TECHNICAL REPORT

ISO/TR 11462-5

Guidelines for implementation of statistical process control (SPC) —

Part 5:
Quality data exchange format for SPC software

Lignes directrices pour la mise en oeuvre de la maîtrise statistique des processus (MSP) —

Partie 5: Format d'échange de jeux de données relatives à la qualité pour les logiciels MSP

Contents

Foreword

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A list of all parts in the ISO 11462 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

Online data recording is becoming more and more important. A major advantage is the accurate and reliable recording of data within a minimum of time. It creates the foundation for fast and concise evaluations based on data collected online, and enables validated decision taking.

These possibilities help create more transparency and improve the analysis of internal and external procedures and processes. Thus, online data transfer helps to improve process quality and efficiency as well as to increase customer satisfaction. However, along with the growing possibilities, also the number of possibilities and variations for a multitude of solutions and the degree of complexity increases.

For this reason, the measuring values generating device manufacturers have to invest plenty of time and effort for customer specific adaptations, as well as during the specification and control phase at the customers and with regard to investment cost for implementation. To minimize this effort, a generally valid data format was developed for an exchange of quality data in industrial production that is independent of manufacturer and user.

With the objective to find a satisfactory solution for all parties involved, a number of users of the software function "Data Interface" from the automotive production and supplier industry joined forces to create a standardized and coordinated specification. The objective was to include a group of users in this work group as big as possible, in order to get a representative cross-section through the scope and interpretation of the key fields and their application. The result is a standardized catalogue of the data fields important to every user.

Guidelines for implementation of statistical process control (SPC) —

Part 5:
Quality data exchange format for SPC software

1 Scope

This document describes a data format for the exchange of quality information:

— the data format is distinguished by a transparent structure that is easy to edit;

— it is flexible, space saving and easily be copied and compacted;

All files are language independent because of the allocation of an explicit key to a language independent field, the content of which can be translated into any language required.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 22514-2, *Statistical methods in process management — Capability and performance — Part 2: Process capability and performance of time-dependent process models*

3 Terms and definitions, and symbols and abbreviated terms

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 22514-2 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

3.2 Symbols and abbreviated terms

3.2.1 Symbols

Symbols used in this document are identical to symbols used in ISO 22514-2 and ISO 7870-2.

C_p	process capability index
C_{pk}	minimum process capability index
C_{pkU}	upper process capability index
C_{pkL}	lower process capability index
U_{CL}	upper control limit
L_{CL}	lower control limit
m	the number of subgroups
n	sample size of each subgroup
P_p	process performance index
P_{pk}	minimum process performance index
P_{pkU}	upper process performance index
P_{pkL}	lower process performance index
U_{SL}	upper specification limit
L_{SL}	lower specification limit

3.2.2   Abbreviations

ELS	error log sheet
SPC	Statistical Process Control
File type *.DFQ	a file which contains all needed information (part/characteristic/values)
File type *.DFD	a file which contains only header information (part/characteristic information)
File type *.DFX	a file which contains only value and additional information

4   Data model

4.1   Basic data model structure

A basic data model has been defined, which distinguishes between three main groups of data. The highest level contains parts data, the second level characteristics data and the third level are data related to the measured values. The characteristics data contain a voluntarily subgroup for quality control chart application. Furthermore, separately from the three groups there are some key fields for structure information.

This basic data model structure is illustrated in Figure 1.
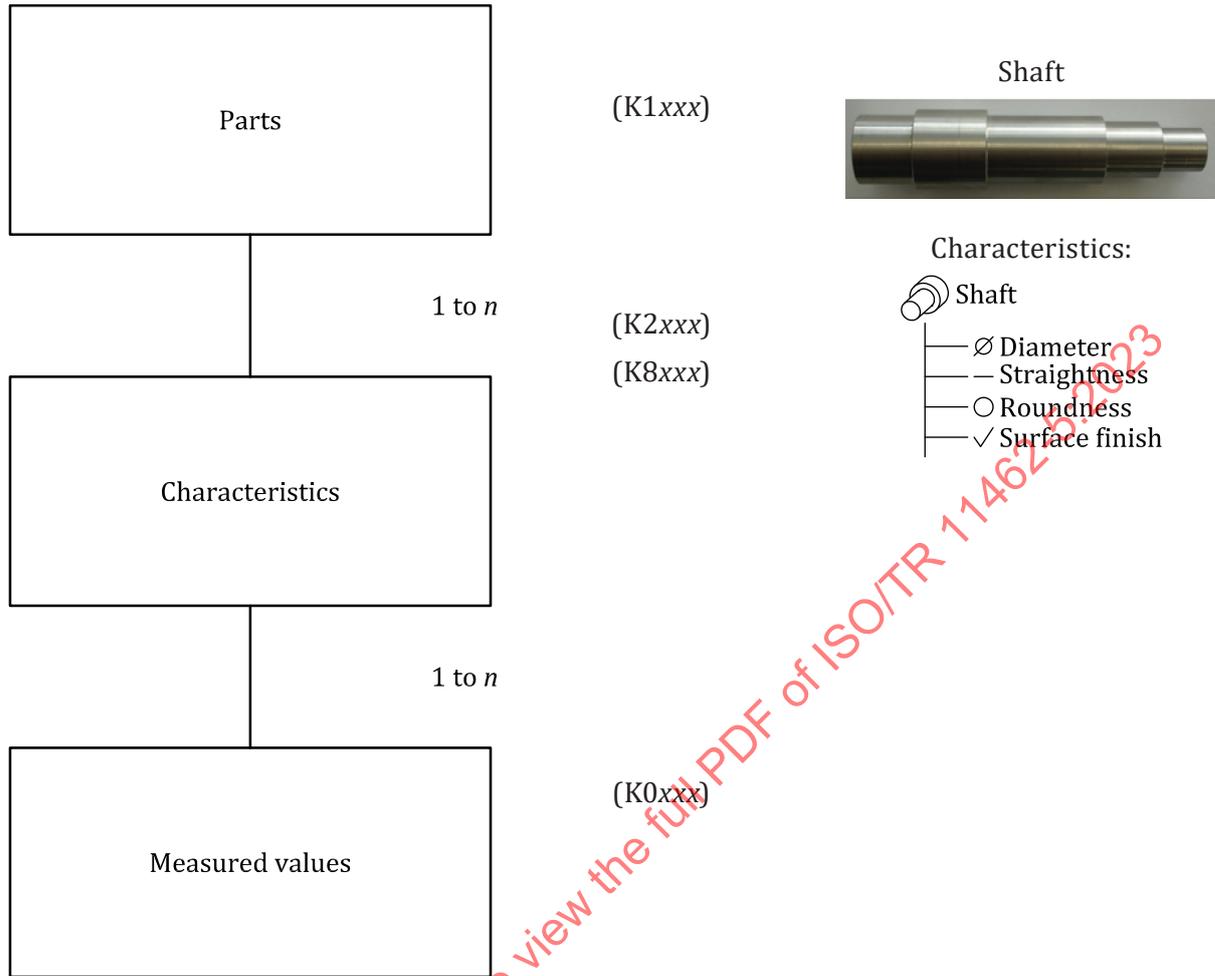
Figure 1 — Data model

Every data group (level) contains a large number of defined so called key fields, which describe the properties of the individual elements of the data model. The names of these key fields consist of an upper case "K", followed by a four digit number. These numbers are based on a general key structure as listed below:

K1000   ...   K1999   parts data describing the part type, a component of a product

K2000   ...   K2999   characteristics data containing characteristic-specific information

K0001   ...   K0999   description of value formats /measured values

K8000   ...   K8999   quality control chart information

K5000   ...   K5999   structure information (not shown in <u>figure 1</u>)

The so called k field lists in <u>Clause 5</u> shows the keys supported by this data model.

