

# FF Reader/Writer

## FORMAT NOTES:

To use this format, you will need to purchase an extra module from METRIA in Sweden:

- <http://www.lantmateriet.se/metriadefault.aspx?id=4415>

The AutoKa PC Transfer File (FF) reader and writer modules provide the Feature Manipulation Engine (FME) with access to the Swedish FF (FlyttFil) file format. The FF file format is the export, or transfer file format for exchanging information between applications such as AutoKa-PC and BankIR.

## FF Quick Facts

Format Type Identifier	FF
Reader/Writer	Both
Dataset Type	File
Feature Type	Geometry type
Typical File Extensions	.ff
Automated Translation Support	Yes
User-Defined Attributes	No
Coordinate System Support	No
Generic Color Support	No
Spatial Index	Never
Schema Required	No
Transaction Support	No
Geometry Type Attribute	ff_type
Rich Geometry	Yes
Geometry Support	

Geometry	Supported?	Geometry	Supported?
aggregate	no	polygon	yes
circles	no	donut polygon	yes
circular arc	no	line	yes
elliptical arc	no	point	yes
ellipses	no	text	yes
none	no	3D	yes

## Overview

FF files may contain both two-dimensional (2D) and three-dimensional (3D) features. FF files store feature geometries as well as several predefined attributes. There is only one user defined attribute. There are 6 kinds of features which are separated into two groups: points, lines, and text are considered **simple** details, whereas polygons, groups, and clusters are **compound** details.

By default, the FME looks for an extension of `.ff` for the input FF files, but will accept any FF file as input regardless of the filename or extension. The FME considers an FF dataset to be a single AutoKa FF file. FF files are binary files consisting of variable-length binary records or packets which make up individual features or details.

The FF format also contains some metadata, such as the creation date of the original data, a user's signature, scaling factors, and so forth. However, a wide variety of applications use the FF format to shuttle information back and forth, some of which cannot properly maintain this metadata. The standard solution was to store this metadata in a small partnering text file, usually with the name `autoka.par` when necessary. The FME has adopted this convention and can automatically read and write the appropriate `autoka.par` parameter file when importing from or exporting to the FF format.

Be aware that there are a few cases where FF terminology differs from what is used in the majority of other formats. If referring to FF documentation, you may notice some difference in the terminology used in this manual. FME documentation uses the word "polygon" in its mathematical definition of a closed region. FF documentation uses the word "polygon" to refer to an unclosed region and the word "area" to refer to a closed region. Another item to note is that in FF documentation the X axis increases vertically and the Y axis increases horizontally. In contrast, the FME defines the X and Y directions to be consistent with mathematics and most other formats: X is the horizontal axis and Y is the vertical axis. FME automatically takes this axis switching into account where necessary, translating the data as it was intended.

AutoKa FF has been upgraded to take advantage of the FME rich geometry model. Advantages include the storage of linear and bulge arc segments of polygon and text features. This addition of rich geometry model support increases accuracy of geometric representation for both translating to FF and from FF to other FME formats.

## Reader Overview

The FF reader simply opens the input file and immediately starts reading features and returning them to the rest of the FME for processing. If directed to do so, the FF reader will produce a partner `autoka.par` parameter file that contains the relevant metatext found in the FF file. The reader doesn't have any requirement for definition statements, as there are no user-defined attributes in the FF specification.

If the data being read contains self-intersecting polygons, the "Fix self-intersecting polygons" parameter in the Input Settings dialog can be checked (set to "yes") to break self-intersecting polygons into non-intersecting polygons.

Each feature returned has its feature type set to the geometric type of the feature, as follows: `point`, `line`, `text`, `polygon`, `cluster`, or `group`.

The first three feature types are simple details and are processed completely by the reader itself. The last three feature types are passed to the rest of the FME with attributes (up-links and down-links) indicating how the compound features may be re-assembled from several other features, but this is not done directly by the reader. Final processing and construction of the compound features may be done in the mapping file if the user desires. By default, all auto-generated mapping files and drag-and-drop translations with the FME provide the mapping file functions necessary to collect the pieces and construct the compound features completely, flagging any file errors it may encounter.

## Reader Directives

The suffixes listed are prefixed by the current <ReaderKeyword> in a mapping file. By default, the <ReaderKeyword> for the FF reader is FF.

### DATASET

**Required/Optional:** *Required*

The value for this directive is the file containing the FF dataset to be read.

**Example:**

```
FF_DATASET /usr/data/input.ff
```

### STORE\_FF\_BULGE\_INFO (applicable only with classic geometry)

**Required/Optional:** *Optional*

This setting determines whether lines with bulges are converted to simple polylines or if the bulge information is stored on each feature in the form of an attribute list. Setting a value of YES adds an attribute `ff_arc_bulges` to each linear feature with line bulges and not alter the geometry. With NO, no such attribute will be added, but the geometry of the feature has the vectorized bulge information added to it. The value of YES allows the FF writer to reconstruct the line with line bulges as it was initially given, without losing any precision through vectorizing bulges. A typical control file fragment specifying that line bulges should not be vectorized and instead have the information added as an attribute looks like:

```
FF_STORE_FF_BULGE_INFO YES
```

### FF\_PARAMETERFILE

**Required/Optional:** *Optional*

This setting gives the name of the file that is used as a parameter file. This file is created by the FF reader and is used to store many metadata values for future use with other formats.

