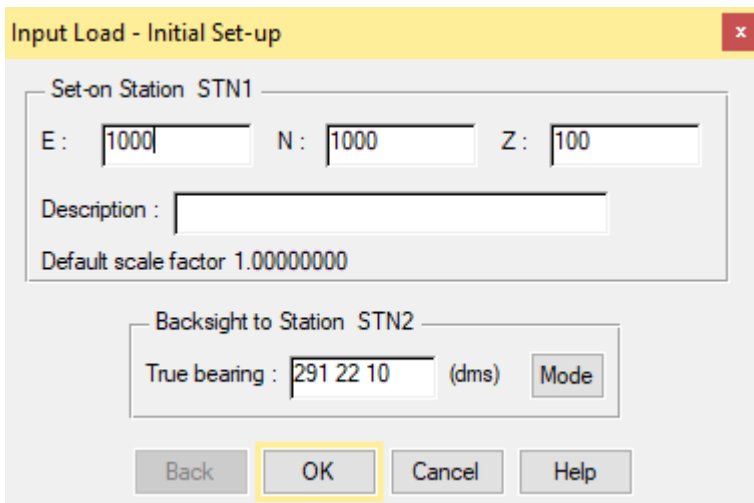
Those control observations with 'Warning : Large Difference.' next to them, are where the warning tolerance (0.01m) was exceeded (but not the error tolerance).

Note: if an observed station does not exist in the survey, then the **first** observation is used to compute its coordinates – they are not meaned here. Subsequent station 'shots' become 'check' observations'.

Note: if any errors are encountered the load will not be permitted. It will be necessary to review these errors and maybe respecify the error tolerance to allow the load.

Often errors occur simply because the stations have been incorrectly labelled during the set-ups, or there is one poor observation.

To correct these, click 'Back' and then 'Edit' to open up the load file. If you have set 'PFE' as your editor program then use 'CTRL+G' to go to the line directly.

If the survey is empty and no station coordinates are provided prior to the first instrument set-up in the Load file,
then an Initial Set-up dialog will be presented to verify the station coordinates and orientation.

Otherwise the station coordinates from the Topcon logger are loaded along with the detail.

Click 'OK'.