4.2   Types of data

The data format consists of two different types of data

— descriptive data, and

— value data

They are contained either in two separate files or in a common file. All three files have the same file name but different file extensions. The file extensions are as follows:

— descriptive file: *.DFD;

— value file: *.DFX;

— shared file: *.DFQ.

4.3   General notation regulations

Key number and field contents are separated by a space.

One field is written per line.

As line-end identification, apply the combination of <CR> and <LF> (hexadecimal $0D $0A), (decimal #13 #10).

If several elements (parts or characteristics) are entered in one file, the distinction is made by extending the applicable K-field number with "/" and a sequence number i = 1 to n, where n corresponds to the number in field K0100.

> An example is
>
> K0100 3
>
> K1xxx/1 any part information
>
> K2002/1 characteristic 1
>
> K2002/2 characteristic 2
>
> K2002/3 characteristic 3

Characteristics information that applies globally to all characteristics can be assigned to all characteristics simultaneously with the assignment "/0".

> As an example the number of decimal places is set "2" for all values in this file:
>
> K2022/0 2

Mandatory fields:

The following fields are absolutely necessary to be included in the data format to allow unique identification of the records.

— K0100 total number of characteristics in the file (characteristics of all parts concerned); for technical reasons this K field is in the first line of the file header.

— At least one field out of the parts group (1xxx) and one field out of characteristics group (2xxx) are necessary for the identification of the part. It is recommend to use two fields per group (K1001 – part number, K1002 – part name, K2001 – characteristic number and K2002 – characteristic name). As soon as a key for characteristic data appears, the part header is considered as completed and no more K1xxx fields may follow. For examples see Annex A.

— After blocks 1 and 2 are written, measured values and additional data can be written into the fields K0xxx.

5 Description and listing of the key fields

5.1 General

The following tables contain the respective designations of key fields (K*xxxx*) for a part, the characteristics and the corresponding measured values. They also specify the field type and the maximum field length.

The "Misc." column shows the following additional information:

a) Fields marked with an "o" have a field content which is meaningfully to be clarified with the statistical evaluation software supplier. Examples can be found in Annex A.

b) The catalogue for catalogue fields is specified under "Remarks" (marked with a "K").

Legend of the tables

Field type	Character set	Explanation
A	Alpha numeric	
D	Date / time format	
F	Floating point	
I3	Integer (1 Byte)	Signed positive integer value range 1-127
I5	Integer (2 Byte)	Signed positive integer value range 1-32767
I10	Integer (4 Byte)	Signed positive integer value range 1-2147483647
S	Special coding	

Miscellaneous	Meaning
o	Defined field content
K	Catalogue reference / transferred from catalogue

5.2 List of key fields for parts data

Table 1 lists the defined key fields for the description of the part.

It can be seen from the K-field numbers listed here that numerous theoretically available numbers have not been filled, so that if additional K-fields are required, they can be placed in the appropriate subject group.

Table 1 — List of key fields for parts data

Key	Field type	Max. number of characters	Field name
K1001	A	30	Part number
K1002	A	80	Part description
K1003	A	20	Part abbreviation
K1004	A	20	Part amendment status
K1005	A	40	Product
K1007	A	20	Part number abbreviated

Table 1 *(continued)*

Key	Field type	Max. number of characters	Field name
K1008	A	20	Part type
K1009	A	20	Part code
K1011	A	20	Variant
K1022	A	80	Manufacturer name
K1041	A	30	Drawing number
K1042	A	20	Drawing amendment
K1053	A	40	Contract
K1072	A	40	Supplier description
K1081	A	24	Machine number
K1082	A	40	Machine description
K1083	I5	5	Machine number
K1085	A	40	Machine location
K1086	A	40	Work cycle / operation
K1087	A	40	Work cycle description
K1100	A	40	Plant sector
K1101	A	40	Department
K1102	A	40	Workshop
K1103	A	40	Cost centre
K1110	A	20	Order number
K1201	A	24	Test facility number
K1202	A	40	Test facility description
K1203	A	80	Reason for test
K1206	A	40	Test location
K1209	A	20	Inspection type
K1230	A	40	Gauge room
K1231	A	20	Measuring program number
K1232	A	20	Measuring program version
K1303	A	40	Plant
K1343	A	20	Test plan development date
K1344	A	40	Test plan developer
K1802	A	255	User field content 1
K1900	A	255	Remark

5.3   List of key fields for characteristics data

Table 2 lists the defined key fields for the description of the characteristics.

Table 2 — List of key fields for characteristics data

Key	Field type	Maximum number of characteristics	Field name	Misc.	Remarks
K2001	A	20	Characteristic number		
K2002	A	80	Characteristic description		
K2003	A	20	Characteristic abbreviation		
K2004	I5	5	Characteristic type	o	System has to generate it automatically
K2005	I5	5	Characteristics class	o	
K2006	I5	5	Control item	o	
K2007	I5	5	Control type	o	
K2008	I5	5	Group type	o	System has to generate it automatically
K2009	I5	5	Measured quantity	o	
K2015	I3	3	Tool wear type (trend)	o	
K2016	I3	3	100 % measurement	o	
K2019	I3	3	Ordinal classes catalogue		Required with the use of ordinal and nominal charact.
K2022	I5	5	Decimal places		
K2043	A	40	Name of measuring device		
K2060	I5	5	Events catalogue		Required with the use of K0005 Syntax with /0 possible, selection at "part/system level" available
K2061	I5	5	Process parameter catalogue		Required with the use of K0011 Syntax with /0 possible, selection at "part/system level" available
K2062	I5	5	Cavity catalogue		Required with the use of K0007 Syntax with /0 possible, selection at "part/system level" available
K2063	I5	5	Machine catalogue		Required with the use of K0010 Syntax with /0 possible, selection at "part/system level" available
K2064	I5	5	Gauge catalogue		Required with the use of K0012 Syntax with /0 possible, selection at "part/system level" available
K2065	I5	5	Operator catalogue		Required with the use of K0008 Syntax with /0 possible, selection at "part/system level" available

Table 2 *(continued)*

Key	Field type	Maximum number of characteristics	Field name	Misc.	Remarks
K2066	I5	5	Subcatalogue K0061		Required with the use of K0061 Syntax with /0 possible, selection at "part/ system level" available
K2067	I5	5	Subcatalogue K0062		Required with the use of K0062 Syntax with /0 possible, selection at "part/ system level" available
K2068	I5	5	Subcatalogue K0063		Required with the use of K0063 Syntax with /0 possible, selection at "part/ system level" available
K2092	A	50	Characteristic text		
K2093	A	80	Processing status		
K2100	F	22	Target value		
K2101	F	22	Nominal value		Only one combination can be shown to the user: K2101/K2110/K2111 or K2101/K2112/K2113 but for technical reasons it is necessary that all 5 fields are included in the data set.
K2110	F	22	Lower specification limit		
K2111	F	22	Upper specification limit		
K2112	F	22	Lower allowance		
K2113	F	22	Upper allowance		
K2114	F	22	Lower scrap limit		
K2115	F	22	Upper scrap limit		
K2120	I3	3	Type of lower limit	o	
K2121	I3	3	Type of upper limit	o	
K2130	F	22	Lower plausibility limit		
K2131	F	22	Upper plausibility limit		
K2142	A	20	Unit		
K2301	A	20	Machine number		
K2302	A	40	Machine description		
K2303	A	40	Department / cost centre		
K2311	A	20	Production type (operation)		
K2312	A	40	Description of production type		
K2320	A	20	Contract number		
K2401	A	40	Gauge number		
K2402	A	40	Gauge description		
K2403	A	20	Gauge group		