**Example:**

```
FF_PARAMETERFILE /usr/data/autoka.par
```

The contents of a typical parameter file look like this:

```
-- Metadata for translation back into a Transfer File --
-- Original filename : C:\Data\city.ff

FFVER 9
ISONR 1
RUBRIK "AutoKa-PC Lokal ADB"
BANKNAMN " "
BASNAMN "007LYRAN\CLUSTER"
```

```

PLANSYSTEM " "
HOJDSYSTEM " "
BASORIGOX 7000000
BASORIGOY 1500000
BASXYPREC -3
BASORIGOZ 0
BASZPREC -3
XIDLGDMAX 64
BASDATUM "1997-11-25, 21:14"
BASSIGN " "

```

## **FIX\_SELF\_INTERSECTING\_POLYGONS**

**Required/Optional:** *Optional*

This setting determines whether self-intersecting polygons are broken up into non-intersecting polygons.

A typical mapping file fragment specifying an input FF dataset looks like:

```
FF_FIX_SELF_INTERSECTING_POLYGONS YES
```

**Range:** YES or NO

**Default:** NO

## **OUTPUT\_POLYGON\_EDGES**

**Required/Optional:** *Optional*

This setting determines whether lines used to build polygon geometries should also be read and presented as separate lines.

A typical mapping file fragment specifying an input FF dataset looks like:

```
FF_OUTPUT_POLYGON_EDGES YES
```

**Range:** YES or NO

**Default:** NO

## **SUPPRESS\_TEXT\_POINTS**

**Required/Optional:** *Optional*

This setting determines whether texts attached to point geometries should be extracted to standalone texts with their own point geometry. The value set to YES results in text-features being made for those points that have a list called `ff_text_point{}`. If the value is set to NO the user can later chose to create text by using an ElementFactory with the `ff_text_point` list.

A typical mapping file fragment specifying an input FF dataset looks like:

```
FF_SUPPRESS_TEXT_POINTS YES
```

**Range:** YES or NO

**Default:** NO

## **BUILD\_CLUSTERS**

**Required/Optional:** *Optional*

When this directive is set to NO, no clusters are built. The user can later rebuild clusters by using the AggregateFactory and the `ff_up_cluster` attribute.

A typical mapping file fragment specifying an input FF dataset looks like:

```
FF_BUILD_CLUSTERS YES
```

**Range:** YES or NO

**Default:** YES

## **BUILD\_MULTI\_GEOMETRY\_CLUSTERS**

**Required/Optional:** *Optional*

In TransferFiles (FF-files), clusters may have a mix of features with different geometry types, but by default such clusters are not built. If a user wants to build clusters with different geometries, this directive must be set to YES. (Note that this will generate objects that are not commonly supported by other formats, so with this setting the user may have to split the clusters before sending them to the writer.)

A typical mapping file fragment specifying an input FF dataset looks like:

```
FF_BUILD_MULTI_GEOMETRY_CLUSTERS YES
```

**Range:** YES or NO

**Default:** NO

## **NULL\_HEIGHT\_REPLACE\_VALUE**

**Required/Optional:** *Optional*

In FF, a 3D-line or area (polygon) is not required to have heights on all vertices. Since not many other formats allow this, this directive allows you to replace all NaN values (null values) with a valid height value.

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**Note:** This will not turn 2D-features into 3D-features: only NaN values on 3D-features will be replaced.

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**Example:**

```
FF_NULL_HEIGHT_REPLACE_VALUE 123.456
```

**TRIM\_DEP\_ATTRIBUTE****Required/Optional:** *Optional*

The dep-attribute (dep = detail type) is stored on all FF features as a string of 10 characters. Any dep-value shorter than 10 characters will have spaces padded on the left side to make the string 10 characters long. As a standard behavior, FME does not try to trim any values read from an FF file. Therefore, by setting this directive to YES, FME will trim those spaces from the left side of the dep-value.

**Example:**

```
FF_TRIM_DEP_ATTRIBUTE YES
```

## Writer Overview

The FF writer creates and writes feature data to the FF file specified by the `DATASET` directive. Any FF file with the same name is overwritten with the new feature data.

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**TIP:** It is important to mention that polygons can be written out in two different methods.

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If a polygon feature is written out with a closed area as its geometry, the topology for this feature will be computed and all the appropriate pieces will be written to the FF file automatically. The second method of writing out polygons is to compute the topology before hand and write out each piece separately. In this method polygons will have no geometry, but will have the appropriate up and down links to the edges and centroid features, as necessary.

## Writer Directives

The following table lists the directives processed by the FF Writer. The suffixes shown are prefixed by the current `<WriterKeyword>` in a mapping file. By default, the `<WriterKeyword>` for the FF writer is `FF`.

**DATASET****Required/Optional:** *Required*

The value for this directive is the file containing the FF dataset to write out.

**Example:**

```
FF_DATASET /usr/data/output.ff
```

**FF\_PARAMETERFILE****Required/Optional:** *Optional*

This setting gives the name of the file that is used as a parameter file. This file may be used to store the values to all of the directives below, instead of listing them all in mapping files. If there are definitions both in a parameter file and in the mapping file, the latter prevails.

**Example:**

```
FF_PARAMETERFILE /usr/data/autoka.par
```

The contents of a typical parameter file look like this:

```
-- Metadata for translation back into a Transfer File --
-- Original filename : C:\Data\city.ff
```

```
FFVER 9
ISONR 1
RUBRIK "AutoKa-PC Lokal ADB"
BANKNAMN " "
BASNAMN "007LYRAN\CLUSTER"
PLANSYSTEM " "
HOJDSYSTEM " "
BASORIGOX 7000000
BASORIGOY 1500000
BASXYPREC -3
BASORIGOZ 0
BASZPREC -3
XIDLGDMAX 64
BASDATUM "1997-11-25, 21:14"
BASSIGN " "
```

## FFVER

**Required/Optional:** *Optional*

The value for this directive is the FF format version number.

### Example:

```
FF_FFVER 8
```

## ISONR

**Required/Optional:** *Optional*

The value for this directive is the ISO 8859/alphabetical number.

