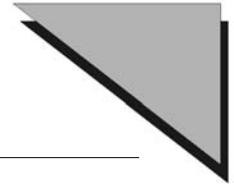

Bentley[®] MX 2004 Edition



MX Command Language Reference

DAA035540-Q/0001



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Introduction

The MX command language is called Linemode. Using Linemode, you can perform all of the functions on a model that you can through the user interface. The commands can be typed in and actioned immediately, grouped together and actioned, or saved in an input file for processing later.

Major options perform operations on models, files and drawings. They also define the models to be operated on by subsequent minor options.

Minor options are numeric and perform operations on strings and points.

Command macros consist of a combination of major and/or minor options, with values assigned to variables at run time.

- ✎ Major and minor options can also be combined in an input file for processing by major option INPUT.

Intended audience

The Command Language Reference is not intended for a novice but for an experienced user of MX.

Conventions

Command structure

The overall structure of minor options within major options is as follows:

```
MAJOR,MODEL 1,MODEL 2
minor,field 1,field 2, .....field 10
minor,field 1,field 2, .....field 10
minor,field 1,field 2, .....field 10
999
```

```
MAJOR, MODEL 1
minor,field 1,field 2, .....field 10
minor,field 1,field 2, .....field 10
minor,field 1,field 2, .....field 10
999
```

Major options

The format of a line of data using a major option in linemode is:

```
MAJOR,MODEL 1,MODEL 2
```

MAJOR is the name of the function to be applied; for example, REPORT. MX will access data from MODEL 1 and MODEL 2.

In some cases a third model may be required and if so a second major option line is specified. For example:

```
MAJOR,MODEL 1,MODEL 2
MAJOR,MODEL 3
```

- ✎ Major option names may be abbreviated to four characters.



Minor options

Minor option data consists of the minor option number followed by up to ten other fields of data:

`minor,field 1,field 2,.....field 10.`

Minor is always a three-digit number.
Fields 1, 2 and 3 are each four alphanumeric characters.
Fields 4 to 10 are numeric data values.

Each of the fields are specific to the option being invoked though there is a regular pattern throughout the system.

- ☞ Where a field is not used, ie it remains blank, it is excluded from the documentation.
- ☞ No line can exceed 80 characters, and continuation lines are not provided
- ☞ If too many characters are specified for a given field the correct number of characters is taken, starting from the leftmost. For example:

`100,MASTER,,ICL1,,0,, -2,100`

would result in:

`100,MAST,,ICL1,,0,, -2,100`

Free format

In free format each line of data consists of a continuous string of characters, with the data for each field separated by commas from the next field. A blank field, therefore, is represented by two consecutive commas. You don't need to type any commas for fields following the last non blank field.

`DESIGN,ROAD MODEL
100,MAST,,ICL1,,0.0,-2.0,100.0`

Field number format

In field number format, data is assigned to a specific field. You do this by typing in sequence:

the field number - an '=' character - and the data value.

For example:

`567,MAST,10=1.0`

This will place a value of 1.0 in field 10.

The following lines all input identical data in linemode:

`009,X001,,BDRY,,,5.0,,,20.0
009,1=X001,,BDRY,6=5.0,9=20.0
009,6=5.0,9=20.0,1=X001,3=BDRY`

Notation

	If data is mandatory the field number is suffixed by an asterisk. For example:
Field 3*	String name
	Characters written in CAPITALS are the actual characters to be coded. For example:
Field 2	OUT if area is within boundary 1 and outside boundary 2. IN if area is within boundary 1 and inside boundary 2.

Standard Point Reference Data (SPRD)

SPRD is the data coded when specifying a point on a string. The point can either be an actual point within a string (an exact point) or another location in the model (non-exact point).

Point sequence number

A point sequence number is the sequence number of the point from the beginning of the string as stored. The sequence number can be determined from the output of the REPORT option or the point sequence numbers may be drawn using major option DRAW. Note that if a point is deleted from a string all the subsequent points are renumbered immediately.

Point sequence numbers are specified in Field 6 (start point) or Field 9 (end point) of a minor option.

XY coordinates

Exact X and Y coordinates may be specified (found to within the location tolerance). If a non-exact point is specified, the associated point is found by dropping a normal from the point on to the curve-fit string.

The X and Y coordinates are specified in Fields 5 and 6 (start point) or Fields 8 and 9 (end point) of a minor option.

Chainage

For a master string, it is possible to define a point on a string by chainage. An exact chainage point is found to within the location tolerance. If a non-exact chainage is specified the associated point is determined on the curve fit string.

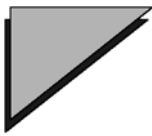
The chainages are specified in Field 5 (start point) and Field 8 (end point) of a minor option.

Specifying SPRD

Fields 5 and 6 are used to specify a start point.

Fields 8 and 9 are used to specify an end point.

The data coded in the fields depends upon the type of SPRD to be specified:



Introduction

<i>SPRD type</i>	<i>Field(s) for start</i>	<i>Field(s) for end</i>
Coordinates	5 and 6	8 and 9
Chainage	5	8
Point sequence number	6	9
First point	Blank	
Last point		Blank

- ✎ If field 6 or field 9 is coded as -1 then the end point of the string is taken.
- ✎ If field 6 or field 9 is coded as -2 then the penultimate point of the string is taken (major option DRAW, geometry strings only).
- ✎ The end point may be defined by a different method to the start point but must not be the same point.

Command macros

If you frequently apply the same sequence of minor options but with varying data, before you start a particular job you can group options into macros. To invoke this set of data, use minor option 900, then type the name of the macro followed by the data values you wish to apply. MX then executes the group of options in sequence, inserting the current data into the data fields as appropriate.

Long Filenames

Long filenames can now be used for the following major options:

ASSIGN

OVERWRITE

INPUT

OUTPUT

NEWDPF


DRAW (Stylesets 850/001)

Up to 256 characters can be used for the path, filename and extension.
Space characters can be used in the filename.

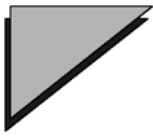
Global Options

000 Add log comments

Option	000 (or blank)
Fields 1-10	Alphanumeric text

 Comment lines may not be used within major options HCUSP and VCUSP.

 Comment lines may appear outside major options.

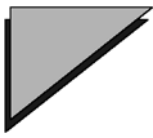


001 Provide supplementary information

For details, refer to the description of the minor option with which 001 is being used.

003 Define the order of items


For details, refer to the description of the minor option with which 003 is being used.

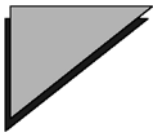


017 Define system parameters

Option	017
Field 1	First system parameter
	Curve fitting status:
CURV	switch on curve fitting (default)
NOCU	switch off curve fitting
	Input coordinate notation:
XY	coordinates input as (X,Y)
YX	coordinates input as (Y,X)
DANE	Danish convention (for both input and output)
CZ01	Czech coordinates, first convention (for both input and output)
CZ02	Czech coordinates, second convention (for both input and output)
	English/French design:
EDES	English design
FDES	French design
	Triangle error echo:
ECHO	output coordinates of points added to a triangulation.
NOEC	cancel ECHO code.
	Triangle FLAT/NOFL:
FLAT	allows flat triangles.
NOFL	cancel FLAT code.
	Vertical/normal/slope offsets:
VOFF	use vertical offset from horizontal offset
NOFF	use normal offset from horizontal offset
SOFF	use normal offset from slope offset
	Angular input:
DMS	Degrees minutes and seconds - sexagesimal
DEGR	Degrees and decimal degrees - centesimal
GRAD	Grads
RADI	Radians

	NORM	Mixture of sexagesimal and centesimal
	QUAD	Quadrant bearings.
	Vertical Tangent Points	
	NOTP	disables the addition of Vertical Tangent Points into the master alignment string when using VALGN/VERAT.
Field 2	Second system parameter	
	French road type:	
	AR	Autoroute (motorway)
	AR2	ICTAAL2000 Autoroute
	RP	Route principale (major road)
	UR	Route urbaine (urban road)
	Output coordinate notation:	
	XY, YX, DANE, CZ01, CZ02. See input coordinate for details.	
	Angular output:	
	DMS, DEGR, GRAD, RADI, NORM, QUAD as above.	
Field 3	Survey station string name default PSSA	
Field 4	Secondary interpolation tolerance:	
	Supply 0.0 to switch off secondary interpolation. Default is 20.0 model units.	
Field 5	Point search tolerance:	
	Default is 0.01 Minimum is 0.001	
Field 7	Maximum section offset to left of reference string:	
	Default is -100.0 model units.	
Field 8	Bearing of baseline for automatic sections:	
	If NORM is the angular input give the value in centesimal	
Field 9	Secondary interpolation offset:	
	Default is the secondary interpolation tolerance	
Field 10	Maximum section offset to right of reference string:	
	Default is 100.0 model units.	


 017 changes the set values only until the end of the current MX session. To permanently modify the default values you need to set the new values in your project settings.

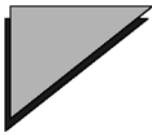


018 Define linear units

Option	018
Field 1	MET - Model units interpreted as metres IMP - Model units interpreted as feet

019 Define string masking

Option	019
Field 1	Name mask OR Sub reference mask if field 4 = +/-5.0 OR Section set initial character if field 4 = +7.0
Field 2	Sub reference mask if field 4 = +/-6.0 (field 1 must be a name mask in this case) OR Cut string partial string name if field 4 = +7.0
	 Both fields 1 and 2 can consist of up to 4 alphanumeric, blank or special characters.
Field 4	+1.0 inclusive string name mask -1.0 exclusive string name mask +5.0 inclusive sub reference mask -5.0 exclusive sub reference mask +6.0 inclusive combination mask -6.0 exclusive combination mask
<i>Major option TRIANGLE</i>	
Field 4	+2.0 inclusive and interpret as P string +3.0 inclusive and interpret as linked string
<i>Major option SURFACE</i>	
Field 4	+4.0 mask of strings which are to cause bearing discontinuities -4.0 mask of strings which are not to cause bearing discontinuities
<i>Major option DRAW</i>	
Field 4	+7.0 mask to display only those sections in a section set which are cut by a string or strings.
	Note that this mask is available in DRAW minor options 805, 806, 810, 846 and 861 only.



900 Invoke a macro option

If you frequently apply the same sequence of minor options but with varying data, before you start a particular job you can group options into macro-options (or 'macros' for short). You invoke this set of data by typing 900 and the name of the macro, followed by the data values you wish to apply. MX then executes the group of options in sequence, inserting the current data into the data fields as appropriate. This eliminates time consuming and error prone typing.

Option 900

Record 1

Fields 1 & 2 Name of command macro (8 characters maximum)

Record 2

Values to be assigned to variables within the macro. These are coded:

'name = value'

For example, A = 3.0


999 End a major option

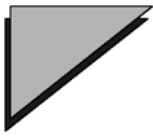
Used to mark the end of input data to a major option.

Option

999

There is no associated field data.

 Option 999 should not be used with major options that have no associated minor option data.



Major option **3DDXF**

Model 1

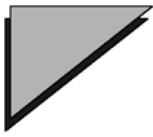
Name of DXF file to be created.

This is followed by an 001 record specifying the name of the model to be converted. For example:

```
3DDXF,mydesign.dxf  
001,mydesign
```


451 Transfer strings to DXF


Minor option	451
Field 1	String name or partial string name, or blank
Field 2	LINE to interpret strings as polylines SPOT to interpret strings as discrete points blank to interpret P strings as points, all others as lines.
Field 3	SING to interpret each string to a separate layer MULT to interpret all strings to a layer (default)
Field 5 & 6	SPRD start
Field 8 & 9	SPRD end



453 Transfer triangulation to DXF

Minor option	453
Field 1*	Triangulation name
Field 2	Group code. If blank the whole triangulation is transferred.

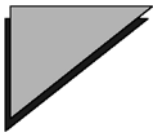
 If field 2 is coded each triangle group creates a DXF layer with the same name.

 If field 2 is left blank the DXF layer is given the name of the triangulation.

Major option ALIAS

Model 1	Name of model to be given an alias.
Model 2	Single letter to be used as alias Both model name positions are used but the second is simply for the alias letter or digit.

- 🔗 Up to 20 aliases may be assigned in any one session.
- 🔗 Any alias may be reassigned during the session.
- 🔗 The alias is only remembered for the duration of the current MX session.
- 🔗 If neither model name nor alias is typed, all the current aliases are reported.



ARCHIVE

Major option **ARCHIVE**



Minor option

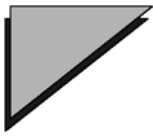
001

Fields 1-6

Name of model to be archived (up to 28 characters).

Major option AREA

Model 1	Reference or triangulation model. For option 045 this must be a triangulation model type TRIA.
Model 2	Model containing boundary or section strings.  For options 046, 047 and 048 this must be a sections model.  For option 040 and 042 the boundary strings may be in model 1 or model 2.
Major option	AREA
Model 3	Model to store area string (option 048 only)




AREA

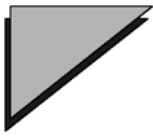
040 Within a boundary string

Minor option	040
Field 3*	Boundary string
Field 4	Multiplying factor to be applied to the resultant area to produce a crude volume. (default 1).

041 Between two strings


Minor option	041
Field 1*	Reference string name.
Field 2*	Name of string 1.
Field 3*	Name of string 2.
Field 4	Multiplying factor to be applied to the resultant area to produce a crude volume. (default 1).
Field 5 & 6	SPRD for start point on reference string.
Field 8 & 9	SPRD for end point on reference string.

 The strings must not cross one another or loop back on themselves.



042 Two intersecting boundaries

Minor option	042
Field 1*	Boundary string 1
Field 2	OUT if area is inside boundary 1 and outside boundary 2. IN if area is inside boundary 1 and inside boundary 2.
Field 3*	Boundary string 2
Field 4	Multiplying factor to be applied to the resultant area to produce a crude volume (default 1).

 The two boundary strings must be in the same model.


043 Slope area between two strings


Minor option	043
Field 1*	Reference string name.
Field 2*	Name of string 1.
Field 3*	Name of string 2.
Field 4	Multiplying factor to be applied to the resultant area to produce a crude volume. (default 1).
Field 5 & 6	SPRD for start point on reference string.
Field 8 & 9	SPRD for end point on reference string.




045 Triangulation area

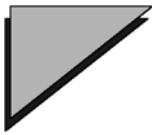
Minor option	045
Field 1	Group code. If this is specified, only the area of the associated triangle group is calculated.
Field 2*	Triangulation string.
Field 3	Boundary string.

 Field 3 can only be used if model 2 has been coded.

 Where both model 1 and model 2 have been coded, the search for the boundary string will take place in model 2 first and then in model 1.

046, 047, 048 Section based area

Minor option	046
Field 1*	Reference string name
Field 2*	Name of string 1
Field 3*	Name of string 2
Field 5 & 6	SPRD for start
Field 8 & 9	SPRD for end
Minor option	047
Field 1	SLOP or PLAN (default SLOP)
Field 2	Section set 1 prefix character.
Field 3*	Section set 2 prefix character.
	This section set is the prominent section set, ie, the section set which has sectioned through the subsidiary strings coded in minor option 046. The prominent section set determines the surface along which the slope areas are measured.
Field 7	Minimum gradient limit This determines the gradient above which areas are calculated.
Field 10	Maximum gradient limit This determines the gradient below which areas are calculated. Minimum and maximum gradient limits should be used to avoid unwanted areas being included in the calculation. For example, vertical structures such as kerb edges and retaining walls can be excluded by specifying gradient limits.
	 This option must be preceded by minor option 046.
Minor option	048
Field 3*	Name of the area string to be created.



Major option ASSIGN

Model 1 Name of file to be assigned. If blank, then the GENIO channel is closed depending on the second model name.

Model 2 Identifier for channel to be assigned.

GENIO assign the GENIO channel

ARCH assign the ARCHIVE channel

RETR assign the RETRIEVE channel


🔗 Long filenames may be used with this option. Long filenames allow a total of 256 characters to be used for the path, the filename and the extension, and the filename can include space characters. If you do not specify a path, the project directory is used by default.

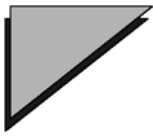
🔗 If you don't give a file extension, MX adds '.txt' automatically. For example, ASSIGN, new would create the file new.txt.

Major option AUTODRAW

1 or ON - switch automatic drawing on

0 or OFF - switch automatic drawing off (default)

 In MX, AUTODRAW is ON by default, but OFF in input files. It is your responsibility to make sure that if you turn it off, you turn it back on again.



COMPRESS

Major option **COMPRESS**

Model 1	File to be compressed
MODELFILE	Compress the model file
DPF	Compress the current drawing file.

Major option COPY


Model 1

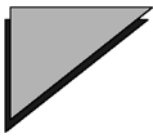
COPY takes string data from model 1 and stores it in model 2.

Model 2

If a boundary string is being referenced, the program will look for it first in model 2 and, if unsuccessful, in model 1.

The global options available are 000, 017, 018, 019, 900 and 999.

 You can restrict the model content being analysed by applying minor option 019.



059 Transformations

Scaling transformation

Option	059
Field 1	SCAL
Field 4	1 = X Dimension to be scaled (optional) 2 = Y or 3 = Z etc.
Field 5	SCALEX Scaling factor for X values or SCALE Scaling factor of field 4 dimension
Field 6	SCALEY Scaling factor for Y values
Field 7	SCALEZ Scaling factor for Z values
Field 8	XDISP X displacement or DISP Displacement of field 4 dimension
Field 9	YDISP Y displacement
Field 10	ZDISP Z displacement

Assuming Field 4 is left blank then the transformation applied is:

```
XNEW = SCALEX * XOLD + XDISP  
YNEW = SCALEY * YOLD + YDISP  
ZNEW = SCALEZ * ZOLD + ZDISP
```

If field 4 is coded then fields 5 and 8 define the transformation to be applied to the appropriate dimension

```
NEWVALUE = SCALE * OLDVALUE + DISP
```

- 🔗 Multiple SCAL options may be coded for complex transformations.
- 🔗 The SCAL option can be combined with ROTA and MIRR options.
- 🔗 All strings above three dimensions can only have a scaling factor applied if the X and Y scaling factors are identical
- 🔗 SCALEX and SCALEY must be greater than zero.
- 🔗 Care should be taken to ensure meaningful results when dimensions other than X, Y and Z are individually scaled or displaced.
- 🔗 To copy a model and set all Z values to -999.999 (or NULL), set Field 10 to -10,000.

Rotation transformation

Option	059
Field 1	ROTA
Field 3	String name defining common point (optional)
Field 4	ANGLE Whole circle bearing of new Y axis from existing Y axis.
Field 5 & 6*	Coordinates of common point on old grid or SPRD of point on string in field 3 XCPOLD, YCPOLD
Field 8 & 9*	Coordinates of common point on new grid XCPNEW, YCPNEW

🔗 Multiple ROTA options may be coded for complex transformations.

🔗 The ROTA option can be combined with SCAL and MIRR options
Values of the common point (XCPOLD, YCPOLD, XCPNEW, YCPNEW) and ANGLE are substituted in the following equation to determine the displacement (XDISP, YDISP) between the original and new origin values.

$$\begin{aligned} XDISP &= XCPNEW - XCPOLD * \cos(\text{ANGLE}) + YCPOLD * \sin(\text{ANGLE}) \\ YDISP &= YCPNEW - XCPOLD * \sin(\text{ANGLE}) - YCPOLD * \cos(\text{ANGLE}) \end{aligned}$$

The transformation applied is now given by:

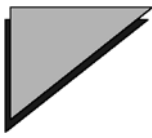
$$\begin{aligned} XNEW &= XOLD * \cos(\text{ANGLE}) - YOLD * \sin(\text{ANGLE}) + XDISP \\ YNEW &= XOLD * \sin(\text{ANGLE}) + YOLD * \cos(\text{ANGLE}) + YDISP \end{aligned}$$

Helmert transformation

Option	059
Field 1	HELM
Field 3	String name defining common point (optional)
Field 4	Tolerance in residual coordinate errors, dx and dy, for the transformed position of the control points – Only needed on first 059 record – Default value = 1.0 (model units)
Field 5 & 6*	Coordinates of common point on old grid or SPRD of point on string in field 3
Field 8 & 9*	Coordinates of common point on new grid.

🔗 A minimum of two and a maximum of ten 059 options are needed to provide the necessary control point information.

🔗 The HELM option cannot be combined with other options.

**Tilt transformation**

Option	059
Field 1	TILT
Field 3	String name defining reference point (optional)
Field 5 & 6*	Coordinates of reference point on old grid or SPRD of point on string in field 3
Field 7	New level (optional)
Field 10	Level difference (optional).

☞ Exactly three 059 options are needed to provide the necessary control point information.

☞ The TILT option cannot be combined with other options

☞ Either Field 7 or Field 10, but not both, must be coded.

☞ 2D contour strings are converted to 3D strings.

☞ TILT is only a vertical transformation and no change is made to X and Y coordinates.

☞ Ensure correct selection of model before applying TILT. For example if applied to a highway design, design criteria will be invalidated.

Mirror transformation

Option	059
Field 1*	MIRR
Field 2	Reference string 1 name This defines the string through which the axis of reflection is to pass.
Field 3	Reference string 2 name If the axis of reflection is not an X or Y axis, this defines the second string through which the axis is to pass.
Field 4	Axis of reflection 1 X axis (default) 2 Y axis 3 user defined axis
Field 5 & 6*	SPRD of point on reference string 1 through which the axis is to pass.

Field 8 & 9 If no reference string is specified in Field 2, any coordinate position may be specified.

SPRD of point on reference string 2 through which the axis is to pass.

If no reference string is specified in Field 3, any coordinate position may be specified.

☞ The MIRR option can be combined with SCAL and ROTA options

Cancel existing transformations

Option 059

All fields must be left blank

☞ Scaling, rotation and mirror transformations can be combined (up to a maximum of 100).

☞ Transformations will be applied in the order in which they are presented to COPY.

☞ All strings above three dimensions can only have a scaling factor applied if the X and Y scaling factors are identical.

☞ Null levels and radii of infinity are unaffected by transformation.

☞ Cadastre strings - the X, Y, and Z coordinates of cadastre strings subject to rotation, translation, scaling or tilt will be changed. The symbol reference bearing of a cadastre string subject to rotation will be changed only if the string sub reference is NORT. Mirror transformation of cadastre strings is not permitted.



060 Copy strings

Option	060
Field 1	Name or partial name of string to be copied (if left blank all strings are copied)
Field 2	IN/OUT indicator Leave blank to copy inside the boundary Type OUT to copy outside the boundary
Field 3	Boundary string name

☞ If you type a string name or a partial name, any selection masks will be ignored.

☞ No curve fitting is applied in finding intersections with boundaries.

☞ P strings and text strings (*) are not interpolated at boundaries.

☞ Cadastre strings - where a boundary is specified only the points included by the IN/OUT definition will be copied.

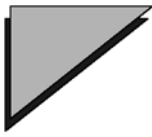
☞ Where the receiving model has strings with the same name as the new strings, the new strings are automatically renamed.

☞ Cadastre strings - the X, Y, and Z coordinates of cadastre strings subject to rotation, translation, scaling or tilt will be changed. The symbol reference bearing of a cadastre string subject to rotation will be changed only if the string sub reference is NORT. MIRROR transformation of cadastre strings is not permitted.

061 Move strings


Option	061
Field 1	Name or partial name of string to be copied (if left blank all strings are copied)


- ✎ If you type a string name or a partial string name, any selection masks will be ignored.
- ✎ Cadastre strings - the X, Y, and Z coordinates of cadastre strings subject to rotation, translation, scaling or tilt will be changed. The symbol reference bearing of a cadastre string subject to rotation will be changed only if the string sub reference is NORT. Mirror transformation of cadastre strings is not permitted.
- ✎ Where the receiving model has strings with the same name as the new strings, the new strings are automatically renamed.




064 Copy strings with curve fitting


Option	064
Field 1	Name or partial name of string to be copied (if left blank all strings are copied)
Field 2	Curve fitting style
	MOSS invokes MX curve fitting and this is the default.
	SPLI invokes SPLINE curve fitting
Field 4	Chord-to-arc tolerance. The default chord-to-arc tolerance is defined by the project settings.

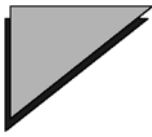
 This option does not select within or outside a boundary, nor apply a transformation. Use option 059/060/061 first.

 For all curve fit strings the third dimension of inserted points is always linearly interpolated.

 The generated string will be produced independently of any other strings in the model. Consequently if two adjacent strings are nearly parallel without curve fitting, their curve fit representations may not necessarily appear parallel and they may in fact intersect. This may occur if you curve fit contours to achieve smoother strings.

065 Move strings with curve fitting

Option	065
Field 1	Name or partial name of string to be copied (if left blank all strings are copied)
Field 2	Curve fitting style
	MOSS invokes MOSS curve fitting and this is the default.
	SPLI invokes SPLINE curve fitting
Field 4	Chord-to-arc tolerance. The default chord-to-arc tolerance is defined in the project settings.
	 This option does not select within or outside a boundary, nor apply a transformation. Use option 059/060/061 first.




066 Copy triangulation

Option 066

Field 1 Leave blank to copy all triangulations in the model.

To copy individual strings, use the full string name.

To copy groups of strings, use a partial name.

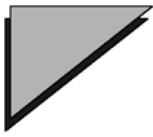
 Triangulations can be copied only to existing triangulation models (for example, those with a TRIA suffix in the name), or blank models.

Major option **CREATE**

Model 1

Name of model to be created.

- ⚠ Only one model can be created with any one **CREATE**.
- ⚠ The model name may be up to 28 characters long.
- ⚠ The model name must not exist beforehand. Hence you cannot recreate a model; you must delete the model first using major option **DELETE**.



DELETE

Major option **DELETE**

Model 1

Name of model to be deleted.

- ⚠ Only one model may be deleted with any one **DELETE** command
- ⚠ If a model has been protected by applying major option **SECURE**, you will be unable to delete it until you have removed the protection using major option **FREE**.

Major option DESIGN

Model 1	Model containing reference and subsidiary strings.
Model 2	Model to contain the new or amending string if different from the first model name, otherwise blank.

 A second model cannot be specified for minor options 104 to 108.

Global options 000, 017, 018, 019, 900, and 999 may be used with DESIGN.

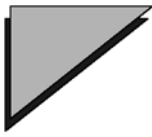


099 Invoke the simplified design process

Minor option	099
Field 1*	Reference string.
Field 2	Subsidiary string (optional)
Field 3*	New, extended or amended string.
Field 5 & 6	SPRD of global start point. This point defines the lower extent of the range of the following options.
Field 8 & 9	SPRD of global end point.

100 Add string: constant H / constant C

Minor option	100
Field 1*	Reference string.
Field 2	Subsidiary string (optional)
Field 3*	New, extended or amended string.
Field 4	Crossfall to be applied with respect to the subsidiary string (reference string by default). If zero is coded the resultant level of the new string will be the same as the subsidiary string; if the field is left blank the levels will be set to -999.0
Field 5 & 6	SPRD start.
Field 7*	Constant horizontal offset to be applied.
Field 8 & 9	SPRD end.

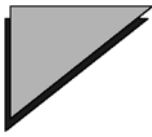


101 Add string: linear H / constant C

Minor option	101
Field 1*	Reference string.
Field 2	Subsidiary string (optional)
Field 3*	New, extended or amended string.
Field 4	Crossfall to be applied with respect to the subsidiary string (reference string by default). If zero is coded the resultant level of the new string will be the same as the subsidiary string; if the field is left blank the levels will be set to -999.0
Field 5 & 6	SPRD start.
Field 7*	Horizontal offset required at start point.
Field 8 & 9	SPRD end.
Field 10*	Horizontal offset required at end point.

102 Add string: reverse H / constant C

Minor option	102
Field 1*	Reference string.
Field 2	Subsidiary string (optional)
Field 3*	New, extended or amended string.
Field 4	Crossfall to be applied with respect to the subsidiary string (reference string by default). If zero is coded, the resultant level of the new string will be the same as the subsidiary string; if the field is left blank the levels will be set to -999.0
Field 5 & 6	SPRD start.
Field 7*	Horizontal offset required at start point.
Field 8 & 9	SPRD end.
Field 10*	Horizontal offset required at end point.




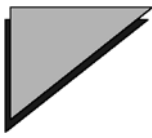
103 Add string: extend/contract crossfall

Minor option	103
Field 1*	Reference string.
Field 2*	Subsidiary string (blank if used with options 104 and 105)
Field 3*	New, extended or amended string.
Field 4	Vertical or normal offset. If zero is coded the resultant level of the new string will lie on the plane formed by the reference and subsidiary strings, if the field is blank the levels will be set to -999.0.
Field 5 & 6	SPRD start.
Field 7*	Horizontal or slope offset to be applied.
Field 8 & 9	SPRD end.

104 Horizontal extension of slope/offset

Minor option	103
Field 1*	Reference string.
Field 3*	New string.
Field 5 & 6	SPRD start.
Field 8 & 9	SPRD end.
Minor option	104
Field 2*	First string defining slope definition (S1.)
Field 3*	Second string defining slope definition (S2).
Field 4*	Vertical or normal offset to be applied (V). The offset is considered to be vertical or normal depending upon the setting specified by minor option 017, 'Define system parameters'.
Field 7*	Horizontal or slope offset to be applied (H) from S2.

 Slope is positive if it rises to the right (looking in direction of the string) and negative if it falls to the right.



105 Intersection of 2 slopes

Two minor option 105 records must follow an initial option 103.

Minor option	103
Field 1*	Reference string.
Field 3*	New string.
Field 5 & 6	SPRD start.
Field 8 & 9	SPRD end.

Definition of slope extension between two existing strings

Minor option	105
Field 2*	First string defining slope definition.
Field 3*	Second string defining slope definition.
Field 4	Vertical, normal or slope offset to be applied.

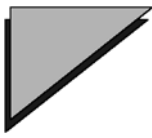
Definition of slope by explicit definition

Minor option	105
Field 2*	String to which slope is related.
Field 4	Vertical, normal or slope offset to be applied. The offset is measured from the second string defining the slope definition. The offset is considered to be vertical, normal or slope depending upon the setting specified by minor option 017, 'Define system parameters'. The sign of the offset is positive if the offset is above the plane being considered and negative if it is below.
Field 7*	Slope to be applied at start of application.
Field 10	Slope to be applied at end of application. If left blank a constant slope as defined in field 7 is applied.

106 Hard shoulder design

Minor option 106 must be preceded by option 103.

Minor option	103
Field 1*	Reference string.
Field 3*	Hard shoulder string.
Field 5 & 6	SPRD start.
Field 8 & 9	SPRD end.
Minor option	106
Field 2*	First string defining carriageway slope.
Field 3*	Second string defining carriageway slope.
	Hard shoulder offsets are measured from this string.
Field 4	Outer curve hard shoulder crossfall (default value -0.015). This crossfall is applied when the carriageway crossfall $C_f > 4.0\%$.
Field 5	Standard hard shoulder crossfall (default value -0.040). This crossfall is applied when the carriageway crossfall, C_f , is within the range $-4.0\% \leq C_f \leq +4.0\%$.
Field 7	Horizontal offset at start point (default value 0).
Field 8	Crossfall changeover length (default value 0). If a changeover length is specified, additional points are inserted into the hard shoulder string at the start and end of the changeover.
Field 9	Changeover offset (default value 0). This is the distance between the start of the crossfall changeover and the point where the carriageway crossfall moves above $+4.0\%$.
Field 10	Horizontal offset at end point (default value = Field 7).



107/108 Subgrade design

Minor option	107
Field 1*	Upper surface centre line string
Field 2*	Upper surface left channel string
Field 3*	Upper surface right channel string
Field 4	% gradient at which subgrade crossfall will change
Field 5 & 6	SPRD start
Field 8 & 9	SPRD end
Field 10 *	Road type indicator
	1 Single carriageway and dual carriageway with no central reservation
	2 Dual carriageway with central reservation
Minor option	108
Field 1 *	Lower surface centre line string
Field 2*	Lower surface left channel string
Field 3 *	Lower surface right channel string
Field 4 *	Vertical offset between upper and lower surfaces
Field 7 *	Horizontal offset of string in field 2
Field 10 *	Horizontal offset of string in field 3

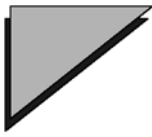
☞ Centre lines are always coded in field 1

☞ Left channel strings are always coded in field 2

☞ Right channel strings are always coded in field 3

110 Add string: constant H / constant V

Minor option	110
Field 1*	Reference string.
Field 2	Subsidiary string (optional)
Field 3*	New, extended or amended string.
Field 4	Vertical offset to be applied with respect to the subsidiary string (reference string by default). If zero is coded the resultant level of the new string will be the same as the subsidiary string, if the field is blank the levels will be set to -999.0.
Field 5 & 6	SPRD start.
Field 7*	Constant horizontal offset to be applied.
Field 8 & 9	SPRD end.

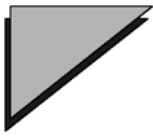


111 Add string: linear H/constant V

Minor option	111
Field 1*	Reference string.
Field 2	Subsidiary string (optional)
Field 3*	New, extended or amended string.
Field 4	Vertical offset to be applied with respect to the subsidiary string (reference string by default). If zero is coded, the resultant level of the new string will be the same as the subsidiary string, if the field is left blank the levels will be set to -999.0.
Field 5 & 6	SPRD start.
Field 7*	Horizontal offset required at start point.
Field 8 & 9	SPRD end.
Field 10	Horizontal offset required at end point.

112 Add string: reverse H/constant V

Minor option	112
Field 1*	Reference string.
Field 2	Subsidiary string (optional)
Field 3*	New, extended or amended string.
Field 4	Vertical offset to be applied with respect to the subsidiary string (reference string by default). If zero is coded the resultant level of the new string will be the same as the subsidiary string, if the field is left blank the levels will be set to -999.0.
Field 5 & 6	SPRD start.
Field 7*	Horizontal offset required at start point.
Field 8 & 9	SPRD end.
Field 10*	Horizontal offset required at end point.

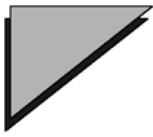


120 Amend levels: constant vertical offset

Minor option	120
Field 1*	Reference string.
Field 2	Subsidiary string (optional)
Field 3*	String to be amended.
Field 4	Datum level (optional).
Field 5 & 6	SPRD start.
Field 7*	Constant vertical offset to be applied.
Field 8 & 9	SPRD end.

121 Amend levels: linear vertical offset

Minor option	121
Field 1*	Reference string.
Field 2	Subsidiary string (optional)
Field 3*	String to be amended.
Field 4	Datum level (optional).
Field 5 & 6	SPRD start.
Field 7*	Vertical offset required at start point.
Field 8 & 9	SPRD end.
Field 10	Vertical offset required at end point.



122 Amend levels: symmetrical reverse curve offset

Minor option	122
Field 1*	Reference string.
Field 2	Subsidiary string (optional)
Field 3*	String to be amended.
Field 4	Datum level (optional).
Field 5 & 6	SPRD start.
Field 7*	Vertical offset required at start point.
Field 8 & 9	SPRD end.
Field 10*	Vertical offset required at end point.