Table 2 *(continued)*

Key	Field type	Maximum number of characteristics	Field name	Misc.	Remarks
K2404	F	22	Gauge resolution		
K2406	A	40	Gauge manufacturer		
K2407	A	20	SPC device number		
K2408	A	40	SPC device manufacturer		
K2409	A	20	SPC device type		
K2410	A	40	Test location		
K2411	A	40	Test begin		
K2415	A	20	Gauge serial number		
K2440	A	40	Assembly component		
K2505	A	20	View description		
K2506	I3	3	Sheet number		
K2630	F	22	Calibration uncertainty		
K2900	A	255	Remark		

5.4 List of key fields for measured values data

Table 3 lists the defined key fields for the measured values data.

Table 3 — List of key fields for measured values data

Key	Field type	Maximum number of characteristics	Field name	Misc.	Remarks
K0001	F	22	Measured value		
K0002	I5	5	Attributes	o	
K0004	D	—	Date / time	o	
K0005	S	—	Event	K	Catalogue see K2060 More than one entry can be written
K0006	A	14	Batch number		
K0007	I10	10	Cavity number	K	
K0008	I10	10	Operator name	K	
K0009	A	255	Text		
K0010	I10	10	Machine number	K	
K0011	S	—	Process parameter	K	Catalogue see K2061 More than one entry can be written
K0012	I10	10	Gauge number	K	
K0014	A	40	Part ID		
K0015	I5	5	Reason for test	o	
K0016	A	30	Production number		
K0017	A	30	Work piece fixture number		

Table 3 *(continued)*

Key	Field type	Maximum number of characteris-tics	Field name	Misc.	Remarks
K0020	I5	5	Subgroup size		Only for attributes tests. For the content the subgroup size is multiplied by 1 000
K0021	I5	5	Number of errors		Only for attributes tests
K0053	A	20	Order		
K0054	A	30	K0054		User defined name
K0055	A	30	K0055		User defined name
K0056	A	30	K0056		User defined name
K0057	A	30	K0057		User defined name
K0058	A	30	K0058		User defined name
K0059	A	30	K0059		User defined name
K0060	A	30	K0060		User defined name
K0061	I10	10	K0061	K	User defined name
K0062	I10	10	K0062	K	User defined name
K0063	I10	10	K0063	K	User defined name
K0080	A	64	Subgroup ident		
K0081	I5	5	Position of measured value within subgroup		

5.5 List of key fields for structural data

Table 4 contains key fields helping to generate and manage structures related to the respective situation.

Table 4 — List of key fields for structural data

Key	Field type	Max. number of characteris-tics	Field name
K0100	I5	5	Total number of characteristics in file
K2030	I5	5	Group number (text)
K2031	I5	5	Group description

5.6 List of key fields for quality control charts data

The information required for the application of quality control charts are given in Table 5.

Table 5 — List of key fields for quality control charts data

Key	Field type	Maximum number of characteris-tics	Field name	Misc.	Remarks
K8010	S	—	Chart type (location) + addi-tional attributes	o	
K8011	F	22	Central position (location)		
K8012	F	22	Lower control limit (loca-tion)		
K8013	F	22	Upper control limit (loca-tion)		
K8110	S	—	Chart type (variation) + additional attributes	o	
K8111	F	22	Central position (variation)		
K8112	F	22	Lower control limit (varia-tion)		
K8113	F	22	Upper control limit (varia-tion)		
K8500	I5	5	Subgroup size		
K8501	I3	3	Subgroup type	o	
K8502	A	40	Subgroup frequency		
K8503	I3	3	Subgroup type (attribute)	o	Only for attributes tests

6 Applications

6.1 General

In order to support various applications of process qualification and process capability analysis, it is important to consider specific field contents and field relations.

6.2 Process qualification

If the measuring value generating device is able to measure or provide the following kinds of characteristics, the respective format requirements for the output are necessary:

— variables characteristics either with:

  — characteristics having one-sided/two-sided limits;

  — or a fixed/moving subgroup size;

  — positional tolerances;

  — quality control chart (to be written with files applied in process capability analysis/SPC);

— discrete characteristics (binary characteristics / conform or non-conform);

  — error log sheets.

6.3 Writing modes

Only the following writing modes apply:

— *.DFQ (one file per job, time unit, study or subgroup);

— *.DFQ (one file per measurement);

— *.DFD/*.DFX (one file per job, time unit, study or subgroup);

— *.DFD/*.DFX (one file per measurement);

— *.DFD/*.DFX (count-up mode).

7 Catalogues

7.1 General

In the fields K00xx a number of important information for identification and assignment of the respective measured value is entered. For many users and in many cases, it is desirable to store a lot of further information on the current measured value in order to be able to carry out detailed analyses later on if required or to ensure comprehensive traceability.

This additional data usually contains frequently occurring or recurring content. In order to drastically reduce the effort for input, storage and data transfer, standardized catalogues with predefined contents were developed. This means that not all the data to be stored have to be entered or read in for a data record, but it is assigned to a defined catalogue content by entering a code in the associated K field. In particular, the use of free text is reduced to a minimum.

With the use of these catalogues, the required storage space and input error possibilities are significantly reduced, and the transfer speed is increased many times over.

Catalogues are defined for different criteria, e.g. machine catalogue, test equipment catalogue and operator catalogue. The first field of each catalogue contains the name, the following field the assignment to the corresponding K00xx field. In addition to permanently defined catalogues, 3 catalogues are available to the user for free assignment (K4270, K4280 and K4290 for fields K0061, K0062 and K0063).

Subcatalogues can be defined for each catalogue, which only contain the contents of the main catalogue required for the sub-unit (e.g. machine 1, machine 2). These subcatalogues are identified by appending a slash and the sequential number of the subcatalogue. For example, the field number of the machine catalogue is K4060, K4060/1 is the subcatalogue for machine 1 and K4060/2 is the subcatalogue for machine 2.

For all catalogues, the last field defined is one that indicates whether the data is currently in use or only archived. This ensures that such information, which was recorded and stored in the past, is no longer displayed and does not pose unnecessary queries to the user of the software system. If necessary, however, this data can be reactivated at any time. This data field has an offset of 501 to the field number of the catalogue title as its field number.

The other fields of the catalogues in Table 6 are self-explanatory.

It is not necessary for measuring systems to be able to write catalogues, they only need to be able to read them.