### Example:

```
FF_ISONR 1
```

## RUBRIK

**Required/Optional:** *Optional*

The value for this directive holds the FF file header string. It can be a maximum of 80 characters.

### Example:

```
FF_RUBRIK "AutoKa-PC Lokal ADB"
```

### **BANKNAMN**

**Required/Optional:** *Optional*

The value for this directive holds name of the bank. It can be a maximum of 80 characters.

**Example:**

```
FF_BANKNAMN "TEST"
```

### **BASNAMN**

**Required/Optional:** *Optional*

The value for this directive holds the AutoKa-PC base name. It can be a maximum of 80 characters. A typical mapping file fragment using this directive looks like:

```
FF_BANKNAMN "007LYRAN\CLUSTER"
```

### **PLANSYSTEM**

**Required/Optional:** *Optional*

The value for this directive holds planimetric system. It can be a maximum of 80 characters.

**Example:**

```
FF_PLANSYSTEM "SYSTEM1"
```

### **HOJDSYSTEM**

**Required/Optional:** *Optional*

The value for this directive holds height system. It can be a maximum of 80 characters.

**Example:**

```
FF_PLANSYSTEM "SYSTEM2"
```

### **BASORIGOX, BASORIGOY, BASORIGOZ**

**Required/Optional:** *Optional*

The values for these directives hold the false origin of the map. These values are used as shifting factors when writing out the FF file. A typical mapping file fragment using these directives looks like:

```
FF_BASORIGOX 7000000
FF_BASORIGOY 1500000
FF_BASORIGOZ 0
```

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**Note:** If FF\_BASORIGOX, FF\_BASORIGOY, FF\_BASORIGOZ, FF\_BASXYPREC, and FF\_BASZPREC are not specified, then reasonable values will be calculated based on the range and scale of the data being written.

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**Workbench Parameter:** <WorkbenchParameter>

### **BASXYPREC**

**Required/Optional:** *Optional*

The value for this directive holds the planimetric precision. This value is used as a scaling factor in the X and Y directions when writing out the FF file. The precision is given as powers of ten. The permitted interval of values is between -6 and 3 (0 = meter, -3 = mm, etc.).

**Example:**

```
FF_BASXYPREC -3
```

---

**Note:** If FF\_BASORIGOX, FF\_BASORIGOY, FF\_BASORIGOZ, FF\_BASXYPREC, and FF\_BASZPREC are not specified, then reasonable values will be calculated based on the range and scale of the data being written.

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### **BASZPREC**

**Required/Optional:** *Optional*

The value for this directive holds the height precision. This value is used as a scaling factor in the Z direction when writing out the FF file. The precision is given as powers of ten. The permitted interval of values is between -6 and 3 (0 = meter, -3 = mm, etc.).

```
FF_BASZPREC 4
```

---

**Note:** If FF\_BASORIGOX, FF\_BASORIGOY, FF\_BASORIGOZ, FF\_BASXYPREC, and FF\_BASZPREC are not specified, then reasonable values will be calculated based on the range and scale of the data being written.

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### **XIDLGDMAX**

**Required/Optional:** *Optional*

The value for this directive holds the maximum length of the external ID in the FF file. The value must be an even number no greater than 64.

```
FF_XIDLGDMAX 64
```

**BASDATUM****Required/Optional:** *Optional*

The value for this directive holds the date when the WdB was created.

**Example:**

```
FF_BASDATUM "1997-11-25, 21:14"
```

**BASSIGN****Required/Optional:** *Optional*

The value for this directive holds the signature of the person who created the WdB. In receipt files `basDatum` and `basSign` must have the same contents as in the checked-in Transfer file.

```
FF_BASSIGN "USER3"
```

## Feature Representation

In addition to the generic FME feature attributes that FME Workbench adds to all features (see *About Feature Attributes* on page 7), this format adds the format-specific attributes described in this section.

FF features consist of geometry and attribute information. All FF FME features contain the `ff_type` attribute to identify the geometric type, as well as many common attributes. The attribute `ff_type` is required when writing to FF. Depending on the geometric type, the feature contains additional attributes that are specific to the geometric type. These are described in subsequent sections.

Attribute Name	Description
<code>ff_type</code>	<p>The FF geometric type of this entity.</p> <p><b>Range:</b>  <code>ff_point</code>    <code>ff_line</code>    <code>ff_text</code>    <code>ff_polygon</code>    <code>ff_cluster</code>    <code>ff_group</code>            Default: No default</p>

## FF Attributes

The following table lists all the common FF attributes that are returned on all features produced by the FME reader. If these attributes are present on any feature that is written out to FF, they will be used to set the appropriate values in the output file.

Attribute Name	Description
<code>ff_type</code>	The type of vector. This is required to be present on all features written to FF. When reading FF files, the value will be one of the following: <code>ff_point ff_line ff_text ff_polygon</code> <code>ff_cluster ff_group</code> <b>Range:</b> Character string
<code>ff_post_variant</code>	The record variant. 0 or 32767 = a normal record. (At present there are only normal records.) <b>Range:</b> Integer
<code>ff_checkin_mark</code>	This indicates that the record is to be checked into an SDb and/or a GdB. A GdB feature is a feature that can be checked into both an SDb and into a GdB. An SDb feature can only be checked into a Server Database (not into a GdB). <b>0 = GdB feature</b> Must not be checked in and has not been changed since last check-in <b>1 = GdB feature</b> Must be checked in as new or changed. This is the only value that is accepted by a GdB. <b>2 = SDb feature</b> Must be checked in as new or changed <b>3 = Server Database feature</b> Must not be checked in and has not been changed since last check-in <b>Range:</b> Integer
<code>fnr</code>	The unique creation number for this feature. This ID is set when reading FF files and ignored if set when writing FF files. <b>Range:</b> Unique integer > 0
<code>ff_override_fnr</code>	The unique creation number for this feature. This ID is set to the same value as <code>fnr</code> when reading FF files. When writing FF files, this value is given as the creation number for this feature, overriding any unique creation number the FME may want to calculate and give this feature automatically. This is potentially dangerous, as it may cause invalid FF files to be written with poor choices for this value. The user may set an <code>fnr</code> ID to a feature that has already been assigned automatically to a previous feature. <b>Range:</b> Unique integer > 0
<code>dep</code>	The detail type; for example, <code>fastid</code> <b>Range:</b> to a maximum length of 10 characters