When available, Click 'Continue'

```
Input Load                                                                                    x

To C              HA          VA          SD        TH     Easting    Northing   Level   ObsNo
Expected        3.7276      90.5432      12.588            1039.116   1045.460   98.765
Observed        3.7276      90.5432      12.586    1.600   1039.116   1045.458   98.765     0
Differences     0.0000      0.0000       -0.002                       0.000     -0.002    0.000
Difference (slope distance)        0.002
   0049 : 5, 4, 269.22, 89.6666, 24.75, 1.6, K1
   0050 : 5, 5, 269.1104, 89.449, 24.75, 1.6, K1,-SO,KT1
   0052 : 5, 7, 276.9434, 89.7477, 26.77, 1.6, K2,CS1
   0054 : 5, 8, 277.0493, 89.5311, 26.763, 1.6, K2,-SO,KT2
   0107 : 5, 43, 291.3685, 89.604, 18.288, 1.6, -STB
To B              HA          VA          SD        TH     Easting    Northing   Level   ObsNo
Expected       291.3694     89.6021      18.287            1021.269   1039.562   99.011
Observed       291.3685     89.6040      18.288    1.600   1021.268   1039.562   99.010    43
Differences    -0.0009      0.0019        0.001           -0.001      0.000     -0.001
Difference (slope distance)        0.002
   0108 : 5, C, 3.72765, 90.54325, 12.587, 1.6, -STC
To C              HA          VA          SD        TH     Easting    Northing   Level   ObsNo
Expected        3.7276      90.5432      12.588            1039.116   1045.460   98.765
Observed        3.7277      90.5433      12.587    1.600   1039.116   1045.459   98.765     0
Differences     0.0001      0.0001       -0.001                       0.000     -0.001    0.000
Difference (slope distance)        0.001
   0111 : 0, Conversion information from SDR22/33 - radials data.
   0113 : 0, Stations              :    2
   0115 : 0, Set-ups               :    1
   0117 : 0, Converted radial obs. :   48
   0119 : 9

Warning : string contains only one obs ( 10 on record 56) - loaded as spot level

File verified successfully.

Press :  Continue to update DTM or
         Cancel to terminate Load...

         Pause    Continue      Back     OK     Cancel
```
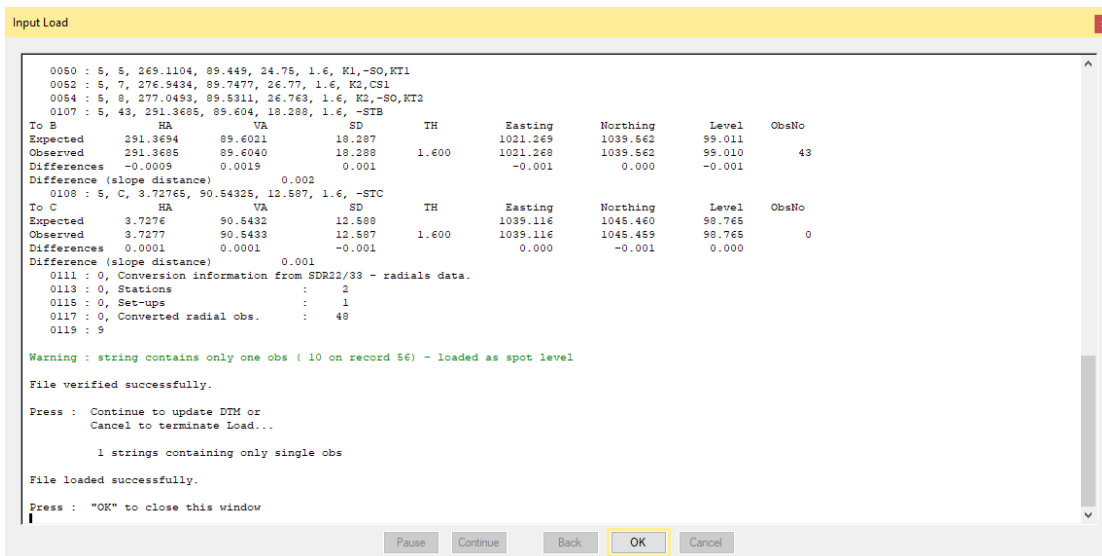
```
Input Load                                                                                    x

   0050 : 5, 5, 269.1104, 89.449, 24.75, 1.6, K1,-SO,KT1
   0052 : 5, 7, 276.9434, 89.7477, 26.77, 1.6, K2,CS1
   0054 : 5, 8, 277.0493, 89.5311, 26.763, 1.6, K2,-SO,KT2
   0107 : 5, 43, 291.3685, 89.604, 18.288, 1.6, -STB
To B              HA          VA          SD        TH     Easting    Northing   Level   ObsNo
Expected       291.3694     89.6021      18.287            1021.269   1039.562   99.011
Observed       291.3685     89.6040      18.288    1.600   1021.268   1039.562   99.010    43
Differences    -0.0009      0.0019        0.001           -0.001      0.000     -0.001
Difference (slope distance)        0.002
   0108 : 5, C, 3.72765, 90.54325, 12.587, 1.6, -STC
To C              HA          VA          SD        TH     Easting    Northing   Level   ObsNo
Expected        3.7276      90.5432      12.588            1039.116   1045.460   98.765
Observed        3.7277      90.5433      12.587    1.600   1039.116   1045.459   98.765     0
Differences     0.0001      0.0001       -0.001                       0.000     -0.001    0.000
Difference (slope distance)        0.001
   0111 : 0, Conversion information from SDR22/33 - radials data.
   0113 : 0, Stations              :    2
   0115 : 0, Set-ups               :    1
   0117 : 0, Converted radial obs. :   48
   0119 : 9

Warning : string contains only one obs ( 10 on record 56) - loaded as spot level

File verified successfully.

Press :  Continue to update DTM or
         Cancel to terminate Load...

             1 strings containing only single obs

File loaded successfully.

Press :  "OK" to close this window

         Pause    Continue      Back     OK     Cancel
```

and 'OK'

to complete the load and display the data. This includes updating the triangulation to create the DTM.
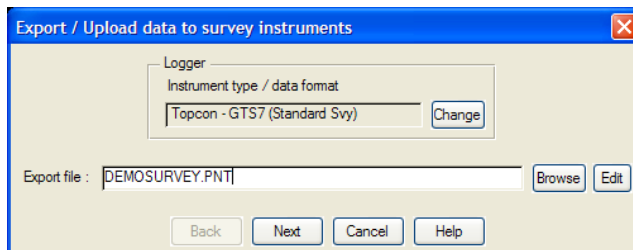
Chapter 4