7.2 List of key fields for catalogues

Table 6 — List of key fields for catalogues

Key	Field description	Length	Type	Remarks
K4060	**Machine catalogue (name of main/ subcatalogue)**	**[80]**	A	**Applies to K-field K0010**
K4061	Element allocation to the respective subcatalogue	[5]	I5	
K4062	Machine number	[20]	A	
K4063	Machine name	[80]	A	
K4561	Identification of records being out of use			0 = in use; 1 = out of use
K4070	**Gauge catalogue (name of main/ subcatalogue)**	**[80]**	A	**Applies to K-field K0012**
K4071	Element allocation to the respective subcatalogue	[5]	I5	
K4072	Gauge number	[20]	A	
K4073	Gauge name	[80]	A	
K4571	Identification of records being out of use			0 = in use; 1 = out of use
K4090	**Operator catalogue (name of main/ subcatalogue)**	**[80]**	A	**Applies to K-field K0008**
K4091	Element allocation to the respective subcatalogue	[5]	I5	
K4092	Operator name 1	[20]	A	
K4093	Operator name 2	[80]	A	
K4591	Identification of records being out of use			0 = in use; 1 = out of use
K4220	**Event catalogue (name of main/ subcatalogue)**	**[80]**	A	**Applies to K-field K0005**
K4221	Event catalogue element (allocation event <-> subcatalogue)	[5]	I5	
K4222	Event number	[20]	A	
K4223	Event text	[80]	A	

Table 6 *(continued)*

Key	Field description	Length	Type	Remarks
K4721	Special identification of records			0 = in use 1 = obsolete 2 = process intervention 3 = obsolete process inter-vention
K4240	**Process parameter catalogue (name of main/ subcatalogue)**	**[80]**	**A**	**Applies to K-field K0011**
K4241	Catalogue element (allocation process parameter <-> subcatalogue)	[5]	I5	
K4242	Process parameter number	[20]	A	
K4243	Process parameter name	[80]	A	
K4244	Process parameter short text	[20]	A	
K4245	Process parameter value – number	[20]	A	
K4246	Process parameter value – text	[80]	A	
K4249	Allocation process parameter <-> process parameter values	[5]	I5	
K4741	Identification of records being out of use			0 = in use; 1 = out of use
K4250	**Cavity catalogue (name of main/ subcatalogue)**	**[80]**	**A**	**Applies to K-field K0007**
K4251	Element allocation to respective subcatalogue	[5]	I5	
K4252	Cavity number	[20]	A	
K4253	Cavity name	[80]	A	
K4751	Identification of records being out of use			0 = in use; 1 = out of use
K4270	**Catalogue K0061 (name of main/ subcatalogue)**	**[80]**	**A**	**Applies to K-field K0061**
K4271	Element allocation to respective subcatalogue	[5]	I5	
K4272	K0061 – number	[20]	A	
K4273	K0061 – name	[80]	A	
K4771	Identification of records being out of use			0 = in use; 1 = out of use
K4280	**Catalogue K0062 (name of main/ subcatalogue)**	**[80]**	**A**	**Applies to K-field K0062**
K4281	Element allocation to respective subcatalogue	[5]	I5	
K4282	K0062 – number	[20]	A	
K4283	K0062 – name	[80]	A	
K4781	Identification of records being out of use			0 = in use; 1 = out of use
K4290	**Catalogue K0063 (name of main/ subcatalogue)**	**[80]**	**A**	**Applies to K-field K0063**
K4291	Element allocation to respective subcatalogue	[5]	I5	
K4292	K0063 – number	[20]	A	
K4293	K0063 – name	[80]	A	
K4791	Identification of records being out of use			0 = in use; 1 = out of use

Table 6 *(continued)*

Key	Field description	Length	Type	Remarks
K4230	**Ordinal classes catalogue (name of main/ subcatalogue)**	**[50]**	**A**	**Applies to ordinal and nominal characteristics**
K4231	Element allocation to the respective subcatalogue	[5]	I5	
K4232	Ordinal class – number	[20]	A	
K4233	Ordinal class – description	[50]	A	
K4234	Ordinal class – evaluation	[20]	A	
K4235	Ordinal class – rank	[10]	I5	
K4236	Ordinal class – O.K./n.O.K.	[5]	I5	
K4237	Ordinal class – validity	[5]	I5	
K4731	Identification of records which are out of use			0= in use, 1=out of use

Annex A
(informative)

Application examples and explanations

A.1 General

The information shown in this annex are examples and explanations only to convey the requirement of the format.

A.2 Defined field contents and special formats

This subclause contains examples of how defined field contents could be defined, see Tables A.1 to A.27. It is necessary to clarify the data content in detail with the statistical evaluation software supplier.

In case of a table with columns for "value" and "description", it is necessary to write the value in the field with defined field content.

In case of a table with a column "Format – example", the entry displayed is considered as just an example for the content.

Table A.1 — K0004 Date/time

Format example
DD.MM.YYYY/HH:MM:SS
MM/DD/YYYY/HH:MM:SS
YYYY-MM-DD/HH:MM:SS
DD.MM.YYYY/HH:MM:SSam
MM/DD/YYYY/HH:MM:SSam
YYYY-MM-DD/HH:MM:SSam
DD.MM.YYYY/HH:MM:SSpm
MM/DD/YYYY/HH:MM:SSpm
YYYY-MM-DD/HH:MM:SSpm

Table A.2 — K0005 Event

Format example	Remark
3	Only one written entry from the catalogue
3,5,6	More than one entry written from the catalogue, separated by comma

Table A.3 — K0011 Process parameter

Format example	Remark
[1,2]	Only one "Process parameter" (1) written with the process parameter value (2), separated by a blank, always written in square brackets
[1-3,8,5,7]	More than one entry written from the catalogue, separated by comma inside the square brackets

K0080/K0081 Subgroup-ident

K0080 stands for the unique sample ident, which is the same for all measured values of the sample.

K0081 is the position within the sample.

For technical reasons it is required that the information given here matches the sample size (K8500) and sample type (K8501).

Figure A.1 — Example of a values mask for sample of 5 values

Table A.4 — K2004 Characteristic type

Value	Description
0	Variable
1	Attributive
3	Ordinal
4	Nominal
5	Error type
6	Error log sheet

Table A.5 — K2005 Characteristic class

Value	Description
0	Unimportant
1	Less important
2	Important
3	Significant
4	Critical

Table A.6 — K2006 Control item

Value	Description
0	No
1	Yes/DwsA characteristic
2	S characteristic
3	R characteristic
4	R&S characteristic
5	A characteristic

Table A.6 *(continued)*

Value	Description
6	B characteristic
10	Special characteristic
11	Special characteristic BP 1
12	Special characteristic BP 2
13	Special characteristic BP 1 SPC
14	Special characteristic BP 2 SPC
15	R1
16	R2
17	1
18	2
19	3
20	4
22	Documentation required for safety reasons
23	Documentation required for certification
24	Relevant to production (no documentation required)
25	Relevant to manufacturing (no documentation required)
26	Special characteristic F
27	Special characteristic L/CoP
28	Special characteristic S

Table A.7 — K2007 Control type

Value	Description
0	No control
1	Conditional control
2	Manual
3	Automatic control

Table A.8 — K2008 Group type

Value	Description
0	No group/coordinate
2	2D- positional tolerance (with 2 subordinate axis)
6	Error log sheet
8	Best fit move group
10	3D- positional tolerance (with 3 subordinate axis)
11	AFNOR E60-181 max/min
12	MMC (hole)
13	MMC (shaft)
18	Unbalance (with 2 subordinate axis)
19	Perpendicularity (with 2 subordinate axis)
20	Concentricity (with 2 subordinate axis)
21	Coaxiality (with 2 subordinate axis)