Attribute Name	Description
ff_AutoKa_file_type	The file type in AutoKa-PC: 0 = simple detail 1 = compound detail <b>Range:</b> Integer
extid	The external ID; for example, 3180>BERGA>1:59>1 <b>Range:</b> To a maximum length of 64 characters.
extidfmt	The format of the external ID having the following valid values: <b>0 = none</b> <b>1 = name</b> A name must not look like a designation or property designation. <b>2 = designation</b> <b>"Area * Detail type * Running number"</b> The running number has a maximum value of 2147483647. Running number is numerical, others are alphanumeric. <b>3 = property designation</b> The ID is a string with a maximum length of 64 characters which is divided into nine partial strings separated by special characters. This Boolean flag indicates if this object is a line resulting from a combination. Maximum size is 3 characters. <b>Range:</b> Integer
ff_external_ID_name	If the external ID contains a name (for example, extidfmt=1), the name will be stored in this attribute. <b>Range:</b> To a maximum of 64 characters
ff_external_ID_area	If the external ID contains a designation (for example, extidfmt=2) or has a property designation (for example, extidfmt=3), this attribute will hold the area. <b>Range:</b> Character string
ff_external_ID_detail_type	If the external ID contains a designation (for example, extidfmt=2), this attribute will hold the detail type. <b>Range:</b> To a maximum of 62 characters
ff_external_ID_running_number	If the external ID contains a designation (for example, extidfmt=3), this attribute will hold the running number. <b>Range:</b> Integer
ff_external_ID_district_code	If the external ID contains a property designation (for example, extidfmt=3), this attribute will hold the district code. <b>Range:</b> Integer
ff_external_ID_sub_district	If the external ID contains a property designation (for example, extidfmt=3), this attribute will hold the subdistrict. <b>Range:</b> Character string

Attribute Name	Description
ff_external_ID_block	If the external ID contains a property designation (for example, <code>extidfmt=3</code> ), this attribute will hold the block. <b>Range:</b> Character string
ff_external_ID_unit	If the external ID contains a property designation (for example, <code>extidfmt=3</code> ), this attribute will hold the unit. <b>Range:</b> Character string
ff_external_ID_spec	If the external ID contains a property designation (for example, <code>extidfmt=3</code> ), this attribute will hold the spec. <b>Range:</b> Character string
ff_external_ID_additional_info	If the external ID contains a property designation (for example, <code>extidfmt=3</code> ), this attribute will hold the additional information portion. <b>Range:</b> Single character
ff_external_ID_number_of_areas	If the external ID contains a property designation (for example, <code>extidfmt=3</code> ), this attribute will hold the number of areas. <b>Range:</b> Integer
adat	The date when the last change was made. This is a character string in the form: 1997-11-25, 21:14 <b>Range:</b> Character string
asign	The signature of the last change. <b>Range:</b> To a maximum number of 8 characters
gdat	The date from which the changes became valid. This is a character string in the form: 1997-11-25, 21:14 <b>Range:</b> Character string
bsign	The signature of the person who created this file. <b>Range:</b> To a maximum number of 8 characters
atgard	The action flag on the feature, having the following possible values: <b>0 = normal position</b> <b>1 = deleted</b> no longer valid <b>2 = wiped</b> the record has been physically removed from the GdB <b>3 = deleted with gdat</b> <b>4 = date set by user in gdat</b> This is not changed when checking in. <b>5 = set</b> gdat is not changed when checking in. <b>6 = registered</b> gdat is not changed when checking in. <b>7 = updated</b> This flag should only be used with records that are to be stored in the GdB and never with records that come from the GdB. <b>Range:</b> Integer

## Points

**ff\_type:** ff\_point

FF point features represent single point features and may be either 2D or 3D. Symbols can be represented with these point features. These features may have supplementary anchor points—or text points—defined in their attributes. FF points may have the following special attributes associated with them:

Attribute Name	Description
xyfel	The standard error in planimetry (X and Y) <b>Range:</b> Any real number
zfel	The standard error in height (Z) <b>Range:</b> Any real number
lagestat	The position status—the value must be one of the following: 0 = reliable position 1 = uncertain position 2 = planned position
ff_geo_area_status	This gives the position of the feature relative to a geographic area. The concept geographic area in a GdB has different meanings, depending on the type of operation to be carried out in the bank. It is a unit used for organizing data in the bank. The signal is set when checking out from a GdB. The attribute may have one of the following values: 0 = inside 1 = on edges 2 = outside
srikt	The rotation of the point or symbol in degrees counterclockwise from horizontal. <b>Range:</b> Integer
markering	The type of symbol or marker; for example, TG = tube in ground <b>Range:</b> Integer
ff_text_point{}.X ff_text_point{}.Y	If this feature has a supplementary anchor point or text point, this is its location. <b>Range:</b> Integer
ff_text_point{}.rotation	If this feature has a supplementary anchor point or text point, this is its rotation. <b>Range:</b> Integer
ff_text_point{}.text_height	If this feature has a supplementary anchor point or text point, when reading if $thojd > 0$ , this attribute is set to the height of the text point in 1/100mm. <b>Range:</b> Integer
ff_text_point{}.text_height_code	If this feature has a supplementary anchor point or text point, when reading if $thojd < 0$ , this attribute is set to the height code of the text point. <b>Range:</b> Integer