123 Amend levels: spline curve offset

Minor option	123
Field 1*	Reference string.
Field 2	Subsidiary string (optional)
Field 3	String to be amended.
Field 5 & 6	SPRD start.
Field 8 & 9	SPRD end.



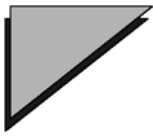
125 Amend levels: reverse circular curve offset

This option must be preceded by an option 122 on which the start and end vertical offsets are left blank.

Minor option	122
Field 1*	Reference string
Field 2	Subsidiary string (optional)
Field 3*	String to be amended.
Field 4	Datum level (optional)
Field 5 & 6	SPRD start
Field 8 & 9	SPRD end
Minor option	125
Field 5*	Length of first arc
Field 7*	Vertical offset to be applied at start
Field 8*	Length of second arc
Field 10*	Vertical offset to be applied at end

126 Amend levels: biquadratic reverse curve offset

Minor option	126
Field 1*	Reference string.
Field 2	Subsidiary string (optional)
Field 3*	String to be amended.
Field 4	Datum level (optional).
Field 5 & 6	SPRD start.
Field 7*	Vertical offset required at start point.
Field 8 & 9	SPRD end.
Field 10*	Vertical offset required at end point.

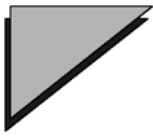


130 Amend levels: constant crossfall

Minor option	130
Field 1*	Reference string.
Field 2	Subsidiary string (optional)
Field 3*	String to be amended.
Field 5 & 6	SPRD start.
Field 7*	Constant crossfall to be applied
Field 8 & 9	SPRD end.

131 Amend levels: linear crossfall

Minor option	131
Field 1*	Reference string.
Field 2	Subsidiary string (optional)
Field 3*	String to be amended.
Field 5 & 6	SPRD start.
Field 7*	Crossfall required at start point
Field 8 & 9	SPRD end.
Field 10	Crossfall required at end.



132 Amend levels: cubic reverse curve crossfall

Minor option	132
Field 1*	Reference string.
Field 2	Subsidiary string (optional)
Field 3*	String to be amended.
Field 5 & 6	SPRD start.
Field 7	Crossfall required at start point.
Field 8 & 9	SPRD end.
Field 10*	Crossfall required at end.

133 Amend levels: superelevation

Minor option	133
Field 1*	Reference string.
Field 2	Subsidiary string (optional)
Field 3*	String to be amended.
Field 4*	Design speed (km/h) or V^2/K if the constant K is different from the default or if imperial units are being used.
Field 5 & 6	SPRD start.
Field 7	Minimum percentage crossfall - optional. This value is used to determine the superelevation if the absolute value of the calculated superelevation is less than this minimum amount. (1 in 40 = 0.025).
Field 8 & 9	SPRD end.
Field 10	Maximum percentage crossfall - optional This value is used to determine the superelevation if the absolute value of the calculated superelevation is greater than this maximum amount (1 in 14 = 0.07).



134 Amend levels: extend crossfall (2 strings)

Minor option	134
Field 1*	Reference string.
Field 2	Subsidiary string. If field 2 is coded the slope is calculated between the reference string and this string. If field 2 is left blank then a complementary option 104 must follow to define the strings dictating the slope.
Field 3*	String to be amended.
Field 5 & 6	SPRD start.
Field 8 & 9	SPRD end.
Minor option	104 (Only required if field 2 on option 134 is left blank.)
Field 2	First string defining slope (SUB1).
Field 3	Second string defining slope (SUB2).
Field 4	Vertical or normal offset to be applied.

135 Amend levels: reverse circular curve crossfall

This option must be preceded by an option 132 on which the start and end vertical crossfalls are left blank.

Minor option	132
Field 1*	Reference string
Field 2	Subsidiary string (optional)
Field 3*	String to be amended.
Field 5 & 6	SPRD start
Field 8 & 9	SPRD end
Minor option	135
Field 5	Length of first arc
Field 7	Vertical crossfall to be applied at start
Field 8	Length of second arc
Field 10	Vertical crossfall to be applied at end

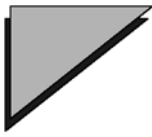


136 Amend levels: biquadratic reverse curve crossfall

Minor option	136
Field 1*	Reference string.
Field 2	Subsidiary string (optional)
Field 3*	String to be amended.
Field 5 & 6	SPRD start.
Field 7*	Crossfall required at start point.
Field 8 & 9	SPRD end.
Field 10	Crossfall required at end.

140 Create master string

Minor option	140
Field 3*	New string name - must start with M
Field 4*	Chainage interval
Field 5	Start chainage. If blank it is assumed to be the same as the chainage of the initial point.
Field 6	Chainage of initial point. If blank it is assumed to be zero. The following fields are only coded for option 141:
Field 7	Chord-to-arc tolerance. The default chord-to-arc tolerance is determined by the project settings.
Field 8 & 9*	X and Y coordinates of circle centre
Field 10*	Circle radius, positive for right hand or clockwise and negative, for left hand or anti-clockwise curve.

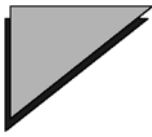


141 Create curved master string

Minor option	141
Field 1	String to define initial point using SPRD in fields 5 & 6
Field 2	String to define final point using SPRD in fields 8 & 9
Field 4	Level of string. If blank the level is set to -999.0
Field 5*	X coordinate of initial point, or bearing (centesimal) or SPRD if field 1 coded
Field 6*	Y coordinate of initial point, or SPRD if field 1 coded
Field 8*	X coordinate of end point, or bearing (centesimal) or SPRD if field 2 coded
Field 9*	Y coordinate of end point, or SPRD if field 2 coded
Field 10*	End chainage (optional)

142 Create straight master string

Minor option	142
Field 1	String to define initial point using SPRD in field 5 & 6
Field 2	String to define final point using SPRD in field 8 & 9
Field 4	Level of string. If blank the level is set to -999.0
Field 5	X coordinate of initial point, or SPRD if field 1 coded
Field 6	Y coordinate of initial point, or SPRD if field 1 coded
Field 8	X coordinate of end point, or bearing (centesimal) or SPRD if field 2 coded
Field 9	Y coordinate of end point, or SPRD if field 2 coded
Field 10	End chainage. Essential if bearing specified in field 8 otherwise optional. A final special case is catered for by the following combination on the 142 option:
Field 1	Reference string
Field 5 & 6	SPRD on reference string
Field 8*	Bearing adjustment clockwise relative to reference string (default-0) -centesimal
Field 10	End chainage



144 Chamfer corner


Minor option	144
Field 1*	Intersecting string 1
Field 2*	Intersecting string 2
Field 3*	New string name (must be a master string and begin 'M')
Field 4*	Distance of chamfer from intersection between string 1 and string 2 or length of chamfer string.
Field 5*	X coordinate to define quadrant in which chamfer is required.
Field 6*	Y coordinate to define quadrant in which chamfer is required.
Field 7	Chainage interval (default 10)
Field 10	0 = value in field 4 is length of chamfer string 1 = value in field 4 is distance from intersection.


🔗 Where the strings specified in fields 1 and 2 intersect more than once, care must be taken to ensure that the coordinates specified in fields 5 and 6 identify both the intersection and the quadrant in which the chamfer is to be created.

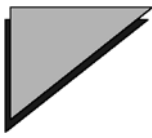
🔗 A new point will be added to Intersecting string 1 and Intersecting string 2 at the start and end of the new string, if one does not already exist. The levels on the new string will be calculated as a linear variation between these new or existing points.

145 Create circular master string

Minor option	145
Field 1*	First string name.
Field 2*	Second string name.
Field 3*	String to be created which must start with M. If this field is omitted, the option will be considered simply as a report option.
Field 4*	Radius of string to be created. For left hand curve code -ve radius.
Field 5*	Chainage interval.
Field 6	Chainage of initial point. This is the point at which the string is tangential to the string defined in field 1.
Field 7*	Offset of element centre from first string.
Field 8 & 9	Approximate coordinates of element centre (optional).
Field 10	Offset of element centre from second string. If omitted the value as coded in field 7 will be assumed. This will normally have the same absolute value as field 7 but depending on the direction of the string it may be of different sign.

 This option will create an additional point on each reference string to ensure that, should the model subsequently be triangulated and passed to a visualisation system for rendering, no anomalies exist in the triangulated surfaces. These points can be omitted by specifying a negative chainage in field 5.

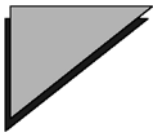
 Points are not added to 5D interface strings.



146/147 Create three centre curve

Minor option	146
Field 1*	First string name
Field 2*	Second string name
Field 3*	New master string name
Field 4*	Radius of arc 2
	The radius should be coded negative for a left hand arc and positive for a right hand arc.
Field 5*	Chainage interval along the new string
Field 6	Chainage of initial point (default 0).
	This is the point at which the new string is tangential to the first string.
Field 7*	Location of new string relative to the first string
	-1 New string is to the left.
	1 New string is to the right.
Field 8	Approximate X coordinate of the centre of arc 2
Field 9	Approximate Y coordinate of the centre of arc 2
Field 10*	Location of new string relative to the second string
	-1 New string is to the left.
	1 New string is to the right.
Minor option	147
Field 4	Radius of arc 1
	By default, the project settings ratio is used to calculate this radius from the radius of arc 2.
Field 5	Subtended angle of arc 1
	By default, the angle defined in the project settings is used.
Field 6	Length of arc 1
	If specified, this length overrides the subtended angle in Field 5.
Field 7	Radius of arc 3
	By default, the project settings ratio is used to calculate this radius from the radius of arc 2.
Field 8	Subtended angle of arc 3

Field 9 By default, the angle defined in the project settings is used.
Length of arc 3
If specified, this length overrides the subtended angle in Field 8.



152 Tilted plane

First command


Minor option	152
Field 1	Reference string.
Field 3*	String to be amended.
Field 5 & 6	SPRD start.
Field 8 & 9	SPRD end.

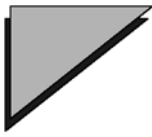
Second and third commands

Minor option	152
Field 5, 6 & 7*	First point on plane (third point on plane).
Field 8, 9 & 10*	Second point on plane.

160 Report displacements

Minor option	160
Field 1	Reference string, from which normal is erected. This string must be in the first DESIGN model specified.
Field 2	Subsidiary string, from which displacements are measured.
Field 3	String to be intersected by normal.
Field 5 & 6	SPRD for start point of reference string where normal is erected.
Field 7	Significance level for vertical displacement. Values used may be 50, 80, 90, 95, 98 or 99.
Field 8 & 9	SPRD for end point of reference string where normal is erected.
Field 10	Significance level for horizontal displacement.

 The significance levels in Fields 7 and 10 are only relevant for statistical analysis of the horizontal and vertical displacements. For further details, refer to 'Survey Accuracy Validation'.





350 Create SLD master string: String details

Minor option	350
Field 3*	New string name - must start with M
Field 4*	Chainage interval
Field 5	Start chainage (default =0)
Field 6	Chainage of initial point (default = 0)

The following fields are only coded for option 351:


Field 7	Tolerance for straight line fit (default value 0.1)
Field 8 & 9*	X and Y coordinates of circle centre
Field 10*	Circle radius, positive for a right hand (clockwise) curve, negative for a left hand (anti-clockwise) curve.


 Option 355 is used to create an offset string from a straight line design master string or a previously created offset string.

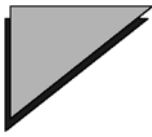
 Options 359 to 363 can be used to create an earthworks string from an offset string. See major option INTERFACE for further details.

351 Create SLD master string: First arc

Minor option	351
Field 1	String to define initial point using SPRD in Fields 5 & 6
Field 2	String to define final point using SPRD in Fields 8 & 9
Field 4	End chainage
Field 5 & 6*	Start SPRD or bearing (Field 5)
Field 7	Start level
Field 8 & 9*	End SPRD or bearing (Field 8)
Field 10	End level (default Field 7)


 If Fields 1 and 6 are blank, then Field 5 is the start bearing.


 If Fields 2 and 8 are blank, then Field 9 is the end bearing.



352 Create SLD master string: First straight


Minor option	352
Field 1	String to define initial point using SPRD in Fields 5 & 6
Field 2	String to define final point using SPRD in Fields 8 & 9
Field 4	End chainage
Field 5 & 6	Start SPRD
Field 7	Start level
Field 8 & 9	End SPRD or bearing (Field 8)
Field 10	End level (default Field 7)

 If Fields 1 and 6 are blank, then Field 5 is the start bearing.

 If Fields 2 and 8 are blank, then Field 9 is the end bearing.

353 Create SLD master string: Next arc

Minor option	353
Field 1*	Arc definition indicator
	1 Next two points with intermediate level
	2 Next point, hand and radius
	3 Centre, hand and length
	4 Deflection angle, next point and radius
	5 Bearing, radius and length
	6 Next point on diameter and hand
	7 Centre hand and next point
Field 2	Hand of arc
	1 Right hand
	-1 Left hand
Field 3*	Straight line design master string name
	This string must have been created with option 350.
Field 4	Length of arc (overrides end coordinates, if set)
Field 5 & 6	Intermediate SPRD or Centre or Bearing (Field 6)
Field 7	Intermediate level (if field 1 = 1) or radius
Field 8 & 9	End SPRD
Field 10	End level (default Field 7)

 Field 3 string name 'passed through' from first straight.



354 Create SLD master string: Next straight

Minor option	354
Field 1*	Straight definition indicator
	1 Next point
	2 Bearing of straight and length
	3 Deflection angle and length
Field 3*	Straight line design master string name
	This string must have been created with option 350.
Field 4	Length
Field 5 & 6	Next SPRD or bearing (field 6)
Field 7	End level (default previous element end level)

🔗 Field 3 string name 'passed through' from first straight.

🔗 Either Field 4, 5 or 6 must be coded.

355 Create SLD offset string

Minor option	355
Field 1	Reference string (in Model 1)
Field 2	Corner condition
	STRA Straight (default)
	CIRA Circular (with angular increment in field 4)
	CIRS Circular (with numerical sub-division in field 4)
	SPLA Splay
Field 3	New string name
Field 4	Angular increment (if Field 2 = CIRA)
	Numerical sub-division (if Field 2 = CIRS)
Field 5 & 6	Start SPRD (default first point on reference string)
Field 7	Start offset
Field 8 & 9	End SPRD (default end point on reference string)
Field 10	Crossfall or gradient indicator
	0 Same level as reference string
	<1 Crossfall
	>1 Gradient




Major option **DISPLAY**

1 or ON - update the display immediately

0 or OFF - update the display only when a DISPLAY or DISPLAY ON command is issued.

RESIZE - reset the extents of the display.


 DISPLAY,OFF clears the screen.

 DISPLAY, RESIZE can be useful if you have more than one model displayed, then hide or delete the larger model. By using this option, you can reset the extents to be those of the smaller model, so that *Zoom Extents* zooms to the correct size.

DRAW macros

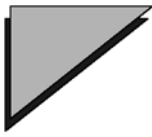
Macro PLANDRAW

Code	Description	Alternatives	Default
FD	First of a series of overlaid drawings, or if SL or SW are to be specified	”	-
OD	Subsequent overlaid drawing	”	-
TR	Truncation or no truncation (of page area)	TRUN NOTR	DF
SL	Page length	PV	DF
SW	Page width	PV	DF
FR	Draw a frame Do not draw a frame Put registration marks on single page Draw frame around apertures	FRAM NOFR REGR WIND	DF
ML	Left margin	PV	1.0
MB	Bottom margin	PV	1.0
MT	Top margin	PV	1.0
MR	Right margin	PV	1.0
PA	Paged or non-paged drawing	PAGE NOPA	DF

 If SL is assigned but not SW an A size page is specified.
If SW is assigned but not SL a B size page is specified

Drawing details

Code	Description	Alternatives	Default
SC	Scale	PV	-
XL	Relationship of model to drawing aperture. Coordinates of bottom left point and bearing of left hand side	PV	Minimum model coordinates: bearing zero
YL		PV	
BE		PV	
LC	String colour	CV	BLACK
TC	Text colour	CV	BLACK
GR	Grid with edge ticks Grid with crosses at intersections Full line grid Do not draw a grid	EDGE CROS FULL NOGR	CROS
XG	X spacing interval of grid	PV	100
YG	Y spacing interval of grid	PV	100



DRAW macros

Model details

Code	Description	Alternatives	Default
IO	Plot inside or outside a boundary	IN OUT	-
BD	Boundary string name if IO=IN or IO=OUT	CV	-
XB	Minimum model co-ordinate restricting region to be drawn	PV	0.0
YB		PV	0.0
XT	Maximum model coordinates restricting region to be drawn	PV	99999999.9
YT		PV	99999999.9
LB	Name of string to be drawn (if not coded, strings obeying any masks will be drawn).	CV	
LA	Annotate strings with name at start Annotate strings with name at both ends Do not annotate name Annotate contour strings with level at start Annotate contour strings with level at both ends	LABS LABL NOLA LEVS LEVB	DF
DE	Draw the information according to detail defined. Detail interpretation to all strings Contours with height embedded Pip marks at each point Cross and level at each point Spot level with decimal point marking position.	DETA CONP PIPS SPOT SPDP	-
PS	Pip size	PV	-
IN	Pip or chainage marking interval	PV	-

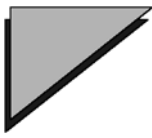
Macro PLANLINE

Drawing details

Code	Description	Alternatives	Default
LC	Line and string colour	CV	BLACK
TC	Text colour	CV	BLACK
FR	Draw a frame Do not draw a frame Put registration marks on page edge Draw frame around apertures	FRAM NOFR REGR WIND	DF

Model details

Code	Description	Alternatives	Default
LB	Name of string to be drawn (if not coded, strings obeying any masks will be drawn)	CV	-
LA	Annotate strings with name at start Annotate strings with name at both ends Do not annotate names Annotate contour strings with level at start Annotate contour strings with levels at both ends	LABS LABL NOLA LEVS LEVB	DF
PS	Pip size	PV	-
IN	Pip or chainage marking interval	PV	-
DE	Draw the information according to detail defined: Detail interpretation to all strings Contours with height embedded Pip marks at each point Cross and level at each point Spot level with decimal point marking position.	DETA CONP PIPS SPOT SPDP	-

**Macro LONGDRAW**

Code	Description	Alternatives	Default
FD	First of several overlaid drawings or if SL or SW are to be specified	”	-
OD	Subsequent overlaid drawing	”	-
TR	Truncation or no truncation (of page area)	TRUN NOTR	DF
SL	Page length	PV	DF
SW	Page width	PV	DF
FR	Draw a frame Do not draw a frame Put registration marks on single page Draw frame around apertures	FRAM NOFR REGR WIND	DF
ML	Left margin	PV	1.0
MB	Bottom margin	PV	1.0
MT	Top margin	PV	1.0
MR	Right margin	PV	1.0
PA	Paged or non-paged drawing	PAGE NOPA	DF

Drawing details

Code	Description	Alternatives	Default
XO	Offset to be added to the left of the leftmost point	PV	0.0
YO	Offset to be added to the lowest point	PV	0.0
AL	Absolute level datum	PV	-
LP	Box in which the level parameter is to be annotated	PV	1
LD	Box in which the distance parameter is to be annotated	PV	2
HP	Box description of the level parameter	C = chainage D = distance E = existing P = proposed L = level * = text coded at TP	P
TP	Box description if HP=*	CV	-
DP	Dimension of proposed parameter	CV	3
DD	Dimension of distance parameter	CV	4
SF	Ordinates, short or full	VF VS HS HF	VF

IN	Interval for ordinates and ordinate annotation Chainage interval for M strings Point sequence interval for general strings	PV -n for every nth point	every point every point
HD	Box description of the distance parameter	C = chainage D = distance E = existing P = proposed L = level * = text coded at TD	D
TD	Box description if HD=*	CV	-
HS	Horizontal scale	PV	
VS	Vertical scale	PV	
LC	String colour	CV	BLACK
DL	Dashed line indicator	” for dashed line	Solid
TC	Text colour	CV	BLACK
DT	Distance to top of section box	PV - distance from highest string point to top of aperture in model units NV - maximum level displayed	- -

Model details

Code	Description	Alternatives	Default
LR	Reference string	CV	
LB	Section string	CV	
XS	Start point on reference string SPRD	PV	First point
YS		PV	
XE	End point on reference string SPRD	PV	Last point
YE		PV	
LS	Length of section to be drawn per page	PV	-



Macro **LONGLINE**

Drawing details

Code	Description	Alternatives	Default
LN	Box in which the 'level' parameter is to be annotated	PV	-
HN	Box description to the 'level' parameter	C = chainage D = distance E = existing P = proposed L = level * = text coded at TN	L
TN	Box description of HN=*	CV	-
LC	String colour	CV	BLACK
TC	Text colour	CV	BLACK
DL	Dashed line indicator	” for dashed line	Solid
IN	Interval indicator Chainage interval for M strings Point sequence interval for general strings	PV -n for every nth point	every point every point

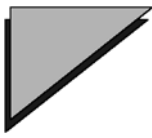
Model details

Code	Description	Alternatives	Default
LR	Reference string	CV	
LB	Name of string to be drawn	CV	
XS	Start point on reference string (S.P.R.D.)	PV	First point
YS		PV	
XE	End point on reference string (S.P.R.D.)	PV	Last point
YE		PV	
DN	Dimension to be drawn		

Macro SECTDRAW

Page details


Code	Description	Alternatives	Default
FD	First of several overlaid drawings or if SL or SW are to be specified or if no truncation is required	”	-
OD	Subsequent overlaid drawing	”	-
TR	Truncation or no truncation (of page area)	TRUN NOTR	DF
SL	Page length	PV	120
SW	Page width	PV	68
FR	Draw a frame Do not draw a frame Put registration marks on single page Draw frame around apertures	FRAM NOFR REGR WIND	DF
ML	Left margin	PV	1.0
MB	Bottom margin	PV	1.0
MT	Top margin	PV	1.0
MR	Right margin	PV	1.0
PA	Paged or non-paged drawing	PAGE NOPA	DF
Code	Description	Alternatives	Default
HS	Horizontal scale	PV	-
VS	Vertical scale	PV	-
AL	Code for absolute level datum	-	-
YO	Offset from lowest string point	PV	0.0
OL	Offset to be applied to left	CV	-
OR	Offset to be applied to right	CV	-

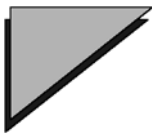


DRAW macros

UD	Arrangement of sections A three character code where 1st character - U = sections drawn in ascending chainage up the aperture D = sections drawn in ascending chainage down the aperture 2nd character - L = Left justify sections in each column C = Centre justify sections in each column R = Right justify sections in each column 3rd character - - A = Align each row of sections along a common base line S = Space the sections in each row according to the value in field 10.		UCS
HG	Horizontal gap between columns of sections	PV	1
VG	Vertical gap between rows of sections	PV	2
NR	Number of rows of sections per aperture	PV	-
NC	Number of columns of sections per aperture	PV	-
OF	Section width definition	ADD Displacement ABS Absolute units	ADD
SF	Ordinates, short or full	VF VS HF HS	VF
LE	Box in which the 'existing' level parameter is to be annotated	PV	
LD	Box in which the 'distance' /offset parameter is to be annotated	PV	2
HE	Box description of the 'existing' parameter	C = chainage D = distance E = existing P = proposed L = level * = text coded in TE	E
TE	Box description if HE=*	CV	-
TE HD	Box description of the 'distance' parameter	C = chainage D = distance E = existing P = proposed L = level * = text coded in TD	D
TD	Box description if HD=*	CV	
LC	String colour	CV	BLACK

TC	Text colour	CV	BLACK
DL	Dashed line indicator	” for dashed line	Solid
LB	Reference string on which sections are based	CV	
XS	Start point on reference string (S.P.R.D.)	PV	First point
YS			
XE	End point on reference string (S.P.R.D.)	PV	Last point
YE			
SE	Initial character of sections set		
IN	Interval at which sections are needed.	PV	

 AL and YO should not be coded together



Macro SECTLINE

Drawing details

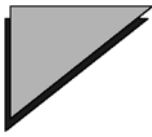
Code	Description	Alternatives	Default
LN	Box in which the 'level' parameter is to be annotated	PV	2
HN	Box description of the 'level' parameter	C = chainage D = distance E = existing P = proposed L = level * = text coded at TN	L
TN	Box description if HN=*	CV	-
LC	String colour	CV	BLACK
TC	Text colour	CV	BLACK
DL	Dashed line indicator	" for dashed line	SOLID
EO	Extra ordinate indicator	" for extra ordinates and annotation	-
SF	Ordinate short or full (only applies if EO=" coded)	VF VS HF HS	VS

Model details

Code	Description	Alternatives	Default
SN	Initial character of sections to be drawn	CV	
XS	Start point on reference string (LB in CROSDRAW)	PV	First point
YS	(S.P.R.D.)	PV	
XE	End point on reference string (S.P.R.D.)	PV	Last point
YE			
DN	Dimension to be annotated (see minor option 846 for details of permitted values)		3

Macro SURVDRAW

Code	Description	Alternatives	Default
FD	First overlaid drawing or if SL or SW are to be specified	”	-
OD	Subsequent overlaid drawing	”	-
PA	Paged or non-paged drawing	PAGE NOPA	DF
TR	Truncation or no truncation (of page area)	TRUN NOTR	DF
SL	Page length	PV	DF
SW	Page width	PV	DF
FR	Draw a frame Do not draw a frame Put registration marks on page edge Draw frame around apertures	FRAM NOFR REGR WIND	DF
ML	Left margin	PV	1.0
MB	Bottom margin	PV	1.0
MT	Top margin	PV	1.0
MR	Right margin	PV	1.0
SC	Scale	PV	-
XL	Relationship of model to drawing aperture. Co-ordinates of bottom left point and bearing of left hand side	PV	
YL		PV	
BE		PV	
LC	String colour	CV	BLACK
TC	Text colour	CV	BLACK
GR	Grid with edge ticks Grid with crosses at intersections Full line grid Do not draw a grid	EDGE CROS FULL NOGR	NOGR
XG	X spacing interval of grid	PV	50
YG	Y spacing interval of grid	PV	50
IO	Plot inside or outside a boundary	IN OUT	-
BD	Boundary string name if IO=IN or IO=OUT	CV	-
XB	Minimum model co-ordinate restricting region to be drawn	PV	0.0
YB		PV	0.0
XT	Maximum model co-ordinates restricting region to be drawn	PV	99999999.9
YT		PV	99999999.9
LE	Spot levels required	”	-
AN	Rotation of north point from left hand side		90 (angle in degrees)



DRAW


Major option **DRAW**

Plan and long section drawings:

DRAW

Model 1 Model containing strings to be drawn.

Model 2 Model containing reference strings, if not in Model 1. Otherwise leave blank.


 If a temporary model is to be drawn, for example as a result of contouring, leave both model names blank.

Cross section drawings:

DRAW


Model 1 Model containing cross sections to be drawn.

Model 2 Model containing reference strings, if not in Model 1. Otherwise leave blank.

 Global minor options 000, 017, 018, 019, 900 and 999 may be used in DRAW.

701 Set up schematic reference data

Minor option	701
Field 1	Reference string name (global)
Field 3	Area name (annotation box defined in 845)
Fields 5 & 6	SPRD for start
Fields 8 & 9	SPRD for end

 This option must be used for each Type 1 schematic to be drawn.



711 Draw schematic line (type 1)

Minor option	711
Field 1	First string for superelevation calculation (if Field 3 = SUPE). First string for widening calculation (if Field 3 = WIDE)
Field 2	Second string for superelevation calculation, only used for dual carriageway annotation (if Field 3 = SUPE) Second string for widening calculation (if Field 3 = WIDE)
Field 3	SUPE, CENT, HLIN, VLIN or WIDE SUPE draw the superelevation schematic for the string defined in Fields 1 and 2. CENT draw the centre line for horizontal schematics. HLIN draw the horizontal alignment schematic line. VLIN draw the vertical alignment schematic line. WIDE draw the widening schematic line.
Field 4	Defines a minimum offset (in drawing units) from the edge of the annotation area to the widest part of the horizontal, vertical or superelevation schematic line to make room for text.

721 Annotate schematic (type 1)

Minor option 721

First record

Field 1 String to be annotated

Field 2 BOX = text is drawn relative to annotation area
LINE = text is draw relative to the horizontal or superelevation schematic line.
See diagram below.

Field 3 Increment or Decrement

Field 7 Text offset

Field 10 Rotation


If the angle is positive, text is positioned measured clockwise relative to the left hand side of the drawing. If negative, text is positioned clockwise relative to the normal lying to the left of the string.

Subsequent records

Minor option 721

Field 3 Text variable name


Field 4 String dimension to be drawn


 This option must be followed by a 001 record.



731 Draw schematic ordinates (type 1)

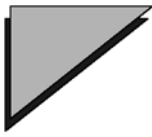
Minor option	731
Field 1	String name
Field 3	Each of the following codes will annotate at either the superelevation change points, the horizontal tangent points or vertical tangent points as specified in Field 3 of minor option 711. PIP Draw pips at point LINE Draw ordinate from point to centre of box (default) BOX Draw ordinates for the full height of the box.

 Field 3 must always be coded.

 When using VLIN the only available ordinate type is BOX.

712 Draw schematic line work (type 2)

Minor option	712
Field 1	Geometry string
Field 3	Annotation box name
Field 4	Factor for length of gradient 'element' (x). If coded as negative, the length of gradient element is a fixed number of units.
Fields 5 & 6	SPRD for start
Field 7	Factor for height of gradient 'element' (y)
Fields 8 & 9	SPRD for end
Field 10	Factor for diameter of circle (z)




722 Annotate schematic (type 2)

First record

Minor option	722
Field 1	Geometry string
Field 3	Increment and Decrement
Field 4	Text item position
	1 at element mid point
	2 at Vertical IP
Field 7	Text offset
	For text item position 1, text offset does not apply. The text can only be positioned at the element mid point.
Field 10	Rotation (about the centre of text)

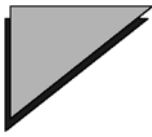
Subsequent records

Minor option	722
Field 3	Text variable name
Field 4	String dimension to be drawn.

 This option must be followed by a 001 record.

732 Draw schematic ordinates (type 2)

Minor option	732
Field 1	Geometry string name
Minor option	713
Field 1	Reference string.
Field 3	Diagram style.
Field 4	Interval for intermediate annotation.
Fields 5 & 6	SPRD for start.
Field 7	Distance of diagram from VM point on string. (Model units).
Fields 8 & 9	SPRD for end.
Field 10	Positive offset of diagram above section datum (Model units).



713 Draw schematic line work (type 3)

Minor option	713
Field 1	Reference string
Field 3	Diagram style
	1 Diagram style 1. See below
	2 Diagram style 2. See below
	3 Diagram style 3. See below
Field 4	Interval for intermediate annotation (styles 1 and 3). For style 1, the intermediate annotation starts at the first VTP. For style 3, the intermediate annotation starts at the first whole chainage after the first VTP.
Fields 5 & 6	SPRD for start
Field 7	Distance of diagram from VM point on string. (Model units) See also Field 10
Fields 8 & 9	SPRD for end
Field 10	Positive offset of diagram above section datum (Model units)

🔗 Field 10 is ignored if Field 7 is coded,

🔗 The diagram will appear above or below the profile depending on the contents of Field 2 of minor option 809 (INOUE or ONES). INOUE will draw diagram and annotation above the profile for sag curves and below the profile for hog curves.

🔗 To draw just the VTPs and VIP ordinates, code a large interval in Field 4.

🔗 The gradient annotation can be shown as percent or permille. The default value is defined in project settings.

723 Annotate schematic (type 3)

First record

Minor option 723

Field 1 Geometry string

Field 3 Increment and Decrement

Field 4 Text item position

If option 713 field 3 = 1 or 3, see the diagram below.

1 At curve mid point (ie centre of chord)

2 At VIP

3 At start VTP

4 At end VTP

5 At both VTPs and VIP

6 At intermediate points (see Minor option 713, Field 4)


if option 713 field 3 = 2 see the diagram below.

1 At curve mid point (ie centre of chord)

2 Between first VTP and VIP

3 Between VIP and last VTP

Field 7 Text offset

 For text item position 1, text offset does not apply. The text can only be positioned at the mid point of the curve.


Field 10 Rotation (about the centre of text)

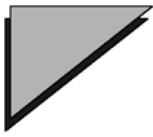
Subsequent records

Minor option 723

Field 3 Text variable name

Field 4 String dimension to be drawn.

 This option must be followed by a 001 record.



DRAW

733 Draw schematic ordinates (type 3)

Minor option

733

Field 1

Geometry string name

 If this option is omitted the intermediate ordinates will be omitted.

714 Draw schematic line work (type 4)

Minor option	714
Field 1	Reference string
Field 3	Annotation area name
Fields 5 & 6	SPRD for start
Field 7	Factor for diameter of circle (x)
Fields 8 & 9	SPRD for end
Field 10	Factor for diameter of symbol (y)




724 Annotate schematic (type 4)

First record

Minor option	724
Field 1	Reference string
Field 3	Increment and Decrement
Field 4	Text item position (1 to 6)

Subsequent records


Minor option	724
Field 3	Text variable name
Field 4	String dimension to be drawn.

 This option must be followed by a 001 record.

734 Draw key diagram (type 4)


First record

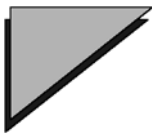
Minor option	734
Field 3	Annotation area name (from 845)
Field 7	Factor for diameter of circle (x) (optional)
Field 10	Factor for diameter of symbol (y) (optional)

 The circle and symbol size will be the same as defined in minor option 714 if Fields 7 and 10 are omitted.

Subsequent records

Minor option	734
Field 4	Text item position.


 This option will be followed by as many 001 records as are necessary to define the text for each text item.



800 Define page size and orientation

Case 1 Specify a plan working display

Minor option	800
Field 4	Page size
	0 page size is defined by the size and scale of the model.

 A value of 0 in Field 4 defines a page of infinite size therefore 803,3 = TRUN must also be coded to truncate the page.

Case 2 Specify drawing page size by units


Minor option	800
Field 4	Page size
	1 page size is coded in fields 5 and/or 6.
Field 5	Page length in drawing units
Field 6	Page width in drawing units
Field 8	X magnification factor
Field 9	Y magnification factor

 X and Y factors will only be applied when converting to a plot file.

Case 3 Specify drawing page by A size

Minor option	800
Field 1	Page orientation
	LAND landscape orientation (default)
	PORT portrait orientation
Field 4	Page size
	1 page size is coded in Field 5.
Field 5	A size. eg 3 would give an A3 size page
Field 7	Multiple of page length
Field 8	X magnification factor
Field 9	Y magnification factor
Field 10	Multiple of page width


 X and Y factors will only be applied when converting to a plot file.

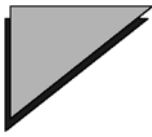
 The default page orientation can be changed using the project settings.