Table A.9 — K2009 Measured quantity

Value	Description
0	Undefined
100	Straightness
101	Flatness
102	Roundness
103	Cylindricity
104	Profile of a line
105	Profile of a surface
106	Angularity
107	Perpendicularity
108	Parallelism
109	True position (value)
110	Concentricity
111	Symmetry
112	Runout
113	Total runout
114	CompCoaxial
115	CompPattern
117	Coordinates
118	Surface runout
120	X coordinate
121	Y coordinate
122	Z coordinate
125	Offset
132	Ovality
140	Appraisal number angle area
145	Surface finish
149	Excavation depth
150	Max. profile height Rz
151	Total profile height Rt
152	Deviation assessed prof. Ra
153	Max. profile height Pt
154	Profile height point Rk
155	Red. height of centres
156	Red. score depth
157	Profile Wave depth Wt
158	Maximum Wave depth
159	Basic roughness depth
160	Material proportion Pmr
161	Material proportion Mr1
162	Material proportion Mr2
170	Swirl depth
171	Swirl angle
172	Swirl pitch
180	Average dominant waviness

Table A.9 *(continued)*

Value	Description
181	Max. dominant waviness
182	Length of the dominant waviness
190	Mean depth of roughness motifs
191	Max. depth of profile irregularity
192	Mean width of roughness motifs
193	Material fraction Rmr
194	Material fraction tp
200	Distance
201	Radius
202	Diameter
203	Angle
204	Ellipsis minor
205	Ellipsis major
206	Cone angle
207	Inside diameter
208	Outside diameter
210	Spherical measuring rod
211	Depth/height of tooth
212	Tooth thickness at the reference cylinder
214	Deviation of tooth thickness (at the reference cylinder)
215	Variation in tooth thickness
216	Span distance (over k teeth or gaps)
220	Spring rate
230	Width
231	Squareness
232	Diameter maximum
233	Diameter minimum
234	Diameter average
250	Temperature [°C]
251	Temperature [F]
255	Pressure [bar]
260	Coating thickness
270	Volume
280	Mass
282	Force
285	Hardness
290	Viscosity
300	Unbalance
301	Torque
302	Tightening torque
303	Additional torque
310	2D note
311	3D note
320	Rotation angle

Table A.9 *(continued)*

Value	Description
350	Revolution speed
360	Angle error
362	Profile error
364	Velocity error
370	Shape deviation
372	Form increase
380	Cam height
501	Resistance
502	Capacity
503	Inductivity
504	Phase shift
505	Frequency
506	Amperage
507	Voltage
508	Output
509	Field intensity
601	Pitch
602	Pitch error
604	Cumulative pitch bias
605	Cumulative pitch error
606	Pitch fluctuation
607	Total pitch error
608	Base pitch variation
609	Axial pitch variation
610	Tip diameter
612	Root diameter
617	Slot width at the reference cylinder
620	Line
621	Formal line error
630	Tooth profile
631	Formal profile error
632	Profile angle bias
633	Profile wobble
640	Tip relief
641	Profile crowning
642	Crowning
643	Crowning height
651	Flank line angle bias
652	Flank line wobble
660	Radial run-out bias
661	Eccentricity
662	Wobble
663	Coaxiality
670	Two-flank working variation

Table A.9 *(continued)*

Value	Description
671	Two-flank tooth-to-tooth radial composite deviation
672	Contact runout deviation
673	Diametrical two-ball dimension
674	Diametrical two-roll dimension
675	Radial one-ball dimension
676	Radial one-roll dimension
800	Time
805	Number
820	Noise
910	Leak rate
950	Cleanliness of the component
955	Residual particle

Table A.10 — K2015 Tool wear type

Value	Description
0	Undefined
1	Ascending
2	Descending

The default value is "0"

Table A.11 — K2016 100 % measurement

Value	Description
0	No
1	Yes

The default value is "0"

Table A.12 — K2120 / K2121 Type of Limit

Value	Description
0	No limit
1	Limit value
2	Natural limit

The default value is "1"

Table A.13 — K8010 Chart type (location)

Value	Description
13 1	Raw value chart
23 1	Median Chart
33 1	Average Chart

Table A.14 — K8110 Chart type (variation)

Value	Description
53 1	S-chart
63 1	R-chart

Table A.15 — K8501 Subgroup type

Value	Description
0	Fixed
1	Moving
2	Pseudo permanent

Table A.16 — K8503 Subgroup type (attributive)

Value	Description
0	Variable
1	Constant
2	Individual storage

A.3 Enconding

Different encoding types can be used.

a) ASCII-format, ANSI – coded

b) Unicode

In case of Unicode:

— UTF8;

— Big-Endian UTF16;

— Little-Endian UTF16.

At the beginning of the file the BOM has to be written (Byte Order Mark):

BOM:

Little Endian UTF16:   FF FE (255 254, 2 Bytes)

Big Endian UTF16:   FE FF (254 255, 2 Bytes)

UTF8:   EF BB BF (239 187 191, 3 Bytes)

ANSI: (no BOM)

A.4 General data-model and writing rules

Table A.17 — General data-model and writing rules

K0100 3	The first block is K0100 which contains the correct number of existing characteristics inside of the dataset.

Table A.17 *(continued)*

K1001/1 1 K1002/1 Partname K1*xxx*/1	The 2nd block contains the Part-Information.
K2022/0 3	The 3rd block contains all characteristic information which is written directly for all characteristics, written with /0. All information can also be written as in block 4, individually per characteristic.
K2001/1 1 K2002/1 Characteristic 1 K8500/1 5 K8501/1 0 K2001/2 2 K2002/2 Characteristic 2 K8500/2 2 K8501/2 1 K2001/3 3 K2002/3 Characteristic 3 K8500/3 5 K8501/3 0	The 4th block contains the information for the characteristics. (K2*xxx* and K8*xxx*). The order does not have to be ascending.
K0001/1 10.1 K0001/2 20.1 K0001/3 30.1	The 5th Block contains the value information.
K0002/0 0 K0004/0 01.01.2017/22:45:23 K0005/2 1	The 6th Block contains the additional data for the measurement of block 5. Written for all characteristics (/0), or for separated characteristics.
K0001/1 10.2 K0001/2 20.2 K0001/3 30.2 K0002/0 0 K0004/0 01.01.2017/22:48:46 K0005/3 6	In case of more than 1 measurement in the file blocks 5 and 6 are appended for each additional measurement.

A.5 Variable characteristics

This example shows 2 variable characteristics with 2 measurements, some additional data.

The minimum requirements next to the describing elements (K2001/K2002) are:

Table A.18 — Example for variable characteristics

K-Field	Content/Remark
K2004	0 = Characteristic type "variable" (defined field contents)
K2101	Nominal value / required in combination with K2112 / K2113
K2110	Alternative to K2112
K2111	Alternative to K2113
K2112	Alternative to K2110

