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Do our measurement devices speak the same language?

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Abstract. Online data recording is becoming more and more important. The current practice results in a large number of different company and plant specific solutions. Measurement device manufacturers have to invest plenty of time and effort for customer specific adaptions of their measurement solution. This article describes the AQDEF data exchange format, a standardized Interface for the management of measurement data, which will reduce this effort.

No standardization means effort

Online data recording and transfer helps to improve process quality and efficiency as well as to increase customer satisfaction. The existing procedure results in a large number of different company and plant specific individual solutions, which have a similar structure, like for example the SPC control of a production process or the acceptance of a facility. For this reason, the measurement 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 or license fees.

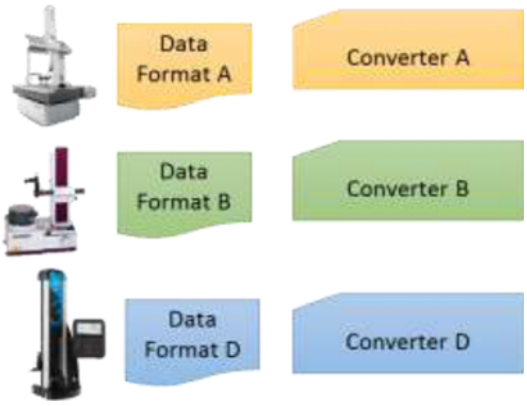

Fig. 1. Typical situation regarding the data format and the Interface of measurement devices for the quality data management in the production area.

Advantages of a standardized data format

The advantages of a companywide uniform data format are clear. We can combine easily and smoothly the data from different measurement systems. A uniform data format facilitates standardized data storage and the evaluation of measured values. This is a requirement to be able to compare results company-wide. No data conversion is required.

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

Fig. 2. The standardized data exchange format AQDEF reduces the effort for creating Interfaces and related tasks.

What is the AQDEF data exchange format?

The AQDEF Work group develops and maintains the **A**dvanced **Q**uality **D**ata **E**xchange **F**ormat (short: AQDEF), a standardized catalogue of data fields important to every user. The objective is to define the scope and interpretation of the key fields and their application.

The AQDEF File Structure

The data structure is defined in the specification "Advanced Quality Data Exchange Format".

The main features of this data format are:

- A simple, transparent ASCII-based structure
- Flexible (required and optional data fields)
- Space saving
- Easily transferred
- Language independent

In its core, an AQDEF-File is a list of key-value-pairs. Each key starts with the letter K followed by a four digit numeric value. Its values range groups the key fields according to the following group structure.

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AQDEF-File - Structure Overview

Table 1. The structure of the content of an AQDEF-File

Header	
Data Block of the first Part	
	Part Data of the first part
	Characteristic data of the first part
⋮	
	⋮
	⋮
Data Block of the n^{th} part	
	Part data of the n^{th} part
	Characteristic Data of n^{th} part
Measurement Data	

Header Block

The first line is the header line and contains only one Key-Field: K0100. The content of this K-Field is an integer value, which sets the overall number of characteristics given in the file.

Part- and Characteristic-Data Block

Part data and part related characteristic data are written block-wise (see Table 1). The field- range from K1000 to K1999 is reserved for part related data. The AQDEF-specification has currently defined 38 K-fields for the Part.

The field-range from K2000 to K2999 is reserved for characteristics data. The AQDEF-specification currently uses 64 characteristic related K-Fields.

Table 3 shows a small example of an AQDEF-file - one part, one characteristic and five measurements. This example demonstrates the block structure of the file. The headline has a yellow background color. All cells with a light gray background color belong to the block 'part and characteristic'. The last block is for the measurement data and has no background color.

Table 3. The example shows the typical data-structure of an AQDEF-File

K-Field	*Description*
K0100 1	Header (= Number of Characteristics)
K1001 EP-1	Part Number
K1002 Part # 1	Part Name
K1004 AD-001	Amendment-Status of the Part
K1900 Description	Remark for the Part
K2001/1 Chr-01	Number of the first Characteristic
K2002/1 Hole M1	Name of the first Characteristic
K2004/1 0	Data Type
K2005/1 3	Characteristic Class
K2006/1 0	Control Item flag
K2009/1 202	Measured Quantity
K2022/1 3	Number of decimal places
K2101/1 30.000	Nominal Value of the first Character.
K2110/1 29.970	Lower Limit of the 1st Characteristic
K2111/1 30.03	Upper Limit of the 1st Characteristic
K2112/1 -0.03	Lower Allowance of the 1st Charac.
K2113/1 0.03	Upper Allowance of the 1st Charac.
K2120/1 1	Lower Boundary Type
K2121/1 1	Upper Boundary Type
K2142/1 mm	Unit of the first Characteristic
K2404/1 0.001	Gage Resolution
K2900/1 Description	Description of the 1st Characteristic
K0001/1/1 30.001	1st Measurement of the 1st Character.
K0002/1/1 0	Attribute of the 1st Measurement
K0001/1/2 30.008	2nd Measurement of the 1st Character.
K0002/1/2 0	Attribute of the 2nd Measurement
K0001/1/3 30.002	3rd Measurement of the 1st Character.
K0002/1/3 0	Attribute of the 3rd Measurement
K0001/1/4 30.003	4th Measurement of the 1st Character.
K0002/1/4 0	Attribute of the 4th Measurement
K0001/1/5 29.994	5th Measurement of the 1st Character.
K0002/1/5 0	Attribute of the 5th Measurement

AQDEF Certification Categories

One focus of the AQDEF work group is the definition of requirements of multiple specifications for interfaces and data formats. The intended application dictates the range of supported Key-Fields. The AQDEF work group has defined five categories of use cases:

Table 2. Certification categories based on use cases for the AQDEF-Data Interface

Category	*Description*	*Remark*
A	Variable and attribute characteristics including positional deviations	Full certification scope
B	Variable characteristics including positional deviations	
C	Variable characteristics (without positional deviations)	
D	Discrete characteristics (no variable characteristics)	
E	Header Data	

The choice of a specific use case category becomes handy when customer and supplier have to specify the data interface for a new measurement solution.

Conclusion

A key task in all production companies is the management of measurement data and related information. The AQDEF data exchange format provides a common language that makes it easy to handle the structure and content of measurement data. The user specification of the AQDEF work group offers recommendations for the development of an AQDEF interface.

Reference

1. AQDEF working group: AQDEF-Specification