4.1 Setting-Out with LSS and TopSURV

### 4.1.1 Export / Survey Instruments – Survey Data

From the main menu, select 'Export/Upload data to survey instruments'. The selected logger uses the parameters as per Input/Download & convert.

Note*:* The logger parameters can be set by clicking the 'Change' button or by using Configure/Hardware & System / logger.

Leave the default option Topcon GTS7 selected and click 'Next'.

This dialog allows the selection of observation and station data.
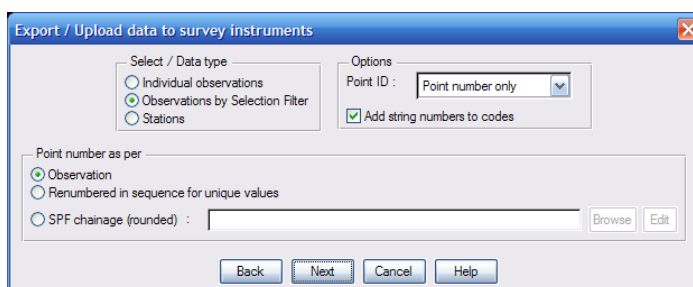
The defaults assume that the 'Observations' will be exported using the Selection filter. Click 'Next'.

Note*:* The observations can have the code added to the point number, which can be related to the SPF chainage.

If chosen the Selection filter dialog will offer the opportunity of multiple observation selection criteria. As soon as there are observations selected using 'Apply' then the 'Cancel' button is replaced by 'Finish'.

Note: The data selected by the Selection filter is grouped in the export set first as complete strings and then as individual points related to their loaded order. To export the observations in the order they were located use 'Individual observations' from the previous dialog.
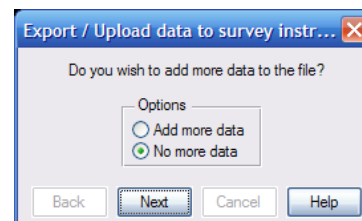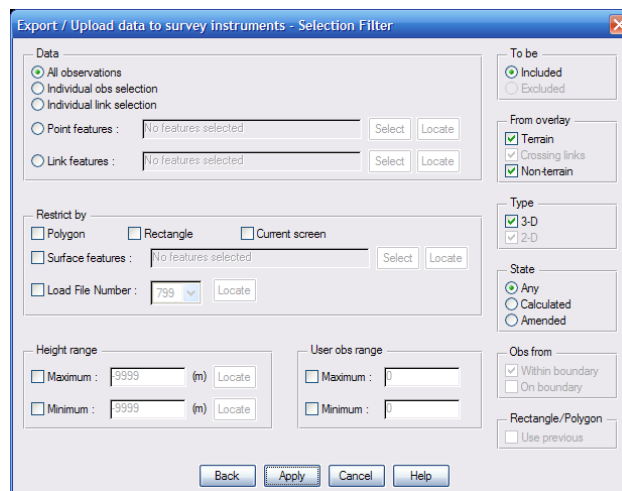
There is the possibility of repeating several selection criteria / method to the same data set. If required click 'Add more data' and then choose to add more observations/stations. When 'No more data' is chosen see below for the data transfer.
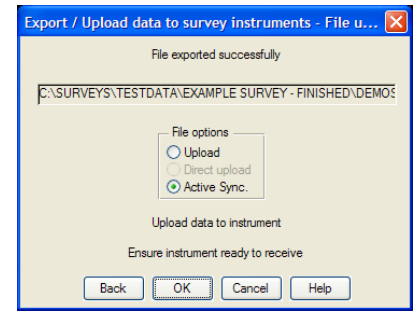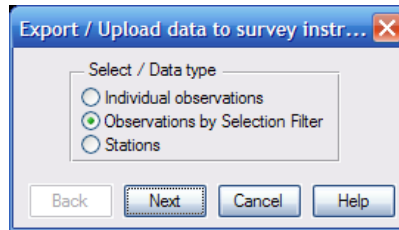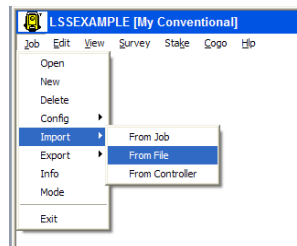
Select 'Active Sync' and click 'OK'.