Attribute Name	Description
ff_source_type_1 ff_source_type_2	This feature may have up to two sources. These attributes hold the type of each source, as follows: 0 = planimetry 1 = height
koordsys ff_source_coordsys_2	This feature may have up to two sources. These attributes hold the coordinate system of each source, as follows: 0 = changed when checking into GdB empty value = will not be changed when checking into GdB fnr = creation number for coordinate system <b>Range:</b> Integer
m_typ ff_source_method_2	This feature may have up to two sources. These attributes hold the source method of each source: 0 = unspecified 1 = field survey 2 = photogrammetry 3 = digitising 4 = pointing together 5 = cartographic position
ff_measurement_type_1 ff_measurement_type_2	This feature may have up to two sources. These attributes hold the measurement type of each source. If the source method = field survey 0 = unspecified 1 = control network 2 = orthogonal/polar detail surveys If the source method = photogrammetry 0 = unspecified 1 = block triangulation 2 = stereo plotting
ff_technique_1 ff_technique_2	This feature may have up to two sources. These attributes hold the technique of each source. <b>If the source method = field survey</b> 0 = other technique 1 = conventional (if source type = 0) 1 = levelling (if source type = 1) 2 = GPS (if measurement type = 1 and source type = 0) 2 = ISS (Inertial Survey Systems) (if measurement type = 2 and source type = 0) 2 = trig. (heighting) (if source type = 1) 3 = ISS (if measurement type = 2 and source type = 1) 4 = GPS (if measurement type = 1 and source type = 0) <b>If the source method = photogrammetry</b> 0 = unspecified 1 = analogue 2 = analytical <b>If the source method = digitising</b> 0 = unspecified 1 = table digitising 2 = screen digitising 3 = scanning

Attribute Name	Description
ff_info_1 ff_info_2	This feature may have up to two sources. If the source method = field survey, this attribute hold Info information. This field can contain the value 1 if source type = 0 and measurement type = 2. <b>Range:</b> Integer
ff_flight_altitude_1 ff_flight_altitude_2	This feature may have up to two sources. These attributes hold the flight altitude of each source. If the source method = photogrammetry, this attribute holds the altitude in metres. <b>Range:</b> Integer
ff_manuscript_1 ff_manuscript_2	This feature may have up to two sources. These attributes hold the manuscript of each source. If the source method = digitising, the following is the case: 0 = unspecified 1 = older survey 2 = modern survey 3 = photogrammetry 4 = orthophoto
ff_manuscript_scale_1 ff_manuscript_scale_2	This feature may have up to two sources. These attributes hold the manuscript scale of each source if the source method = digitising. <b>Range:</b> Integer
aktdatum	This is the up-to-dateness date. This is a character string in the form: 1997-11-25, 21:14 <b>Range:</b> Character string
aktsign	This is the up-to-dateness signature. <b>Range:</b> Character string to a maximum of 8 characters
ff_geo_link	If this feature is linked to a polygon, this attribute will be present. <b>Range:</b> Yes
ff_geo_ptr{}	This list attribute holds the creation number of the polygon to which it is linked. <b>Range:</b> Integer
ff_up_point_link	If this feature is the centroid part of an area, this attribute will be present. <b>Range:</b> Yes
ff_point_link	If this feature is the centroid part of an area, this attribute will contain the creation number of this feature. <b>Range:</b> Integer
ff_up_area	If this feature is the centroid part of an area, this attribute will contain the creation number of the parent area (polygon) feature. <b>Range:</b> Integer
ff_up_cluster	If this feature is linked to a cluster, this attribute will be present. <b>Range:</b> Integer

Attribute Name	Description
ff_up_cluster_link	If this feature is linked to a cluster, this attribute will contain the creation number of the parent cluster feature. <b>Range:</b> Integer
ff_up_parent_link	If this feature a member of a group, this attribute will be present. <b>Range:</b> Yes
ff_up_parent	If this feature is a member of a group, this attribute will contain the creation number of the parent group feature. <b>Range:</b> Integer

## Lines

**ff\_type:** ff\_lines

FF line features represent linear features that may be either 2D or 3D. FF documentation often refers to these linear features as polygons. These features may have supplementary anchor, or text, points defined in their attributes. FF line features may have the following special attributes associated with them.

Attribute Name	Description
xyfel	The standard error in planimetry (X and Y) <b>Range:</b> Any real number
zfel	The standard error in height (Z) <b>Range:</b> Any real number
lagestat	The position status. The value must be one of the following: 0 = reliable position 1 = uncertain position 2 = planned position <b>Range:</b> Integer
ff_geo_area_status	This gives the position of the feature relative to a geographic area. The concept geographic area in a GdB has different meanings, depending on the type of operation to be carried out in the bank. It is a unit used for organizing data in the bank. The signal is set when checking out from a GdB. The attribute may have one of the following values: 0 = inside 1 = on edges 2 = outside
linjeanp	The line adaptation of plotting style when viewed in AutoKa. 0 = adaptation of plotting style per segment 1 = adaptation of plotting style along the whole polygon 2 to 9 = reserved 10 to 300 = Adaptation to arcs during plotting: 100 is the standard value. However, lower values result in better adaptation to the original polygon, whereas higher values result in rounder shapes. <b>Range:</b> Integer