Case 4 Specify drawing page by B size

Minor option	800
Field 1	Page orientation
	LAND landscape orientation (default)
	PORT portrait orientation
Field 4	Page size
	1 page size is coded in Field 6.
Field 6	B size no. eg 3 would give a B3 size page
Field 7	Multiple of page length
Field 8	X magnification factor
Field 9	Y magnification factor
Field 10	Multiple of page width

 X and Y factors will only be applied when converting to a plot file.

 The default page orientation can be changed using the project settings.




801 Start drawing on existing or new page

Case 1 Overlay model information on an existing page

Minor option	801
Field 1	OVER
Field 2	FREE - expand the drawing as required to fit the overdrawn information. FIX - restrict the drawing to the current limits and clip any information which is drawn outside.
Field 4	Page number of the page to be overdrawn. Major option DRAW may be followed by option 800 or 801,OVER or neither, but not both. Within any one entry to DRAW all strings are drawn on the currently defined page, without any need to request overlay.

Case 2 Add a new set of drawing pages to the DPF

Minor option	801
Field 1	NEWP This record must be the first minor option encountered after the DRAW record and it can be followed by an option 800.

 The use of this facility to create drawing files containing many different drawings is not recommended if the drawing files are to be used within the interactive system. This facility should only be used for the production of sets of drawings in linemode or from input files.

802 Define page margins

802 Plan and long section drawings

Field 4 Constant margin width in drawing units

Or:-

Field 5 Left margin width in drawing units

Field 6 Bottom margin width in drawing units

Field 8 Right margin width in drawing units

Field 9 Top margin width in drawing units

802 Cross section drawings

Case 1 - Automatic placement of cross sections

Minor option 802

Field 1 UP if first section to be drawn in bottom left aperture with successive sections moving upwards

DOWN if first section to be drawn in top left aperture with successive sections moving downwards

Alternatively columns 1, 2 and 3 of this field may be used individually to specify the layout of the sections as follows:

Column 1

U Up. As above (default if omitted)

D Down. As above

Column 2

L Left justify sections in each column

C Centre sections in each column around their origins (default if omitted)

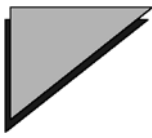
Right justify sections in each column.

Column 3

A Align each row of sections along a common base line

S Space the sections in each row according to the value in field 10 (default if omitted).

Field 2 Number of rows of cross section diagrams to be drawn, coded as a right justified integer



DRAW

Field 3	Number of columns of cross section diagrams to be drawn, coded as a right justified integer
Field 4	Constant margin width in drawing units OR use Fields 5, 6, 8 and 9.
Field 5	Left margin width in drawing units
Field 6	Bottom margin width in drawing units
Field 7	Intermediate horizontal spacing in drawing units. If omitted, the margin width is assumed
Field 8	Right margin width in drawing units
Field 9	Top margin width in drawing units
Field 10	Intermediate vertical spacing in drawing units. If omitted, the margin width is assumed

Case 2 - Manual placement of cross sections

Using this method, two 802 records are required.

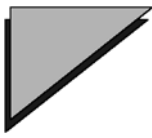
First record:

Minor option	802
Field 1	MARG
Field 4	Constant margin width in drawing units
Or:-	
Field 5	Left margin width in drawing units
Field 6	Bottom margin width in drawing units
Field 8	Right margin width in drawing units
Field 9	Top margin width in drawing units

Second record:

Minor option	802
Field 1	UP if first section to be drawn in bottom left aperture with successive sections moving upwards DOWN if first section to be drawn in top left aperture with successive sections moving downwards Alternatively columns 1, 2 and 3 of this field may be used individually to specify the layout of the sections as follows: Column 1 U Up. As above (default if omitted)


	D	Down. As above
	Column 2	
	L	Left justify sections in each column
	C	Centre sections in each column around their origins (default if omitted)
	Right justify sections in each column.	
	Column 3	
	A	Align each row of sections along a common base line
	S	Space the sections in each row according to the value in field 10 (default if omitted).
Field 2		Number of rows of cross section diagrams to be drawn, coded as a right justified integer
Field 3		Number of columns of cross section diagrams to be drawn, coded as a right justified integer
Field 5		X coordinate of bottom left hand corner (BLCX)
Field 7		X offset of next section (XSHIFT)
Field 8		Y coordinate of bottom left hand corner (BLCY)
Field 10		Y offset of next section (YSHIFT)



803 Define page scale and rotation

803 Plan drawing

Minor option	803
Field 1	PLAN
Field 2	PAGE to invoke automatic paging. NOPA to produce one page only.
Field 3	TRUN for each aperture to be truncated at the top and right hand side. NOTR to maintain the aperture size.
Field 4	Angle of rotation of left hand side of drawing clockwise relative to due north.
Field 5 & 6	Model coordinates of bottom left aperture.
Field 7	Scale of drawing (ie 500 for 1:500)

 If fields 5 and/or field 6 are omitted the major option will determine these values from the minimum coordinates of the model data to be drawn.

803 Long section drawing

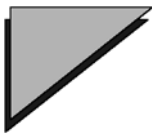
Minor option	803
Field 1	LONG to draw long section. LCRP to crop top of section according to value entered in Field 4. This facility allows the upper part of profiles to be truncated when insufficient space is available for drawing. Four alternative methods are provided for defining how the long section is split into pages, using Fields 2 and 3 in combination.
Field 2	PAGE to invoke automatic paging. 1. Produce an infinite page containing all of the long section drawing
Field 2	NOPA
Field 3	TRUN 2. Split the long section drawing into multiple pages
Field 2	PAGE
Field 3	NOTR 3. Draw a single page at the current page size.
Field 2	PAGE
Field 3	TRUN

	4. Create stepped long sections
	Stepped long sections can be drawn on either a single page or multiple pages
Field 2	NOPA or PAGE
Field 3	NOTR
	Field 4 then follows:
Field 4	Positive value - displacement from highest string point to top of section aperture in model units. Negative value - maximum level displayed in the section aperture in model units. If LCRP is coded in Field 1, enter desired height of section aperture in model units measured from profile datum. Two alternative methods are provided for defining the origins of the horizontal and vertical axes. 1. Specification of origin in absolute model units.
Field 5*	Origin of horizontal axis in model units.
Field 7	Horizontal scale.
Field 8	Origin of vertical axis in model units.
Field 10	Vertical scale
	2. Specification of origin in displacement model units.
Field 6	Displacement from leftmost string point to the vertical axis. (X0)
Field 7	Horizontal scale.
Field 9	Positive value - displacement from lowest string point to the horizontal axis, referred to as the minimum actual level difference. (Y0). The resultant datum level is rounded down. Negative value - the nearest multiple of the given value below the lowest string point.
Field 10*	Vertical scale.

803 Cross section drawing

Manual setting of drawing scales

Minor option	803
Field 1	CROS
Field 2	PAGE to invoke automatic paging. NOPA to produce one page only.
Field 3	TRUN for each aperture to be truncated at the top and right hand side.



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	NOTR to restrict truncation.
Field 4	Positive value - displacement from highest string point to top of section aperture in model units. Negative value - maximum level displayed in the section aperture in model units. A number of alternatives is provided. 1. Specification of origin in absolute model units.
Field 7*	Horizontal scale.
Field 8	Origin of vertical axis in model units. (Absolute level datum).
Field 10*	Vertical scale. 2. Specification of origin in displacement model units.
Field 7*	Horizontal scale.
Field 9	Positive value - displacement from lowest string point to the horizontal axis. The resultant datum level is rounded down. Negative value - the nearest multiple of the given value below the lowest string point.
Field 10*	Vertical scale.

Automatic setting of drawing scales


First record:


Minor option	803
Field 1	ACRS to invoke automatic setting of drawing scale
Field 2	PAGE to invoke automatic paging. NOPA to produce one page only.
Field 3	NOTR to restrict truncation.
Field 4	Positive value - displacement from highest string point to top of section aperture in model units. Negative value - maximum level displayed in the section aperture in model units. 1. Specification of origin in absolute model units.
Field 8	Origin of vertical axis in model units. (Absolute level datum). 2. Specification of origin in displacement model units.
Field 9	Positive value - displacement from lowest string point to the horizontal axis. The resultant datum level is rounded down.

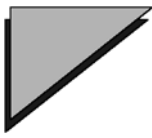
Negative value - the nearest multiple of the given value below the lowest string point.

Subsequent records:

Minor option	803
Field 7*	Horizontal scale.
Field 10*	Vertical scale.

 Up to ten records may be used to specify the drawing scales.


 The drawing scales must be coded in ascending order.



804 Restrict model area

804 Plan drawing

Minor option	804
Field 1	PLAN
Field 2	IN = draw information inside boundary string OUT = draw information outside boundary string.
Field 3	Boundary string name. If the boundary string resides in a different model from the strings to be drawn, the model name should be coded on the DRAW major option. and/or
Field 5	Minimum X coordinate of rectangular boundary
Field 6	Minimum Y coordinate of rectangular boundary
Field 8	Maximum X coordinate of rectangular boundary
Field 9	Maximum Y coordinate of rectangular boundary

 If this option is omitted the whole model will be considered for drawing


804 Long section drawing

Minor option	804
Field 1*	LONG
Field 4	Length of section to be drawn on each page. If omitted, the length to be drawn is determined by the length of the drawing aperture. Two alternatives are provided. 1. Define the length of section to be drawn by reference to a string.
Field 3*	Reference string.
Field 5 & 6	SPRD for start.
Field 8 & 9	SPRD for end. 2. Define the length of section to be drawn by reference to a base line.
Field 5 & 6	Model coordinates for start.
Field 8 & 9	Model coordinates for end.

804 Stepped long sections

Minor option	804
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Field 1	STEP
Field 2	WIND to create a step at the first string intersection with the top of the drawing aperture (default). POIN to create a step at the first string point before the intersection with the top of the drawing aperture. CHAN to create a step at a point which is the nearest multiple of the chainage interval coded in Field 10 which occurs before the intersection with the top of the drawing aperture. For example, if the long section intersects with the aperture at chainage 93.3 and the value in Field 10 is 10, the step will occur at chainage 90.0.
Field 3	Reference string.
Field 4	Length of section to be drawn. If no length is coded, a suitable scale must be chosen to ensure that all the strings appear on the page.
Field 5 & 6	SPRD for start.
Field 8 & 9	SPRD for end.
Field 10	Chainage factor. Only used if Field 2 is set to CHAN.

 If the datum level box is to be drawn every time there is a step, options 845, 847 and 848 can be used. However, the box name on those options must be coded as DT and the variable name as DV. The third and fourth characters will be allocated by the program.

804 Cross section drawing

Minor option	804
Field 1	CROS
Field 4	Distance interval. This value determines which sections will be drawn and must be a multiple of the original section interval. If a negative value -n is coded, every n'th section will be drawn. A reference chainage for distance intervals may be specified on an additional 804 record. Two alternatives for specifying the sections to be drawn are provided: 1. Specification of reference string from which sections were generated.
Field 3	Name of reference string used to generate the sections.
Field 5 & 6	SPRD for first section to be considered.
Field 8 & 9	SPRD for last section to be considered. 2. Specification of base line from which sections were generated.



DRAW

Field 5 X coordinate of start point

Field 6 Y coordinate of start point

Field 8 X coordinate of end point

Field 9 Y coordinate of end point

Two alternatives for specifying the extent of the horizontal axis are also provided. Note that either of these can be specified simultaneously with one of the previous alternatives.

1. Specification of horizontal extent using absolute offsets (model units).

Field 2 ABS

Field 7 Left offset (negative) measured from the reference string.

Field 10 Right offset (positive) measured from the reference string.

2. Specification of horizontal extent relative to the edge of each section (model units).

Field 2 ADD

Field 7 Incremental offset (negative) to be added to the left of each section.

Field 10 Incremental offset (positive) to be added to the right of each section.


804 Reference chainage

Minor option 804

Field 1 NEXT

Field 4 Reference chainage

805 Set current line width and colour

Minor option	805
Field 1,2	Line colour index 1 to 255. By default, the first 10 colours are as follows: <ul style="list-style-type: none"> 1 - Black 2 - Red 3 - Green 4 - Blue 5 - Cyan 6 - Yellow 7 - Orange 8 - Pink 9 - Pale Blue 10 - Grey <p>All the available colours are defined in the file <i>palette.dat</i> in the <lang>sys directory, where <lang> is your chosen language, eg, ??.</p>
Field 4	Line width
Field 7	Null/zero levels indicator <ul style="list-style-type: none"> Blank Line width and colour to be applied to all lines (default) 1 Line width and colour to be used to display null/zero levels <p> Field 7 is only required if minor option 825 field 2 is coded NCOL, ZCOL, NULL or ZERO.</p>



806 Set text line width and colour

Minor option

806

Field 1,2

Text colour index 1 to 255.

By default, the first 10 colours are as follows:

1 - Black

2 - Red

3 - Green

4 - Blue

5 - Cyan

6 - Yellow

7 - Orange

8 - Pink

9 - Pale Blue

10 - Grey

All the available colours are defined in the file *palette.dat* in the <lang>sys folder, where <lang> is your chosen language, eg, ??.

Field 4

Text line width

807 Set current fill style

Case 1 Solid fill

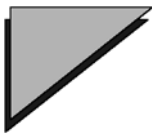
Minor option	807
Field 1	Fill colour index 1 to 255. By default, the first 10 colours are as follows: 1 - Black 2 - Red 3 - Green 4 - Blue 5 - Cyan 6 - Yellow 7 - Orange 8 - Pink 9 - Pale Blue 10 - Grey All the available colours are defined in the file <i>palette.dat</i> in the <lang>sys directory, where <lang> is your chosen language, eg, ??.
Field 7	Code 0.001
Field 10	Code 90.0 if in degrees or 100.0 if in grads

Case 2 Line hatching

Minor option	807
Field 1	Colour of fill pattern. The colours available for this option are defined in the file 'drcolour.dat'.
Field 7	Spacing
Field 10	Angle of hatching relative to the left hand side

Case 3 Cross hatching

Minor option	807
Field 1	Fill colour index 1 to 255. By default, the first 10 colours are as follows: 1 - Black 2 - Red 3 - Green 4 - Blue



DRAW

- 5 - Cyan
- 6 - Yellow
- 7 - Orange
- 8 - Pink
- 9 - Pale Blue
- 10 - Grey

All the available colours are defined in the file *palette.dat* in the <lang>sys directory, where <lang> is your chosen language, eg, ??.

- Field 6 Spacing of lines in first direction
- Field 7 Spacing of lines in second direction
- Field 9 Angle of hatching , first direction, relative to the left hand side
- Field 10 Angle of hatching, second direction, relative to the left hand side

Case 4 Symbol hatching, fixed spacing, fixed symbol angle

Minor option 807

Field 1 Fill colour index 1 to 255.

By default, the first 10 colours are as follows:

- 1 - Black
- 2 - Red
- 3 - Green
- 4 - Blue
- 5 - Cyan
- 6 - Yellow
- 7 - Orange
- 8 - Pink
- 9 - Pale Blue
- 10 - Grey

All the available colours are defined in the file *palette.dat* in the <lang>sys directory, where <lang> is your chosen language, eg, ??.

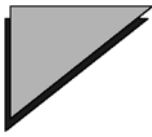
- Field 2&3 Macrosymbol name. Leave Field 4 blank
- Field 4 Standard symbol number. Leave Fields 2 and 3 blank
- Field 5 Width of symbol
- Field 6 Spacing of symbols in first direction
- Field 7 Spacing of symbols in second direction
- Field 8 Height of symbol
- Field 9 Angle of hatching , first direction, relative to the left hand side
- Field 10 Angle of hatching, second direction, relative to the left hand side

Case 5 Symbol hatching, random position, fixed symbol angle

Minor option	807
Field 1	Fill colour index 1 to 255. By default, the first 10 colours are as follows: 1 - Black 2 - Red 3 - Green 4 - Blue 5 - Cyan 6 - Yellow 7 - Orange 8 - Pink 9 - Pale Blue 10 - Grey All the available colours are defined in the file <i>palette.dat</i> in the <lang>sys directory, where <lang> is your chosen language, eg, ??.
Field 2&3	Macrosymbol name. Leave Field 4 blank
Field 4	Standard symbol number. Leave Fields 2 and 3 blank
Field 5	Width of symbol
Field 6	Code 1.0
Field 7	Code 0.0
Field 8	Height of symbol
Field 10	Angle of symbol. See 'Rotating text and symbols'

Case 6 Symbol hatching, random position, random angle


Minor option	807
Field 1	Fill colour index 1 to 255. By default, the first 10 colours are as follows: 1 - Black 2 - Red 3 - Green 4 - Blue 5 - Cyan 6 - Yellow 7 - Orange 8 - Pink 9 - Pale Blue 10 - Grey



DRAW

All the available colours are defined in the file *palette.dat* in the <lang>sys directory, where <lang> is your chosen language, eg, ??.

Field 2&3	Macrosymbol name. Leave Field 4 blank
Field 4	Standard symbol number. Leave fields 2 and 3 blank
Field 5	Width of symbol
Field 6	Code 1.0
Field 7	Code 0.0
Field 8	Height of symbol
Field 9	Code any non zero value (Suggest 45.0)
Field 10	Code same value as field 9 (Suggest 45.0)

 If minor option 807 is specified with no field data, the colour, hatching intervals and angles are set to the default values.

808 Set current text style

Minor option	808
Field 1	Font name or TTFN True Type font to be used. True Type font name specified on next 001 option.
Field 2	Column 1 L All alphabetic characters to be drawn in lower case with a prefix. O All alphabetic characters to be drawn in lower case with a suffix. U All alphabetic characters drawn in upper case with a prefix. P All alphabetic characters drawn in upper case with a suffix. N No conversion - all characters drawn as input with a prefix. S No conversion - all characters drawn as input with a suffix. Column 2 Code the character that will prefix or suffix all numbers, for example + or £ or \$ or %. If not required, leave blank. Column 3 Separator character for thousands + gives 5 + 678.0 0 gives no separator 5678.0 1 gives 5 678.0 2 gives 5,678.0 3 gives 56+78.0 4 gives 5+678.0 If special action not required, leave blank. Column 4 Separator for the decimal part 0 gives no separator 5678 (only use with no decimal places) 1 gives 5678 0 2 gives 5678,0 for a decimal point, leave blank.
Field 3	Code a four character text style name if you want MX to remember the combination of data on this option for later recall within the current entry to DRAW, otherwise leave blank.
Field 4	Character height in linear measure units.
Field 5	Number of decimal places to be used on numeric values.
Field 6	Width to height ratio of characters expressed as a decimal fraction for example, 1.5 gives wide characters.



DRAW

Field 7	Character spacing ratio. This is the distance between one character and its neighbour.
Field 10	Line spacing ratio. This is used in conjunction with the text increment options which are described under the special annotation options.

⚠ If Field 1 contains TTFN, Field 6 can only be used with mono-spaced True Type fonts. In this case, the value in Field 6 will be used for text justification and will not affect the text width.

Second 808 option - used when TTFN is specified in field 1 of the first 808 option and point size is required for the character height. To use a True Type font with drawing units, do not specify this second option.

Minor option	808
Field 4*	Point size

⚠ Follow 808 option(s) with an 001 option specifying the True Type font name, if TTFN is coded on the first 808 option.

To recall a previously defined text style, code the following:

Minor option	808
Field 3	Style name

809 Set geometry string point type and annotation parameters

Minor option	809
Field 1	Geometry string point type
	HTPS Horizontal tangent points
	HCEN Horizontal arc centres
	HIPS Horizontal intersection points
	VTPS Vertical tangent points
	VIPS Vertical intersection points
	VFPS Vertical flat points
	VMOS Vertical mid-ordinate points
	SUPE Superelevation points
	If this field is omitted, the default geometry string code is determined by the project settings.
Field 2	Offset indicator
	ONES Annotation is to be drawn on one side of a string.
	INOU Annotation is to be drawn on the outside or inside of curves in a string.
Field 4	Superelevation indicator (2 digits) (note that this can be used for any string type)
	For crossfall and gradient annotation (first digit):
	1 Annotate as a percentage.
	2 Annotate as a decimal percentage.
	Annotate as a ratio (1:n)
	4 Annotate as permille
	For cant annotation (second digit):
	1 Annotate cant in metres (or feet)
	2 Annotate cant in centimetres (or inches)
	3 Annotate cant in millimetres

☞ If Field 1 = SUPE, crossfall is annotated if a code of XF** is found on the geometry string. Cant is annotated if a code of CA** is found on the geometry string.

☞ Metric or imperial units are used for cant depending upon the units defined in the project settings.



DRAW



- Field 7 Primary annotation offset.
- The primary offset defines the position of text on either side of a string.
- If Field 2 = ONES, in plan, a positive offset is to the right and a negative offset to the left. For long sections, a positive offset is above the string and a negative offset below. Text is always drawn left justified.
- If Field 2 = INOU, in plan and for long sections, a positive offset is to the outside of curves and a negative offset to the inside.
- The default primary offset is defined in the project settings.
- Field 8 Secondary annotation offset (only used if Field 2 = INOU).
- The secondary offset defines the position of text on the left hand side of a string, so that text may be left justified.
- If a secondary offset is not specified, the primary offset is used and text on the left hand side of a string is right justified.
- Field 9 Chainage base
- Enter chainage base for incremental style chainage annotation.
- ✎ Fields 7 and 8 define text annotation offset only, and not symbol offset.
- ✎ The primary annotation offset may be overridden by specifying an offset on the individual minor option. However, it is preferable to code an 809 option each time a change in offset is required.

810 Set current line style

Select solid line style

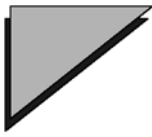
Minor option	810
	Leave all other fields blank to set the current line style to be solid.

Define a four element dashed line

Minor option	810
Field 1	DASH
Field 5*	Length of first solid line in drawing units. If the length is positive drawing units (ie cms or inches) are used. If the length is negative model units are used.
Field 6*	Length of first gap. If the length is positive drawing units (ie cms or inches) are used. If the length is negative model units are used.
Field 7	Clockwise rotation of second solid line relative to first solid line.
Field 8*	Length of second solid line. If the length is positive drawing units (ie cms or inches) are used. If the length is negative model units are used.
Field 9*	Length of second gap. If the length is positive drawing units (ie cms or inches) are used. If the length is negative model units are used.
	<p> The length of the first gap is -</p> <ul style="list-style-type: none"> a) measured between the ends of the first and second solid lines when the rotation of the second line is zero. b) measured between the end of the first solid line and the centre point of the second line when its rotation is not zero. <p> The length of the second gap is measured in the same way as the first gap but between the second solid line and the next first solid line.</p>


Define a macro line

Minor option	810
Field 1	MACR
Field 2, 3*	Name of the macro line. The macro line should have been previously defined and be stored in the macro file.



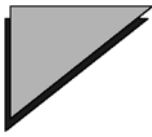
DRAW

- Field 4 The string dimension to be used to determine the depth of the macro line. The value stored in the string is assumed to be model units. The depth defined at a point extends to the following point.
- If this field is coded then field 6 should be left blank.
- Field 5 Drawn length of the pattern in drawing units.
- If -1.0 is coded the pattern will be stretched between adjacent string points.
- If -n is coded the pattern will be stretched between points 1 and 2 and between points n+1 and n+2 and between points 2n+1 and 2n+2 and so on.
- An example of this would be with a string containing the location of gates, in which case n=-2.0 would produce a 'gate-line' between every pair of consecutive points.
- Field 6 Depth of the pattern.
- If the depth is positive, drawing units (cms or inches) are used.
- If the depth is negative, model units are used.
- If this field is coded then field 4 should be left blank.
- If neither Field 4 nor Field 6 is coded then the pattern will be drawn with its original length/depth ratio.
- If a macro line has been defined with reference points these will be used to scale the pattern provided Field 5 is negative. In this case the reference points in the macro will coincide with the string points.
- Field 7 The scale to be used for converting the depth of the macro line from model units to drawing units.
- Field 8 Drawn length of the pattern.
- If the length is positive drawing units (ie cms or inches) are used.
- If the length is negative model units are used.
- If this field is coded then field 5 should be left blank.

 Field 8 and Field 5 cannot both be coded.

812 Set curve fitting

Minor option	812
Field 1	Curve fit indicator
	OFF No curve fitting required.
	MOSS Use curve fitting.
	SPLI Spline type fitting.
Field 4*	Chord-to-arc tolerance



DRAW

814, 815 Open/close group

Minor option	814
Field 1	'SING' - subsequent elements are formed into a single element group
Field 3*	Name of group to be opened.
Minor option	815
	No associated data.

817 Erase element

Minor option	817
Field 1	Element name or partial name to be deleted from the group specified in Field 3. If this field is blank, the group specified in Field 3 is deleted.
Field 2	Style set erase indicator LIST erases the strings which match the style set component ALL erases all strings in the model
Field 3	Group name or partial name containing element(s) to be erased. If this field is blank, all occurrences of the element specified in Field 1 are erased.

 Field 2 can only be used when both Field 1 and Field 3 are blank, and is for use within style sets only.

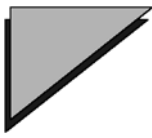


821 Add drawing frame

Minor option	821
Field 1	<p>FRAM draw frame around page boundary(s) using the current line style.</p> <p>WIND draw frame around drawing aperture using the current line style. Note that if the margin width has been set to zero using option 802, this will have the same effect as FRAM.</p> <p>REGR draw registration marks outside the page boundary.</p> <p>NOFR no frame required.</p> <p>If left blank, use the installation default.</p>
Field 3	Element name (plan drawings only)

822 Add grid

Minor option	822
Field 1	Grid type
	NOGR Omit grid (default)
	FULL Draw line grid with interval numbering using current line style and text style.
	CROS Draw crosses at grid intersections and interval numbers at edges.
	EDGE Draw edge ticks and interval numbers.
	or
Field 1 & 2	Macrosymbol name.
	Draws a macrosymbol at each grid intersection point and draw grid interval numbers.
Field 3	Element name
Field 5	Horizontal grid interval in model units. Leave blank to omit horizontal grid. Code negative interval to suppress annotation.
Field 6	Vertical grid interval in model units. Leave blank to omit vertical grid. Code negative interval to suppress annotation.
	For a plan drawing: Field 5 = X coordinate, Field 6 = Y coordinate
	For a long section: Field 5 = Distance, Field 6 = Level
	For cross sections: Field 5 = Offset, Field 6 = Level.
	If 'FULL' or 'CROS' or 'EDGE' is coded in Field 1 but Fields 5 and 6 are both left blank, no grid is produced. Only FULL or EDGE can be used for selective drawing of the grid since for CROS the relevant spacing would not be coded. However, the effect can be achieved with CROS by coding both Fields 5 and 6 and requesting a very small tick size in either of Fields 8 and 9 as appropriate.
	Cross type grid (CROS)
Field 8	Horizontal tick mark size in drawing units.
Field 9	Vertical tick mark size in drawing units.
	Macrosymbol grid
Field 8	Width of macrosymbol in drawing units.
Field 9	Height of macrosymbol in drawing units.



825 Draw string according to string name

Case 1 Draw strings using standard detail interpretation

Minor option	825
Field 1	String name if only one string is to be drawn. Partial string name if a set of strings is to be drawn. Care should be taken when mixing this style of masking with option 019 selection mask tables. If this field is left blank all strings satisfying the current selection mask table will be drawn.
Field 2	DETA The standard detail interpretation based on the first character of each string will be drawn.
Field 3	Annotation to be drawn LABL draw the string name at both ends of the string. LABS draw the string name at the start of the string. LABA draw the string name with a directional arrow at both ends of the string. ARRO draw a directional arrow at both ends of the string. LEVS for contours draw the level only at the start of the string and draw all other strings as NOLA. LEVB for contours draw the level only at both ends of the string and all other strings as NOLA. NOLA do not draw string names.
Field 4	Pip length used for marking chainage on master (M) strings.
Field 5 & 6	SPRD for start.
Field 7	Chainage marking interval for master (M) strings. Note that chainages will appear at integer multiples of this value, irrespective of the start chainages.
Field 8 & 9	SPRD for end of string.

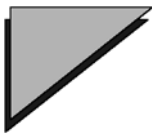
Case 2 Draw strings with pips at every string point

Minor option	825
Field 1	String name if only one string is to be drawn. Partial string name if a set of strings is to be drawn. Care should be exercised when mixing this style of masking with option 019 selection mask tables.

		If this field is left blank all string satisfying the selection masks will be drawn.
Field 2		Pips indicator
	PIPS	draw all strings with pip marks at each string point. The current line style will be used. Point sequence numbers will also be drawn.
Field 3		Annotation to be drawn
	LABL	draw the string name at both ends of the string.
	LABS	draw the string name at the start of the string.
	LABA	draw the string name with a directional arrow at both ends of the string
	ARRO	draw a directional arrow at both ends of the string.
	LEVS	for contours draw the level only at the start of the string and draw all other strings as NOLA.
	LEVB	for contours draw the level only at both ends of the string and all other strings as NOLA.
	NOLA	do not draw string names.
Field 4		Pip length. If blank a default value of 1mm will be used.
Field 7		Point sequence number marking interval. If omitted every fifth point will be annotated.

Case 3 Draw strings with spot levels at every string point

Minor option	825	
Field 1		String name if only one string is to be drawn. Partial string name if a set of strings is to be drawn. Care should be exercised when mixing this style of masking with option 019 style. If this field is left blank all string satisfying the selection masks will be drawn.
Field 2		Level indicator
	SPOT	draw all strings as a series of points with a cross annotated with the level.
	SPDP	draw all strings as level annotation justified by the decimal point.
Field 3		Annotation to be drawn
	LABL	draw the string name at both ends of the string.
	LABS	draw the string name at the start of the string.
	LABA	draw the string name with a directional arrow at both ends of the string



DRAW

ARRO	draw a directional arrow at both ends of the string.
LEVS	for contours draw the level only at the start of the string and draw all other strings as NOLA.
LEVB	for contours draw the level only at both ends of the string and all other strings as NOLA .
NOLA	do not draw string names.

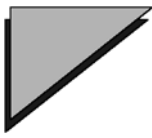
Case 4 Draw contour strings and spot levels

Minor option	825
Field 1	String name if only one string is to be drawn. Partial string name if a set of strings is to be drawn. Care should be exercised when mixing this style of masking with option 019 style. If this field is left blank all strings satisfying the 019 selection masks will be drawn.
Field 2	LEVE Draw all contour strings with level drawn at the start and end of the string and all other strings as spot levels with a cross and level annotation.
Field 3	Annotation to be drawn LABL draw the string name at both ends of the string. LABS draw the string name at the start of the string. LABA draw the string name with a directional arrow at both ends of the string. ARRO draw a directional arrow at both ends of the string. LEVS for contours draw the level only at the start of the string and draw all other strings as NOLA. LEVB for contours draw the level only at both ends of the string and all other strings as NOLA. NOLA do not draw string names.

Case 5 Draw contour strings

Minor option	825
Field 1	String name if only one string is to be drawn. Partial string name if a set of strings is to be drawn. Care should be exercised when mixing this style of masking with option 019 style.

	If this field is left blank all strings satisfying the 019 selection masks will be drawn.
Field 2	Type of contour annotation
	CONT Contour level drawn at start and end of string.
	CONP Contour levels drawn beginning on every nth point.
	COND Contour levels drawn at a regular spacing defined by the cumulative straight line distance along a string.
	CONX Contour levels drawn at a regular spacing defined by a set distance along the X axis from a local origin.
	CONY Contour levels drawn at a regular spacing defined by a set distance along the Y axis from a local origin.
	CONL Contour levels drawn beginning at the intersection between the contours and a defined line.
Field 3	Other annotation to be drawn.
	LABL draw the string name at both ends of the string.
	LABS draw the string name at the start of the string.
	LABA draw the string name with a directional arrow at both ends of the string.
	ARRO draw a directional arrow at both ends of the string.
	LEVS for contours draw the level only at the start of the string and draw all other strings as NOLA.
	LEVB for contours draw the level only at both ends of the string and all other strings as NOLA.
	NOLA do not draw string names.
Field 4	Frequency of annotation for CONP, COND, CONX, CONY.
Field 5 & 6	Local origin for CONX, CONY, start point of line CONL.
Field 7	Level style
	1.0 embed the annotation without a gap
	-1.0 embed the annotation with a gap
	2.0 embed the annotation and its image without a gap
	-2.0 embed the annotation and its image with a gap
	Default is -1, no image with a gap.
Field 8 & 9	End point of line for CONL.



DRAW

Field 10 Angle of text

See Rotating text and symbols

✎ As Fields 5, 6, 8, 9 are used for contour annotation, no SPRD is possible.

Case 6 - Draw string links with null/zero levels

Minor option 825

Field 1 String name if only one string is to be drawn. Partial string name if a set of strings is to be drawn. Care should be exercised when mixing this style of masking with option 019 style. If this field is left blank all strings satisfying the 019 selection masks will be drawn.

Field 2 Null/zero level indicator

NCOL Draw string links having a null level at either end in the current colour or the special colour for null/zero levels which should be defined by a preceding minor option 805. All links are drawn.

ZCOL Draw string links having a zero level at either end in the current colour or the special colour for null/zero levels which should be defined by a preceding minor option 805. All links are drawn.

NULL Draw only string links having a null level at either end in the current colour or the special colour for null/zero levels which should be defined by a preceding minor option 805. String links with zero or other defined levels are not drawn.

ZERO Draw only string links having a zero level at either end in the current colour or the special colour for null/zero levels which should be defined by a preceding minor option 805. String links with null or defined levels are not drawn.

Field 5 & 6 SPRD for start.

Field 8 & 9 SPRD for end.

✎ If field 2 is coded NCOL, ZCOL, NULL or ZERO the string links drawn will use the special colour for null/zero levels defined by minor option 805.

✎ Null or zero levels can also be annotated using a macrosymbol. See minor option 861, 'Annotate every string point with a macrosymbol' for further details.

826 Draw string using current line style

826 Plan drawing

Minor option	826
Field 1	Name of string to be drawn. If a geometry string name is specified, the geometry string code used to indicate the points to be drawn should be specified by a preceding minor option 809. or blank to draw all strings that satisfy the current selection mask table (if any). or partial string name to draw selected strings.
Field 3	Annotation to be drawn LABL draw the string name at both ends of the string. LABS draw the string name at the start of the string. LEVS for contour strings, draw the level only at the start of the string. LEVB for contour strings, draw the level only at both ends of the string. NOLA do not draw string names.
Field 5 & 6	SPRD for start of string to be drawn; if omitted the start of the string is assumed.
Field 8 & 9	SPRD for end of string to be drawn; if omitted the end of the string is assumed.

826 Cross section drawing


Minor option	826
Field 1	Section set reference letter
Field 3	Annotation to be drawn LABL draw the string name at both ends of the string. NOLA do not draw string names.
Field 4	Interval for cross sections to be drawn. If the reference string used to generate the cross section was a master string, code a chainage interval which must be a multiple of the original chainage interval. If the reference string was a 3D string, the section nearest to the multiple of the coded interval is drawn. If the interval is negative, it is assumed to be a point number interval, eg, -2 would mean draw every other section.




DRAW

Field 5 & 6 SPRD for first section to be drawn; if omitted the first section is assumed.

Field 8 & 9 SPRD for last section to be drawn; if omitted the last section is assumed.