Active Sync via LSS will now automatically select the last accessed folder (if uploading for the first time to this logger then browse to the 'Topsurv\IEFiles' folder on the TopSURV logger).
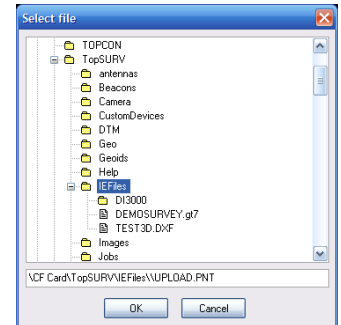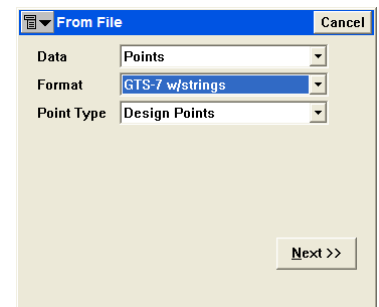
Click 'OK' to transfer the data file.

4.1.2 TopSURV

If required select Job New (as procedure described above).

Select 'Import / From File / Points / GTS7 w/strings / Design points'...

Select the uploaded data file
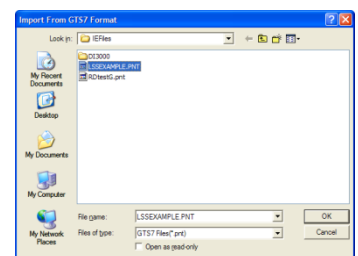
Select the Coordinate System and Finish...
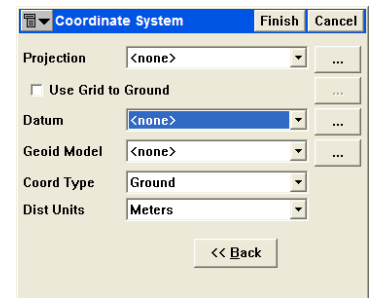
TopSURV will now attempt to bring the data file into the job.

Please refer to the TopSURV documentation for the Stakeout procedure.

4.2 Export a Code Library to TopSURV

An LSS legend can be exported to TopSURV as a new code library using the option 'Export / Upload code list to survey instruments'.

Note: This option is only needed once you have built an alternative LSS legend to the prototype supplied at LSS install. If you are using the LSS prototype legend then the equivalent TopSURV Global code library has already been created and is supplied on the LSS media (see above).

Open a survey containing the prototype legend to be exported as a code library.

Select ' Export/Code list to survey instruments/Topcon TopSurv XML code library
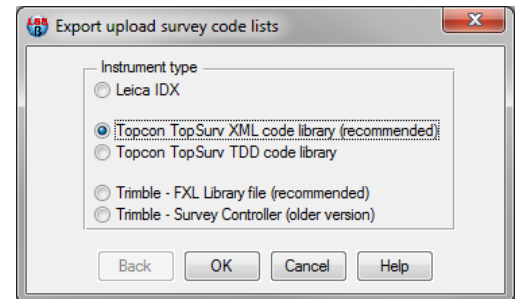
Provide the feature code library name.

'Select' the required point features.