Attribute Name	Description
ff_text_point{}.X ff_text_point{}.Y	If this feature has a supplementary anchor point or text point, this is its location. <b>Range:</b> Integer
ff_text_point{}.rotation	If this feature has a supplementary anchor point or text point, this is its rotation. <b>Range:</b> Integer
ff_text_point{}.text_height	If this feature has a supplementary anchor point or text point, when reading if thojd > 0, this attribute is set to the height of the text point in 1/100mm. <b>Range:</b> Integer
ff_text_point{}.text_height_code	If this feature has a supplementary anchor point or text point, when reading if thojd < 0, this attribute is set to the height code of the text point. <b>Range:</b> Integer
mtyp_par1 mtyp_par2 mtyp_par3 ff_source_field1_2 ff_source_field2_2 ff_source_field3_2	This feature may have up to two sources. These attributes hold the raw values of the three parameter fields for each of the two sources. <b>Range:</b> Integer
ff_source_type_1 ff_source_type_2	This feature may have up to two sources. These attributes hold the type of each source, as follows: 0 = planimetry 1 = height <b>Range:</b> Integer
koordsys ff_source_coordsys_2	This feature may have up to two sources. These attributes hold the coordinate system of each source, as follows: 0 = changed when checking into GdB empty value = will not be changed when checking into GdB fnr = creation number for coordinate system <b>Range:</b> Integer
m_typ ff_source_method_2	This feature may have up to two sources. These attributes hold the source method of each source: 0 = unspecified 1 = field survey 2 = photogrammetry 3 = digitising 4 = pointing together <b>Range:</b> Integer

Attribute Name	Description
ff_measurement_type_1 ff_measurement_type_2	<p>This feature may have up to two sources. These attributes hold the measurement type of each source.</p> <p>If the source method = field survey</p> <ul style="list-style-type: none"> <li>0 = unspecified</li> <li>1 = control network</li> <li>2 = orthogonal/polar detail surveys</li> </ul> <p>If the source method = photogrammetry</p> <ul style="list-style-type: none"> <li>0 = unspecified.</li> <li>1 = block triangulation</li> <li>2 = stereo plotting</li> </ul> <p><b>Range:</b> Integer</p>
ff_technique_1 ff_technique_2	<p>This feature may have up to two sources. These attributes hold the technique of each source.</p> <p>If the source method = field survey</p> <ul style="list-style-type: none"> <li>0 = other technique</li> <li>1 = conventional (if source type = 0)</li> <li>1 = levelling (if source type = 1)</li> <li>2 = GPS (if measurement type = 1 and source type = 0)</li> <li>2 = ISS (Inertial Survey Systems) (if measurement type = 2 and source type = 0)</li> <li>2 = trig. (heighting) (if source type = 1)</li> <li>3 = ISS (if measurement type = 2 and source type = 1)</li> </ul> <p>If the source method = photogrammetry</p> <ul style="list-style-type: none"> <li>0 = unspecified</li> <li>1 = analogue</li> <li>2 = analytical</li> </ul> <p>If the source method = digitising</p> <ul style="list-style-type: none"> <li>0 = unspecified.</li> <li>1 = table digitising</li> <li>2 = screen digitising</li> <li>3 = scanning</li> </ul> <p><b>Range:</b> Integer</p>
ff_flight_altitude_1 ff_flight_altitude_2	<p>This feature may have up to two sources. These attributes hold the flight altitude of each source.</p> <p>If the source method = photogrammetry, this attribute holds the altitude in metres.</p> <p><b>Range:</b> Integer</p>
ff_manuscript_1 ff_manuscript_2	<p>This feature may have up to two sources. These attributes hold the manuscript of each source.</p> <p>If the source method = digitising, the following is the case:</p> <ul style="list-style-type: none"> <li>0 = unspecified</li> <li>1 = older survey</li> <li>2 = modern survey</li> <li>3 = photogrammetry</li> <li>4 = orthophoto</li> </ul> <p><b>Range:</b> Integer</p>
ff_manuscript_scale_1 ff_manuscript_scale_2	<p>This feature may have up to two sources. These attributes hold the manuscript scale of each source if the source method = digitising.</p> <p><b>Range:</b> Integer</p>

Attribute Name	Description
aktdatum	This is the up-to-dateness date. This is a character string in the form: 2001-11-25, 21:14 <b>Range:</b> Character string
aktsign	This is the up-to-dateness signature. <b>Range:</b> Character string to a maximum of 8 characters
ff_circle_radius	If this feature represents a circle, the radius is stored in this attribute. <b>Range:</b> Any real number
<b>Applicable only with classic geometry.</b>	
ff_arc_bulges	If this is a linear feature with line bulges, they may be removed from the coordinates and replaced by multiple edges. This attribute may be present and hold information necessary to recreate line bulges where they have been vectorized on reading. <b>Range:</b> Comma-Separated Value character string
<b>Applicable only with classic geometry.</b>	
ff_geo_link	If this feature is linked to a point, this attribute will be present. <b>Range:</b> Yes
ff_geo_pointer_breakpoint{}	This list attribute indicates to which coordinate or breakpoint the geo-link belongs. <b>Range:</b> Integer
ff_geo_ptr{}	This list attribute holds the creation number of the polygon to which it is geo-linked. <b>Range:</b> Integer
ff_up_poly_link	If this feature is a part of the boundary of a polygon area, this attribute will be present. <b>Range:</b> Yes
ff_up_right_area	If this feature is part of a boundary of a polygon area, this attribute holds a list of the creation numbers of the polygons on its right. This will be a single number for proper coverages. <b>Range:</b> Integer
ff_up_left_area	If this feature is part of a boundary of a polygon area, this attribute holds a list of the creation numbers of the polygons on its left. This will be a single number for proper coverages. <b>Range:</b> Integer
ff_up_from_hole	If this feature is a part of the boundary of a hole within a polygon area, this attribute holds the creation number of the polygon surrounding the hole. <b>Range:</b> Integer
ff_up_cluster	If this feature is linked to a cluster, this attribute will be present. <b>Range:</b> Integer