Table A.18 *(continued)*

| K-Field	Content/Remark
K2113	Alternative to K2111
K2120	Lower limit type (defined field contents)
K2121	Upper limit type (defined field contents)
K8500	Subgroup size (for Process Capability Analysis)
K8501	Subgroup type / defined field contents (for Process Capability Analysis)
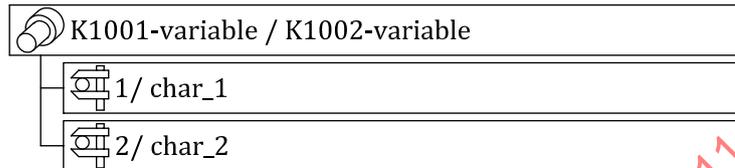
Figure A.2 — Example with two variable characteristics
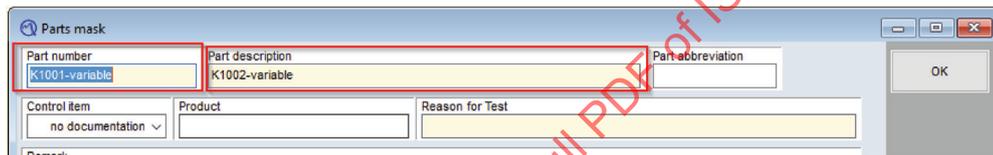
Figure A.3 — View of the parts mask
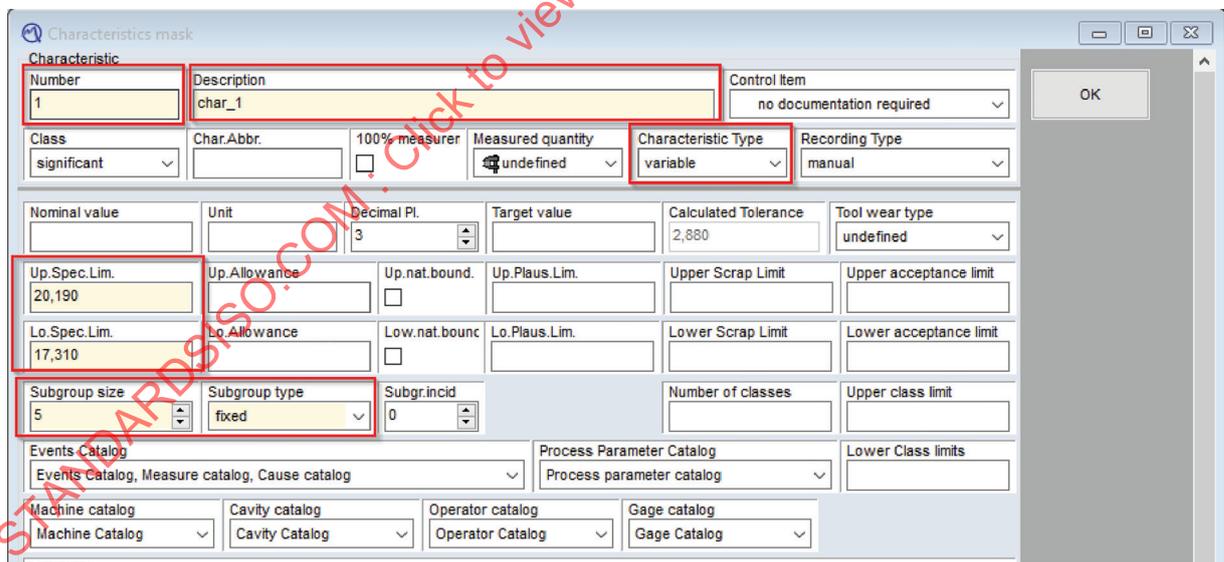
Figure A.4 — View of the characteristics mask

	char_1	Time	Date	Machine number	Order	char_2	Time	Date	Machine number	Order
1	17,692	12:22:22	06.12.2016	Machine 7	0815_TEST1	12,412	12:22:22	06.12.2016	Machine 7	0815_TEST1
2	18,614	12:22:22	06.12.2016	Machine 8	0815_TEST2	13,907	12:22:22	06.12.2016	Machine 8	0815_TEST2

Figure A.5 — View of the values with additional fields for date/time, order and machine

File content in ASCII-format:

K0100 2

K1001/1 K1001-variable

K1002/1 K1002-variable

K2001/1 1

K2002/1 char_1

K2110/1 17,31

K2111/1 20,19

K2120/1 1

K2121/1 1

K8500/1 5

K8501/1 0

K2001/2 2

K2002/2 char_2

K2110/2 7.2

K2111/2 22.09

K2120/2 1

K2121/2 1

K8500/2 5

K8501/2 0

K0001/1 17,692 2

K0001/2 12,411 9

K0004/0 06.12.2016/12:22:22

K0053/0 081 5_TEST1

K0010/0 7

K0001/1 18,613 7

K0001/2 13,906 9

K0004/0 06.12.2016/12:22:22

K0053/0 0815_TEST2

K0010/0 8

A.6 Attributive characteristics

Measurement results for attribute characteristics can be understood to be the no. of defective units.

The minimum requirements next to the describing elements (K2001/K2002) are:

Table A.19 — Attributive characteristics

K-Field	Content/Remark
K2004	1 = Characteristic type "attributive" (defined field contents)
K8500	Subgroup size (alternative K8505)
K8501	Subgroup type / defined field contents (only affects individual storage: K8503/x 2)
K8503	Subgroup type "attributive" (defined field contents)

Different examples displayed in the data format:

Constant subgroup size

K2002/1 Attributive charact.   {Characteristic description}

K2004/1 1   {Characteristic type attributive}

K8500/1 5   {Subgroup size 5}

K8503/1 1   {Subgroup type attributive constant}

Variable subgroup size

K2002/1 Attributive charact.   {Characteristic description}

K2004/1 1   {Characteristic type attributive}

K8500/1 5   {Subgroup size 5}

K8503/1 0   {Subgroup type attributive variable}

Individual storage

K2002/1 Attributive charact.   {Characteristic description}

K2004/1 1   {Characteristic type attributive}

K8500/1 5   {Subgroup size 5}

K8501/1 1   {Subgroup size e.g. moving}

K8503/1 2   {Individual storage}

This example shows 2 attribute characteristics as "individual storage" with 2 measurement results each, as well some additional data:
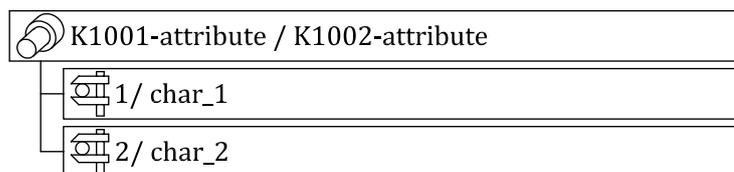
Figure A.6 — Example with two attributive characteristics
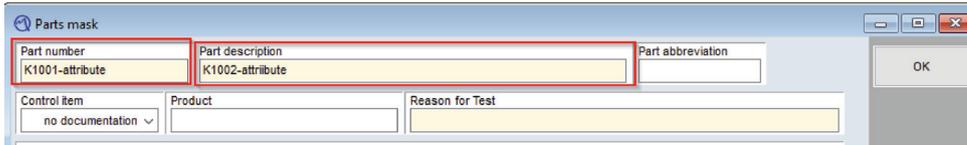
Figure A.7 — View of the parts mask
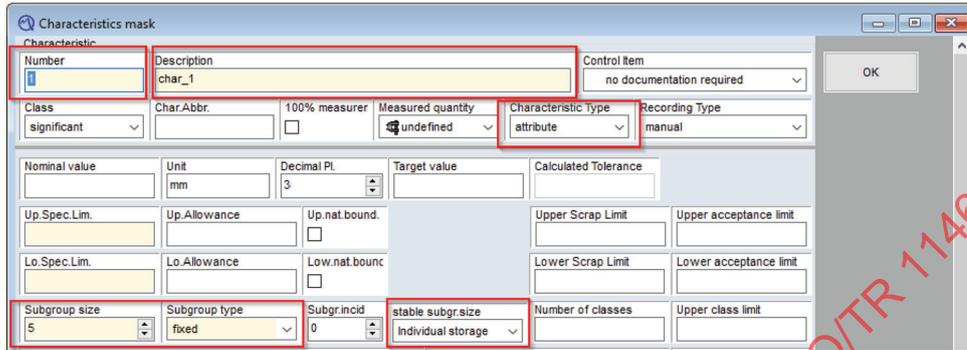
Figure A.8 — View of the characteristics mask

	char_1	Time	Date	Machine number	Order	char_2	Time	Date	Machine number	Order
1	O.K	14:14:14	06.12.2016	Machine 7	0815_TEST1	n.O.K.	14:14:14	06.12.2016	Machine 7	0815_TEST1
2	n.O.K.	12:22:22	06.12.2016	Machine 8	0815_TEST2	O.K	12:22:22	06.12.2016	Machine 8	0815_TEST2