Note: with dimension features e.g. the trees PT1, PT2 etc, LSS requires that the legend also contains the stub such as PT. Although LSS will still produce only one feature PT with a dimension attribute the PT legend feature will aid the processing.
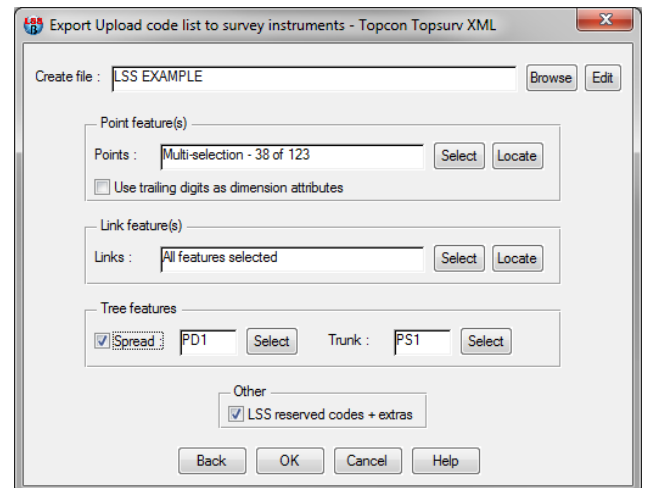
'Select' the required link features.

Tick the 'Spread' option to allow the special Tree feature code that has several attributes. The LSS prototype uses PD1 and PS1 as the spread and the trunk respectively.

Leave the 'Extra LSS codes' box ticked to include all the Reserved codes etc.

Click 'OK'.

Once the file has been created, either copy the XML file onto a memory stick, or upload it via Active Sync onto the instrument and follow the same procedure as above to Configure the Global code library.

Note: Certain early versions of Topsurv v8 will not handle the minus character "-" in the code input field. We have been informed that this bug has been corrected and therefore your TopSurv firmware may need to be updated.
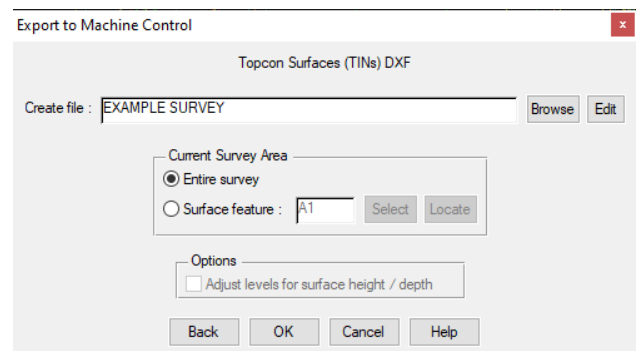
4.3 Export to Machine Control

Provides onboard determination of the height difference to the model calculated from the current survey position

Select DTM file format (as shown) from the Export to Onboard Instrument DTM option.
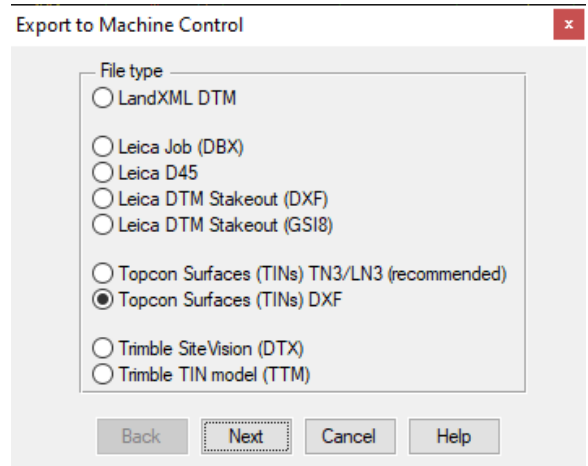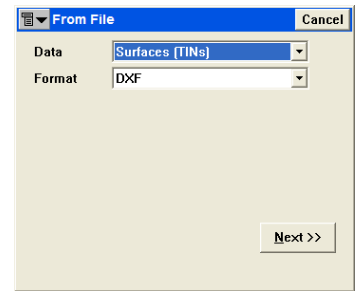
This option produces a DXF file which can be copied directly to the 'Topsurv\IEFiles' folder on the TopSURV logger via Active Sync.
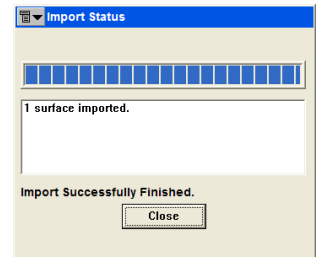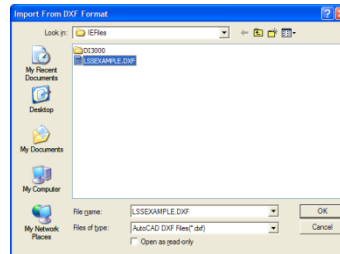
4.4 Import DTM data to TopSURV

Create a job as described above.