 If you are drawing more than one cross section set, it is advisable to draw the section sets in the order in which they occur on the reference string to ensure that the sections are drawn in the correct order.

 A maximum of 841 cross sections can be drawn on an infinite page (29 rows by 29 columns).

826 Long section drawing

Minor option 826

Field 1 Name of string to be drawn. If a geometry string name is specified, the geometry string code used to indicate the points to be drawn should be specified by a preceding minor option 809.

Field 2 Name of string from which normals are erected to define the extents of the string to be drawn. If omitted, the string in Field 1 is assumed.

Field 3 Annotation to be drawn

LABL draw the string name at both ends of the string.

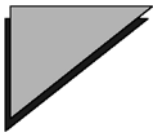
Field 5 & 6 SPRD for start of string to be drawn; if omitted the start of the string is assumed.

Field 7 Dimension of string to be drawn on the vertical axis (default 3 - Z coordinate).
Derived (negative) dimensions are not allowed in this option.

Field 8 & 9 SPRD for end of string to be drawn; if omitted the end of the string is assumed.


827 Draw triangulation and annotate triangles

Minor option	827
Field 1*	Triangulation name
Field 2	Annotation to be drawn
	CENT draw crosses at triangle centroids
	LEVC draw levels at triangle centroids
	LEVV draw levels at triangle vertices
	FLOW draw arrows at triangle centroids in the direction of maximum gradient.
Field 3	Triangles to be drawn
	Group draw only the triangles that are within the specified group.
	NULL draw only null triangles
	UNGP draw only ungrouped triangles.
Field 4	Triangle/annotation indicator
	1 draw triangulation (default).
	-1 draw annotation only.



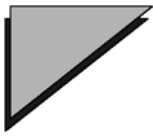
828 Draw drainage network, pipes, manholes and gullies

Minor option	828
Field 1	Drainage string name. If blank all strings will be drawn.
Field 2	Code DETA for standard detail interpretation Code SYMB for (manhole) symbol according to string data.
Field 3	Code ANNO for standard annotation
Field 4	Manhole/inlet size in drawing units.

 To use DETA and SYMB standard drainage macros DRAINSY1, DRAINSY2, DRAINSY3 and DRAINSY4 must be present in the macro library.

829 Draw drainage long section

Minor option	829
Field 1*	Pipe string name
Field 2	Annotation to be drawn
	DETA Pipes are drawn between string points and scaled according to pipe dimensions. Manholes are drawn as scaled manhole symbols with a vertical pipe between the cover and invert levels.
Field 4	Base of manhole drawing style
	0 = flat (default)
	1 = slope



DRAW

830 Draw text strings

Minor option	830
Field 1	Name of text string to be drawn must start with * Mask to select all strings to be drawn must start with * Blank - assumes all text strings (starting with *)
Field 2	Blank - use character height and angle from text string.
Field 6	Point no. of first point on text string to be drawn, if omitted the start is assumed.
Field 7	Character height in drawing units, overrides the value stored in the string.
Field 9	Point number of last point on text string to be drawn, if omitted the end is assumed.
Field 10	Bearing of the base of the characters, overrides the value stored in the string.


831 Draw raster backcloth


Major option	DRAW
Model 1	RASTER
Minor option	831
Field 1*	Element name to be used for reference purposes (4 characters).
Field 4	Bearing of left hand side of image.
Field 5 & 6*	Bottom left corner coordinates.
Field 7	Resolution in model units per pixel in the X direction.
Field 8 & 9	Top right corner coordinates.
Field 10	Resolution in model units per pixel in the Y direction.


 Enter data in either Fields 7, 7 & 10 or 8 & 9.

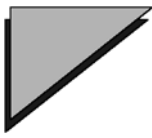
The name of the file containing the image to be drawn must be specified in a subsequent 001 record.

Minor option	001
	Path name of file containing the image. The file extension must be specified. Windows and OS/2 bitmap (.bmp), JPEG (.jpg, .jpeg), PC Paintbrush (PCX), TIFF (.tif), Targa (.tga), Sun Raster (.ras), Photo CD, MacPaint, CMU, WM Raster, Portable Bit Map (PBM, PGM, PPM), FBM, Faces Project (.fbm), Utah RLE, X Window Dump (.xwd), McIDAS areafile, G3 FAX, GEM Bit, X Pixmap, and X Bitmap (.xbm).

 If more than one image is to be drawn, they must all be drawn within the same major option.

 Images are overlaid in alphabetical sequence; for example, an image with an element name of AAAA is drawn underneath an image with an element name of BBBB.

 The only valid minor options when model name RASTER is specified are 800, 801, 802, 803, 805, 814, 815, 817, 831 and 001.



845 Define axis annotation area

Minor option	845
Field 1	<i>Column 1</i> B draw complete box L draw a line <i>Column 2</i> Position of the annotation box on section aperture: T Top B Bottom <i>Column 3</i> Position of the annotation box on section aperture: L Left R Right C position at zero offset point If this field is omitted, the reference point is bottom left corner, and the area outline is not drawn. <i>Column 4</i> (used in conjunction with L in column 1) B draw a line along the bottom of the defined annotation area. T draw a line along the top. L draw a line along the left hand side R draw a line along the right hand side.
Field 2	Axis annotation positioning. <i>Column 1</i> T Place annotation abutting the top of the box. B Place annotation abutting the bottom of the box. C Centre the annotation vertically. <i>Column 2</i> L Left justify the annotation. R Right justify annotation. C Centre the annotation. M Midway between adjacent points. <i>Column 3</i> P Draw pips at the actual point. Blank No pips drawn. <i>Column 4</i> (position of pips)

L	Left hand side
R	Right hand side
T	Top
B	Bottom

Field 3* Area name, this is used to refer to the area in subsequent options.
 A number of alternatives is provided.

Define area in model units

Field 5 Horizontal distance of bottom left hand corner of area from reference point in model units. This may be positive or negative.

Field 7 Horizontal length in model units.

Field 8 Vertical distance of bottom left hand corner of area from reference point in model units. This may be positive or negative.

Field 10 Height of area in model units.

Define area in drawing units

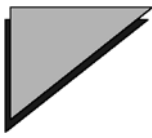
Field 6 Horizontal distance of bottom left hand corner of area from reference point in drawing units. This may be positive or negative.

Field 7 Horizontal length of area in drawing units.

Field 9 Vertical distance of bottom left hand corner of area from reference point in current linear measure units.

Field 10 Height of area in drawing units.

- ☞ If fields 5, 6, 7, 8, 9, 10 are omitted, the area abuts the base of the section aperture. In this case, the length of the area is the full length of the drawing aperture and the height of the area is three times the current character height.
- ☞ If field 7 is coded and field 10 is not, the default for field 10 (height of the area) is the height of the drawing aperture, this allows areas adjacent to the vertical axis to be defined. If a value of 0.0 is coded in field 7 and field 10 is left blank, this has the effect of boxing the complete aperture.
- ☞ If field 10 is coded and field 7 is not, the default for field 7 (length of area) extends to the full drawing aperture: this allows areas adjacent to the horizontal axis to be defined.



846 Draw axis annotation

846 Cross section drawing

Minor option	846
Field 1	Leave blank to draw the offset at the interval given in Field 4. Code the cross section set reference to draw the annotation extracted from the cross section string. The actual annotation drawn is determined by Field 7.
Field 3*	Name of area in which annotation is drawn (previously defined on an 845 option).
Field 4	Interval for the drawing of annotation. If omitted, annotation is drawn at all section string points. For a section string, the point nearest to the multiple of this distance is taken. If the interval is coded as a negative number, it is assumed to be a point number interval, eg -2 means draw annotation at every second string point.
Field 5 & 6	SPRD for first cross section to be annotated. This must be greater than or equal to the start point supplied with option 804.
Field 7	String dimension to be drawn. See <i>String types and dimensions in Related Topics</i> .
Field 8 & 9	SPRD for last cross section to be annotated. This must be less than or equal to the end point supplied with option 804.
Field 10	Angle of annotation measured clockwise relative to the left hand side of the drawing.

846 Long section drawing

Minor option	846
Field 1	To draw the chainage or distance at the interval given in Field 4, leave blank To draw extracted information, code the name of the string from which the annotation is to be extracted. This may be a long section string or any other string. The actual annotation drawn is determined by Field 7. To draw a crossfall schematic (Field 7=-36), code SUPE . Note that in this case, two 846 minor options have to be specified (see below). To draw superelevation between two strings (Field 7=-37, code the name of the first string for the superelevation calculation (usually the centre line or reference string). To annotate the level difference between two strings (Field 7 = -49) at the reference string chainages, code the name of the first string.

Field 2	<p>String name</p> <p>To draw the chainage or distance or extracted information, specify the name of the string from which normals are erected to define the extent of the string to be drawn. If omitted, the string in Field 1 is assumed.</p> <p>To draw a horizontal schematic 1 (Field 7=-30.0), horizontal schematic 4 (Field 7= -33.0) or vertical schematic 1 (Field 7=-34.0) this string must be a geometry string.</p> <p>To draw superelevation between two strings (Field 7=-37), this is the second string for the superelevation calculation (usually a channel or offset string).</p> <p>To annotate the level difference between two strings (Field 7 = -49) at the reference string chainages, code the name of the second string. If omitted, the level difference between the first string and the reference string is annotated.</p>
Field 3*	<p>Name of area in which annotation is drawn (previously defined on an 845 option).</p>
Field 4	<p>Interval for the drawing of annotation (positive value)</p> <p>If omitted, annotation is drawn at all string points.</p> <p>If the string is a master string, this is the chainage interval and annotation will be drawn at each point on the string which is a multiple of this chainage interval</p> <p>If the string is a 3D, interface or section string, the point nearest to the multiple of this distance is taken.</p> <p>If the interval is coded as a negative number it is assumed to be a point number interval, eg -2 means draw annotation at every second string point.</p>
Field 5 & 6	<p>SPRD for start point of part of string for which annotation is drawn, if omitted the start of the string is assumed.</p>
Field 7	<p>String dimension to be output. See <i>String types and dimensions</i> in <i>Related Topics</i>.</p> <p>In addition to the derived (negative) string dimensions which are available for all strings, the following values may also be coded.</p> <ul style="list-style-type: none"> -9.0 Datum of profile -22.0 Cumulative distance between adjacent points -49.0 Level difference between two profiles <p>To draw the schematic diagrams:</p> <ul style="list-style-type: none"> -30.0 Geometry string only, horizontal schematic 1 -33.0 Geometry string only, horizontal schematic 4 -34.0 Geometry string only, vertical schematic 1 -35.0 Vertical annotation schematic -36.0 Crossfall schematic -37.0 Superelevation between two strings
Field 8 & 9	<p>SPRD for end point of part of string for which annotation is drawn. If omitted, the end of the string is assumed.</p>



DRAW

- Field 10 Angle of annotation measured clockwise relative to the left hand side of the drawing.
- ✎ When using dimensions -21 to -24, M should be coded in column 2, field 2 of the 845 option.
 - ✎ When using dimension -36, two 846 records have to be defined in order to obtain the crossfall schematic diagram.
 - ✎ Transitions in schematic diagrams may be represented by 'A' value or 'RL' value according to the project settings.
 - ✎ When extracting information from a geometry string, the type of information extracted is indicated by minor option 809, 'Geometry string annotation'.
 - ✎ A reference chainage for distance intervals may be specified on an additional 804 record.
 - ✎ By default, overlapping and cluttered text is tidied up in the drawing. You can change this behaviour by setting the parameter CLUTTEXT to be zero in the parameter file *.prj in the ... \mfw\parameters folder.



Second record

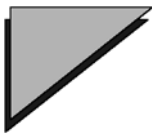
(Crossfall schematic - only if Field 7=-36 on preceding 846 option)

Minor option 846

- Field 1 Name of first string for the superelevation calculation, usually the centre line string
- Field 2 Name of the second string for the superelevation calculation, usually a channel string.
- Field 3 Name of the third string for the superelevation calculation, usually a channel string.
- ✎ In areas where annotation is drawn overlapping, it is automatically discarded. If you want to retain overlapping annotation, you should set the parameter CLUTTEXT in the parameter file for your project.

847 Draw text in an annotation area

Minor option	847
Field 1*	<p>C use STATION D DISTANCE E EXISTING P PROPOSED L LEVEL</p> <p>* use the text that follows on an 001 option, note that this string may contain embedded text variables.</p>
Field 3*	<p>Area name. The text is placed in this area (previously defined on an 845 option).</p> <p>If a text variable (see option 848) has been defined, only this text is to be included. It is possible to code the text variable name in field 1.</p>
Field 10	<p>Angle of text measured clockwise relative to the left hand side of the drawing.</p> <p>If the angle is positive, text is positioned measured clockwise relative to the left hand side of the drawing. If negative, text is positioned clockwise relative to the normal lying to the left of the string.</p> <p> Note that the text is first rotated, then justified.</p> <p> For variable text (ie Field 1, column 1=*) an option 001 record must immediately follow the 847 record.</p>
Minor option	<p>001</p> <p>Any text is permissible except '&'. Text variables may be included (see option 848) and these are signified by enclosing within ampersands eg &VARI&.</p>



848 Define a text variable

848 Cross section drawing

Minor option	848
Field 2	Section set reference letter (cross sections only). The subreference of the section string will be used to derive the information from the associated reference string where this is needed.
Field 3*	Text variable name.
Field 7	String dimension to be output eg 3.0 would give the level, 5.0 would give the intersecting string name for a section string. If a negative value is coded, values can be extracted from the string index or derived values can be drawn as follows. - 1.0 String name - 2.0 Subreference - 4.0 Number of points in string - 9.0 Value of the level datum of the drawn cross section diagram. - 11.0 Point sequence number of the reference string

848 Long section drawing

Minor option	848
Field 1	Name of string from which information is extracted (this can be a drainage string).
Field 3*	Text variable name.
Field 7	String dimension to be output eg 3.0 would give the level, 5.0 would give the name of the intersecting string for a section string. If a negative value is coded, values can be extracted from the string index or derived values can be drawn as follows. - 1.0 String name - 2.0 Subreference - 4.0 Number of points in string - 9.0 Value of the level datum of the drawn section aperture. - 11.0 Point sequence number of the reference string

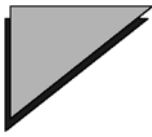
849 Draw ordinates from an axis to a string

849 Cross section drawing


Minor option	849
Field 1	Cross section set reference letter.
Field 3	<i>Column 1</i>
	V draw vertical ordinates from the horizontal axis to the string points.
	H draw horizontal ordinates from the vertical axis to the string points.
	<i>Column 2</i>
	F draw full length line.
	S draw short ordinate from axis.
	draw ordinates to top of section aperture
Field 4	Interval for the drawing of ordinates. If omitted, annotation is drawn at all section string points. For a section string, the point nearest to the multiple of this distance is taken. If the interval is coded as a negative number it is assumed to be a point number interval, eg - 2 means draw annotation at every second string point.
Field 5 & 6	SPRD for first cross section to be annotated. This must be greater than or equal to the start point supplied with option 804.
Field 7	Vertical offset from horizontal axis to start of ordinate (drawing units).
Field 8 & 9	SPRD for last cross section to be annotated. This must be less than or equal to the end point supplied with option 804.
Field 8 & 9	SPRD for end point of part of string for which annotation is drawn. If omitted, the end of the string is assumed.
Field 10	Length of short ordinate. If omitted, the default tick size is used.

849 Long section drawing



Minor option	849
Field 1	Name of string to which ordinates are drawn. If a geometry string is coded, the geometry string code used to indicate the points to which ordinates are drawn should be specified using a preceding minor option 809
Field 2	Name of string from which normals are erected to define the extents of string to be drawn. If omitted, the string in Field 1 is assumed.

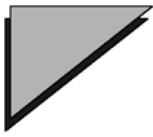


DRAW

Field 3	<i>Column 1</i>
	V draw vertical ordinates from the horizontal axis to the string points.
	H draw horizontal ordinates from the vertical axis to the string points.
	<i>Column 2</i>
	F draw full length line.
	S draw short ordinate from axis.
	draw ordinates to top of section aperture
Field 4	Interval for the drawing of ordinates. If omitted all string points are drawn. If the string is a master string, this is taken as the chainage interval, if it is a 3D, interface or section string the point nearest to the multiple of this distance is taken. If the interval is coded as a negative number it is assumed to be a point number interval, eg - 2 means draw annotation at every second string point. A reference chainage for distance intervals may be specified on an additional 804 record.
Field 5 & 6	SPRD for start point of part of string for which annotation drawn. If omitted the start of the string is assumed.
Field 7	Offset from datum for start of ordinate (drawing units).
Field 8 & 9	SPRD for end point of part of string for which annotation is drawn. If omitted, the end of the string is assumed.
Field 10	Length of short ordinate. If omitted default tick size is used.
	 The geometry string code used to indicate the points to which ordinates are drawn should be specified using minor option 809, 'Geometry string annotation'.

850 Draw selected strings with a style set

Minor option	850
Field 1	String name, mask or blank if all strings are to be drawn
Field 4	Excluded string indicator
	0 do not draw strings which are not explicitly coded in the style set.
	1 draw strings which are not explicitly coded in the style set in the default style.
Minor option	001
Field 1	Style set name.
	If blank, the default style set associated with the current model is used.
	The style set is searched for in the styles directories (as specified in the project file) in the order project, private, public styles directory.
	Alternatively, a full path name can be specified.
	 If the style set specified in the 001 record cannot be found, either no strings or all strings will be drawn according to the setting of Field 4 in minor option 850.
	 Long filenames may be used with this option. Long filenames allow a total of 256 characters to be used for the path, the filename and the extension, and the filename can include space characters.



DRAW

Option 851

Minor option 851

This option is only available from the GUI. No attempt should be made to edit the information in the fields, as no published information for field content will be provided, and results after editing the fields cannot be guaranteed.

Option 852


Minor option 852


This option is only available from the GUI. No attempt should be made to edit the information in the fields, as no published information for field content will be provided, and results after editing the fields cannot be guaranteed.



853 Annotate master string and two other strings with crossfall



Minor option	853
Field 1	Reference string name; note that the string itself is not drawn, only the annotation. The reference string specified must be a master string.
Field 2	First subsidiary string name
Field 3	Second subsidiary string name
Field 4	Interval at which string is to be annotated: If blank, annotate points at which a change in crossfall occurs If positive, annotate at the specified interval If negative, annotate at every specified number of points
Fields 5 & 6	SPRD for first point
Fields 8 & 9	SPRD for last point

 Points of zero crossfall are represented by a line drawn between the subsidiary strings.

 Where two crossfall values are shown, the top value represents the left hand crossfall and the bottom value represents the right hand crossfall relative to the reference string.

854 Annotate master string with vertical intersection points in plan

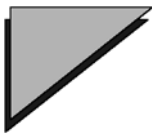
Draw intersection point symbol

Minor option	854
Field 1	Name of geometry string
Field 3	Symbol switch: Plan drawings only: 0 Whole symbol (default) 1 Gradient legs and arrow only 2 VIP symbol only 3 Gradient legs, arrow and VIP symbol Long section drawings only: 10 VIP symbol, gradient links and bottom legs
Field 4	Size of symbol
Fields 5 & 6	SPRD for start
Field 7	Symbol offset Symbol offsets should be coded positive for the outside of a curve and negative for the inside. The default symbol offset is defined in the project settings.
Fields 8 & 9	SPRD for end
Field 10	Size of gradient legs. If no size is specified, the size of the legs is derived from the symbol size.
	 The area fill used within the symbol is determined by minor option 807 'Fill area characteristics'.
	 The bottom leg of the symbol is drawn normal to the string in plan drawings, and normal to the page in long section drawings.


Annotate intersection point symbol

First record:

Minor option	854
Field 1	Name of geometry string; note that the string itself is not drawn, only the annotation.
Field 2	Text increment (Imnn / Dmnn) See 'Positioning text'



DRAW

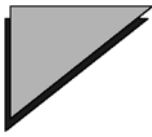
Field 3	Symbol switch: 4 Text
Field 4	Length of symbol
Field 5 & 6	SPRD for start of annotation.
Field 7	Symbol offset
Field 8 & 9	SPRD for end of annotation.
Field 10	Gradient switch (only used if the subsequent 854 option has Field 4 set to -23): 1 Percent gradient (default as per project settings) 2 Per mille gradient The default gradient switch setting is defined in the project settings. Second record:
Minor option	854
Field 3	Text variable name, See 'Text variables'
Field 4	Dimension of string to be drawn.
	 The second record must be followed by an 001 record specifying the text to be used.
Minor option	001 Any text is permissible.

Draw vertical curve details

Minor option	854
Field 1	Label of geometry string
Field 3	Symbol switch: 5 Vertical curve details
Fields 5 & 6	SPRD for start of annotation
Fields 8 & 9	SPRD for end of annotation

856 Annotate cadastre string with symbols at every point

Minor option	856
Field 1	Cadastre string name. The string name must begin with 'P'. A partial string name may be specified.
Field 2	Table name. The table name must match an 'A:' record in the cadastral symbol file.
Field 3	Feature code. A partial feature code may be specified. If blank, the symbols for all codes are drawn. The feature code must match a 'B:' record in the cadastral symbol file.
Field 6	Start point number.
Field 9	End point number.



857 Annotate long section points with text

Minor option 857

Field 1	String name; note that the string itself is not drawn, only the annotation.
Field 2	Intersecting string name (partial string names may be used).
Field 3*	Annotation area name, annotation is placed in this area previously defined on an 845 option.
Field 5 & 6	SPRD for start of string to be drawn, if omitted the start of the string is assumed.
Field 7	Text offset, measured from string to start of text in current linear measure units (blank if field 3 is coded).
Field 8 & 9	SPRD for end of string to be drawn, if omitted the end of the string is assumed.
Field 10	Angle of text. If the angle is positive, text is positioned measured clockwise relative to the left hand side of the drawing. If negative, text is positioned clockwise relative to the normal lying to the left of the string.

Minor option 001

Any text is permissible. Text variables may not be used.

858 Draw annotation between string points

First record

Minor option	858
Field 1	String name. For a geometry string the type of point to be used to indicate the position of the annotation should be specified using a preceding minor option 809 Partial string name; all selected strings will be annotated. If blank, all strings satisfying the current selection mask table, set up with option 019, will be annotated.
Field 2	Text increment (Imnn / Dmnn)
Fields 5 & 6	SPRD of start
Field 7	Text offset, measured from string to start of text in drawing units. For geometry strings, the offset should be specified using minor option 809
Fields 8 & 9	SPRD of end
Field 10	Angle of text. Subsequent records are not required if the first record is followed by: 001,Text (which may include a string dimension in the format &-NN&) For example, 001,Radius = &-44& will annotate curve elements with 'Radius = 1234.56'

Subsequent records

	If a subsequent record is used it must be followed by an 001 record to define the annotation including the text variable
Minor option	858
Field 3	Text variable name given to the required string dimension. This name must appear in a subsequent 001 option.
Field 4	Dimension of string to be drawn. The following values are used for geometry strings with the information code HTPS only: -1.0 String name. -2.0 Subreference -3.0 String contents indicator. -4.0 Number of points in string. -5.0 Minimum x coordinate in string. -6.0 Minimum y coordinate in string. -7.0 Maximum x coordinate in string. -8.0 Maximum y coordinate in string Note that the same values would be drawn at every string point. -11.0 Point sequence number.



DRAW

When using dimensions -19 to -24, M should be coded in column 2, field 2 of the 845 option.

- 19.0 Cumulative slope distance between adjacent points.
- 20.0 Slope distance between adjacent points
- 21.0 Plan distance between adjacent points.
- 22.0 Cumulative plan distance between adjacent points (long sections only)
- 23.0 Percentage gradient between adjacent points.
- 24.0 Level difference between adjacent points.
- 40.0 Length of straight elements.
- 41.0 Bearing of straight elements.
- 42.0 RL value or A value of transition elements.
- 43.0 Length of transition elements.
- 44.0 Radius of curve elements.
- 45.0 Length of curve elements.

001,Text variable name in the format &NNN&

859 Draw annotation at string points

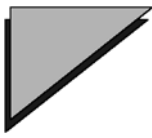
Case 1 - General strings

First record

Minor option	859
Field 1	String name. For a geometry string the type of point to be used to indicate the position of the annotation should be specified using a preceding minor option 809. Partial string name; all selected strings will be annotated. If blank, all strings satisfying the current selection mask table, set up with option 019, will be annotated. To annotate the level difference between two strings (Field 4 = -49, second record) at the reference string chainages, code the name of the first string. Note that this is the string on which the annotation is drawn.
Field 2	Text increment (Imnn / Dmnn), See Positioning text for further details.
Field 3	Second string name (Field 4 = -49, second record). To annotate the level difference between two strings at the reference string chainages, code the name of the second string. If omitted, the level difference between the first string and the reference string is annotated.
Fields 5&6	SPRD of start
Field 7	Text offset, measured from string to start of text in drawing units. For geometry strings, the offset should be specified using a preceding minor option 809
Fields 8&9	SPRD of end
Field 10	Angle of text. See Rotating text and symbols for further details. Subsequent records are not required if the first record is followed by: 001,Text (which may include a string dimension in the format &-NN&) for example, 001,Name = &-1& will annotate curve elements with 'Name = string name ' See String types and dimensions for details of the string dimensions which may be used with this option.

Subsequent records

Minor option	859
Field 3	Text variable name. See Text variables for further details.
Field 4	Dimension of string to be drawn. See String types and Dimensions for further details. 001,Annotation and text variable name



Case 2 - Drainage strings

First record

Minor option	859
Field 1	String name Partial string name; all selected strings will be annotated. If blank, all strings satisfying the current selection mask table, set up with option 019, will be annotated.
Field 2	Text increment (Imnn / Dmnn)
Field 3	Reference string or pipe name, if field 1 is PMAN
Fields 5&6	SPRD of start
Field 7	Text offset, measured from string to start of text in drawing units.
Fields 8&9	SPRD of end
Field 10	Angle of text. Subsequent records are not required if the first record is followed by: 001, Text string (which may include a string dimension in the format &-NN&) for example 001,Name = &-1& will annotate curve elements with 'Name = string name '

Subsequent records

If a subsequent record is used it must be followed by an 001 record to define the annotation including the text variable

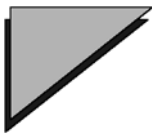
Minor option	859
Field 3	Text variable name.
Field 4	Dimension of string to be drawn. 001, Annotation and text variable name

Case 3 - Cadastre strings

First record

Minor option	859
Field 1*	Cadastre string name Partial string name; all selected strings will be annotated.

	If blank, all strings satisfying the current selection mask table, set up with option 019, will be annotated.
Field 2*	Text increment (Imnn/Dmnn).
Field 3*	Feature code
Field 6	Start point number
Field 7	Text offset, measured from string to start of text in drawing units.
Field 9	End point number
Field 10	Angle of text.
	Subsequent records are not required if the first record is followed by: 001, Text string (which may include a string dimension in the format &N&) For example: 001,Point number = &5& will annotate curve elements with 'Point number = Survey point number'
<i>Subsequent records</i>	
Minor option	859
Field 3	Text variable name.
Field 4	Dimension of string to be drawn. <i>String types and dimensions</i> 001, Annotation and text variable name



860 Annotate every string point with pips

860 Plan drawing

Minor option	860
Field 1	Name of string to be drawn.
Field 1	Name of string; note that the string itself is not drawn, only the annotation. If a geometry string name is specified, the geometry string code used to indicate the pips to be drawn should be specified by a preceding minor option 809. Partial string name; all selected strings will be annotated If blank, all strings satisfying the current selection mask table, set up with option 019, will be annotated.
Field 4	Length of pip in drawing units.
Field 5 & 6	SPRD for first point.
Field 7	Offset of centre of pip, measured normal to the string point. For geometry strings, the offset should be specified using a preceding minor option 809
Field 8 & 9	SPRD for last point.
Field 10	Angle of symbol.

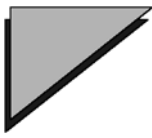
860 Cross section drawing

Minor option	860
Field 1	Section set reference letter; note that the string itself is not drawn, only the annotation.
Field 4	Length of pip in drawing units.
Field 5 & 6	SPRD for the first cross section to be annotated. This must be greater than or equal to the start point supplied on the 804 option.
Field 7	Offset of centre of pip, measured vertically.
Field 8 & 9	SPRD for the last cross section to be annotated. This must be less than or equal to the end point supplied on the 804 option.
Field 10	Angle of symbol relative to the vertical axis.

860 Long section drawing

Minor option	860
Field 1	Name of string; note that the string itself is not drawn, only the annotation. If a geometry string name is specified, the geometry string code used to indicate the pips to be drawn should be specified by a preceding minor option 809.

Field 4	Length of pip in drawing units.
Field 5 & 6	SPRD for first point.
Field 7	Offset of centre of pip, measured normal to the string point. For geometry strings, the offset should be specified using a preceding minor option 809
Field 8 & 9	SPRD for last point.
Field 10	Angle of symbol.



861 Annotate every string point with a macrosymbol

861 Plan drawing

Minor option	861
Field 1	Name of string; note that the string itself is not drawn, only the annotation. If a geometry string name is specified, the geometry string code used to indicate the points where the macrosymbol is drawn should be specified by a preceding minor option 809. Partial string name; all selected strings will be annotated (plan drawings only) If left blank, all strings satisfying the current selection mask table, set up with option 019, will be annotated.
Field 2 & 3	Macrosymbol name. If the macrosymbol name NULLSYMB is used, the macrosymbol is only drawn at points having a null level. If the macrosymbol name ZEROSYMB is used, the macrosymbol is only drawn at points having a zero level.
Field 4	Width of symbol. If the width is positive drawing units (i.e. cms or inches) are used. If the width is negative model units are used.
Field 5 & 6	SPRD for first point.
Field 7	Height of symbol. If the height is positive drawing units (i.e. cms or inches) are used. If the height is negative model units are used.
Field 8 & 9	SPRD for last point.
Field 10	Angle of symbol.

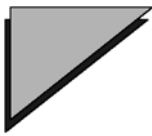
861 Cross section drawing

Minor option	861
Field 1	Section set reference letter; note that the section string itself is not drawn, only the annotation.
Field 2 & 3	Macrosymbol name.
Field 4	Width of symbol. If the width is positive drawing units (i.e. cms or inches) are used. If the width is negative model units are used.
Field 5 & 6	SPRD for the first cross section to be annotated. This must be greater than or equal to the start point supplied on the 804 option.

Field 7	Height of symbol. If the height is positive drawing units (i.e. cms or inches) are used. If the height is negative model units are used.
Field 8 & 9	SPRD for the last cross section to be annotated. This must be less than or equal to the start point supplied on the 804 option.
Field 10	Angle of symbol relative to the vertical axis. See Rotating text and symbols.

861 Long section drawing

Minor option	861
Field 1	Name of string; note that the string itself is not drawn, only the annotation. If a geometry string name is specified, the geometry string code used to indicate the points where the macrosymbol is drawn should be specified by a preceding minor option 809.
Field 2 & 3	Macrosymbol name.
Field 4	Width of symbol. If the width is positive, drawing units (i.e. cms or inches) are used. If the width is negative, model units are used.
Field 5 & 6	SPRD for first point.
Field 7	Height of symbol. If the height is positive drawing units (i.e. cms or inches) are used. If the height is negative model units are used.
Field 8 & 9	SPRD for last point.
Field 10	Angle of symbol.





862 Annotate every string point with a scaled macrosymbol

862 Plan drawing

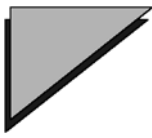
Minor option	862
Field 1	Name of string; note that the string itself is not drawn, only the annotation. If a geometry string name is specified, the geometry string code used to indicate the points where the macrosymbol is drawn should be specified by a preceding minor option 809. Partial string name; all selected strings will be annotated. If blank, all strings satisfying the current selection mask table, set up with option 019, will be annotated.
Field 2 & 3	Macrosymbol name
Field 4	The string dimension to be used to determine the size of the macrosymbol at each point.
Field 5 & 6	SPRD for first point.
Field 7	The scale to be used for the symbol, in the form 500.0 for 1:500 scale
Field 8 & 9	SPRD for last point.
Field 10	Angle of symbol A special version of this minor option may be used to annotate geometry strings which include railway switches. The switch annotation is automatically scaled and positioned at the correct points.

Switch annotation

Minor option	862
Field 1	Name of geometry string containing railway switches.
Field 2*	SWITCHES  No SPRD may be specified with this option.  All geometry strings meeting at the switch(s) must be present.

862 Long section drawing

Minor option	862
Field 1	Name of string; note that the string itself is not drawn, only the annotation. If a geometry string name is specified, the geometry string code used to indicate the points where the macrosymbol is drawn should be specified by a preceding minor option 809.
Field 2 & 3	Macrosymbol name
Field 4	The string dimension to be used to determine the size of the macrosymbol at each point.
Field 5 & 6	SPRD for first point.
Field 7	The scale to be used for the symbol, in the form 500.0 for 1:500 scale
Field 8 & 9	SPRD for last point.
Field 10	Angle of symbol.



863 Annotate every string point with a standard symbol

863 Plan drawing

Minor option	863
Field 1	Name of string; the string itself is not drawn, only the annotation. If a geometry string name is specified, the geometry string code used to indicate the points where the symbol is drawn should be specified by a preceding minor option 809. Partial string name; all selected strings will be annotated. If blank, all strings satisfying the current selection mask table, set up with option 019, will be annotated.
Field 2	Symbol number, coded left justified.
Field 4	The width of the symbol in drawing units .
Field 5 & 6	SPRD for first point.
Field 8 & 9	SPRD for last point.
Field 10	Angle of symbol.

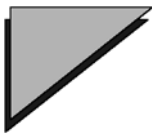
863 Cross section drawing

Minor option	863
Field 1	Section set reference letter; note that the string itself is not drawn, only the annotation.
Field 2	Symbol number, coded left justified.
Field 4	The width of the symbol in drawing units .
Field 5 & 6	SPRD for the first cross section to be annotated. This must be greater than or equal to the start point supplied on the 804 option.
Field 8 & 9	SPRD for the last cross section to be annotated. This must be less than or equal to the start point supplied on the 804 option.
Field 10	Angle of symbol relative to the vertical axis.

863 Long section drawing

Minor option	863
Field 1	Name of string; the string itself is not drawn, only the annotation. If a geometry string name is specified, the geometry string code used to indicate the points where the symbol is drawn should be specified by a preceding minor option 809.

Field 2	Symbol number, coded left justified.
Field 4	The width of the symbol in drawing units .
Field 5 & 6	SPRD for first point.
Field 8 & 9	SPRD for last point.
Field 10	Angle of symbol.