Figure A.9 — View of the values with additional fields for date/time, order and machine

ASCII-format:

K0100 2

K1001/1 K1001-attribute

K1002/1 K1002-attribute

K2001/1 1

K2002/1 char_1

K2004/1 1

K8500/1 5

K8501/1 0

K8503/1 2

K2001/2 2

K2002/2 char_2

K2004/2 1

K8500/2 5

K8501/2 0

K8503/2 2

K0020/1 1 000

K0021/1 0

K0020/2 1 000

K0021/2 1

K0004/0 06.12.2016/14:14:14

K0053/0 0815_TEST1

K0010/0 7

K0020/1 1 000

K0021/1 1

K0020/2 1 000

K0021/2 0

K0004/0 06.12.2016/12:22:22

K0053/0 0815_TEST2

K0010/0 8

A.7 Ordinal characteristics

The minimum requirements next to the describing elements (K2001/K2002) are:

Table A.20 — Ordinal characteristics

K-Field	Content/Remark
K2004	3 = Characteristic type ordinal (defined field contents)
K2019	Ordinal classes catalogue
K8500	Subgroup size
K8501	Subgroup type / defined field contents

Here we have two characteristics with two ordinal class entries for each characteristic.

In this case, it is necessary to use a catalogue file with valid entries, for this example, subcatalogue 3.0 (consecutive subgroup-number 2).

Here we have two characteristics with two ordinal class entries for each characteristic.

In this case, it is necessary to use a catalogue file with valid entries, for this example, subcatalogue 3.0 (consecutive subgroup-number 2).

Figure A.10 — Example of the catalogue for two ordinal characteristics
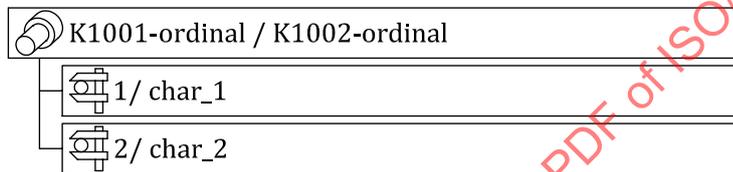
Figure A.11 — Structure of the two characteristics

Figure A.12 — View of the parts mask

Figure A.13 — View of the characteristics mask

	char_1	Time	Date	char_2	Time	Date
1	Okay	15:08:08	06.12.2016	Okay	15:08:08	06.12.2016
2	Rework	15:09:09	06.12.2016	Not okay	15:09:09	06.12.2016

Figure A.14 — View of the values with additional fields for date/time

ASCII-format

K0100 2

K1001/1 K1001-ordinal

K1002/1 K1002-ordinal

K2019/0

K2001/1 1

K2002/1 char_1

K2004/1 3

K8500/1 5

K8501/1 0

K2001/2 2

K2002/2 char_2

K2004/2 3

K8500/2 5

K8501/2 0

K0001/1 3

K0001/2 3

K0004/0 06.12.2016/15:08:08

K0001/1 4

K0001/2 5

K0004/0 06.12.2016/15:09:09

A.8 Nominal characteristics

The minimum requirements next to the describing elements (K2001/K2002) are:

Table A.21 — Nominal characteristics

K-Field	Content/Remark
K2004	4 = Characteristic type nominal (defined field contents)
K2019	Ordinal classes catalogue
K8500	Subgroup size
K8501	Subgroup type / defined field contents

Here we have two characteristics with two nominal class entries for each characteristic.

In this case, it is necessary to use a catalogue file with valid entries, for this example, subcatalogue Nominal (consecutive subgroup-number 4).
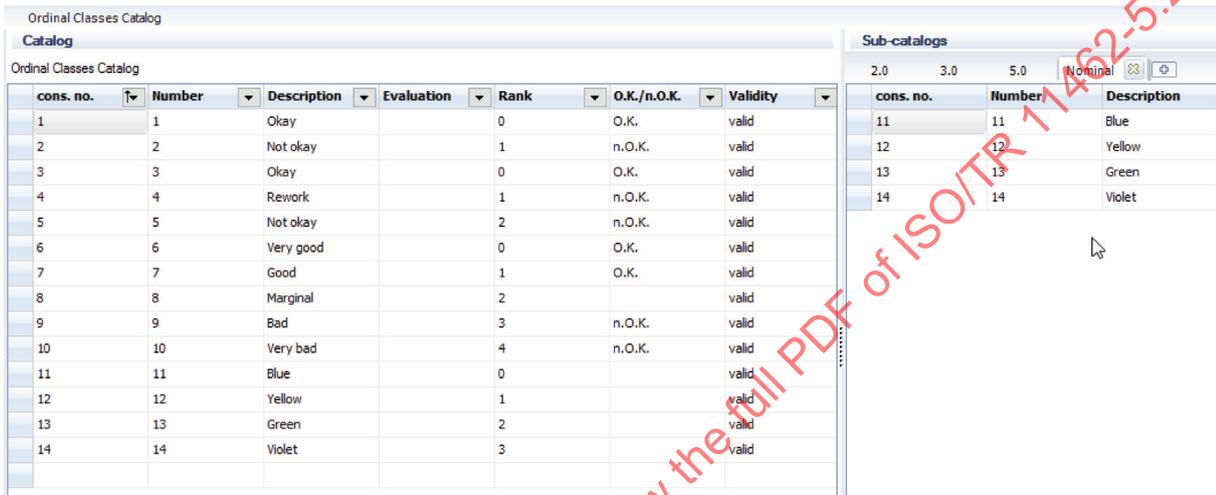

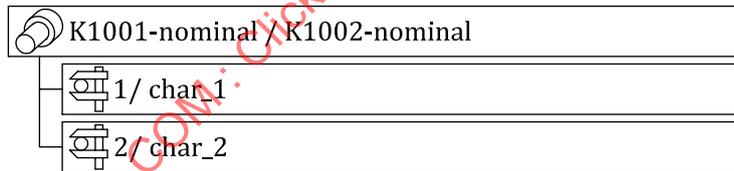**Figure A.15 — Example of the catalogue for two nominal characteristics**

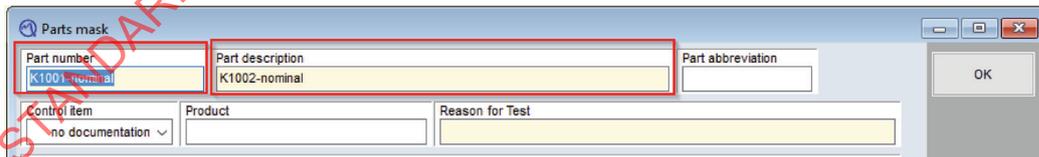**Figure A.16 — Example of the structure for the two characteristics**

Figure A.17 — View of the parts mask

Figure A.18 — View of the characteristics mask

	char_1	Time	Date	char_2	Time	Date
1	Blue	15:42:42	06.12.2016	Yellow	15:42:42	06.12.2016
2	Green	15:43:43	06.12.2016	Violet	15:43:43	06.12.2016

Figure A.19 — View of the values with additional fields for date/time

ASCII-format

K0100 2

K1001/1 K1001-nominal

K1002/1 K1002-nominal

K2019/0 4

K2001/1 1

K2002/1 char_1

K2004/1 4

K8500/1 5

K8501/1 0

K2001/2 2

K2002/2 char_2

K2004/2 4

K8500/2 5

K8501/2 0

K0001/1 11

K0001/2 12

K0004/0 06.12.2016/15:42:42

K0001/1 13

K0001/2 14

K0004/0 06.12.2016/15:43:43

A.9 Positional tolerance (2D)

In general, positional tolerances are always characteristics groupings consisting of variable characteristics.