Then 'Job / Import / From file / Surface (TINs) / DXF' and click Next.
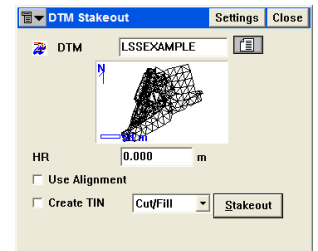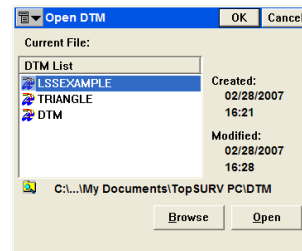
Select the exported DXF file and click OK.

Click Close when the import has completed.

Select 'Stake / DTM' once a setup with backsight has been established.

Open the exported DTM and then click Stakeout.

See Topcon documentation for further stakeout information.

4.5 Export/Upload Stations from LSS to TopSURV

From the main menu, select 'Export / Survey Instruments – Survey Data ' as above.

Note: the stations can be exported within the same file as the survey data but if done separately then they can be imported as Control points into TopSURV.

The only difference required to exporting the survey data is to select Stations which will export all the stations in the current LSS survey.
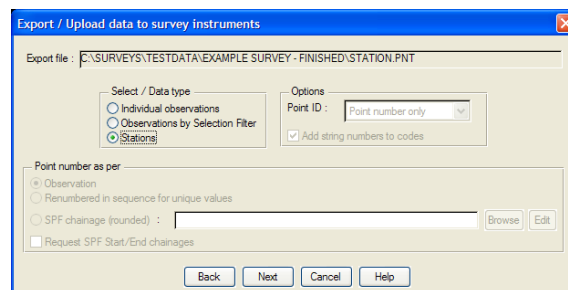
Within the relevant Job in TopSURV select 'Import / From File / Points / GTS7 w/strings / Control points'

Note: the stations are held within the same data format as the survey data and the only required difference between the two is to select Point Type as Control Points.
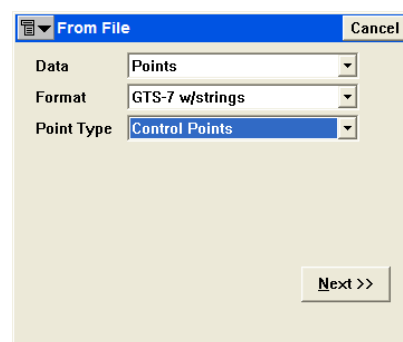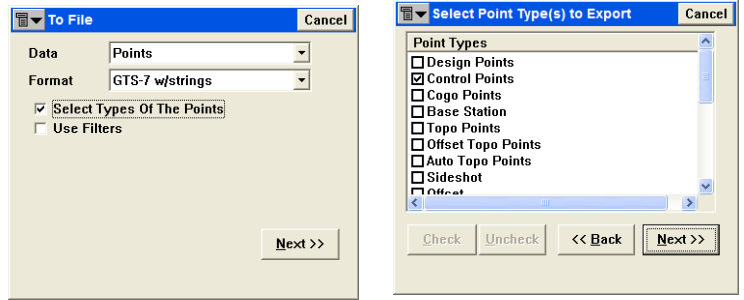
Note: the stations are shown as triangles because of the feature code '-ST' in the LSS code library.

Instrument Manual - Interface to Topcon TopSURV

4.6 Export Stations from TopSURV to LSS

Select 'Export / To file / Points / GTS-7 w/strings' and tick the box 'Select Types of the Points' and click Next.

Set 'Control Points' only and click Next

Follow the usual dialogs to create the file.

Within the LSS 'Input / Download and convert' option choose 'Coordinates' rather that 'Radials'

Note: For this to operate the stations must be set to Control points and the code to '-ST', which would be normally done during the definition of the station coordinates.

Conclusion

Using this manual, we hope that you will be in a position to start making the most of the survey instrument.

We strive to cover and support as much of the capabilities as possible but there are always new methods and developments, so do keep in contact by visiting the LSS Help and other on-line resources or call our support line.

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December 2019