864 Annotate a string between string points


864 Plan drawing

First record

Minor option	864
Field 1	Name of string; The string itself is not drawn, only the annotation. If a geometry string name is specified, the geometry string code used to indicate the points between which the symbol is drawn should be specified by a preceding minor option 809. Partial string name; all strings satisfying this mask will be drawn. Blank; all strings satisfying the current 019 selection mask table, will be drawn.
Field 4	Dimension of string to be drawn.
Field 5 & 6	SPRD for first point of string to be drawn.
Field 7	Text offset, measured from string to start of text in drawing units. For geometry strings, the offset should be specified using a preceding minor option 809
Field 8 & 9	SPRD for last point on string to be drawn.
Field 10	Maximum allowable difference. This refers to the value chosen in field 4 and limits the range of values being drawn. In particular:- If field 4 = -21 Code a minimum distance below which partial distance are omitted. If field 4 = -23 Code a maximum percentage gradient above which the grade information is omitted. If field 4 = -24 Code a maximum level difference beyond which level differences are omitted. A second record may be specified if you wish to use a text variable for the annotation, or if you wish to place the annotation in a box (provided Field 4 in the first 864 record is blank).

Second record

Minor option	864
Field 1	Box indicator BOX draw information inside a box NOBX draw information only
Field 3	Text variable name.
Field 4	Dimension of string to be drawn.
Field 10	Angle of text.

 The second record must be followed by an 001 record specifying the text to be used.

Minor option	001
	Any text is permissible.

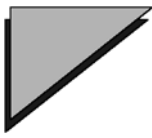
864 Cross section drawing

First record


Minor option	864
Field 1	Section set reference letter; note that the section string itself is not drawn, only the annotation.
Field 2	Name of intersecting string on section where the annotation is to start If blank, annotation will begin from the start of each section.
Field 3	Name of intersecting string on section where the annotation is to end If blank, annotation will continue to the last point on each section.
Field 4	Dimension of string to be drawn. If a second 864 option is to be used, this field must be left blank.
Field 5 & 6	SPRD for the first cross section to be annotated. This must be greater than or equal to the start point supplied on the 804 option.
Field 7	Text offset, measured at right angles to the cross section string link, in drawing units.
Field 8 & 9	SPRD for the last cross section to be annotated. This must be less than or equal to the end point supplied on the 804 option.
Field 10	Maximum allowable difference. This refers to the value chosen in field 4 and limits the range of values being drawn. In particular:- If field 4 = -21 Code a minimum distance below which partial distance are omitted. If field 4 = -23 Code a maximum percentage gradient above which the grade information is omitted. If field 4 = -24 Code a maximum level difference beyond which level differences are omitted. A second record may be specified if you wish to use a text variable for the annotation, or if you wish to place the annotation in a box (provided Field 4 in the first 864 record is blank).

Second record

Minor option	864
Field 1	Box indicator
	BOX draw information inside a box
	NOBX draw information only



DRAW

Field 3	Text variable name.
Field 4	Dimension of string to be drawn.
Field 10	Angle of text
	 The second record must be followed by an 001 record specifying the text to be used.
Minor option	001 Any text is permissible.


864 Long section drawing

First record

Minor option	864
Field 1	Name of string; The string itself is not drawn, only the annotation. If a geometry string name is specified, the geometry string code used to indicate the points between which the symbol is drawn should be specified by a preceding minor option 809.
Field 2	Name of string on section where the annotation is to start If blank, annotation will begin from the start of the section.
Field 3	Name of string on section where the annotation is to end
Field 4	Dimension of string to be drawn.
Field 5 & 6	SPRD for first point of string to be drawn.
Field 7	Text offset, measured from string to start of text in drawing units.
Field 8 & 9	SPRD for last point on string to be drawn.
Field 10	Maximum allowable difference. This refers to the value chosen in field 4 and limits the range of values being drawn. In particular:- If field 4 = -21 Code a minimum distance below which partial distance are omitted. If field 4 = -23 Code a maximum percentage gradient above which the grade information is omitted. If field 4 = -24 Code a maximum level difference beyond which level differences are omitted. A second record may be specified if you wish to use a text variable for the annotation, or if you wish to place the annotation in a box (provided Field 4 in the first 864 record is blank).

Second record

Minor option	864
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Field 1	Box indicator
	BOX draw information inside a box
	NOBX draw information only
Field 3	Text variable name.
Field 4	Dimension of string to be drawn.
Field 10	Angle of text
	 The second record must be followed by an 001 record specifying the text to be used.
Minor option	001
	Any text is permissible.



865 Annotate every string point with point sequence numbers

Minor option	865
Field 1	Name of string; the string itself is not drawn, only the annotation. Partial string name; all selected strings will be annotated. Blank; all strings satisfying the current 019 selection mask table will be annotated.
Field 2	Position of text. The start of the text is computed by offsetting the required distance, normal to the string at the string point. If omitted, the text will be drawn at the start position. To allow multiple sets of text to be associated with one string point, text can be moved up or down in multiples of the defined spacing relative to the start position. The spacing interval is defined on minor option 808.
Field 5 & 6	SPRD for first point of string to be drawn.
Field 7	Text offset, measured from string to start of text in drawing units. For geometry strings, the offset should be specified using a preceding minor option 809
Field 8 & 9	SPRD for last point on string to be drawn.
Field 10	Interval of annotation; if omitted all points are marked.

866 Annotate master string with chainages on one side only

Minor option	866
Field 1	Name of string; The string itself is not drawn, only the annotation. Partial string name; all selected strings will be annotated. Blank; all strings satisfying the current selection mask table, set up with option 019, will be annotated.
Field 2	Position of text. The starting position of the text is calculated by offsetting the required distance, normal to the string point. If omitted, the text will be drawn at the start position. To allow multiple sets of text to be associated with one string point, text can be moved up or down in multiples of a defined spacing relative to the start position. The spacing interval is defined on minor option 808.
Field 4	Length of pip in drawing units, pip is drawn centred on string point.
Field 5 & 6	SPRD for first point on string to be drawn, if omitted start of string is assumed.
Field 7	Text offset, measured from string to start of text in drawing units. For geometry strings, the offset should be specified using a preceding minor option 809.
Field 8 & 9	SPRD for last point on string to be drawn, if omitted end of string is assumed.
Field 10	Chainage marking interval. Chainages are drawn at multiples of this interval. The default marking interval is defined in the project settings.




867 Annotate master string with chainages on both sides

Minor option	867
Field 1	Name of string; note that the string itself is not drawn, only the annotation. Partial string name; all selected strings will be annotated. Blank; all strings satisfying the current selection mask table, set up with option 019, will be annotated.
Field 2	Position of text. The starting position of the text to be drawn is computed by offsetting the required distance, normal to the string point. If omitted, the text will be drawn at the start position. To allow multiple sets of text to be associated with one string point, text can be moved up or down in multiples of a defined spacing relative to the start position. The spacing interval is defined on minor option 808.
Field 4	Length of pip in drawing units.
Field 5 & 6	SPRD for first point on string to be drawn, if omitted start of string is assumed.
Field 7	Text offset, measured from string to start of text in drawing units. For geometry strings, the offset should be specified using a preceding minor option 809
Field 8 & 9	SPRD for last point on string to be drawn; if omitted end of string is assumed.
Field 10	Chainage marking interval. Chainages are drawn at multiples of this interval. The default marking interval is defined in the project settings.

868 Annotate every string point with a string dimension

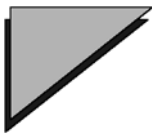
868 Plan drawing

Minor option	868
Field 1	Name of string; note that the string itself is not drawn, only the annotation. If a geometry string name is specified, the geometry string code used to indicate the points where the spot levels are drawn should be specified by a preceding minor option 809. Partial string name; all selected strings will be annotated. Blank; all strings satisfying the current selection mask table, set up with option 019, will be annotated.
Field 2	Position of text. The starting position of the text to be drawn is calculated by offsetting the required distance, normal to the string point. If omitted, the text will be drawn at the start position. To allow multiple sets of text to be associated with one string point, text can be moved up or down in multiples of a defined spacing relative to the start position. The spacing interval is defined on minor option 808. Code I followed by the number of lines (001 to 999) to move the text above the start position I004. Code D followed by the number of lines (001 to 999) to move the text below the start position for example D004.
Field 4	Dimension of string to be drawn.
Field 5 & 6	SPRD for first point on string to be drawn; if omitted start of string is assumed.
Field 7	Text offset, measured from string to start of text in drawing units. For geometry strings, the offset should be specified using a preceding minor option 809
Field 8 & 9	SPRD for last point on string to be drawn; if omitted end of string is assumed.
Field 10	Angle of text.

 For 868, 4=-25 if this field is blank, annotation will appear on the inside of string curves, normal to the string.

868 Cross section drawing

Minor option	868
Field 1	Section set reference letter; note that the string itself is not drawn, only the annotation.
Field 2	Position of text. The starting position of the text to be drawn is calculated by offsetting the required distance vertically.




DRAW

If omitted, the text will be drawn at the start position. To allow multiple sets of text to be associated with one string point, text can be moved up or down in multiples of a defined spacing relative to the start position. The spacing interval is defined on minor option 808.

Field 4	Dimension of string to be drawn.
Field 5 & 6	SPRD for first cross section to be annotated. This must be greater than or equal to the start point supplied on the 804 option.
Field 7	Text offset, measured horizontally from section string point to start of text in drawing units.
Field 8 & 9	SPRD for last cross section to be annotated. This must be less than or equal to the end point supplied on the 804 option.
Field 10	Angle of symbol relative to the vertical axis.

868 Long section drawing

Minor option	868
Field 1	Name of string; note that the string itself is not drawn, only the annotation. If a geometry string name is specified, the geometry string code used to indicate the points where the spot levels are drawn should be specified by a preceding minor option 809
Field 2	Position of text. The starting position of the text to be drawn is calculated by offsetting the required distance, normal to the string point. If omitted, the text will be drawn at the start position. To allow multiple sets of text to be associated with one string point, text can be moved up or down in multiples of a defined spacing relative to the start position. The spacing interval is defined on minor option 808.
Field 4	Dimension of string to be drawn.
Field 5 & 6	SPRD for first point on string to be drawn; if omitted start of string is assumed.
Field 7	Text offset, measured from string to start of text in drawing units. For geometry strings, the offset should be specified using a preceding minor option 809
Field 8 & 9	SPRD for last point on string to be drawn; if omitted end of string is assumed.
Field 10	Angle of text.

 For 868, 4=-25 if this field is blank, annotation will appear below the string curves, normal to the string.

869 Annotate a string at string points

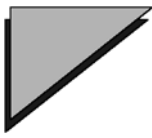
869 Plan/long section drawing

Case 1 - General strings

Minor option	869
Field 1	<p>Name of string; note that the string itself is not drawn, only the annotation. If a geometry string name is specified, the geometry string code used to indicate the points where the spot levels are drawn should be specified by a preceding minor option 809.</p> <p>Partial string name; all strings satisfying this mask will be drawn.</p> <p>Blank; all strings satisfying the current 019 selection mask table will be drawn.</p>
Field 2	<p>Position of text. The starting position of the text to be drawn is computed by offsetting the required distance, normal to the string point.</p> <p>If omitted, the text will be drawn at the start position. To allow multiple sets of text to be associated with one string point, text can be moved up or down in multiples of a defined spacing relative to the start position.</p> <p>The spacing interval is defined on minor option 808.</p>
Field 4	Dimension of string to be drawn.
Field 5 & 6	SPRD for first point on string to be drawn; if omitted start of string is assumed.
Field 7	Text offset, measured from string to start of text in drawing units. For geometry strings, the offset should be specified using a preceding minor option 809 . If this is a geometry string and field 10 is blank, the offset is measured to the nearest edge of the text.
Field 8 & 9	SPRD for last point on string to be drawn; if omitted end of string is assumed.
Field 10	<p>Angle of text.</p> <p>If this is a geometry string and this field is blank, the offset is measured to the nearest edge of the text.</p> <p>If the angle of text is not specified, annotation will appear on the inside of string curves and normal to the string when Field 4 is set to any of the following:</p> <p>869,4=-25 869,4=-46.0 869,4=-47.0</p>

Case 2 - Cadastre strings

Minor option	869
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DRAW

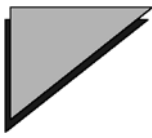
Field 1	Cadastre string name/partial name
Field 2	Position of text
Field 3	Feature code A partial feature code may be specified.
Field 4	Dimension of string to be drawn.
Field 6	Start point number
Field 7	Text offset, measured from string to start of text in drawing units.
Field 9	End point number
Field 10	Angle of text.

869 Cross section drawing

Minor option	869
Field 1	Section set reference letter; note that the section string itself is not drawn, only the annotation.
Field 2	Position of text. The starting position of the text to be drawn is computed by offsetting the required distance, normal to the string point. If omitted, the text will be drawn at the start position. To allow multiple sets of text to be associated with one string point, text can be moved up or down in multiples of a defined spacing relative to the start position. The spacing interval is defined on minor option 808.
Field 4	Dimension of string to be drawn.
Field 5 & 6	SPRD for first cross section to be annotated. This must be greater than or equal to the start point supplied on the 804 option.
Field 7	Text offset, measured from string to start of text in drawing units.
Field 8 & 9	SPRD for last cross section to be annotated. This must be less than or equal to the end point supplied on the 804 option.
Field 10	Angle of text. The following example will annotate each point on cross sections from chainage 60 to 80 with the level, offset and cut string name (dimensions 3,4,5 of a section string). The text will be offset 1 drawing unit to the right and the stacked vertically.

870 Fill selected triangles with current fill style

Minor option	870
Field 1*	Triangulation name.
Field 2	Triangle Group or NULL - if only null triangles are to be filled. UNGP - if only ungrouped triangles are to be filled.
Field 4	Draw/not draw triangulation. +1.0 - draw (default) -1.0 - do not draw.
Field 5	Lower level, above which all triangles are filled.
Field 6	Upper level, below which all triangles are filled.
Field 7	Start slope (decimal fraction), above which triangles are filled, must be zero or positive
Field 8	End slope (decimal fraction), below which triangles are filled. must be zero or positive
Field 9	Start whole circle bearing for aspect. Flat triangles are included in the colour fill when whole circle bearings are specified
Field 10	End whole circle bearing for aspect. Flat triangles are included in the colour fill when whole circle bearings are specified



875, 876 Fill area between two strings

875, 876 Plan drawing

Details of first string and fill details - 875

Details of second string - 876

Minor option	875
Field 1*	First string name.
Field 3	Element name for fill (optional).
Field 5 & 6	SPRD for first point on first string .
Field 7	Boundary indicator.
	1.0 draw boundary
	-1.0 do not draw boundary
Field 8 & 9	SPRD for last point on first string.
Minor option	876
Field 1*	Second string name.
Field 5 & 6	SPRD for first point on second string.
Field 8 & 9	SPRD for last point on second string.

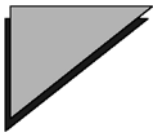
875, 876 Cross section drawing

Details of the design section set and fill - 875

Details of the ground section set - 876

Minor option	875
Field 1*	Design section set reference letter, or individual section string name.
Field 5 & 6	SPRD for first section to be hatched.
Field 7	Boundary indicator.
	1.0 draw boundary
	-1.0 do not draw boundary
Field 8 & 9	SPRD for last section to be hatched.
Field 10	Hatching indicator.
	Blank hatch both cut and fill
	1.0 hatch cut only

	-1.0	hatch fill only
Minor option	876	
Field 1*		Ground section set reference letter, or individual section string name.
Field 5 & 6		SPRD for first section to be hatched.
Field 8 & 9		SPRD for last section to be hatched.




877, 878 Fill area between two lines

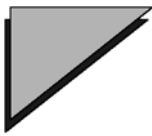
Details of first line and fill details - 877

Details of second line - 878

Minor option	877
Field 3	Element name for fill (optional).
Field 5 & 6*	Start of line 1 (model coordinates).
Field 7	Boundary indicator. 1.0 draw boundary -1.0 do not draw boundary
Field 8 & 9*	End of line 1 (model coordinates).
Minor option	878
Field 5 & 6*	Start of line 2 (model coordinates).
Field 8 & 9*	End of line 2 (model coordinates).

879 Fill area inside a boundary

Minor option	879
Field 1	Name or partial name of boundary string(s)
	 If the area to be filled is not already enclosed, it is closed automatically by the fill.
Field 2	Fill area angle indicator
	SHEE Fill area relative to page (default)
	STRG Fill area relative to first string link
Field 3	Annotation indicator
	NOAN No annotation (default)
	ANNO Annotate with string sub-reference
Field 7	Boundary indicator.
	1.0 draw boundary (default)
	-1.0 do not draw boundary
Field 10	Annotation angle
	Positive Text drawn at the specified angle relative to page (default 0)
	Negative Text drawn at the specified angle relative to the first string link.




DRAINAGE macros

Macro LONGDRAI

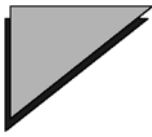
Sheet details

Code	Description	Alternatives	Default
FD	First drawing if there is overplotting or if SL or SW are to be specified or if no truncation is required	”	-
OD	Subsequent drawing if there is overplotting	”	-
TR	Truncation or no truncation (of sheet area)	NOTR TRUN	TRUN
SL	Sheet length	PV	120
SW	Sheet width	PV	68
FR	Draw a frame Do not draw a frame Put registration marks on sheet edge Draw frame around windows	FRAM NOFR REGR WIND	NOFR
ML	Left margin	PV	1.0
MB	Bottom margin	PV	1.0
MT	Top margin	PV	1.0
MR	Right margin	PV	1.0
PA	Paged or non-paged drawing	NOPA PAGE	NOPA

 If SL is assigned but not SW an A size sheet is specified.
If SW is assigned but not SL a B size sheet is specified.

Drawing details

Code	Description	Alternatives	Default
XO	Offset to be added to the left of the leftmost point	PV	0.0
YO	Offset to be added to the lowest point	PV	0.0
AL	Absolute level datum	PV	-
LP	Box in which the level parameter is to be annotated	PV	1
LD	Box in which the distance parameter is to be annotated	PV	2
HP	Box description of the level parameter	C = chainage D = distance E = existing P = proposed L = level * = text coded at TP	P
IN	Interval for annotation Chainage interval for M strings Point sequence interval for general strings	PV -n for every nth point	every point every point
TP	Box description if HP=*	CV	-
HD	Box description of the distance parameter	C = chainage D = distance E = existing P = proposed L = level * = text coded at TD	D
TD	Box description if HD=*	CV	-
DLP	Box in which the invert level is to be annotated	PV	3
TLP	Box description for DLP	CV	Invert level
AM	Annotate manholes	000	”
AP	Annotate branch/pipes	000	”
HS	Horizontal scale	PV	
VS	Vertical scale	PV	
LC	String colour	CV	BLACK
DL	Dashed line indicator	” for dashed line	Solid
TC	Text colour	CV	BLACK



Model details

Code	Description	Alternatives	Default
LB	Drainage branch string to be drawn	CV	
LR	Section string to be drawn	CV	
XS YS	Start point on reference string (SPRD)	PV PV	First point
XE YE	End point on reference string (SPRD)	PV PV	Last point
LS	Length of section to be drawn per page	PV	-


🔗 FD and OD are normally used when producing composite drawings. The assignment FD=" " indicates to the macro that this is the first drawing and OD=" " indicates it is a subsequent drawing.

🔗 The only essential variables which need to be assigned in the macro are HS, VS, LB and LR ie the horizontal and vertical scales, the string name being drawn and the reference string name .

Macro PLANDRAI

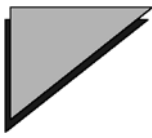
Sheet details

Code	Description	Alternatives	Default
PA	Paging	NOPA PAGE	PAGE
TR	Truncation or no truncation (of sheet area)	NOTR TRUN	NOTR
SL	Sheet length	PV	
SW	Sheet width	PV	
FR	Draw a frame Do not draw a frame Draw frame around window Put registration marks on sheet edge	FRAM NOFR WIND REGR	FRAM
ML	Left margin		1.0
MB	Bottom margin		1.0
MT	Top margin		1.0
MR	Right margin		1.0

 If SL is assigned but not SW an A size sheet is specified
If SW is assigned but not SL a B size sheet is specified

Drawing details

Code	Description	Alternatives	Default
XL	Relationship of model to drawing	PV	
YL	Coordinates of bottom left point and bearing of left	PV	
BE	hand side	PV	
LC	String colour	CV	BLACK
TC	Text colour	CV	BLACK
GR	Grid with edge ticks Grid with crosses at intersection Full line grid Do not draw a grid	EDGE CROS FULL NOGR	NOGR
XG	X spacing of grid	PV	50
YG	Y spacing of grid	PV	50
SC	Scale	PV	500



DRAINAGE macros

Drainage details

Code	Description	Alternatives	Default
CH	Character height for text	PV	0.10
M	Draw manholes (default). Code as 000 to omit manholes from drawing	000	”
MDI	Manhole drawing interpretation	DETA SYMB	”
MAN	Manhole annotation (name /number only)	ANNO	” no annotation
MSS	Manhole symbol size in drawing units. Only code if MDI is left blank	PV	”
MLC	Manhole symbol colour	CV	BLACK
MTC	Manhole text colour	CV	BLACK
P	Draw pipes (default). Code as 000 to omit branches/pipes from drawing	000	”
BD	Branches to be drawn. Code branch string name if you wish to draw one branch only	S ‘PV’ eg, S001	S. for all branches
PDI	Pipe drawing interpretation	”	DETA
PAN	Pipe annotation (branch/pipe number)	ANNO	” no annotation
PLC	Pipe line colour	CV	BLACK
PTC	Pipe text colour	CV	BLACK
G	Draw gullies (default). Code as 000 to omit gullies from drawing.	000	”
GDI	Inlet drawing interpretation	DETA SYMB	”
GAN	Inlet annotation (name /number only)	ANNO	”
GSS	Inlet symbol size in drawing units. Only code if GDI is blank	PV	”
GLC	Inlet symbol colour	CV	BLACK
GTC	Inlet text colour	CV	BLACK
AM	More detailed pipe annotation (name /number, cover level and invert level)	”	000
AP	More detailed pipe annotation (branch/pipe number, diameter, shape, gradient, length and fall)	”	000
AG	More detailed inlet annotation (name /number, cover level and outlet level)	”	000
RS	Reference branch string for detailed manhole annotation (only the default value is permitted at Version 9.0)	S ‘PV’	” for all branches
BA	Branch string for more detailed pipe annotation	S ‘PV’	S. for all branches

Major option EDIT

Model 1 Model containing strings to be manipulated

↳ Global options 000, 001, 017, 018, 019, 900, and 999 may be used in EDIT.



002 Create a text string

002 Create a text string

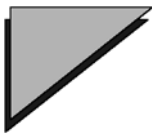
Option	002
Field 3*	String name. It must have an * as first character.
Field 5 & 6*	Position of bottom left of first character
Field 7	Bearing of base line of characters. Default is 0.0
Field 9	Character height (drawing units). Default is 0.15
	Follow each 002 option with one 001 option containing the text information.
Cols 4-43 *	Text to be stored.

002 Create a contour string

Option	002
Field 3*	Name of string being added
Field 4*	Contour level. (This should only be typed on the first record)
Field 5	X coordinate of point
Field 6	Y coordinate of point

004 Delete an entire string

Option	004
Field 3*	Name of string to be deleted



005 Delete part of a string

Case 1 Between two points

Option	005
Field 3*	String to be amended
Fields 5 & 6	SPRD for start
Fields 8 & 9	SPRD for end

Case 2 From an intersection to a point.

Option	005
Field 1*	Intersecting string name
Field 3*	String to be amended
Field 7*	Sequence number of required intersection
Fields 8 & 9	SPRD for end

Case 3 From specified point to string intersection

Option	005
Field 2*	Intersecting string name
Field 3*	String to be amended
Fields 5 & 6	SPRD for specified point
Field 10*	Sequence number of required intersection

Case 4 From normal intersection to specific point

Option	005
Field 1*	Intersecting string name
Field 3*	String to be amended
Fields 5 & 6*	SPRD for point generating normal
Field 7*	Sequence number of required intersection
Fields 8 & 9	SPRD for specified point

Case 5 From specified point to normal intersection

Option	005
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Field 2*	Intersecting string name
Field 3*	String to be amended
Fields 5 & 6*	SPRD for specified point
Fields 8 & 9*	SPRD for point generating normal
Field 10	Sequence number of required normal intersection

Case 6 From string intersection to string intersection

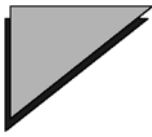
Option	005
Field 1*	Intersecting string name at start
Field 2*	Intersecting string name at end
Field 3*	String to be amended
Field 7*	Sequence number of required intersection at start
Field 10*	Sequence number of required intersection at end

Case 7 From normal intersection to string intersection

Option	005
Field 1*	Intersecting string name at start
Field 2*	Intersecting string name at end
Field 3*	String to be amended
Fields 5 & 6*	SPRD for point generating normal
Field 7*	Sequence number of required intersection at start
Field 10*	Sequence number of required intersection at end

Case 8 From string intersection to a normal intersection

Option	005
Field 1*	Intersecting string name at start
Field 2*	Intersecting string name at end
Field 3*	String to be amended
Field 7*	Sequence number of required intersection at start
Fields 8 & 9*	SPRD for point generating normal



Field 10* Sequence number of required intersection at end

Case 9 From a normal intersection to a normal intersection

Option 005

Field 1* Intersecting string name at start

Field 2* Intersecting string name at end

Field 3* String to be amended

Fields 5 & 6* SPRD for point generating normal at start

Field 7* Sequence number of required normal intersection at start

Fields 8 & 9* SPRD for point generating normal at end

Field 10* Sequence number of required normal intersection at end

006 Add one gap

Case 1 Between two points

Option	006
Field 3*	String to be amended
Fields 5 & 6	SPRD for start
Fields 8 & 9	SPRD for end

Case 2 From an intersection to a point.

Option	006
Field 1*	Intersecting string name
Field 3*	String to be amended
Field 7*	Sequence number of required intersection
Fields 8 & 9	SPRD for end

Case 3 From specified point to string intersection

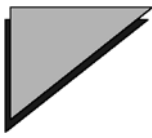
Option	006
Field 2*	Intersecting string name
Field 3*	String to be amended
Fields 5 & 6	SPRD for specified point
Field 10*	Sequence number of required intersection

Case 4 From normal intersection to specific point

Option	006
Field 1*	Intersecting string name
Field 3*	String to be amended
Fields 5 & 6*	SPRD for point generating normal
Field 7*	Sequence number of required intersection
Fields 8 & 9	SPRD for specified point

Case 5 From specified point to normal intersection

Option	006
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Field 2*	Intersecting string name
Field 3*	String to be amended
Fields 5 & 6*	SPRD for specified point
Fields 8 & 9*	SPRD for point generating normal
Field 10*	Sequence number of required normal intersection

Case 6 From string intersection to string intersection

Option	006
Field 1*	Intersecting string name at start
Field 2*	Intersecting string name at end
Field 3*	String to be amended
Field 7*	Sequence number of required intersection at start
Field 10*	Sequence number of required intersection at end

Case 7 From normal intersection to string intersection

Option	006
Field 1*	Intersecting string name at start
Field 2*	Intersecting string name at end
Field 3*	String to be amended
Fields 5 & 6*	SPRD for point generating normal
Field 7*	Sequence number of required intersection at start
Field 10*	Sequence number of required intersection at end

Case 8 From string intersection to a normal intersection

Option	006
Field 1*	Intersecting string name at start
Field 2*	Intersecting string name at end
Field 3*	String to be amended
Field 7*	Sequence number of required intersection at start
Fields 8 & 9*	SPRD for point generating normal

Field 10* Sequence number of required intersection at end

Case 9 From a normal intersection to a normal intersection

Option 006

Field 1* Intersecting string name at start

Field 2* Intersecting string name at end

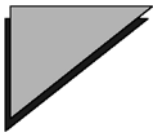
Field 3* String to be amended

Fields 5 & 6* SPRD for point generating normal at start

Field 7* Sequence number of required normal intersection at start

Fields 8 & 9* SPRD for point generating normal at end

Field 10* Sequence number of required normal intersection at end



EDIT

007 Add some gaps

Option	007
Field 3*	String to be amended
Field 4	Number of points between gaps

008 Create a string

Case 1 One or two points

Option	008
Field 3*	New string name
Fields 5 & 6*	First and second dimensions of point
Field 7	Third dimension of point. (optional)
Fields 8 & 9	First and second dimensions of point
Field 10	Third dimension of point. (optional)

Case 2 Part of string

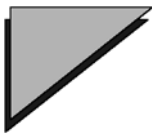
Option	008
Field 1*	Name or string from which points are to be extracted.
Field 3*	New string name
Field 4	Single point identifier. Type 1.
Fields 5 & 6	SPRD for first point to be sent to string. If omitted, the start of the string is assumed.
Fields 8 & 9	SPRD for the last point to be sent to string. If omitted, then the end of the string is assumed. These fields are ignored if field 4 is typed (send one point only).

Case 3 Intersection of two strings

Option	008
Fields 1 & 2*	Names of intersecting strings. Note that the level taken is that of the string in field 1.
Field 3*	New string name
Field 4	Single point identifier. Type 1.
Field 7*	Sequence number of required intersection of string in field 1 with string in field 1 with string in field 2.

Case 4 From string intersection to specified point

Option	008
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Field 1*	Name of string from which points are extracted.
Field 2*	Name of string that intersects string in field 1. The intersection point defines the first point to be sent.
Field 3*	New string name
Field 7*	Sequence number of required intersection of string in field 1 with string in field 2.
Fields 8 & 9	Identification of last point to be sent. If omitted then the end of the string is assumed.

Case 5 From specified point to string intersection

Option	008
Field 1*	Name of string from which points are extracted.
Field 2*	Name of string that intersects string in field 1. The intersection point defines the last point to be sent.
Field 3*	New string name
Fields 5 & 6*	SPRD for first point to be sent. If omitted then the start of string is assumed.
Field 10*	Sequence number of required intersection of string in field 1 with string in field 2.

Case 6 Intersection of string with normal from another string

Option	008
Field 1*	Name of string that intersects normal.
Field 2*	Name of string generating normal.
Field 3*	New string name
Field 4	Single point identifier. Type 1.
Fields 5 & 6*	Identification of point on string in field 2 generating normal.
Field 7*	Sequence number of required intersection of normal with string in field 1.

Case 7 From normal intersection to specified point

Option	008
Field 1*	Name of string from which points are extracted.
Field 2*	Name of string generating normal.

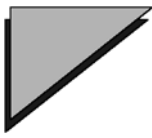
Field 3*	New string name
Fields 5 & 6*	SPRD of point on string in field 2 generating normal.
Field 7*	Sequence number of required intersection.
Fields 8 & 9	SPRD of last point to be sent.

Case 8 From specified point to normal intersection

Option	008
Field 1*	Name of string from which points are extracted.
Field 2*	Name of string generating normal.
Field 3*	New string name
Fields 5 & 6	SPRD for first point to be sent. If omitted then the start of string is assumed.
Fields 8 & 9*	SPRD for point on string in field 2 generating normal.
Field 10*	Sequence number of required intersection of normal with string in field 1.

Case 9 Offset point location

Option	008
Field 1	String providing point at beginning of base line
Field 2*	String providing point at end of base line
Field 3*	String to which point will be added
Field 4	Real level of point being created (default null level)
Fields 5 & 6*	SPRD at point from field 1 string
Field 7*	Chainage from beginning of base line
Fields 8 & 9*	SPRD at point from field 2 string
Field 10*	Horizontal offset.



009 Create a boundary string

Case 1 One or two points

Option	009
Field 3*	New boundary string name
Fields 5 & 6*	First and second dimensions of point
Field 7	Third dimension of point. (optional)
Fields 8 & 9	First and second dimensions of point
Field 10	Third dimension of point. (optional)

Case 2 Part of a string

Option	009
Field 1*	Name or string from which points are to be extracted.
Field 3*	New boundary string name
Field 4	If only one point is to be sent to the boundary string, type 1.0
Fields 5 & 6	SPRD for first point to be sent to boundary string. If omitted, the start of the string is assumed.
Fields 8 & 9	SPRD for the last point to be sent to boundary string. If omitted, then the end of the string is assumed. These fields are ignored if field 4 is typed (send one point only).

Case 3 Intersection of two strings

Fields 1 & 2*	Names of intersecting strings. Note that the level taken is that of the string in field 1.
Field 3*	New boundary string name
Field 4	Single point identifier. Type 1.
Field 7*	Sequence number of required intersection of string in field 1 with string in field 1 with string in field 2.

Case 4 From string intersection to specified point

Option	009
Field 1*	Name of string from which points are extracted.

Field 2*	Name of string that intersects string in field 1. The intersection point defines the first point to be sent.
Field 3*	New boundary string name
Field 7*	Sequence number of required intersection of string in field 1 with string in field 2.
Fields 8 & 9	Identification of last point to be sent. If omitted then the end of the string is assumed.

Case 5 From specified point to string intersection

Option	009
Field 1*	Name of string from which points are extracted.
Field 2*	Name of string that intersects string in field 1. The intersection point defines the last point to be sent.
Field 3*	New boundary string name
Fields 5 & 6	SPRD for first point to be sent. If omitted then the start of string is assumed.
Field 10*	Sequence number of required intersection of string in field 1 with string in field 2.

Case 6 Intersection of string with normal from another string

Field 1*	Name of string that intersects normal.
Field 2*	Name of string generating normal.
Field 3*	New boundary string name
Field 4	Single point identifier. Type 1.
Fields 5 & 6*	Identification of point on string in field 2 generating normal.
Field 7*	Sequence number of required intersection of normal with string in field 1.

Case 7 From normal intersection to specified point

Option	009
Field 1*	Name of string from which points are extracted.
Field 2*	Name of string generating normal.
Field 3*	New boundary string name
Fields 5 & 6*	SPRD of point on string in field 2 generating normal.
Field 7*	Sequence number of required intersection.



Fields 8 & 9* SPRD of last point to be sent.

Case 8 From specified point to normal intersection

Option	009
Field 1*	Name of string from which points are extracted.
Field 2*	Name of string generating normal.
Field 3*	New boundary string name
Fields 5 & 6	SPRD for first point to be sent. If omitted then the start of string is assumed.
Fields 8 & 9*	SPRD for point on string in field 2 generating normal.
Field 10*	Sequence number of required intersection of normal with string in field 1.

010 Create a string (between intersection points)

Option	008 or 009
Field 3*	New string name

Case 9 From string intersection to string intersection

Option	010
Field 1*	Name of string from which points are extracted.
Field 2*	Name of first string that intersects string in field 1.
Field 3*	Name of second string that intersects string in field 1.
Field 7*	Sequence number of required intersection of string in field 1 with string in field 2.
Field 10*	Sequence number of required intersection of string in field 1 with string in field 3.

Case 10 From normal intersection to string intersection

Field 1*	Name of string from which points are extracted.
Field 2*	Name of string generating normal.
Field 3*	Name of string that intersects string in field 1.
Field 5 & 6*	Identification of point on string in field 2 generating normal.
Field 7*	Sequence number of intersection of normal with string in field 1.
Field 10*	Sequence number of required intersection of string in field 1 with field 3.

Case 11 From string intersection to normal intersection

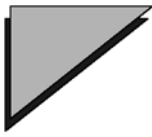
Option	010
Field 1*	Name of string from which points are extracted.
Field 2*	Name of string that intersects string in field 1.
Field 3*	Name of string generating normal.
Field 7*	Sequence number of required intersection of string in field 1 with string in field 2.
Field 8 & 9*	Identification of point on string in field 3 generating normal.
Field 10*	Sequence number of required intersection of normal with string in field 1.