The superordinate position does not require any specification limits and measured values when it is calculated in the statistical evaluation software automatically in the background. If there is not any measured value available, the value is 0 and thus attribute 256 is written in the field.

The coordinates are simple variable characteristics.

The minimum requirements next to the describing elements (K2001/K2002) are:

Table A.22 — Positional tolerance (2D) – True position

K-Field	Content/Remark
K2004	0 = Characteristic type "variable" (defined field contents)
K2008	2 = Group type positional tolerance (defined field contents)
K2030/31	Grouping
K8500	Subgroup size (for Process Capability Analysis)
K8501	Subgroup type / defined field contents (for Process Capability Analysis)

Table A.23 — Positional tolerance (2D) – Coordinates

K-Field	Content/Remark
K2004	0 = Characteristic type "variable" (defined field contents)
K2101	Nominal value / required in combination with K2112 / K2113
K2110	Alternative to K2112
K2111	Alternative to K2113
K2112	Alternative to K2110
K2113	Alternative to K2111
K2030/31	Grouping
K8500	Subgroup size (for Process Capability Analysis)
K8501	Subgroup type / defined field contents (for Process Capability Analysis)

Here we have two 2D positional tolerances with two characteristics (X/Y axis). Each axis includes two values. The first characteristic (true position) will automatically be calculated (no input needed).
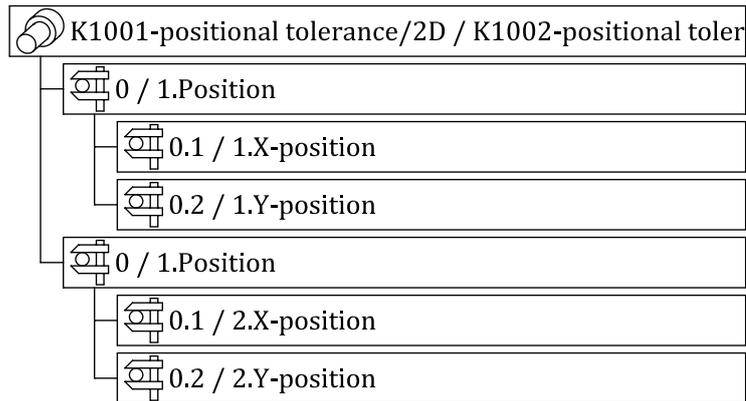
Figure A.20 — Structure of the two 2D positional tolerances

	1. Position	1.X-position	1.Y-position	2.Position	2.X-Position	2.Y-Position
1	0.043	9.979	10.002	0.030	19.985	19.997

Figure A.21 — View of the values with additional fields for date/time

ASCII-format

K0100 6

K1001/1 K1001-positional tolerance/2D

K1002/1 K1002-positional tolerance/2D

K8500/0 5

K8501/0 0

K2004/0 0

K2001/1 0

K2002/1 1.Position

K2008/1 2

K2030/1 1

K2031/1 0

K2001/2 0.1

K2002/2 1.X-position

K2110/2 9.9

K2111/2 10.1

K2030/2 0

K2031/2 1

K2001/3 0.2

K2002/3 1.Y-position

K2110/3 9.9

K2111/3 10.1

K2030/3 0

K2031/3 1

K2001/4 0

K2002/4 2.Position

K2008/4 2

K2030/4 2

K2031/4 0

K2001/5 0.1

K2002/5 2.X-position

K2110/5 19.9

K2111/5 20.1

K2030/5 0

K2031/5 2

K2001/6 0.2

K2002/6 2.Y-position

K2110/6 19.9

K2111/6 20.1

K2030/6 0

K2031/6 2

K0001/1 0

K0002/1 256

K0001/2 9,978 5

K0001/3 10,002 1

K0001/4 0

K0002/4 256

K0001/5 19,985 2

K0001/6 19,997 5

K0004/0 07.12.2016/09:33:33

A.10 Positional tolerance (3D)

In general, positional tolerances are always characteristics groupings consisting of variables characteristics.

The superordinate position does not require any specification limits and measured values since it is calculated in the statistical evaluation software automatically in the background. If there is not any measured value available, the value is 0 and thus attribute 256 is written in the field.

The coordinates are simple variable characteristics.

The minimum requirements next to the describing elements (K2001/K2002) are:

Table A.24 — Positional tolerance (3D) – True position

K-Field	Content/Remark
K2004	0 = Characteristic type "variable" (defined field contents)
K2008	10 = Group type 3D-positional tolerance (defined field contents)
K2030/31	Grouping
K8500	Subgroup size (for Process Capability Analysis)
K8501	Subgroup type / defined field contents (for Process Capability Analysis)

Table A.25 — Positional tolerance (3D) – Coordinates

K-Field	Content/Remark
K2004	0 = Characteristic type "variable" (defined field contents)
K2030/31	Grouping
K2101	Nominal value / required in combination with K2112 / K2113
K2110	Alternative to K2112
K2111	Alternative to K2113
K2112	Alternative to K2110
K2113	Alternative to K2111
K8500	Subgroup size (for Process Capability Analysis)
K8501	Subgroup type / defined field contents (for Process Capability Analysis)

K1001-positional tolerance/2D / K1002-positional toler

0 / 1.Position

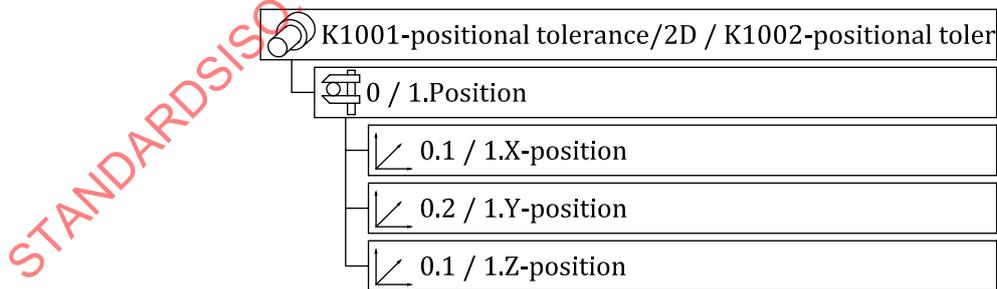0.1 / 1.X-position

0.2 / 1.Y-position

0.1 / 1.Z-position

Figure A.22 — Structure of a 3D positional tolerance with three characteristics (X/Y/Z axis)