Attribute Name	Description
ff_up_cluster_link	If this feature is linked to a cluster, this attribute will contain the creation number of the parent cluster feature. <b>Range:</b> Integer
ff_up_parent_link	If this feature a member of a group, this attribute will be present. <b>Range:</b> Yes
ff_up_parent	If this feature is a member of a group, this attribute will contain the creation number of the parent group feature. <b>Range:</b> Integer

## Polygons (Areas)

**ff\_type:** ff\_polygon

FF polygon features represent closed area features and may be either 2D or 3D. The coordinate on the feature contains the location of the center. The ids of the lines that make up the border of the polygon may be located in the appropriate attributes on these features. Polygon features may have the following special attributes associated with them:

Attribute Name	Description
ff_up_cluster	If this feature is linked to a cluster, this attribute will be present. <b>Range:</b> Yes
ff_up_cluster_link	If this feature is linked to a cluster, this attribute will contain the creation number of the parent cluster feature. <b>Range:</b> Integer
ff_up_parent_link	If this feature is an enclave—a hole with a centroid—within another polygon area, this attribute will be present. Also, if this feature is a member of a group, this attribute will be present. <b>Range:</b> Yes
ff_up_parent	If this feature is an enclave—a hole with a centroid—within another polygon area, this attribute will contain the creation number of the parent polygon feature. Otherwise, if this feature is a member of a group, this attribute will contain the creation number of the parent group feature. <b>Range:</b> Integer
ff_down_point_link	If this feature is linked to a centroid point, this attribute will be present. <b>Range:</b> Yes
ff_down_point	If this feature is linked to a centroid point, this attribute will contain the creation number of the centroid point. <b>Range:</b> Integer
ff_down_poly_link	If this feature is linked to edges of the polygon, this attribute will be present. <b>Range:</b> Yes

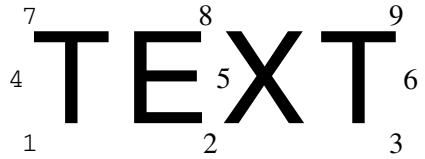
Attribute Name	Description
<code>ff_down_edge_ptr{}</code>	If this feature is linked to edges of the polygon, this list attribute will contain the creation numbers of the outer edges of the polygon. <b>Range:</b> Integer
<code>ff_down_hole_start_ptr{ }.{ }</code>	If this feature is linked to edges of the polygon, this list of list attributes will contain the creation numbers of the edges of all the holes in the polygon. For example, the creation number for the third edge of the second hole would be found in the attribute <code>ff_down_hole_start_ptr{1 }.{2 }</code> . <b>Range:</b> Integer
<code>ff_down_enclave_link</code>	If this feature is linked to enclaves—polygons with centroids—within the polygon, this attribute will be present. <b>Range:</b> Yes
<code>ff_down_enclave_ptr{ }</code>	If this feature is linked to enclaves—polygons with centroids—within the polygon, this list attribute will contain the creation numbers of the enclaves it contains. <b>Range:</b> Any real number
<code>ff_area_point_x</code> <code>ff_area_point_y</code> <code>ff_area_point_z</code>	These attributes do not appear on features read from FF files. If these attributes are on a feature when written to FF, they specify the location to use as the centroid of the polygon instead of automatically generating one. <b>Range:</b> Any real number

## Text

**ff\_type:** `ff_text`

FF text features hold text information. Either a single 2D position or a 2D line may be associated with the text feature that may hold several text strings in list attributes. Text features may have the following special attributes associated with them:

Attribute Name	Description
<code>ff_text_width</code>	The width of the text string <b>Range:</b> Any real number
<code>thojd</code>	The height of the text If $>0$ , the height is in 1/100mm. If $<0$ , the height is based on a height code. The height code is converted to height using a separate table when plotting is done. <b>Range:</b> Integer
<code>ff_text_height</code>	When reading, if <code>thojd</code> $> 0$ , this attribute is set to the height of the text string in 1/100mm. <b>Range:</b> Integer
<code>ff_text_height_code</code>	When reading FF, if <code>thojd</code> $< 0$ , this attribute is set to the height code of the text string. <b>Range:</b> Integer

Attribute Name	Description
trikt	The angle of the string in degrees counterclockwise from horizontal. <b>Range:</b> 0.0 to +360.0
tjust	The anchor point for text (0 to 9) as shown in the figure below:  <b>Range:</b> 0 to 9 for text; 0 = decimal point for decimal text
tskala	The basic scale for text <b>Range:</b> Integer > 0
tstil	The text style <b>Range:</b> Integer > 0
tsparr	The text expansion increase in length of string given in % 0 = no expansion 100 = doubling of length <b>Range:</b> Integer > 0
ff_text_size	When reading FF, this attribute is set to a good estimate of the desired text size in ground units. <b>Range:</b> Any real number
aktdatum	This is the up-to-dateness date which is a character string in the form: 1997-11-25; 21:14 <b>Range:</b> Character string
aktsign	This is the up-to-dateness signature <b>Range:</b> Character string up to a maximum of 8 characters
ff_text{}.text	This list attribute holds the text strings of the feature. They must have an even number of characters, with a maximum length of 64 characters. <b>Range:</b> Character string
ff_text{}.tlgd	This list attribute holds the lengths of the text strings of the feature. <b>Range:</b> Integer
ff_text{}.tkurv	This list attribute steers how the contents in the text field should be interpreted. <b>Range:</b> Integer
ff_text{}.ff_text_start_point_position	This list attribute holds the position of text by holding the reference to the appropriate coordinate on the feature. The value 32767 means the text will not be plotted. <b>Range:</b> Integer