**Case 12 From normal intersection to normal intersection**

Option	010
Field 1*	Name of string from which points are extracted.
Field 2*	Name of string generating the first normal.
Field 3*	Name of string generating the second normal.
Field 5 & 6*	Identification of point on string in field 2 generating first normal.
Field 7*	Sequence number of required intersection of normal with string in field 1.
Field 8 & 9*	Identification of point on string in field 3 generating second normal.
Field 10*	Sequence number of required intersection of normal with string in field 1.

012 Join two strings

Option	012
Field 1*	String name 1
Field 2*	String name 2. This string also governs the resultant string direction
Field 3	New string name. If omitted string name 2 will be assumed
Field 4	If either string name 1 or string name 2 is two dimensional, then the new contour level must be given.



EDIT

020 Change string name / Change contour level

Option	020
Field 1*	Existing name. You do not need to give this if you are simply modifying a contour level.
Field 2	New subreference
Field 3*	New string name. If the contour level is being changed type in the contour string name.
Field 4	If you are changing the level of a 2D string, give the contour level to be adopted.


021 Change any string dimension

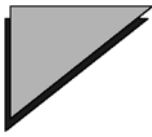
Change any string dimension

Option	021
Field 3*	String name
Field 5 & 6*	SPRD of point to be changed
Field 8*	Dimension to be changed
Field 9*	New data value.

Search and change any string dimension

Option	021
Field 3*	String name
Field 4*	Dimension to be searched
Field 5*	Value to be searched for in the above dimension
Field 8*	Dimension to be changed
Field 9*	New value to be assigned.

 This option cannot be used to modify the text within a text string.



022 Change string dimension 1/2/3

Change string dimension 1/2/3

Option	022
Field 3*	String name
Field 5 & 6*	SPRD of point to be changed
Fields 8,9,10	New X, Y, Z values.

Search and change string dimension

Option	022
Field 3	String name
Field 4*	Dimension to be searched
Field 5*	Value to be searched for in the above dimension
Field 8	New X value
Field 9	New Y value
Field 10	New Z value

023 Add point before a point

Existing string point - using SPRD

Option	023
Field 1*	Secondary string name. This is the string from which the point is to be taken.
Field 3*	String name. This is the string to which the point is to be added.
Field 5 & 6*	SPRD of point on string before which the point is to be added.
Field 8 & 9*	SPRD of point on secondary string.

Existing string point - using a search

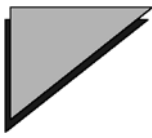
Option	023
Field 1*	Secondary string name. This is the string from which the point is to be taken.
Field 3*	String name. This is the string to which the point is to be added.
Field 4*	Dimension to be searched
Field 5*	Value to be searched for in the above dimension
Field 8 & 9*	SPRD of point on secondary string.

New XY point - using SPRD

Option	023
Field 3*	String name
Field 5 & 6*	SPRD of point before which the point is to be added
Field 8,9,10*	Coordinate of point to be added. If field 10 is left blank the level will be set to null. It will not be interpolated.

New XY point - using a search

Option	023
Field 3*	String name
Field 4*	Dimension to be searched
Field 5*	Value to be searched for in the above dimension
Field 8,9,10*	Coordinate of point to be added. If field 10 is left blank the level will be set to null. It will not be interpolated.



024 Add point after a point

Existing string point - using SPRD

Field 1*	Secondary string name. This is the string from which the point is to be taken.
Field 3*	String name. This is the string to which the point is to be added.
Field 5 & 6*	SPRD of point on string after which the point is to be added.
Field 8 & 9*	SPRD of point on secondary string.

Existing string point - using a search

Option	024
Field 1*	Secondary string name. This is the string from which the point is to be taken.
Field 3*	String name. This is the string to which the point is to be added.
Field 4*	Dimension to be searched
Field 5*	Value to be searched for in the above dimension
Field 8 & 9*	SPRD of point on secondary string.

New XY point - using SPRD

Option	024
Field 3*	String name
Field 5 & 6*	SPRD of point after which the point is to be added
Field 8,9,10*	Coordinate of point to be added. If field 10 is left blank the level will be set to null. It will not be interpolated.

New XY point - using a search

Option	024
Field 3*	String name.
Field 4*	Dimension to be searched
Field 5*	Value to be searched for in the above dimension
Field 8,9,10*	Coordinate of point to be added. If field 10 is left blank the level will be set to null. It will not be interpolated.

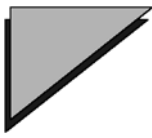
025 Delete a point

Delete a point - using SPRD

Option	025
Field 3*	String name
Field 5 & 6*	SPRD of point to be deleted.

Delete a point - using a search

Option	025
Field 3	String name
Field 4*	Dimension to be searched
Field 5*	Value to be searched for in the above dimension



026 Insert a point

Case 1 Insert a point at a given chainage

Option	026
Field 3*	String name.
Field 5*	Chainage of point to be added

Case 2 Insert a point at the intersection of a normal from an X/Y coordinate

Option	026
Field 3*	String name.
Fields 5 & 6*	X and Y coordinates

Case 3 Insert point at intersection of normal from a point on another string

Option	026
Field 1*	String containing the point from which the normal is generated
Field 3*	String name.
Fields 5 & 6*	SPRD of the point on string 1 generating the normal
Field 7*	Sequence number of the intersection of the normal from string 1 with string 3. This field entry is mandatory.

Case 4 Insert a point at the strings intersection with another string

Option	026
Field 1*	String providing intersection
Field 3*	String name.
Field 7*	Sequence number of required intersection of string in field 3 with string in field 1.

Case 5 Insert a point by explicitly defining its coordinates

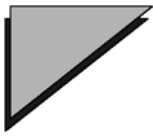
Option	026
Field 3*	String name.
Field 5 & 6*	SPRD identifying the point after which the point is to be added (optional).
Field 8, 9 & 10*	Coordinates of point to be inserted.

Case 6 Insert a point which is a string point on another string

Option	026
Field 1*	String providing point to be included
Field 3*	String name.
Field 5 & 6*	SPRD identifying the point after which the point is to be added (optional)
Field 8 & 9*	SPRD of point in string 1 to be extracted

Case 7 Insert a point at the intersection of two other strings

Option	026
Field 1*	String 1 providing intersection
Field 2*	String 2 providing intersection
Field 3*	String name.
Field 5 & 6*	SPRD identifying the point after which the point is to be added (optional)
Field 8 & 9*	Approximate position of intersection
Field 10*	Sequence number of intersection of field 1 with field 2. Default = 1.0

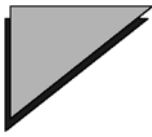


027 Convert to 6D master string

Option	027
Field 1*	Existing string.
Field 2	Code REGU to obtain regular chainage points only.
Field 3*	New master string name. Initial character must be an M.
Field 4	Chainage datum. Default 0.0
Field 5 & 6	SPRD for start point
Field 7	Chainage interval. If blank no additional points will be added.
Field 8 & 9	SPRD for end point
Field 10	Chord-to-arc tolerance The default chord-to-arc tolerance is defined in the project settings.

028 Create string with extra points

Option	028
Field 1*	Reference string name. This is the string from which the new string is to be created.
Field 2	Interpolation method.
	MOSS MX curve fitting (default)
	SPLI SPLINE curve fitting
	DIST Insert points on string links at the distance specified in Field 4. Generally, a short unequal link is left at the end of each original link.
	DIVI Insert points by dividing the existing string links into equal lengths according to the number of divisions specified in Field 4.
	TOLE Insert points by halving the existing string links until the distance between the points is less than the tolerance coded in Field 4.
Field 3	New string name
Field 4	Tolerance
	If Field 2 = MOSS or SPLI, specify the chord-to-arc tolerance. This defines the maximum distance between the chord and arc of a curve which is acceptable before further points are added. The default chord-to-arc tolerance is defined in the project settings.
	If Field 2 = TOLE, specify the tolerance to be used.
	If Field 2 = DIST, specify the distance between points.
	If Field 2 = DIVI, specify the number of divisions.
Field 5 & 6	SPRD for start point
Field 8 & 9	SPRD for end point

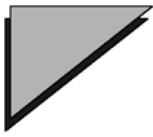


029 Generate master string from a geometry string

Option	029
Field 1*	Geometry string. This must have an initial character G.
Field 4	Chord-to-arc tolerance (the default chord-to-arc tolerance is defined in the project settings).
Field 5	Start chainage of the geometry string. If blank, the first point of the geometry string will be assumed.
Field 7*	Chainage interval on straights and arcs.
Field 8	End chainage of the geometry string. If blank, the last point of the geometry string will be assumed.
Field 10	Chainage interval on transitions. If blank, the interval as given in field 7 will be assumed.

030 Change a series of names

Option	030
Field 1*	Selection mask. If all four characters are used then only one string will be selected.
Field 3*	Mask containing replacement characters



EDIT

031 Delete a series of strings

Option	031
Field 1*	Selection mask

032 Delete loops / tail ends

Option	032
Field 3*	String name
Field 4	Single loop indicator. To remove all loops, leave blank To remove one loop only, type 1.0 To remove the tail ends, type -1.0 and leave fields 5, 6 and 7 blank.
Field 5 & 6	Give the start point of the range if all loops are to be removed. You can give the approximate point coordinate if only one loop is to be deleted.
Field 7*	You can give the intersection point number if only one loop is to be deleted. If none of 5, 6, or 7 is given the first loop will be deleted.
Field 8 & 9	If all the loops are to be removed give the end point of the range. By default the last point will be assumed.

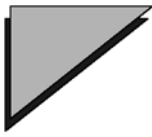


033 Change string subreference

Option	033
Field 1	Partial string name of string(s) whose sub-references are to be modified.
Field 2	Existing sub-reference. Partial names are allowed.
Field 3	New sub-reference. Up to four characters may be used which may include spaces. If this field is blank, the existing sub-references of the specified strings are cleared.

035, 036 Add slope signature string

Option	035
Field 1*	Reference string. The reference string dictates the range of the application and the points within indicate the directions of the slopes. Normally the reference string will be the string from which both the subsidiary strings were designed, for example, the centre line.
Field 2	Subreference (default HACE). This is used to identify a group of slope signature strings.
Field 4*	Chainage interval for notation. This defines the spacing of the longer lines in the notation. If you leave this blank 10.0 will be used.
Field 5 & 6	SPRD for start of application.
Field 8 & 9	SPRD for end of application.
Field 10	Slope signature style. This defines the number of subdivisions between the long lines in the notation. The number of short lines will be one less than this value. The valid range is from 1 to 10 (default 2).
Option	036
Field 1*	First subsidiary string, for example, an edge of shoulder string. This defines the spacing of the longer lines in the notation.
Field 2*	Second subsidiary string, for example, an earthworks string.
Field 3*	New slope signature string name.
Field 5	Minimum gradient below which no slope signature will be drawn.
Field 6	Maximum gradient above which no slope signature will be drawn.
Field 7	0.0 will suppress curve fitting of the first subsidiary string. 1.0 (the default) will invoke curve fitting of the first string.
Field 10	0.0 (the default) will suppress curve fitting of the second subsidiary string. 1.0 will invoke curve fitting of the second string.

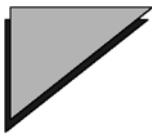


037 Create cadastre string

Option	037
Field 1*	String name. The string name must begin with 'P'.
Field 2	Sub-reference. SHEE defines the rotation datum for the symbol as the left hand sheet edge. NORT defines the rotation datum for the symbol as true north.
Field 3	Append indicator. APP append to existing string. If left blank, a new string is created.
Field 7	Symbol reference bearing - real number (default angular units)
Field 8*	X coordinate.
Field 9*	Y coordinate.
Field 10	Z coordinate. If left blank, a null level is stored.
Option	001
Cols 4-11	Survey point number (8 digit integer)
Cols 12-15	Feature code (4 alphanumeric characters).
Cols 16-31	Cadastral point number (16 alphanumeric characters).

038 Change cadastre point

Option	038
Field 1	Cadastre string name. The string name must begin with 'P'.
Field 6	Point to be amended.
Field 7	Symbol reference bearing.
Field 8	New X coordinate.
Field 9	New Y coordinate.
Field 10	New Z coordinate.
Option	001
Cols 4-11	Survey point number (8 digits integer)
Cols 12-15	Feature code (4 alphanumeric characters).
Cols 16-31	Cadastral point number (16 alphanumeric characters).



ENHANCE macros

Macro LINETEXT

Code	Description	Alternatives	Default
TN	TEXT TO BE WRITTEN	CV	-
XS	START POINT COORDINATES	PV	-
YS			
XE	End point coordinates	PV	-
YE			
BE	Angle of text relative to LHS	PV	”
BX	To box the text	B -	-
LB	Picture object name	CV	
UT	Unjustified text	”	-
JT	Justified text (either UT=” or JT=” should be coded)	”	-
PS	Justification of text (only applicable if JT=” coded)		CC
	Top left		
	Top centre	LT	
	Top right	CT	
	Centre left	RT	
	Centre centre	LC	
	Centre right	CC	
	Bottom left	RC	
	Bottom centre	LB	
	Bottom right	CB RB	

Macros to draw circles and arcs

Macro DRAWCIRC (centre and radius)

Code	Description	Alternatives	Default
XC	CENTER COORDINATES	PV	-
YC		PV	-
RA	RADIUS	PV	-
LB	Picture element name	CV	-

Macro DRAWCIRP (centre and point on circumference)

Code	Description	Alternatives	Default
XC	CENTER COORDINATES	PV	-
YC		PV	-
XP	POINT ON CIRCUMFERENCE	PV	-
YP		PV	-
LB	Picture element name	CV	-

Macro DRAWCIR2 (two points and radius)

Code	Description	Alternatives	Default
X1	FIRST POINT COORDINATES	PV	-
Y1		PV	-
X2	SECOND POINT COORDINATES	PV	-
Y2		PV	-
RA	RADIUS	PV	-
LB	Picture element name	CV	-

Macro DRAWCIRD (two points on a diameter)

Code	Description	Alternatives	Default
X1	FIRST POINT COORDINATES	PV	-
Y1		PV	-
X2	SECOND POINT COORDINATES	PV	-
Y2		PV	-
LB	Picture element name	CV	-



Macro DRAWCIR3 (three points)

Code	Description	Alternatives	Default
X1	FIRST POINT COORDINATES	PV	-
Y1		PV	-
X2	SECOND POINT COORDINATES	PV	-
Y2		PV	-
X3	THIRD POINT COORDINATES	PV	-
Y3		PV	-
LB	Picture element name	CV	-

Macro DRAWARCC (arc defined by centre and radius)

Code	Description	Alternatives	Default
XC	CENTER COORDINATES	PV	-
YC		PV	-
RA	RADIUS	PV	-
LB	Picture element name	CV	-
XS	Start point coordinates	PV	-
YS	or	PV	-
BS	Bearing of start of arc (line drawn from centre)	PV	-
XE	End point coordinates	PV	-
YE	or	PV	-
BE	Bearing of end of arc (line drawn from centre)	PV	-

Macro DRAWARCP (arc defined by centre and a point on circumference)

Code	Description	Alternatives	Default
XC	CENTER COORDINATES	PV	-
YC		PV	-
XP	COORDINATES OF POINT ON	PV	-
YP	CIRCUMFERENCE	PV	-
LB	Picture element name	CV	-
XS	Start point coordinates	PV	-
YS	or	PV	-
BS	Bearing of start of arc (line drawn from centre)	PV	-
XE	End point coordinates	PV	-
YE	or	PV	-
BE	Bearing of end of arc (line drawn from centre)	PV	-

Macro DRAWARC2 (arc defined by two points and radius)

Code	Description	Alternatives	Default
X1	FIRST POINT COORDINATES	PV	-
Y1		PV	-
X2	SECOND POINT COORDINATES	PV	-
Y2		PV	-
RA	RADIUS	PV	-
LB	Picture element name	CV	-
XS	Start point coordinates	PV	-
YS	or	PV	-
BS	Bearing of start of arc (line drawn from centre)	PV	-
XE	End point coordinates	PV	-
YE	or	PV	-
BE	Bearing of end of arc (line drawn from centre)	PV	-

Macro DRAWARCD (arc defined by two points on a diameter)

Code	Description	Alternatives	Default
X1	FIRST POINT COORDINATES	PV	-
Y1		PV	-
X2	SECOND POINT COORDINATES	PV	-
Y2		PV	-
LB	Picture element name	CV	-
XS	Start point coordinates	PV	-
YS	or	PV	-
BS	Bearing of start of arc (line drawn from centre)	PV	-
XE	End point coordinates	PV	-
YE	or	PV	-
BE	Bearing of end of arc (line drawn from centre)	PV	-



Macro DRAWARC3 (arc defined by three points)

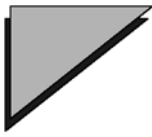
Code	Description	Alternatives	Default
X1	FIRST POINT COORDINATES	PV	-
Y1		PV	-
X2	SECOND POINT COORDINATES	PV	-
Y2		PV	-
X3	THIRD POINT COORDINATES	PV	-
Y3		PV	-
LB	Picture element name	CV	-
XS	Start point coordinates	PV	-
YS	or	PV	-
BS	Bearing of start of arc (line drawn from centre)	PV	-
XE	End point coordinates	PV	-
YE	or	PV	-
BE	Bearing of end of arc (line drawn from centre)	PV	-

Major option ENHANCE

ENHANCE


Leave both model names blank, as none of the options interact with the model file.

The global minor options 000, 017, 018, 900 and 999 may be used.



880 Define page

Minor option	880
Field 1*	Code ALL if all pages are to be enhanced simultaneously (default).
Field 4	Page number of page to be enhanced if only 1 page is to have enhancement applied to it.

 An 880,ALL cannot be combined with any other 880 individual page requirement in a single ENHANCE command.

881 Draw grid

Full grid

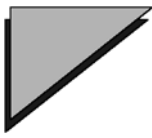
Minor option	881
Field 3	Picture element name (optional).

Grid defined by opposite corners

Minor option	881
Field 1	MSH1
Field 3	Picture element name (optional).
Field 5 & 6	Coordinates of corner of grid.
Field 7	Horizontal spacing interval (default 1.0).
Field 8 & 9	Coordinates of opposite corner of grid.
Field 10	Vertical spacing interval (default 1.0).

Grid defined by corner and number of increments

Minor option	881
Field 1	MSH2
Field 3	Picture element name (optional).
Field 5 & 6	Coordinates of bottom left point of grid.
Field 7	Horizontal spacing interval (default 1.0).
Field 8	Number of horizontal increments.
Field 9	Number of vertical increments.
Field 10	Vertical spacing interval (default 1.0).



882 Draw line / polyline

Draw a line defined by two points

Minor option	882
Field 3	Picture element name (optional).
Field 5 & 6*	First coordinate pair.
Field 8 & 9*	Second coordinate pair.

Draw a polyline

Minor option	882
Field 1	Code CLOS if this record is the last of a polyline series and it is wished to close the polygon. Code LAST if this is the last of a polyline series.
Field 3	Picture element name (must be coded).
Field 5 & 6*	Coordinate pair.
Field 8 & 9*	Next coordinate pair.

Draw line by coordinate and bearing

Minor option	882
Field 3	Picture element name (optional).
Field 5 & 6*	Point coordinates.
Field 7	Bearing of line relative to left hand side of drawing (using current input angle definition style).
Field 8*	Length of line in drawing units.

883, 884 Draw text / polytext

883 Define text location

Minor option	883
Field 1	Outlining of text (optional) <i>Column 1:</i> B draw a complete box surrounding the area. L underline the text (see column 2). <i>Column 2:</i> B underline the bottom of text. T draw a line at the top of the text. L draw a line at the left of the text. draw a line at the right of the text. (default - no outlining)
Field 2	Text positioning relative the text reference point(s) (optional) <i>Column 1:</i> L left justified. R right justified. C centre justified. <i>Column 2:</i> T top justified. B bottom justified. C centre justified. (default - LT)
Field 3	Picture object name (optional)
Field 5 & 6*	Coordinates of text reference point
Field 7	Angle of text relative to LHS. (using current input angle definition) (a value of 0.0 would give horizontal text) or
Field 8 & 9	Coordinates of second reference point.

884 Define text

Minor option	884
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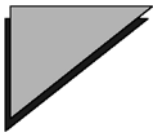


ENHANCE

Field 1	Increment or decrease from the base defined by 883. <i>Column 1:</i> I increase from base. D decrease from base. <i>Column 2, 3, 4:</i> an integer number (right justified) between 000 and 99 (default D000)
Field 2 - 10	Characters defining line of text. The ampersand character (&) is not allowed in normal text. Alternatively, a keyword surrounded by ampersand characters may be entered as follows: SHEE Current page number TOTL Total number of pages in the DPF TIME Time that the enhancement is added, eg, 17.05:43 DATE Date that the enhancement is added in ?? format, eg, 21/02/92 DTUS Date that the enhancement is added in US format, eg, 02/21/92 HSCA Horizontal scale VSCA Vertical scale

886 Draw macrosymbol

Minor option	886
Field 1 & 2	Macro name.
Field 3	Picture element name (optional).
Field 4	Drawn width of the symbol.
Field 5 & 6*	Coordinate point where symbol is to be drawn.
Field 7*	Drawn depth of the symbol.
Field 10*	Bearing of macrosymbol relative to the left hand side of the page.

**887 Draw standard symbol**

Minor option	887
Field 2*	Symbol number.
Field 3	Picture element name (optional).
Field 4	Drawn width of the symbol.
Field 5 & 6*	Coordinate point where symbol is to be drawn.
Field 10	Bearing of the symbol relative to the left hand side of the page.

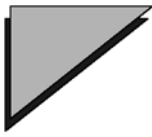
888 Draw box

Define rectangle by opposite corners

Minor option	888
Field 3	Picture element name (optional)
Field 5 & 6*	Coordinates of first corner of rectangle.
Field 8 & 9	Coordinates of second corner of rectangle.

Define rectangle by lengths and bearing of the left hand side

Minor option	888
Field 3	Picture element name (optional).
Field 5 & 6*	Coordinates of bottom left corner of rectangle.
Field 7*	Bearing of the left hand side of the rectangle measured clockwise from the left hand side of the drawing.
Field 8*	Length of the base of the rectangle.
Field 9*	Length of the side of the rectangle.

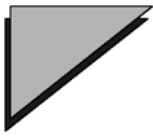


889 Draw circle

Minor option	889
Field 1	Circle type indicator CIRC centre and radius CIRP centre and point on circumference. CIR2 two points and radius. CIRD two points on diameter CIR3 three points.
Field 3	Picture element name (optional).
Field 5 & 6*	Coordinates of centre (CIRC and CIRP) Coordinates of first point (CIR2; CIRD; CIR3)
Field 7*	Radius (CIRC and CIR2)
Field 7 & 8*	Coordinates of second point (CIR3)
Field 8 & 9*	Coordinates of point on circumference (CIRP) Coordinates of second point (CIR2; CIRD)
Field 9 & 10*	Coordinates of third point (CIR3)

889, 890 Draw arc

Minor option	889
Field 1	ARCC ARCP ARC2 ARCD ARC3
Field 3	Picture element name (optional).
Field 5 & 6*	Coordinates of centre (ARCC and ARCP) Coordinates of first point (ARC2; ARCD; ARC3)
Field 7*	Radius (ARCC and ARC2)
Field 7 & 8*	Coordinates of second point (ARC3)
Field 8 & 9*	Coordinates of point on circumference (ARCP) Coordinates of second point (ARC2; ARCD)
Field 9 & 10*	Coordinates of third point (ARC3)
Minor option	890
Field 5 & 6	Start point coordinates. or
Field 7	Bearing of start of arc (drawn from centre).
Field 8 & 9	End point coordinates. or
Field 10	Bearing of end of arc (drawn from centre).



894 Fill area inside a boundary

Minor option	894
Field 1	Boundary element name
Field 7	Boundary indicator
	1.0 draw boundary
	-1.0 do not draw boundary

895 Fill area between two elements

Minor option	895
Field 1	First element name
Field 2	Second element name
Field 3	Hatching name (optional)
Field 4	Hatching interval
Field 7	Boundary indicator
	1.0 draw boundary
	-1.0 do not draw boundary

**896, 897 Fill area between two lines**

Minor option	896
Field 3	Hatching name (optional)
Field 4	Hatching interval
Field 5 & 6	Start of line 1
Field 7	Boundary indicator
	1.0 draw boundary
	-1.0 do not draw boundary
Field 8 & 9	End of line 1
Details of second line - 897	
Minor option	897
Field 5 & 6	Start of line 2
Field 8 & 9	End of line 2

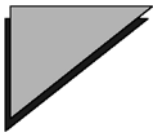
899 Drawing parameters

Define units

Minor option	899
Field 4	Units indicator
	0 or blank use drawing units (cm or in)
	1 use model units (m or ft)

Report parameters

Minor option	899
	No data fields are necessary.



FINISH

Major option **FINISH**

Finish

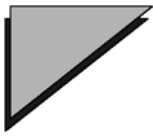
No models are required. There is no associated data.

Major option FREE

FREE

Model 1

Name of model to be freed for amendment.



Major option **GENIO**

Model 1	Model from which information is to be extracted or to which information is to be sent.
Model 2	Model containing reference strings required by particular options if these are not in the first model

001 Change format

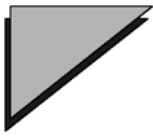
Minor option

001

All fields

Code a complete FORTRAN format statement to define the interpretation and position of the items to be input or output. For example:

```
001,FORMAT (4F10.3,A4)
```

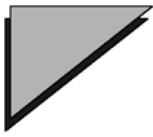


003 Change order

Minor option	003
Field 1	ORDR
Field 4	No of points per record (if blank 1 is assumed)
Field 5*	Code the dimension of the first item to be input/output
Field 6*	Code the dimension of the second item to be input/output
Field 7*	Code the dimension of the third item to be input/output
Field 8*	Code the dimension of the fourth item to be input/output
Field 9*	Code the dimension of the fifth item to be input/output
Field 10*	Code the dimension of the sixth item to be input/output

017 Change angle

Minor option	017
Field 1	Input angle definition (option 080)
Field 2	Output angle definition (option 081)

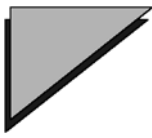


018 Check data

Minor option	018
Field 1	Data checking indicator
	CHEK invoke data checking
	NOCH no data checking (default).
Field 3	Header suppression
	NOQU suppress header information
	QUAL output header information (default)


019 Define selection mask

This facility is only applicable for minor option 081 General output of strings.



080 General input of strings

String input

Minor option	080
Field 1	String name
Field 2	Subreference (if required)
Field 3	Optimisation method 'HORZ', 'VERT' or 'BOTH' (default blank, or HORZ if field 10 is coded)
Field 4	Contour level for a 2D string
Field 5	Origin X coordinate (optional)
Field 6	Origin Y coordinate (optional)
Field 7	Dimension of string being created
Field 8 & 9	String terminator This is the number combination which is used to signify the end of the string. The default values will be 0.0, 0.0. If a string is to be input with the coordinates (0.0, 0.0) then another combination such as (999999.9, 999999.9) or -1.0, -1.0 must be used Once the default terminator has been changed it remains current for the rest of the MX session.
Field 10	Optimising tolerance (default blank or 0.005 if field 3 is coded) The use of an optimising tolerance allows the removal of points from the stored data which are within the defined tolerance.  If the optimising tolerance in field 10 is coded and the optimisation method in field 3 is not specified, the optimisation method will default to 'HORZ'. If field 3 is coded but the optimising tolerance field 10 is not, a warning message will appear.

Text input

For such strings the default input formats are unsuitable and they need to be marked. They are then accessed separately and the most convenient format to input the strings is:

```
001,FORMAT(4F10.3,/,11A4)
```

081 General output of strings

String output

Minor option	081
Fields 1	Name of string to be output. If omitted all strings, or all strings satisfying a predefined selection mask table, will be output.
Field 3	Name to be assigned to string when output (optional) eg if only the first three dimensions of a 6D string are to be output then it may be necessary to call the output string 0C01 (say) instead of M001.
Field 4	Chainage interval. May be specified for a master alignment and may be a multiple of the original interval. If omitted all points in the string are output.
Field 5 & 6	Standard point reference data for the start of the string.
Field 7	Number of items per string element to be output. If blank all items are output, eg in the above example for the output of the first three dimensions of a 6D string the value coded in this field would be 3.0.
Field 8 & 9	Standard point reference data for the end of the string

Non-standard string output

A sample format of data collector records required for Instrument Station details are as follows:-

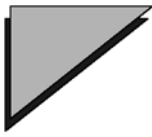
Cols.

1 - 2	Record Type Code (say 08)
3 - 4	Derivation Code (say MS)
5 - 8	Point Number
9 - 18	Y coordinate
19 - 28	X coordinate
29 - 38	Level
39 - 54	Description

Records of the above type may be produced by qualifying the option 081 option by associated minor options 001, 003 and 018.

Text output

Text strings may be automatically output using default formats.



082 Input of section information

Standard format sections

Model 1	Contains the model in which the section strings are to be stored.
Model 2	Contains the model in which the reference string resides. If it is left blank the first model will be searched for the reference string.
Minor option	082
Field 1*	Master alignment string name .
Field 3*	Section string name initial characters eg Sbbb

SYSTEM 050 sections

Model 1	Contains the model in which the section strings are to be stored.
Model 2	Contains the model in which the reference string resides. If it is left blank the first model will be searched for the reference string.
Minor option	082
Field 1*	6D M-string name
Field 2*	Code SY50. This indicates that the model data is in SYSTEM 050 format.
Field 3*	Section string name initial characters eg Sbbb

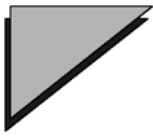
083 Output of section information

Standard format sections

Model 1	Contains the model from which the section information is taken.
Model 2	Contains the reference string on which the sections are based. If left blank the first model will be searched for the reference string.
Minor option	083
Field 1*	Section string name for the first section to be output
Field 5 & 6	Standard Point Reference Data for start point on reference string for sections to be output
Field 7	Chainage Interval (optional)
Field 8 & 9	Standard Point Reference Data for end point on reference string to be output.

SYSTEM 050 sections

Model 1	Contains the model from which the section information is taken.
Model 2	Contains the reference string on which the sections are based. If this field is left blank the reference string will be assumed to reside in the first model.
Minor option	083
Field 1*	Section string name for the first section to be output
Field 2	Code SY50. This indicates that the model data will be output in SYSTEM 050 format.
Field 5 & 6	Standard Point Reference Data for start point on reference string for sections to be output
Field 7	Chainage interval (optional)
Field 8 & 9	Standard Point Reference Data for end point on reference string for sections to be output.

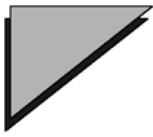


085 Partial output of triangulation

Model 1	Contains the triangulation model. This must be a TRIA model type.
Minor option	085
Field 1*	Triangulation name

087 Section information for HECB drainage design

Model 1	Contains the road sections.
Model 2	Contains any reference strings.
<i>Minor option</i>	<i>087 - Type 1</i>
Field 1	Road section string name for first road section.
Field 2	L.H.S. back of verge string.
Field 3	R.H.S. back of verge string.
Field 4	Leave blank for metric units. Code 1.0 for imperial units.
Field 5 & 6	SPRD for first point on reference string.
Field 7	Chainage interval.
Field 8 & 9	SPRD for last point on reference string.
Field 10	Leave blank for dual carriageway. Code 1.0 for single carriageway.
<i>Minor option</i>	<i>087 - Type 2</i>
Field 1	L.H.S. inner channel.
Field 2	L.H.S. outer channel.
Field 3	L.H.S. step point
<i>Minor option</i>	<i>087 - Type 3</i>
Field 1	R.H.S. inner channel.
Field 2	R.H.S. outer channel.
Field 3	R.H.S. step point



089 Full output of triangulation

Minor option

089

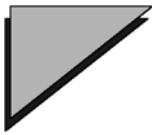
Field 1

Triangulation name.

If blank, all triangulations in the model are output.

090 Full input of triangulation

Minor option	090
Field 1	Triangulation name.
Field 2	Triangulation type
	TRIN - normal triangulation.
	ISOS - full isopachyte triangulation.
	QIS0 - partial isopachyte triangulation.
Field 4	Number of triangles



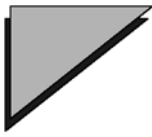
Major option HALGN

Major option	HALGN
Model 1	Model in which the resultant alignment will be stored. If omitted the alignment is analysed but not stored.
Model 2	Model in which the geometry string will be stored. If omitted, no geometry string is stored. The name of the geometry string will be the same as the master alignment but with the first character M replaced by G. Note that this same model name must be used as the second model name for the VALGN or VERAT options (which follows) for a particular alignment.

300 Initial data


The field descriptor is given in the first column with a corresponding explanation in the second column.

LB	Code 4 character string name beginning with M.
SC	Start chainage Default value 0.0.
FC	End chainage Default value is either the last point on the element, or the 1st tangent point of the last element.
CF	Chainage of the first point on the first element. Default value 0.0.
TL	Chord to arc tolerance. Default value 0.1.
CE	Chainage interval on elements. Default value 10.0 (metric) or 25.0 (imperial).
CT	Chainage interval on transitions. Default value chainage interval on elements.
NR	Normal RL value. If the value lies between 10.0 and 150.0 it is taken as the design speed, and the RL value will be calculated as $0.07032 * NR^3$ (metric) $3.155 * NR^3$ (imperial) If the value is greater than 150 it is taken as the actual RL value. Default value 115.0 (metric) 70.0 (imperial)
MR	Minimum RL value. The same conventions are adopted as for NR The smaller of NR and MR is always adopted for MR.
NA	Normal A value.
MA	Minimum A value.
LE	This value is added to all x coordinates of points computed on the alignment. Default value 0.0.
LN	This value is added to all y coordinates of points computed on the alignment. Default value 0.0.
RM	Minimum radius. A warning will be given if any point on the alignment has a radius falling below this value. Default value 0.0.
IM or ME	IMperial or MEtric units required. Default ME.



HALGN

For application of French transition formulae, code for

TR	Type of rules
	AR Autoroute (motorway) – default
	AR2 ICTAAL2000 Autoroute
	RP Route principale (major road)
	UR Route urbaine (urban road)
DS	Design speed (default value 120 kph)
	 DT replaces DS, but DS has been retained for data sets created before V2.5.
DT	Type of design
	L1 AR2 roads
	L2 AR2 roads
	RD Relief difficile (all roads)
	L80 AR roads
	L100 AR roads
	L120 AR roads
	T80 RP roads
	T100 RP roads
	R60 RP roads
	R80 RP roads
	A100 UR roads
	A80 UR roads
	U80 UR roads
	U60 UR roads
MC	Minimum crossfall (related to construction of road) (default value 2.5)
NL	Number of lanes (only used when TR = RP)

301 Element data

Code the element number:

If the element numbers on successive records are not in strictly ascending order they will be modified. Default value is the next consecutive number.

Code the element type as follows:

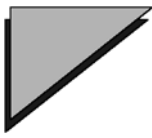
Element	Fix	Floating	Free
Straight	SX	SL	SE
Right hand curve	RX	RL	RE
Left hand curve	LX	LL	LE
Instantaneous radius (C, S, and summit curves)	CS	-	-

Code the following fields according to the element type and the form of the data:-

X1	X coordinate Point P1
Y1	Y coordinate Point P1
X2	X coordinate Point P2
Y2	Y coordinate Point P2
X3	X coordinate Point P3
Y3	Y coordinate Point P3
XC	X coordinate centre of a curve
YC	Y coordinate centre of a curve
BE	Bearing. The bearing may be defined in any of the ways generally available.
RA	Radius of curve. For C, and Summit curves this will be the instantaneous common radius.
CU	Angle of curvature. The angle may be defined in any of the ways generally available.
AS	Alternative solution required.
C1	Chainage of the first point specifying this element.
C2	Chainage of the second point.
C3	Chainage of the third point
C4	Chainage of the tangent point at start of this element
C5	Chainage of the tangent point at end of this element.

Only one of the alternatives C1-C5 should occur in any complete alignment.

Note that minor option 302 may be used to supply any of the following fields from an offset alignment.



P1, P2, P3, BE, RA.

Any transitions associated with the element are also defined on this option and are either leading (L) or trailing (T).

Clothoid transitions

L1, T1	Transition length
L2, T2	No associated data; the transition length is calculated from the default RL value as defined on the minor option 300
L3, T3	No associated data: the transition length is determined according to:- 1) if the radius is less than , the transition length is calculated from the standard RL value defined on minor option 300. 2) if the radius is greater than 4740.31 (metric); 15552 (imperial) then the transition length is

$$8.0 * \sqrt{3.0 * \left(\frac{R}{3.2808}\right)} \text{ (metric)}$$

or

$$8.0 * \sqrt{3.0} * R \text{ (imperial)}$$

3) if the radius lies between the above two limits the transition length is $\frac{R}{9}$.

L4, T4	RL value for Design Speed. If the speed is coded the transition length will be calculated from the RL value as derived for this speed.
L5, T5	No associated data: the transition length is calculated using the French transition formulae.
L6, T6	Transition constants defining the ratio of transitions for C,S, and summit curves (default L6 = 1, T6 = 1)
L7, T7	Use default A value to compute transition length
L8, T8	Use A value to compute transition length

Bloss transitions

LA, TA	Transition length
LG, TG	No associated data; used for transitions between fixed elements.

Cubic transitions

LB, TB	Transition length
LH, TH	No associated data; used for transitions between fixed elements.

Biquadratic transitions

LC, TC	Transition length
--------	-------------------

LK, TK No associated data; used for transitions between fixed elements.

Sine transitions

LD, TD Transition length

LJ, TJ No associated data; used for transitions between fixed elements.



302 Offset alignment

	Code the segment type
ST	Straight
CL	Curve (left hand)
CR	Curve (right hand)
TL	Transition (left hand)
TR	Transition (right hand)
	A point on the segment must be defined by all of the following fields. If the segment is a transition the point defined must be the origin of the transition.
OX	X coordinate
OY	Y coordinate
OB	Bearing. This may be defined in any of the ways generally available.
OC	Chainage
RD	Radius (only if segment is a curve)
RL	RL value (only if segment is a transition)
	The segment is now completely defined. On subsequent offset alignment records if the same segment is to be used all the above fields may be recalled by coding the following:
PA	Previous alignment
	The following two fields define the offset points and both are needed.
CO	Chainage that offset is to be made
LO	Distance of offset point on new alignment from the defined segment to the left.
	or
RO	Distance of offset point on new alignment from the defined segment to the right.
	From the information so far given on this minor option the offset point is uniquely defined by coordinates, tangent bearing and radius. Some or all of these details may be transferred to the previous 301 option by specifying:-
P1	Move the coordinates to P1
	or
P2	Move the coordinates to P2
	or
P3	Move the coordinates to P3

RA	Move the radius
BE	Move the bearing
	or
BR	Move the bearing rotated through 180 degrees.

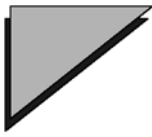


303 Special chainages

There are no field descriptors on this record which simply defines those special chainages at which the user required information. Up to 500 special chainages may be requested but they must be given in strictly increasing chainage.

304 Special chainage intervals

SC	Start chainage.
FC	End chainage.
CI	Chainage interval.



305 Continuation record

For minor options 300, 301, or 302 the quantity of data may necessitate continuation onto another 80 column record. This may be accommodated by invoking minor option 305 and simply continuing with the data input. There is no limit to the number of such continuation records.

HAUL macros

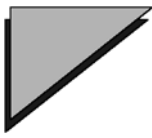
Macro MASSDRAW

Sheet details

Code	Description	Alternatives	Default
FD	First drawing if there is overplotting	”	-
OD	Subsequent drawing if there is overplotting	”	-
TR	Truncation	NOTR TRUN	NOTR
SL	Sheet length	PV	120 (cms)
SW	Sheet width	PV	68 (cms)
FR	Frame	FRAM NOFR	NOFR
ML	Left margin	PV	1.0
MB	Bottom margin	PV	1.0
MT	Top margin	PV	1.0
MR	Right margin	PV	1.0
PA	Paged or non-paged drawing	NOPA PAGE	NOPA
XO	Offset to be added to the left of the leftmost point	PV	0.0

⚠ If SL or SW is defined then FD = ” must also be requested.

⚠ If SL is assigned but not SW an A size sheet is being specified, but if SW is assigned but not SL then a B size sheet is being specified.



HAUL macros

Drawing details

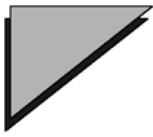
Code	Description	Alternatives	Default
YO	Offset to be added to the lowest point	PV	0.0
LP	Box in which the parameter is to be annotated	PV	1
LD	Box in which the distance parameter is to be annotated	PV	2
HP	Box description of the level parameter	C = chainage D = distance E = existing P = proposed L = level * = whatever is written in TP	*
TP	Box description if HP=*	CV	-
HD	Box description of the distance parameter	C = chainage D = distance E = existing P = proposed L = level * = whatever is written in TD	D
TD	Box description if HD=*	CV	
HS	Horizontal scale	PV	
VS	Vertical scale	PV	
LC	String colour	CV	BLACK
TC	Text colour	CV	BLACK

Model details

Code	Description	Alternatives	Default
LR	Reference string	CV	
LB	Section string	CV	
XS	Start point on reference string (SPRD)	PV	First point
YS		PV	
XE	End point on reference string (SPRD)	PV	Last point
YE		PV	
DN	Dimension to be drawn		


Major option HAUL

- | | |
|---------|--|
| Model 1 | The model containing the volume string and the model in which scheme volume strings and mass haul analysis strings are stored. |
| Model 2 | The model containing any reference string if not contained within model 1.
The global minor options 000, 017, 019, 900 and 999 may be used with HAUL. |



070 Define a scheme volume string


Minor option	070
Field 1*	Reference string name
Field 3*	Scheme volume string to be created
Field 4*	Chainage interval
Field 5 & 6	SPRD start
Field 8 & 9	SPRD end

 The start and end points must be at exact chainage multiples.

071 Include volumes in scheme volume string

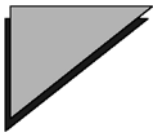
Include an individual volume string

Minor option	071
Field 2*	Individual volume string
Field 5 & 6	SPRD start
Field 8 & 9	SPRD end

 The volume string specified in Field 2 must have been created from sections at regular intervals and with reference to the reference string used by minor option 070 'Define a scheme volume string'.

Include a bulk quantity

Minor option	071
Field 4	Code 1.0 to indicate single point identifier
Field 5 & 6	SPRD start
Field 7*	Cut volume
Field 8 & 9	SPRD end
Field 10*	Fill volume

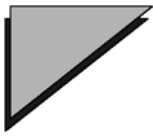


072 Mass haul analysis

Minor option	072
Field 1*	Reference string
Field 2*	Scheme volume string
Field 3*	Mass string
Field 4	Combined bulking/shrinkage factor (applied to material 1) (default value 1.0)
Field 5 & 6	SPRD start
Field 8 & 9	SPRD end

073 Bulking/shrinkage factors

Minor option	073
Field 3*	Material identifier (2 - 5)
Field 4	Combined bulking/shrinkage factor (default 1.0)
Field 5 & 6*	SPRD start
Field 7	Proportion of material, expressed as a decimal
Field 8 & 9*	SPRD end



074 Mass haul adjustment (import and export)

Import adjustment

Minor option	074
Field 3	Material identifier (1 - 5)
Field 4	Combined bulking/Shrinkage factor (default 1.0)
Field 8 & 9	SPRD end
Field 10*	Import quantity

Export adjustment

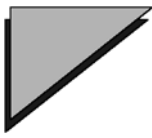
Minor option	074
Field 3	Material identifier (1 - 5)
Field 5 & 6	SPRD start
Field 7*	Export quantity

075 Carry out mass haul analysis

Minor option

075

Leave all fields blank



Major option HCUSP

Major option	HCUSP
Model 1	Model to contain the master alignment. If omitted, the alignment will be calculated but not stored. This facility is useful while testing an alignment.

Initial data

Field 1*	String name. This must start with M but must not be either MOSS or MACR.
Field 2	Start chainage.
Field 3	End chainage. If omitted the option will stop at the last location point.
Field 4*	Chainage interval.
Field 5	Chainage of first point on alignment.
Field 6	Chord-to-arc tolerance
Field 7	Design speed.
Field 8	Minimum radius.
Field 9*	Number of location points to follow (maximum 500 which includes any inserted by the program).
Field 10	Number of special chainages (maximum 32).

Location point details

Field 1*	X coordinate
Field 2*	Y coordinate
Field 3	Bearing at location point if required, in sexagesimal (degrees, minutes and seconds) format. To include this point as a fixed point, you must specify a bearing. You must also specify a bearing for the first and last location points on the alignment.
Field 4	Radius at location point, positive right hand, negative left hand. To include a fixed straight element, specify a radius of 999999.9 at adjacent location points. To include a circular arc element, specify identical radii at adjacent location points. To include a fixed point, specify the radius at the point. To nominate this point as any other spline location point, leave this field blank.

Field 5 Chainage interval for following element (optional).

Special chainages record

Field 1 - 8 Special chainages where coordinates are required.

Final record

The data should be terminated by a 999 minor option.



INPUT

Major option **INPUT**

Major option	INPUT
Model 1	Name of file to be input
Model 2	Error indicator:
	CONT Continue processing after an error
	STOP Stop processing after an error (default)

Major option INTERFACE


INTERFAC

Model 1 If automatic sections through a triangulation model are used, then this must be the required triangulation model containing the triangulation string.

 If stored sections are used this must be the ground section model.

Model 2 Model containing the reference string from which the interface is determined and the level datum string. This will be the model in which the Interface String(s) and any strings through intermediate points on profiles will be stored.

 Global options 000, 017, 019, 900 and 999 may be used in INTERFACE.

 For straight line design, Model 1 must be a triangulation model.



259 Height criteria

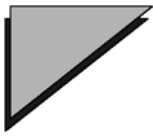
Option	259
Field 1	Vertical height criteria indicator
	INTI Height difference between the level datum string and the interface (default).
	DATM Height difference between the level datum string and a point vertically above or below.

Corner Conditions on Earthworks String (non-tangential alignments only)

Field 4	Number of angular intervals (default 4) at which sections are generated. This should be an even number, so that an odd number of sections is always created and a section which bisects the corner is formed.
Field 5	Angular interval (degrees).

260 Define strings

Option	260																																
Field 1*	Reference string on which the interface is based. If stored sections are used they must have been determined relative to this reference string.																																
Field 2	The name of the interface string for CUT strings.																																
Field 3	The name of the interface string for FILL strings. Either field 2 or 3 may be left blank in which case the name from the non-blank field will be used for the vacant field. This has the same effect as entering the same name in both of these fields - the same string is used for cut and fill interfaces. It is incorrect to leave fields 2 and 3 blank.																																
Field 4	<p>Style of interface</p> <p>Interfacing to the right of the reference string using option order precedence:</p> <table border="0"> <tr> <td>1 or 11</td> <td>forward 261's, forward 262's</td> </tr> <tr> <td>2 or 22</td> <td>reverse 261's, reverse 262's</td> </tr> <tr> <td>12</td> <td>forward 261's, reverse 262's</td> </tr> <tr> <td>21</td> <td>reverse 261's, forward 262's</td> </tr> </table> <p>Interfacing to the left of the reference string using option order precedence:</p> <table border="0"> <tr> <td>-1 or -11</td> <td>forward 261's, forward 262's</td> </tr> <tr> <td>-2 or -22</td> <td>reverse 261's, reverse 262's</td> </tr> <tr> <td>-12</td> <td>forward 261's, reverse 262's</td> </tr> <tr> <td>-21</td> <td>reverse 261's, forward 262's</td> </tr> </table> <p>Interfacing to the right of the reference string using shorter offset precedence:</p> <table border="0"> <tr> <td>91 or 911</td> <td>forward 261's, forward 262's</td> </tr> <tr> <td>92 or 922</td> <td>reverse 261's, reverse 262's</td> </tr> <tr> <td>912</td> <td>forward 261's, reverse 262's</td> </tr> <tr> <td>921</td> <td>reverse 261's, forward 262's</td> </tr> </table> <p>Interfacing to the left of the reference string using shorter offset precedence:</p> <table border="0"> <tr> <td>-91 or -911</td> <td>forward 261's, forward 262's</td> </tr> <tr> <td>-92 or -922</td> <td>reverse 261's, reverse 262's</td> </tr> <tr> <td>-912</td> <td>forward 261's, reverse 262's</td> </tr> <tr> <td>-921</td> <td>reverse 261's, forward 262's</td> </tr> </table>	1 or 11	forward 261's, forward 262's	2 or 22	reverse 261's, reverse 262's	12	forward 261's, reverse 262's	21	reverse 261's, forward 262's	-1 or -11	forward 261's, forward 262's	-2 or -22	reverse 261's, reverse 262's	-12	forward 261's, reverse 262's	-21	reverse 261's, forward 262's	91 or 911	forward 261's, forward 262's	92 or 922	reverse 261's, reverse 262's	912	forward 261's, reverse 262's	921	reverse 261's, forward 262's	-91 or -911	forward 261's, forward 262's	-92 or -922	reverse 261's, reverse 262's	-912	forward 261's, reverse 262's	-921	reverse 261's, forward 262's
1 or 11	forward 261's, forward 262's																																
2 or 22	reverse 261's, reverse 262's																																
12	forward 261's, reverse 262's																																
21	reverse 261's, forward 262's																																
-1 or -11	forward 261's, forward 262's																																
-2 or -22	reverse 261's, reverse 262's																																
-12	forward 261's, reverse 262's																																
-21	reverse 261's, forward 262's																																
91 or 911	forward 261's, forward 262's																																
92 or 922	reverse 261's, reverse 262's																																
912	forward 261's, reverse 262's																																
921	reverse 261's, forward 262's																																
-91 or -911	forward 261's, forward 262's																																
-92 or -922	reverse 261's, reverse 262's																																
-912	forward 261's, reverse 262's																																
-921	reverse 261's, forward 262's																																
Field 5 & 6	SPRD for start point on reference string																																
Field 7	Limit on the number of profile points generated on any one section. This is set by default at 50 which will suffice for most jobs and therefore in most instances it will not be necessary to code this field. If required it can be set within the range 2-200 although setting this limit unnecessarily high may have a detrimental effect on processing time.																																



INTERFACE

Field 8 & 9


SPRD for end point on reference string.

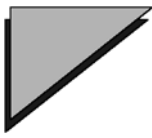
Field 10

A value of 1 invokes rounded/standard interfaces.

261, 262 Interface details

261, 262 Stored and automatic sections

Minor option	261 or 262
Field 1*	Stored section set reference character or AUTO or LEVL or triangulation string name for auto sections through triangulation.
	 If a triangulation string is given, Model 1 must be a triangulation model. The exact points generated on the final interface string will provide greater definition than those generated using AUTO. The quality of the interface between these points can only be improved by generating an 'interface surface' and using isopachytes with the triangulation model.
Field 2	Name of the level datum string.
Field 3	The string to which the element of the profile defined on this option is to be extended. If this is left blank then no string will be generated through this point on the cross section. Field 3 may also contain a partial string name when using repeat patterns. This is the first character defining the name of strings to be developed in a repeat pattern. If this field is coded with a partial name, then field 8 must also be coded. This defines the number of 261/262 records following and including the current one which constitute a repeat pattern.
Field 4	The number of dimensions of the string created at the profile definition point. If this is left blank a 5D string will be created but a 3D string will be created if 3 is entered here.
Field 5	Element width at start SPRD as defined in the immediately preceding 260 record. The horizontal width of the element - if this is left blank a width of 1000 will be used to enable projection of this element to find the interface (ie stretchable element).
Field 6	Surface adjustment height. This is only entered when it is required to vary a gradient at a fixed depth above or below ground surface as shown in the figure in worked example 9.
Field 7	Gradient at the start of the range of application of the interface as defined by SPRD in the immediately preceding 260 record. This is specified as vertical component divided by horizontal component - not as a percentage.
Field 8	The number of elements (n) in the pattern which is defined on this and the next n-1 261/262 records. This field is used only on the first 261/262 record which starts a repeat pattern. (see field 3 above).
Field 9	Element width at end SPRD as defined in the immediately preceding 260 record or level to which the interface is to be calculated if LEVL is specified in field 1.



INTERFACE

- Field 10 Gradient at the end of the range of application of the interface as defined by SPRD in the immediately preceding 260 record. This is specified as vertical component divided by horizontal component - not as a percentage.
- ✎ For flat elements a gradient of 0 may be entered. INTERFACE changes this to a positive gradient of 0.001 to avoid numerical difficulties associated with trigonometrical functions and zero angles. For very wide slopes this effect may be noticed as a very small vertical component on what was specified as a flat surface. This is unavoidable but has no practical significance.
 - ✎ Variable width and variable gradient cannot be coded on the same record.

261, 262 Mandatory elements

- Minor option 261 or 262
- Field 1* IGN
IGN Suffixed with any fourth character
- Field 2 Name of the level datum string.
- Field 3 The string to which the element of the profile defined on this option is to be extended. If this is left blank then no string will be generated through this point on the cross section. Field 3 may also contain a partial string name when using repeat patterns. This is the first character defining the name of strings to be developed in a repeat pattern. If this field is coded with a partial name then field 8 must also be coded. This defines the number of 261/262 records following and including the current one which constitutes a repeat pattern.
- Field 4 The number of dimensions of the string created at the profile definition point. If this is left blank a 5D string will be created but a 3D string will be created if 3 is entered here. See earlier section on this point.
- Field 5 Element width. The horizontal width of the element - if this is left blank a width of 1000 will be used to enable projection of this element to find the interface. (ie a stretchable element).
- Field 7 Gradient at the start of the range of application of the interface as defined by SPRD in the immediately preceding 260 record. This is specified as vertical component divided by horizontal component - not as a percentage.
- Field 8 The number of elements (n) in the pattern which is defined on this and the next n-1 261/262 records. This field is used only on the first 261/262 record which starts a repeat pattern. (see field 3 above).
- Field 10 Gradient at the end of the range of application of the interface as defined by SPRD in the immediately preceding 260 record. If this is entered and is different value from that in field 7 then a linear change of gradient will apply over the range.

261, 262 Barrier string

Minor option	261 or 262
Field 1*	BARR
Field 2	Name of the level datum string.
Field 3*	Name of barrier string.
Field 4	The number of dimensions of the string created at the profile definition point. If this is left blank a 5D string will be created but a 3D string will be created if 3 is entered here.
Field 5*	Element width. The horizontal width of the element - if this is left blank a width of 1000 will be used to enable projection of this element to find the interface (ie stretchable element).
Field 7*	Gradient at the start of the range of application of the interface as defined by SPRD in the immediately preceding 260 record. This is specified as vertical component divided by horizontal component - not as a percentage.
Field 10	Gradient at the end of the range of application of the interface as defined by SPRD in the immediately preceding 260 record. This is specified as vertical component divided by horizontal component - not as a percentage.

261, 262 Cut ditch

Minor option	261 or 262
Field 1	CIRC
Field 2	Name of the level datum string.
Field 3	Name of string at outer edge of ditch. The names of the intermediate strings generated by the circular ditch option are derived from the name of the string at the outer edge of the ditch. The form of this name should be AANN+1 where AA are any two characters and NN is the number of intermediate strings, as defined in Field 8.
Field 4	The number of dimensions of the intermediate strings being generated (default = 5).
Field 5	Width of ditch
Field 6	Depth of ditch The depth of the ditch must not be greater than 50% of the width.
Field 8	Number of strings to be generated excluding the level datum string and the ditch outer edge string.

261, 262 Cut/fill slope

Option	261 or 262
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INTERFACE

Field 1	Stored section set reference character or AUTO or triangulation string name for auto sections through triangulation.
Field 2	Name of the level datum string.
Field 3	Name of standard slope string. If this name is specified, the standard slope string is created in addition to the strings created by the rounding process. This is only relevant if a 264 record is to follow to invoke rounding.
Field 4	The number of dimensions of the interface string (default = 5).
Field 7	Gradient at the start of the range of application of the interface as defined by SPRD in the immediately preceding 260 record. This is specified as vertical component divided by horizontal component - not as a percentage. If this field is left blank, the standard design gradient is used
Field 10	Gradient at the end of the range of application of the interface as defined by SPRD in the immediately preceding 260 record. If this is entered and is different value from that in field 7 then a linear change of gradient will apply over the range. If this field is left blank, the standard design gradient is used

263 Invoke interface analysis



Minor option	263
Field 1	Gap indicator. DISC - include gaps NODI - exclude gaps.

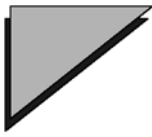


264 Invoke rounding

Minor option	264
Field 3	Initial character to be used for naming the intermediate strings used to describe the parabola. The final string is given the name specified in field 3 of the 260 record.
Field 4	The number of dimensions of the generated strings (default = 5)
Field 5	Tangent length at the start of the range of application of the interface as defined by SPRD in the immediately preceding 260 record. If this field is left blank, the standard tangent length is used.
Field 6	Tangent length at the end of the range of application of the interface as defined by SPRD in the immediately preceding 260 record. If this field is left blank, the standard tangent length is used.
Field 8	Number of intermediate strings to be generated

359 Create SLD earthworks string: Height criteria

Minor option	359
Field 1	Vertical height criteria indicator
	INTI Height difference between the level datum string and the interface (default).
	DATM Height difference between the level datum string and a point vertically above or below.
Field 2	Corner conditions on earthworks string
	Blank chamfered corners (default)
	CIRC circular corners
Field 4	No. of angular intervals (default 3) (only if Field 2 = CIRC)
Field 5	Angular interval (degrees) (only if Field 2 = CIRC)
	 If Field 2 = CIRC, and neither Field 4 nor Field 5 are coded, then Field 4 = 3 is used.
	 This option must precede option 360, Create SLD earthworks string: Define strings



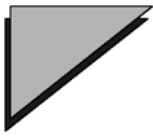
360 Create SLD earthworks string: Define strings

Minor option	360
Field 1	Reference string name
Field 2	Cut string name
Field 3	Fill string name
	Either field 2 or 3 may be left blank, in which case the name from the non-blank field will be used for the vacant field. This has the same effect as entering the same name in both these fields – the same string is used for both the cut and fill earthworks. It is incorrect to leave both fields 2 and 3 blank.
Field 4	Style of interface
	Interfacing to the right of the reference string using minor option order precedence: 1 forward 361's, forward 362's.
	Interfacing to the left of the reference string using minor option order precedence: -1 forward 361's, forward 362's.
Field 5 & 6	Start SPRD (default first point on reference string)
Field 7	Limit on the number of profile points generated on any one section
Field 8 & 9	End SPRD (default end point on reference string)

361, 362 Create SLD earthworks string: Earthworks details

Minor option 361 or 362

Field 1	Triangulation string name
Field 2	Level datum string name
Field 3	String to which the element of the profile on this option is to be extended. If this is left blank, then no string will be generated through this point on the cross section.
Field 5	Element width The horizontal width of the element – if this is left blank, a width of 1000 will be used to enable projection of this element to find the interface (ie stretchable element).
Field 7	Gradient at start This is specified as vertical component divided by horizontal component – not a percentage.
Field 9	Element width at end
Field 10	Gradient at end



363 Create SLD earthworks string: Earthworks analysis

Minor option	363	
Field 1	Gap indicator	
	DISC	include gaps
	NODI	exclude gaps

Major option LIST

LIST

Model 1

File to be listed

ARCHIVEFILE List the archive file

There is no minor option data for this option.



Major option MX

MX

Model 1 & 2

Job title

No models are required but the text given in the model name position will be echoed at the top of each page of output, as the job title.

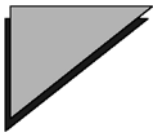
- ✎ To maintain compatibility with old input files, major option MOSS will continue to operate.
- ✎ Major option MX/MOSS forces any error indicators to be reset as if at the start of a job. This ensures, if running a data file, that the set of data following a MX/MOSS option will be processed even though an error may have occurred previously. This rule is particularly useful where several unrelated operations are to be processed in the same session.
- ✎ If an option fails because of an obvious mistake in inputting data (such as field omitted, or surplus data) the system will ask you to re-input. If an option fails because the data supplied is consistent with the option but produces an arithmetic error, then you must use the MX/MOSS option to reset error flags before you can proceed.

Major option NEWDPF

Model 1

Name of working display or DPF to be opened

There are no associated minor options.



NEWFILE

Major option **NEWFILE**

NEWFILE

Model 1

File to be erased

MODELFILE Deletes the contents of the model file.

Major option OUTPUT

OUTPUT

Model 1

Name of output file to record data.

If left blank, any output file already open is closed and output reverts to the screen.

Model 2

Output direction.

TERM Direct output to screen and to file

NOTERM Direct output to file only (default)

In both of the above cases, if you specify a new output file when one is already open, the old file is closed and the new one is opened.

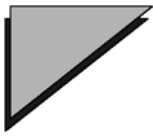
APTE Append output to existing file and direct to screen

APPE Append output to existing file only

🔗 Long filenames may be used with this option. Long filenames allow a total of 256 characters to be used for the path, the filename and the extension, and the filename can include space characters. If you do not specify a path, the project directory is used by default.

🔗 Output of the MX banner can be enabled or disabled in the project settings.

🔗 If you don't give a file extension, MX adds .PRN automatically.
For example, OUTPUT,XYZ would direct output to the file XYZ.PRN



OVERWRITE

Major option **OVERWRITE**

OVERWRITE

Model 1 Name of file to be assigned. If blank, then the GENIO channel is closed depending on the second model name.

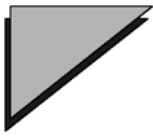
Model 2 Identifier for channel to be assigned.

GENIO	assign the GENIO channel
ARCH	assign the ARCHIVE channel
RETR	assign the RETRIEVE channel

Major option PAGE

PAGE

Number of page to be displayed.



PRISM

Major option **PRISM**

PRISM

Model 1

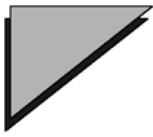
Triangulation model.

Model 2

Model used for reference (boundary) string.

910 Volume from triangulation

Minor option	910
Field 1*	Triangulation name
Field 3	Boundary string (optional)
Field 4	Datum level
Field 7	% unsuitable. If zero, the result is average height which produces cut/fit balance.

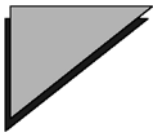


911 Volume from isopachyte

Minor option	911
Field 1*	Isopachyte triangulation name.
Field 3	Boundary string (optional)

912 Mean thickness of isopachyte triangulation

Minor option	912
Field 1*	Isopachyte triangulation name.
Field 3	Boundary string (optional).



RENAME

Major option **RENAME**

RENAME

Model 1 Existing name of model (maximum 32 characters)

Model 2 New name of model (maximum 28 characters).

Major option REPORT

REPORT

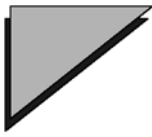
Model 1 Contains the model from which information is to be reported.

Model 2 Second model (if it needs to be referenced).

✎ Leave Model 1 blank if you are not accessing strings; for example, it is unnecessary for options 987, 989, 990.


✎ When you report some models you may find the model name is extended by four characters. These four characters are set automatically and indicate the model type and hence the information held within it.

The global options available in REPORT are 000, 001, 003, 017, 018, 019, 900 and 999.




980 Report geometry information

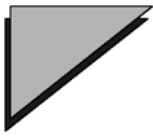
Option	980
Field 1	String name (must be a geometry string)
Field 2	Geometry string code
	ALL All geometry string points
	HTPS Horizontal tangent points
	HIPS Horizontal intersection points
	HCEN Horizontal arc centres
	VTPS Vertical tangent points
	VIPS Vertical intersection points
	VFPS Vertical flat points
	VMOS Vertical mid-ordinate points
	SUPE Superelevation points
	CANT Cant at HTPS
	RAIL Railroad geometry points
Field 5,6	SPRD for first point in the string to be reported
Field 8,9	SPRD for last point in the string to be reported

 If nothing is selected in Field 2, the default setting of ALL will be used.

982 Report triangles

Option	982
Field 1*	Required triangulation string name
Field 4	Code 1 will output level of a given point and the triangle associated with it. Code 2 will output information for a single triangle for a given point. Code 3 will output coordinates of centroid and vertices for all triangles. Code 4 will list allocated triangle group codes.
Field 5*	X coordinate of given point
Field 6*	Y coordinate of given point

 If field 4 = 1 or 2, then the given point coordinates must be coded in field 5 and 6.



984 Report PISTE format information

Major option	REPORT
Model 1	Model containing the geometry string.
Model 2	Model containing the master string.
Option	984
Field 1*	Geometry string name. Must commence with letter G.
Field 4	Style of output: 1 Style 1 2 Style 2 3 Style 3 4 Style 4
Field 5,6	SPRD for first point in the string to be reported
Field 8,9	SPRD for last point in the string to be reported

985, 986 Report section strings in a stylised format

Option	985
Field 1*	Cut string name to be described
Option	001
Field 1 - 10*	Descriptive text to be output. Up to 50 pairs of 985 and 001 records may be defined together. If following a 986 option another 985 and 001 record is defined, the full set must be redefined. However a series of 986 options may follow one group of 985/001 records.
Option	986
Field 1*	Reference string on which sections are based (must be a master string)
Field 3*	Initial character of section strings to be reported
Field 4	Chainage interval (optional)
Field 5 & 6	SPRD for point on reference string generating first sections to be output
Field 8 & 9	SPRD for point on reference string generating last section to be output

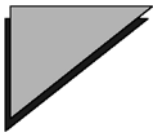


985, 983 Report section strings in (PISTE) format

Option	985
Field 1*	Cut string name to be identified
Option	001
Field 1	Two characters to identify cut string
Option	983 (initial 983)
Field 1*	Reference string on which sections are based (must be a master string)
Field 3*	Initial character of section string to be reported
Field 4	Chainage interval (optional)
Field 5 & 6	SPRD for point on reference string generating first sections to be output
Field 8 & 9	SPRD or point on reference string generating last section to be output.
Option	983 (intermediate 983)
Field 3	Initial character of further section strings to be reported
Option	983 (final 983)
	Blank

987 Check record pointers

Option	987
Field 1	LABS if string index entries are to be printed. Otherwise leave blank.

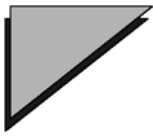


988 Check for loops in a boundary string

Option	988
Field 1*	Name of string to be tested

989 Model file records used

Option	989
	Leave all fields blank.

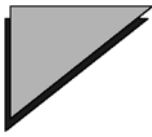


990 Report models

Option	990
Field 1,2	Up to eight characters to report all names beginning with the typed letters
Field 3	SORT to sort the models alphabetically DATE to sort the models on date last updated.


991 Report strings

Option	991
Field 1	Type the name of the one string to be printed. If omitted the string index information is printed for all strings or all strings satisfying a current selection mask table. Alternatively an inclusive selection may be typed.
Field 3	Type SORT to report the string names in ascending order. Type SUMM to report the 991 terminating summary only.



992 Report string details

Option	992
Field 1	Type the name if only one string is required. If omitted all the strings or all the strings in the model satisfying a current selection mask table will be output. Alternatively a partial string name may be used.
Field 2	Type FULL if the plan distance, percentage slope and cumulative plan distance are to be calculated and printed. Type SLOP to report slope lengths. Type ZERO to report only strings with zero levels. Type NULL to report only strings with null levels. Type FNNDI to report the plan distance, percentage slope and cumulative plan distance without the lengths across discontinuities included in the total distance. Type SNNDI to report slope lengths without the lengths across discontinuities included in the total length.
Field 3	Type SORT to report the strings in ascending name order.
Field 5 & 6	SPRD for the first point in the string to be printed.
Field 8 & 9	SPRD for the last point in the string to be printed.

 If fields 5, 6, 8, and 9 are typed field 1 must be typed.

993 String details - user defined format

Order of items

Option	003
Field 1	Type ORDR
Field 5 -10*	Contain the items within each string element in the order in which they are to be output.


Report headings

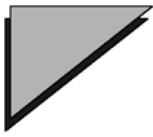
Option	001
Field 1*	HEAD
Field 2*	LINE
Field 3	Line number 1 or 2 (left justified) or blank for continuation records
Field 4-10	Characters for heading.

Page headings

Up to two lines of 117 character headings may be output at the top of each page of printed output.

Option	993
Field 1	Type the name of the string if only one string is required. If omitted, all the strings or all the strings in the model satisfying a current selection mask table will be output. Alternatively a partial string name may be typed.
Field 2	If NUMB is typed the point sequence numbers in the string are printed as the first output field. An integer output field must be provided in the 001 FORMAT option. It is possible to arrange the sequence number to appear on the output at any position in the printed line by skilful use of the FORMAT statement.
Field 3	Type NEWP if a skip to a new page is required for each string to be output.
Field 5 & 6	SPRD for the first point in the string to be printed.
Field 8 & 9	SPRD for the last point in the string to be printed.

 If fields 5, and 6 or 8 and 9 are typed, field 1 must be typed.

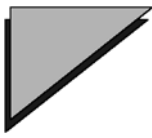


994 Section strings

Option	994
Field 1*	Initial character of section set to be reported
Field 2*	Reference string
Field 5 & 6	SPRD for start point on reference string
Field 8 & 9	SPRD for end point on reference string

995 Report distance and bearing of line


Option	995
Field 1*	String name.
Field 4	Radius within which all points on the string are selected. If omitted only the nearest point is taken.
Field 5 & 6*	Point from which radius is drawn.
Field 7	Z coordinate of the point. If this field is typed then the three dimensional distance will be reported.



996 Report normals to a string


996 Report distance and bearing of a normal

Option	996
Field 1*	String name onto which normal is dropped
Field 2	PLAN - report distances as plan distances SLOP - report distances as slope distances
Field 4	Report style 1 - Abbreviated output (default) 2 - Detailed output 3 - Tabular output
Field 5 & 6*	Coordinates of point through which the normals will pass.
Field 7	Z coordinate of point through which the normals will pass.

 If the z coordinate is typed in field 7 the slope distance will be reported provided field 2 is blank or set to *SLOP*; otherwise the plan distance will be reported.