Attribute Name	Description
ff_text{}.ff_text_end_point_position	<p>If this list attribute &lt; 32767, it means it holds the position of the end of the text by holding the reference to the appropriate coordinate on the feature. The text string is fitted along the coordinates from: ff_text_start_point_position to ff_text_end_point_position <b>Range:</b> Integer</p>
ff_text{}.ff_text_format	<p>This list attribute holds the print-out format of the associated text string. At this point, the format types have not been decided. The format is a text string that must have an even number to a maximum length of 18 characters. <b>Range:</b> Character string</p>
ff_text{}.ff_average_rotation	<p>This list attribute holds the average rotation of all characters in the text string. If the text does not follow a line, then this rotation obviously is the rotation of the entire string. The rotation is given in degrees counterclockwise from horizontal. <b>Range:</b> 0.0 to 360.0</p>
ff_text{}.ff_follows_line	<p>This list attribute is a flag that indicates whether or not the text should be fitted along a line. If not, this attribute is not present. <b>Range:</b> Yes</p>
ff_text{}.ff_text_string{}.ff_text_char	<p>This list attribute lists each character of the associated text string separately. <b>Range:</b> A single character</p>
ff_text{}.ff__text_string{}.ff_text_char_rotation	<p>This list attribute lists the rotation of each character of the associated text string separately. The rotation is given in degrees counterclockwise from horizontal. <b>Range:</b> 0.0 to 360.0</p>
ff_text{}.ff__text_string{}.ff_text_char_Xff_text{}.ff_text_string{}.ff_text_char_Y	<p>This list attribute lists the correct position of each character of the associated text string separately. The rotation is given in degrees counterclockwise from horizontal. <b>Range:</b> Any real number</p>
text	<p>When writing a single text string, this value may be used instead of the list attributes above. This attribute holds the text strings of the feature. They must have an even number of characters with a maximum length of 64. <b>Range:</b> Character string</p>
tlgd	<p>When writing a single text string, this value may be used instead of the list attributes above. This attribute holds the length of the text strings of the feature. <b>Range:</b> Integer</p>
tkurv	<p>When writing a single text string, this value may be used instead of the list attributes above. This attribute steers how the contents in the text field should be interpreted. <b>Range:</b> Integer</p>

Attribute Name	Description
ff_text_start_point_position	<p>When writing a single text string, this value may be used instead of the list attributes above. This attribute holds the position of text by holding the reference to the appropriate coordinate on the feature. The value 32767 means that the text is not to be plotted. <b>Range:</b> Integer</p>
ff_text_end_point_position	<p>When writing a single text string, this value may be used instead of the list attributes above. If this attribute is &lt; 32767, it means it holds the position of the end of the text by holding the reference to the appropriate coordinate on the feature. The text string is fitted along the coordinates from: ff_text_start_point_position ff_text_end_point_position <b>Range:</b> Integer</p>
ff_text_format	<p>When writing a single text string, this value may be used instead of the list attributes above. This attribute holds the print-out format of the associated text string. At this point, the format types have not been decided. The format is a text string that must have an even number to a maximum length of 18 characters. <b>Range:</b> Character string</p>
ff_circle_radius	<p>If this feature represents a circle, the radius is stored in this attribute. <b>Range:</b> Any real number</p>
<b>Applicable only with classic geometry.</b>	
ff_arc_bulges	<p>If this is a linear feature with line bulges, they may be removed from the coordinates and replaced by multiple edges. This attribute may be present and hold information necessary to recreate line bulges where they have been vectorized on reading. <b>Range:</b> Comma-Separated Value character string</p>
<b>Applicable only with classic geometry.</b>	
ff_up_parent	<p>If this feature is linked to a group, this attribute will be present. <b>Range:</b> Yes</p>
ff_up_group_link	<p>If this feature is linked to a group, this attribute will contain the creation number of the parent group feature. <b>Range:</b> Integer</p>
ff_up_cluster	<p>If this feature is linked to a cluster, this attribute will be present. <b>Range:</b> Yes</p>
ff_up_cluster_link	<p>If this feature is linked to a cluster, this attribute will contain the creation number of the parent cluster feature. <b>Range:</b> Integer</p>
ff_up_parent_link	<p>If this feature a member of a group, this attribute will be present. <b>Range:</b> Yes</p>

Attribute Name	Description
<code>ff_up_parent</code>	If this feature is a member of a group, this attribute will contain the creation number of the parent group feature. <b>Range:</b> Integer

## Groups

**ff\_type:** `ff_group`

FF group features represent an aggregate consisting of any number of features. Group features may have the following special attributes associated with them.

Attribute Name	Description
<code>ff_down_group_link</code>	If this feature is linked to members of a group as the parent, this attribute will be present. <b>Range:</b> Yes
<code>ff_down_group_ptr{}</code>	If this feature is linked to members of a group as the parent, this attribute will contain the creation numbers of the members of the group. <b>Range:</b> Integer

## Clusters

**ff\_type:** `ff_cluster`

FF cluster features represent an aggregate consisting of any number of features. The `extid` of all features within a Cluster must be the same. Cluster features may have the following special attributes associated with them.

Attribute Name	Description
<code>ff_down_cluster_link</code>	If this feature is linked to members of a cluster as the parent, this attribute will be present. <b>Range:</b> Yes
<code>ff_down_cluster_ptr{}</code>	If this feature is linked to members of a cluster as the parent, this list attribute will contain the creation numbers of the members of the cluster. <b>Range:</b> Integer