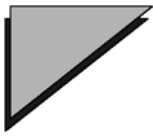
996 Report distance and bearing of several normals

Option	996
Field 1*	String name onto which normals are dropped.
Field 2	PLAN - report distances as plan distances (default) SLOP - report distances as slope distances
Field 3	String name containing reference points.
Field 4	Report style 1 - Abbreviated output (default) 2 - Detailed output 3 - Tabular output
Field 5 & 6*	SPRD of start point of string containing reference points.
Field 8 & 9	SPRD of end point of string containing reference points.

 If the string of reference points contains a null level, a plan distance will be reported.

997 Report intersection of 2 strings

Option	997
Field 1	First string name; this string must be in model 1.
Field 2*	Second string name; if two model names are typed on the major option record, this string must be in model 2.
Field 5 & 6	SPRD for start point on first string.
Field 7	Intersection number required, if omitted all will be printed.
Field 8 & 9	SPRD for start point on second string.

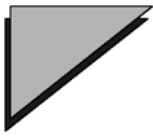


998 Report normal intersections

Option	998
Field 1	Reference string, from which normal is erected. If two model names are typed on the REPORT option, this string can be in either model.
Field 2*	String to be intersected by normal. If two model names are typed on the REPORT option, this string must be in model 1.
Field 4	If the normal is required at only 1 point type 1.0.
Field 5 & 6	SPRD for start point of reference string where normal is erected.
Field 7	Significance level for vertical differences. Values used may be 50, 80, 90, 95, 98 or 99.
Field 8 & 9	SPRD for end point of reference string where normal is erected.
Field 10	Significance level for horizontal displacement.

Major option RETRIEVE

Minor option	001
Model 1	Model name to be retrieved, up to 32 characters.
Model 2	New model name to be used, if different from old. Up to 28 characters may be specified.



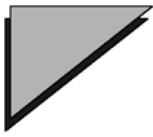
SECTION

Major option SECTION

Major option	SECTION
Model 1	Model containing the strings used to determine the sections, or model containing the triangulation to be sectioned (must be a .TRIA type model). This model must also contain the section reference string if no second model is specified.
Model 2	Model containing the section reference string.
Major option	SECTION
Model 3	Model for storing the extracted sections. Global options 000, 017, 019, 900 and 999 may be used with SECTION.

017 Define section parameters

Minor option	017
Field 4	Secondary interpolation tolerance, default 20.0
Field 9	Secondary interpolation offset, default equal to secondary interpolation tolerance.



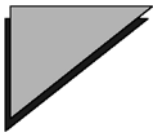
SECTION

170 Long section between two points

Minor option	170
Field 2	If secondary interpolation is required specify SINT.
Field 3*	A unique four character name for storing the section string.
Field 5 & 6*	Coordinates of the start of the section.
Field 8 & 9*	Coordinates of the end of the section.

171 Long section along a string

Minor option	171
Field 1*	Reference string.
Field 2	If secondary interpolation is required specify SINT.
Field 3	A unique 4 character name for storing the section string. If levels are to be supplied to the reference string leave blank but note that in this instance SINT must be defined in Field 2.
Field 5 & 6	SPRD start
Field 8 & 9	SPRD end.

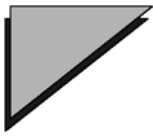


173 Cross section relative to a string

Minor option	173
Field 1*	Reference string. The string may be any dimension (eg master string or simply two dimensions) and sections will be produced for all points on the string.
Field 2	If secondary interpolation is required specify SINT.
Field 3*	Specify an initial character to give a unique reference to the stored sections eg C.
Field 5 & 6	SPRD start.
Field 7*	Left most offset - specify sign if negative.
Field 8 & 9	SPRD end.
Field 10*	Right most offset - specify sign if negative.

174 Cross section relative to a master

Minor option	174
Field 1	Reference string, must be a master string.
Field 2	If secondary interpolation is required, code SINT.
Field 3*	Specify an initial character to give a unique reference to the stored sections eg D
Field 4*	Chainage interval between sections
Field 5 & 6	SPRD start
Field 7	Left most offset - specify sign if negative
Field 8 & 9	SPRD end
Field 10	Right most offset - specify sign if negative

**175, 176 Visibility along/against a section**

Minor option	175/176
Field 1*	String name to define the eye position
Field 2*	String name to define target position
Field 3	Visibility string name if visibility details are to be stored
Field 4*	Minimum visibility distance
Field 5	Eye horizontal offset
Field 6	Eye vertical offset
Field 7	Eye chainage interval
Field 8	Target horizontal offset
Field 9	Target vertical offset
Field 10	Target chainage interval.

177 Long section through triangulation

Minor option	177
Field 1*	Reference string
Field 2*	Triangulation name
Field 3*	Section name
	If the name in field 3 is the same as the name in field 1, only levels on the reference string are amended.
Field 5 & 6	SPRD of start
Field 8 & 9	SPRD of end

Derive the level at a point

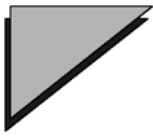
Minor option	177
Field 2*	Triangulation name
Field 5 & 6	Code the X and Y coordinates of the point.

Derive the level of a point on a string

Minor option	177
Field 1*	Reference string
Field 2*	Triangulation name
Field 4	Code 1.0 to indicate single point identifier
Field 5 & 6	SPRD of point

Derive the levels at a series of points along a string

Minor option	177
Field 1*	Reference string
Field 2*	Triangulation name
Field 5 & 6	SPRD start
Field 8 & 9	SPRD end



178 Cross section through triangulation

Minor option	178
Field 1*	Reference string
Field 2*	Triangulation name
Field 3*	Section set initial character
Field 4	Chainage interval, if blank use all points on the reference string
Field 5 & 6	SPRD of start
Field 7	Leftmost offset
Field 8 & 9	SPRD of end
Field 10	Rightmost offset.

Major option SECURE

Major option	SECURE
Model 1	Name of model to be protected



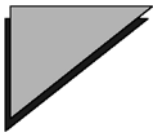
SETOUT

Major option **SETOUT**

Major option	SETOUT
Model 1	The model which contains the strings to be set out.
Model 2	The model in which any reference stations reside. If left blank it will be assumed that all the stations are in model 1.

180 Add, amend, or delete reference stations

Minor option	180
Field 3*	Station reference
Field 4	Code -1.0 if a station is to be deleted
Field 5*	X coordinate
Field 6*	Y coordinate
Field 7	Level; if omitted a null level is assumed (-999.0)

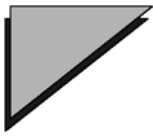


181 Setting out a string by deflection angles

Minor option	181
Field 1*	Reference string
Field 2*	First reference station
Field 3	Second reference station (if check angle required)
Field 4	Chainage interval (optional and only if reference string is a master string)
Field 5 & 6	Chainage or coordinates of start point on reference string
Field 7	Instrument interval (if not required leave blank)
Field 8 & 9	Chainage or coordinates of end point on reference string

182 Setting out a string by intersecting rays

Minor option	182
Field 1*	Reference string
Field 2*	First survey station reference
Field 3*	Second survey station reference
Field 4	Chainage interval (optional and only if reference string is a master string)
Field 5 & 6	Chainage or coordinates of start point on reference string
Field 8 & 9	Chainage or coordinates of end point on reference string



183 Setting out by offsets

Minor option	183
Field 1*	Reference string
Field 2*	First survey station
Field 3*	Second survey station
Field 4	Chainage interval (optional and only if reference string is a master string)
Field 5 & 6	Chainage or coordinates of start point on reference string - optional
Field 8 & 9	Chainage or coordinates of end point on reference string - optional

SUBSYSTEM

SUBSYSTEM

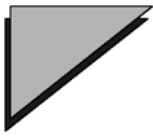
SYSDEL,<file> - deletes a file.

or

SYSRENAME,<file1>,<file2> - renames a file.

or

SYSCOPY,<file1>,<file2> - copies a file.



SURFACE

Major option SURFACE

Major option	SURFACE
Model 1	Triangulation model.
Major option	SURFACE
Model 3	Model used to store contours, ridge strings and valley strings, or flow line data.

970 Generate contours

Minor option	970
Field 1*	Triangulation name.
Field 2	String name initial character for normal contour interval (default = D).
Field 3	String name initial character for prominent contour interval (default = 0).
Field 4	Normal contour interval (default = 1.0 unless field 9 or 10 is coded).
Field 5	Special contour interval to be applied when slope exceeds value in field 6; if omitted the normal contour interval is assumed.
Field 6	Slope for interval changes from value in field 4 to that specified in field 5. Expressed as a decimal fraction (1 in 20 = 0.05), default = 1.0.
Field 7	Prominent contour interval. Default 5 : 1 normal contour interval.
Field 8	Slope above which omitted. Expressed as a decimal fraction; default = 200.
Field 9	Level above which contours are required. The lowest contour is generated at the nearest multiple of the contour interval below this value.
Field 10	Level below which contours are required. The highest contour is generated at the nearest multiple of the contour interval above this value.

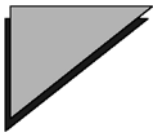


971 Generate isopachytes

Minor option	971
Field 1*	Triangulation name.
Field 2	String name initial character for normal isopachyte interval (default = D).
Field 3	String name initial character for prominent isopachyte interval (default = 0 (zero)).
Field 4	Normal isopachyte interval (default = 1.0 unless field 9 or 10 is coded).
Field 5	Special isopachyte interval to be applied when slope exceeds value in field 6; if omitted the normal isopachyte interval is assumed.
Field 6	Slope for interval changes from value in field 4 to that specified in field 5. Expressed as a decimal fraction (1 in 20 = 0.05), default = 1.0.
Field 7	Prominent isopachyte interval. Default 5 : 1 normal isopachyte interval.
Field 8	Slope above which omitted. Expressed as a decimal fraction; default = 200.0.
Field 9	Level difference above which isopachytes are required. The lowest isopachyte is generated at the nearest multiple of the isopachyte interval below this value.
Field 10	Level difference below which isopachyte are required. The highest isopachyte is generated at the nearest multiple of the isopachyte interval above this value.

972 Generate ridge and valley strings

Minor option	972
Field 1*	Triangulation name.
Field 2*	Ridge string name.
Field 3*	Valley string name.
Field 4	Code 1 if an option 973 is to follow to generate flow lines.

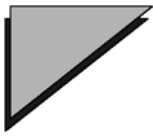


973 Generate flow lines

Minor option	973
Field 2*	Initial character for storing flow lines.
Field 4	Plan tolerance for interval of flow lines (default 5m).

Major option SURVEY

Major option	SURVEY
Model 1	Model to contain survey information.
Model 2	Model containing the stations string and points string if different from model 1. Global options 000, 017, 018, 900 and 999 may be used in SURVEY.

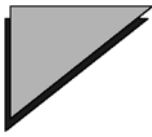


180 Add, amend or delete survey station

Minor option	180
Field 3*	Station name.
Field 4	-1.0 delete station.
Field 5, 6*	Coordinates of station.
Field 7	Level of station.

189 Set survey parameters

Minor option	189
Field 1	OLD - specify this indicator if you wish to use survey option 199, Least squares transformation.
Field 2	Curve fitting style MX (default) SPLI All curves will use this curve fitting style unless the other style is specifically coded for the individual curve.
Field 3	Point string name If a point string for the whole survey is required, then code this field. If this field is not coded, a point string will not be created. If the string already exists the observed points will be added to it.
Field 4	Chord-to-arc tolerance If curved elements are being observed the chord-to-arc tolerance for the addition of extra points may be defined. The default value is determined by the current project settings. The following fields 5, 6 and 7 hold the standard errors of the instrument for use in location of stations by resectioning or intersecting rays.
Field 5	Angular error (default = 3 seconds).
Field 6	Distance error, constant part, in millimetres (default = 5 mm). Code a value in the range 1.0 to 9.9
Field 7	Distance error, proportional part, expressed in ppm (Default = 5 ppm). Code a value in the range 1.0 to 9.9.
Field 8	Radius of the Earth The default value, assumed by the program, for the radius of the earth is 6.370×10^6 . This value is used in the corrections for sea level and curvature/ refraction. If this value is to be changed, code the mantissa as a decimal number eg 6.370. The exponent 10^6 will be automatically applied by the program. Therefore the value used for the radius of the earth will be 6370000.
Field 9	Curvature/refraction coefficient. Code the value of the curvature/refraction coefficient if different from the default value of 0.071.



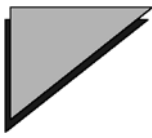
190 Set theodolite and traversing constants

Minor option	190
Field 1	Absolute error check indicator Code NRCH if checks on the absolute errors encountered in the resection processing are to be ignored.
Field 2	Traverse adjustment method indicator (default BOWD) BOWD for Bowditch (compass) method of adjustment. UNAL for unaltered bearings (Crandall's) method of adjustment. BIRD for Bird's method of adjustment.
Field 3	INCR if the vertical angle increases to zenith. DECR if the vertical angle decreases to zenith (default).
Field 4	Vertical angle datum (default 900000 DMS, 100 grad).
Field 5	K^1 (preset 100.0).
Field 6	K^2 (preset 0.0).
Field 7	Z Constant for Bird's method of adjustment. (default 0.005)
Field 8	F Constant for Bird's method of adjustment. (default 5 parts per million).
Field 9	Permissible linear closing errors. (1 in 10,000 expressed as 10000.0 - default value 10000.0).


199 Least squares transformation


Minor option 199

Field 1	Existing station name (optional).
Field 3	New station name. If blank then the point is not stored after the transformation.
Field 4	Tolerance in residual coordinate errors, dx and dy for the transformed position of the block control points. Only specified on the first minor option.
Field 5,6,7	Point coordinates (x, y and z) in the existing system. If these fields are entered then field 1 should be blank and vice-versa.
Field 8,9	Point coordinates in the new system. Only entered for the control points.



200 Set up survey station

Minor option	200
Field 1*	Instrument station name
Field 2*	Reference station name
Field 3*	Style of observation Total Station equipment - Define the components which along with the horizontal angle complete the geometry of the observation, for example HDVA, SDVA, HDVT, HDLD, VAHD, VTHD etc where :- HD = Horizontal Distance SD = Slope Distance VA = Vertical Angle VT = Vertical Tangent LD = Level Difference CHOF - Chain and Offset STAD - 3-Stadia Tacheometry STAK - 3-Stadia with Height Factor REAL - Real Coordinates BORE - Borehole logging
	 This field must be entered on the first survey station set up command but thereafter is optional unless the style of observation is changed.
Field 4	Horizontal angle datum.
Field 5	Level component to establish collimation from the reference station (optional).
Field 7	Establishment of collimation level. Height of telescope above the instrument station. The collimation level may also be established from the reference station in which case this field may contain a target height. If the instrument and target height are to be set equal then field 7 may be left blank.
Field 8	Code 1.0 to invoke the curvature correction.
Field 9	Code the elevation to be used for sea level correction.
Field 10	Scale factor to be applied to distances. This is optional and will apply to following observations until changed. Default value is 1.0. If a scale factor is applied then sea level correction is made first.

 If this field is coded then field 9 must also be coded.

201/202 Observation point on straight/curve

Minor option	201 or 202
Field 1	<p>Leave blank or code one of the following indicators:-</p> <p>IGN, IGL, IGLL</p> <p>Used to prevent an observation being stored in the model (IGN) or to assign null levels to points.</p> <p>LEV</p> <p>Associate the value defined in field 7 as an absolute level.</p> <p>APP, APL, APLL</p> <p>Used when making an observation to a point which is the first of several points to be added to a previously stored string. APL will ignore the level for this point, APLL will ignore all levels subsequently appended to this string.</p> <p>DISC, DISB</p> <p>Insert a discontinuity into the currently observed string at this point. DISC will indicate a break in the string whilst DISB will indicate a break in the direction of the string</p> <p>TAPE, TAPL, TAPN, TAPR</p> <p>Locate a point by taped measurements relative to the previous observed link. Various alternatives exist for the definition of the level.</p> <p>OFFS, OFFL, OFFR</p> <p>Offsetting of features. Points may be generated by offsetting from links defined by other observations. A surveyed level (OFFS), a null level (OFFL), or a real level (OFFR) can be assigned.</p> <p>TIE, PIV, LINE</p> <p>These indicators are used only with Chain and Offset Surveys to record tie observations and line of sight observations.</p> <p>CHE</p> <p>Used when making a check observation to an existing station.</p> <p>FLY, FLYT</p> <p>A new station may be established by a single observation. It is a simple unchecked fix and is often established as a temporary station. (FLYT) for recording local details.</p> <p>RESN</p> <p>A new station may be established by observing from an unknown location on to three or more known stations using resection methods to determine the station's position.</p>



SURVEY

INTS

A new station may be established by observing its position from several existing stations. Intersecting ray analysis then determines the station's position.

TRAV

A set of new stations may be established by the construction of a simple open traverse or a closed traverse with facilities for adjusting the traverse with varying fixed end conditions.

REPR, REPS, REPL

Record rectangular feature by 3 points assigning a real, surveyed, or null level.

REMR , REMS, REML

Record rectangular feature by 2 points and the width.

CRCR, CRCS, CRCL

Record circular feature by centre and the radius.

CR2R, CR2S, CR2L

Record circular feature by centre and a point on the circumference.

CRDR, CRDS, CRDL

Record circular feature by 2 points on a diameter.

CR3R, CR3S, CR3L

Record circular feature by 3 points on circumference.

Field 2

Leave blank or code one of the following indicators:-

MX, SPLI

(Option 202 only.) Indicates whether a circular (MX) or a spline curve (SPLI) is required.

CLOS

Invokes the automatic closure of strings for features such as buildings or boundaries.

SQUR, SQUC

Invokes the squaring of strings. The Ordnance Survey method of squaring is adopted. The facility is invoked by coding SQUR against the final recorded point. Both Squaring and Closing may be applied using the indicator SQUC.

OBJ

Indicates that a circular or rectangular feature is to be stored in the model as an object.

Field 3

The name of the string where the observation is to be stored or the name of the station being observed.

Basic measurement

Not completed if field 1 is TAPE, TAPL, TAPR, TAPN, or OFFS, OFFR, OFFL, or if a previous observation is being recalled.

Geometric:

Field 4*	Horizontal angle measured clockwise from the reference station.
Field 5*	First measurement component (usually distance component) as defined by field 3 of the 200 option.
Field 6*	Second measurement component (usually level component) as defined by field 3 of the 200 option.
Field 7	Target height.
Field 8	Azimuth bearing for traverse observation. This can be coded if field 1 contains TRAV. If coded then fields 3, 5 and 6 must be omitted

3-stadia:

Field 4*	Horizontal angle measured clockwise from the reference station.
Field 5*	Vertical angle or height factor.
Field 6*	First stadia reading (usually top).
Field 7*	Second stadia reading (usually middle).
Field 8*	Third stadia reading (usually bottom).

Chain and offset:

Field 5	Traverse distance or intersection distance (LNE).
Field 6	Offset (negative to the left, positive to the right) or feature length (LNE).
Field 7	Reduced level. If blank a null level will be assigned.

Real:

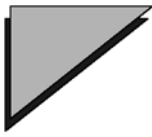
Field 5	First coordinate. (X or Y depending on coordinate system).
Field 6	Second coordinate. (Y or X depending on coordinate system).
Field 7	Level. If blank null level will be assigned.

Adjusted measurement (geometric observations only)

Field 7	Adjusted target height.
Field 8	Line of sight adjustment (forward positive, backwards negative).
Field 9	Lateral adjustment (left negative, right positive).

Taped measurements (for geometric, 3-stadia, real coordinate surveys)

Field 1 must be TAPE, TAPL, TAPN, TAPR.



SURVEY

Field 5	Longitudinal distance along the previous link. (forwards positive, backwards negative).
Field 6	Lateral offset from the previous link (left negative, right positive).
Field 7	Vertical adjustment to be applied to the level of the previous observation, or real level for TAPR.

Offset measurements

	Field 1 must be OFFS, OFFL, or OFFR.
Field 7	Vertical adjustment to be applied (OFFS), or real level (OFFR).
Field 9	Offset (left negative, right positive).

Circular/rectangular features

Field 9	Width of rectangle or radius of circle.
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Recall previous measurement

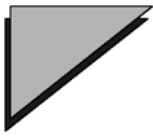
Field 10	Point number of the observation to be recalled. Negative value specifies point by relative position.
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Specify point number for observation

Field 10	The point number to be allocated to the observation. If blank, the number is incremented from that of the previous observation.
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203 Offset strings

Minor option	203
Field 1*	Reference string from which offsets are to apply.
Field 3*	Name of string to be generated.
Field 4	Vertical offset to be applied. If blank then null levels will be assigned to the generated string. If zero is coded then the levels of the reference string will be assigned.
Field 7	Horizontal offset to be applied.





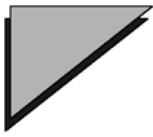
TRIANGLE

Major option **TRIANGLE**

Global options 000, 017, 019, 900 and 999 may be used with TRIANGLE.

960 Create triangulation


Major option	TRIANGLE
Model 1	Model to be triangulated.
Model 2	Reference model for boundary.
Model 3	Model used to store the triangulation.
	 Models 1 & 2 must not be a triangulation model.
Minor option	960
Field 1	String name used to define boundary for point selection.
Field 3*	Triangulation name.
	 Triangulations have the subreference <i>TRIN</i> .



TRIANGLE

961 Trim triangulation


Major option	TRIANGLE
Model 1	Triangulation model
Model 2	Boundary model
Model 3	Model used to store the triangulation.

 Model 2 must not be a triangulation model.

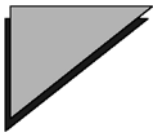
Minor option	961
Field 1	String name used to define boundary for trimming. Leave blank to ignore boundary string.
Field 2*	Existing triangulation name.
Field 3*	Trimmed triangulation name.
Field 10	Code 1.0 if method A trimming (SHRINK) is required. Leave blank to invoke method B trimming (ALL).

962 Create full isopachyte triangulation

Major option	TRIANGLE
Model 1	Existing string model to be used for isopachyte triangulation.
Model 2	Proposed model to be used for isopachyte triangulation.
Model 3*	Model used to store isopachyte triangulation.

 Models 1 & 2 must not be a triangulation model.

Minor option	962
Field 1	String name used to define boundary for point selection within model 1.
Field 2	String name used to define boundary for point selection within model 2.
Field 3	Isopachyte triangulation name.



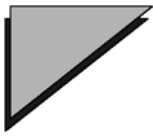
TRIANGLE

963 Subdivide triangulation

Major option	TRIANGLE
Model 1	Triangulation model.
Model 2	Blank.
Model 3	Model used to store smoothed triangulation.
Minor option	963
Field 2*	Primary (existing) triangulation name.
Field 3*	Secondary (smoothed) triangulation name.

964 Create isopachytes from stored triangulations


Major option	TRIANGLE
Model 1	Existing triangulation model.
Model 2	Proposed triangulation model.
Model 3	Model used to store isopachyte triangulation.
Minor option	964
Field 1*	Existing triangulation name.
Field 2*	Proposed triangulation name.
Field 3*	Isopachyte triangulation name.



TRIANGLE


965 Create simple isopachyte triangulation

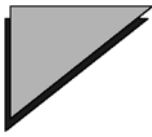
Major option	TRIANGLE
Model 1	Existing string model to be used for isopachyte triangulation.
Model 2	Proposed model to be used for isopachyte triangulation.
Model 3	Model used to store isopachyte triangulation.

 Models 1 & 2 must not be a TRIA triangulation model.

Minor option	965
Field 1	String name used to define boundary for point selection within model 1.
Field 2	String name used to define boundary for point selection within model 2.
Field 3	String name used to define name of isopachyte triangulation.

966 Group triangles

Major option	TRIANGLE
Model 1	String model
Model 2	Reference model
Model 3	Model used to store the triangulation group
	 Models 1 & 2 must not be a TRIA triangulation model.
Minor option	966
Field 1	Seed string name A partial name may be used. If a partial name is specified, the seed strings must be contained in the reference model. If a full name is specified, the seed string may be contained in either the string or the reference model.
Field 2	Group code 4 alphanumeric characters
Field 3	Triangulation string name
Field 4	Single seed point indicator 0 Multiple seed points 1 Single seed point
Fields 5 & 6	SPRD of start point on seed string
Field 7	Link tolerance (default 0.010)
Fields 8 & 9	SPRD of end point on seed string



TRIANGLE

967 Group triangles by criteria

Major option	TRIANGLE
Model 1	String model
Model 2	Reference model
Model 3	Model used to store the triangulation group

⚠ Models 1 & 2 must not be a TRIA triangulation model.

Minor option 967

Field 2	Group name of triangles, which must be four characters.
Field 3	Triangulation name, which must be four characters.
Field 5	Lower level, above which all triangles are grouped.
Field 6	Upper level, below which all triangles are grouped.
Field 7	Start slope (decimal fraction), above which triangles are grouped.
Field 8	End slope (decimal fraction), below which all triangles are grouped.
Field 9	Start whole circle bearing for aspect.
Field 10	End whole circle bearing for aspect.

⚠ Fields 7 and 8 must be zero or positive.

⚠ Flat triangles are included in the colour fill when whole circle bearings are specified.

Major option VALGN

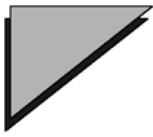
Major option	VALGN
Model 1	Model containing the master string. This option adds levels to an existing string.
Model 2	Model containing the geometry string . If omitted the geometry string will not be updated. If the master string and the geometry string are in the same model, code the second model name the same as the first.

Initial data

Field 1*	Existing master string name.
Field 2	Start chainage This must lie on the master string. If left blank the start of the master string is assumed.
Field 3	End chainage This must lie on the master string. If left blank the end of the master string is assumed.
Field 4	Maximum percentage gradient A warning will be output if this absolute value is exceeded. If left blank a value of 10.0 is assumed.
Field 5	Maximum M value (hog) A warning will be given if this value is exceeded. If left blank a value of 10.0 is assumed.
Field 6	Maximum M value (sag) A warning will be given if this value is exceeded. If left blank a value of 10.0 is assumed.
Field 7*	Number of curves (maximum 500).
Field 8	Definition of curvature (+1 indicates M value: +2 indicates Radius). The default definition is defined in the project settings.

Element details

Field 1	Curvature The curvature is specified as the radius or M value, depending upon the value of Field 8 in the Initial Data record. M value is defined as 10000.0/radius. This data must be entered as a decimal and a value of 0.0 indicates a straight whether the M value or radius is used.
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VALGN

Field 2	Chainage at point A
Field 3	Level at point A
Field 4	Chainage at point B
Field 5	Level at point B
Field 6	Chainage at point C
Field 7	Level at point C
Field 8	Percentage gradient

Final record

The data should be terminated by a 999 minor option.

Major option VCUSP

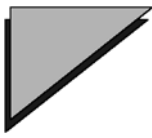
Major option	VCUSP
Model 1	Model containing the master string. This option adds levels to an existing string.

Initial data

Field 1*	String name.
Field 2	Start chainage.
Field 3	End chainage.
Field 9*	Number of location points to follow (maximum 500).

Location point details

Field 1*	Chainage
Field 2*	Level
Field 3	Percentage gradient, if required
Field 4	Radius of curvature, negative hog curve, positive sag curve.



Major option VERAT

- Model 1 Model containing the master string. This option adds levels to an existing string.
- Model 2 Model containing the geometry string. If omitted, no geometry string will be updated. If the master string and the geometry string are in the same model, code the second model name to be the same as the first.

Initial data

- Field 1* Existing master string name.
- Field 2 Start chainage
- Field 3 End chainage
- Field 4 Minimum curve length - This value will be used if for a curve neither the curve length nor the M value is defined. Warnings will also be given if any curve has a length smaller than this value.
- Field 5 Maximum M value - Hog
- Field 6 Maximum M value - Sag
- Field 7* Number of intersection points (maximum 500).
- Field 8 Definition of curvature (+1 indicates M value: +2 indicates Radius).

Element data

First intersection point

- Field 1* Chainage
- Field 2* Level

Intermediate intersection point

- Field 1* Chainage of intersection point opposite curve under consideration
- Field 2* Level
- Field 3 Curve length
- Field 4 M value or radius, depending upon the definition of curvature specified in Field 8 of the initial data record.

Last intersection

- Field 1* Chainage
- Field 2* Level

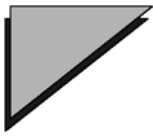
Final record

The data should be terminated by a 999 minor option.

Comments and blank lines cannot be included within VERAT data.

Major option VIEW

Major option	VIEW
Model 1	Model which is to be viewed.
Model 2	Model containing reference strings, if not in first model. Otherwise leave blank.
Major option	VIEW
Model 3	Model for storing the resultant perspective view. If blank, a temporary model is generated.
Model 4	Model containing stored triangulation. This model is only required when performing hidden line removal. Global options 000, 017, 019, 900 and 999 may be used with major option VIEW.



920 Definition of viewing parameters

Minor option	920
Field 1	If picture is to be corrected to the vertical code TILT
Field 2	If hidden lines are to be suppressed code HIDE
Field 3	Triangulation name of stored triangulation for use in hidden line removal. If hidden line removal is not required, leave this field blank.
Field 4	Iteration tolerance for photomontage, default value 0.000001
Field 5 & 6	Coordinates of bottom left hand corner of picture, default values 1.0,1.0
Field 7	Distance from eye that picture will be viewed, default value 1.0
Field 8	Width of picture, default 1.0
Field 9	Height of picture, default value 1.0
Field 10	Depth of picture, beyond which nothing can be seen, default value 1000.0

921 Definition of picture orientation

Minor option	921
Field 3	Code EYE if the position of the eye is being defined Code TARG if the position of the target is being defined
Field 4	Code -1.0 if the point being defined is only an estimate

Specification in relation to a set of coordinates

Field 5, 6 & 7*	Code the X, Y and Z coordinates of either the eye point or the target point
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Specification in relation to a reference string

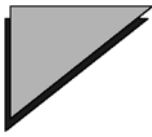
Field 1*	Reference string name
Field 5 & 6*	SPRD for the point on the reference string.
Field 8	Offset of defined point normal to point on the reference string.
Field 9	Offset of defined point tangential to the point on the reference string.
Field 10	Vertical offset of the defined point relative to the point on the reference string.

Specification in relation to a survey station

Field 2*	Station name.
Field 10	Vertical offset to be applied to the level of the station point.

Specification of target point in relation to angle of view

Field 8	Azimuth bearing of direction of view, measured clockwise from due North.
Field 9	Vertical angle of direction of view, measured anti-clockwise from horizontal.
Field 10	Angle of swing measured clockwise from the vertical in the picture plane.



922 Definition of photomontage points

Minor option 922
Field 8 & 9* Picture coordinates of photomontage point.

Specification in relation to a set of coordinates

Field 5, 6 & 7* X,Y and Z model coordinates of the point

Specification in relation to a reference string

Field 1* Reference string name
Field 5 & 6* SPRD for the point on the reference string.

Specification in relation to a survey station

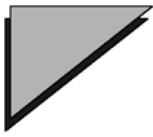
Field 2* Station name
Field 10 Vertical offset to be applied to the level of the station point.

923 Production of perspective view

Minor option 923

Wire line perspectives

Field 4 Coincident point tolerance (default value 0.0001)



924 Sketch facility

Minor option	924
Field 2	Specify CONT if the first point is to be joined by a line to the last point on the previous 924 option.
Field 3*	String to which points will be added.
Field 4	Coincident point tolerance (default value 0.001) (See the equivalent description for minor option 923)
Field 5*)	
Field 6*)	Coordinates of first point.
Field 7*)	
Field 8)	
Field 9)	Coordinates of second point.
Field 10)	

Major option VOLUME

Model 1

- for options 050, 052, 053 and 054 the model defining the existing surface
- for options 050 and 052 the model containing the boundary string, if it does not exist in the second model.
- for option 056 the model containing both sets of sections.

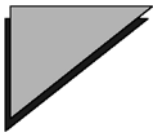
Model 2

- for options 050 and 052 the model containing the new surface and boundary string
- for options 052, 053, 054 and 056 the model containing the cross section reference string.

Model 3

- for all options the model for storing volume strings and End Area strings. (This record is only needed if volumes information is to be stored).

Global options 000, 017, 019, 900 and 999 may be used with VOLUME.



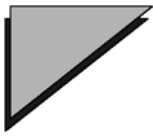
VOLUME

050 Volume using parallel sections

Minor option	050
Field 2	If secondary interpolation is required code SINT.
Field 3*	Boundary string name.
Field 7	Topsoil depth
Field 10	The required cross section interval. If blank an interval of 1/25 of the axis length is assumed.

051 Volume environment

Minor option	051
Fields 1 & 2	Text to be displayed in each row of the 'Position' column of the volume output (maximum 8 characters).
Field 4	Cut/fill indicator 1 = cut, 2=- fill
Field 5	Curvature correction indicator 0 = curve correction off 1 = curve correction on Curve correction may be used by minor options 052 and 056.
Field 6	Output format 0 = full output (default) 1 = full output with summary 2 = summary only
Field 7	Initial volume. The value specified must be positive.
Field 10	Title indicator 1.0 = title follows in a 001 record. The title can have a maximum of 80 characters.

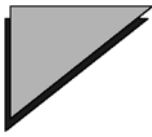


052 Volume using cross sections

Minor option	052
Field 1*	Reference string name If curve correction is on, this string must be a master string.
Field 2	If secondary interpolation is required code SINT
Field 3*	Boundary string
Field 4	Cross section interval on reference string, only coded if the reference string is a master string.
Field 5 & 6	SPRD start
Field 7	Topsoil depth
Field 8 & 9	SPRD end

053 Auto standard profile

Minor option	053
Field 1*	Reference string for cross sections (need not be a master string).
Field 2	If secondary interpolation is required code SINT
Field 4	Cross section interval, coded if reference string is a master string.
Field 5 & 6	SPRD start
Field 7	Topsoil depth.
Field 8 & 9	SPRD end



054 Standard profile and existing sections

Minor option	054
Field 1*	Reference string from which sections were taken.
Field 2*	The cross section set reference character in the first character position.
Field 5 & 6	SPRD start
Field 7	Topsoil depth.
Field 8 & 9	SPRD end

055 Define standard profile

Minor option	055
Field 1	Code START if first offset. Code END if last offset.
Field 4*	Code the offset value from the reference string (left hand offsets negative, options must be in order left to right).
Field 5*	Code the level difference from the reference string (negative value for a fall).
Field 6	For START and END records only, code the required slope in cut (ie slope upwards) as a decimal fraction eg for a slope of 1 in 3, code 0.33.
Field 7	For START and END records only, code the required slope in fill (ie slope downwards), as a decimal fraction.



056 Two existing cross sections

Minor option	056
Field 1*	Reference string name. If curve correction is on, this string must be a master string.
Field 2*	Section set 1 prefix character.
Field 3*	Section set 2 prefix character.
Field 5 & 6	SPRD start
Field 7	Topsoil depth (metres) Depth reduced from section set specified in field 2.
Field 8 & 9	SPRD end

058 Create volume string

Minor option	058
Field 2	The name of the end area string to be created.
Field 3*	The name of the volume string to be created.

