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CONCEPT DIAGRAM AROUND SOFTWARE FOR INTERNATIONAL VOCABULARY IN LEGAL METROLOGY

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Abstract: This paper describes the concepts for software in legal metrology and presented proposals for the concept diagram around concept software in legal metrology for the new edition of the International Vocabulary of Terms in Legal metrology (VIML).

Keywords: legal metrology, software, vocabulary, concept diagram.

1. INTRODUCTION

Legal metrology is part of metrology relating to activities which result from statutory requirements and concern measurement, units of measurement, measuring instruments and methods of measurement and which are performed by competent bodies [1].

The VIML now includes only the concepts used in the field of legal metrology. These concepts concern the activities of the legal metrology service, the relevant documents as well as other problems linked with this activity. The importance of international aspects of terminology in legal metrology and the need to speak a common language in international cooperation resulted in the continuation of work on the VIML for his improvement [2].

International Document OIML D31 [3] specifies the general requirements applicable to software related functionality in measuring instruments and gives guidance for verifying the compliance of an instrument with these requirements. As software controlled devices are always electronic, it is also necessary to consider International Document OIML D 11 [4].

To prevent unauthorized adjustments or interventions, the regulations may restrict access to certain parts or functions of the instruments (including software) in legal metrology. This access may be required to be physically protected by sealing marks (or protection of access to the software) defined by the regulations [5].

The VIML does not reflect all modern concepts that are used in legal metrology now, in particular, within wide using in legal metrology of modern information technologies including specialized software for measuring instruments.

2. CONCEPTS AROUND SOFTWARE FOR INTERNATIONAL VOCABULARY OF TERMS IN LEGAL METROLOGY

The VIML is intended to bring together the general concepts, term and definitions that are specific to the field of legal metrology and to promote the harmonization and common use of these concepts, term and definitions within the International Organization of Legal Metrology (OIML) and in particular in OIML Publications.

The current edition of a VIML now includes four main parts:

1 Basic term in legal metrology,
2 Legal metrology activities,
3 Documents and marks within legal metrology,
4 Units and measuring instruments.

The definition of terms given in a VIML, as well as their formats, comply as far as possible with the rules of terminology work, as outlined in international standards ISO 704, ISO 1087-1 and ISO 10241 [6–8]. In particular, the substitution principle applies; that is, it is possible in any definition to replace a term referring to a concept defined elsewhere in the VIML by the definition corresponding to that term, without introducing contradiction or circularity.

In [2] indicated structure for the new edition of VIML:

0 Introduction. Basic terms,
1 Metrology and its legal aspects,
2 Legal metrology activities,
3 Documents and marks in legal metrology,
4 Classification of measuring instruments,
5 Construction and operation of measuring instruments,
6 *Software in legal metrology*,
7 Test in legal metrology.

For a new VIML proposed to extend an existent part related to measuring instruments, and to enter two new parts, related to software and test in legal metrology.

The instructions given in OIML D31 apply only to software controlled measuring instruments or electronic devices. Some of the definitions used in OIML D31 are in conformity with the International Vocabulary of Basic and General Terms in Metrology

(VIM) [9], with the VIML, with the OIML D 11, which gives general requirements for electronic measuring instruments.

In Table 1 the OIML D11, VIM and VIML concepts around "software in legal metrology" are given.

composition, process and will distribute information got at measuring, take them to the user and others like that. All these processes will take place expressly and correctly only on terms, if measuring instruments software will have proper metrological algorithmic and certain level protected from external interference.

Table 1 OIML D11, VIM and VIML concepts around "software in legal metrology"

<table>
<tr><th>OIML D11</th><th>VIM</th><th>VIML</th></tr>
<tr><td>Electronic measuring instrument is measuring instrument intended to measure an electrical or non-electrical quantity using electronic means and/or equipped with electronic devices (3.1)
Electronic device is device employing sub-assemblies and performing a specific function. An electronic device is usually manufactured as a separate unit and is capable of being tested independently (3.2)
Sub-assembly is part of an electronic device employing electronic components and having a recognizable function of its own (3.3)
Fault is defect that has an impact on the properties or functions of the measuring instrument or that causes an error of indication greater than the maximum permissible error (3.9)
Checking facility is facility that is incorporated in a measuring instrument and which enables significant faults to be detected and acted upon (3.18)
Performance is ability of a measuring instrument to accomplish its intended functions (3.16)
Durability is ability of the measuring instrument to maintain its performance characteristics over a period of use (3.17)
Test is series of operations intended to verify the compliance of the equipment under test with the specified requirements (3.20)</td><td>Measuring instrument is Device intended to be used to make measure-ments, alone or in conjunction with supplemen-tary device(s) (4.1)</td><td rowspan="2">Evaluation (type) is systematic examination and testing of the performance of one or more specimens of an identified type (pattern) of measuring instruments against documented requirements, the results of which are contained in the evaluation report, in order to determine whether the type may be approved (2.5)
Verification is procedure (other than type approval) that includes the examination and marking and/or issuing of a verification certificate that ascertains and confirms that the measuring instrument complies with the statutory requirements (2.13)</td></tr>
<tr><td colspan="2">Error (of indication) is indication of a measuring instrument minus a true value of the corresponding input quantity (OIML D11 3.5, VIM 5.20)
Maximum permissible error (of a measuring instrument) is extreme value of an error permitted by specifications, regulations, etc. for a given measuring instrument (OIML D11 3.6, VIM 5.21)
Intrinsic error is error of a measuring instrument, determined under reference conditions (OIML D11 3.7, VIM 5.24)</td></tr>
</table>

3. SOFTWARE CONTROLLED MEASURING INSTRUMENTS

Introduction in metrological activity of modern information technologies pulls out new requirements control of measuring instruments. The specialized measuring instrument software plays everything important role in the conditions of the practically widely use of information technologies.

Software are used by the measuring instrument producers and informatics and measuring systems, specialists in field of metrology and information technologies, workers of inspections authorities and laboratories accreditation bodies, measuring instruments users and metrological services.

The modules of the microprocessor systems, which directly lead the measuring processes, have majority of modern measuring instruments in the

Simplified block diagram of software controlled measuring instruments is presented on Fig. 1.

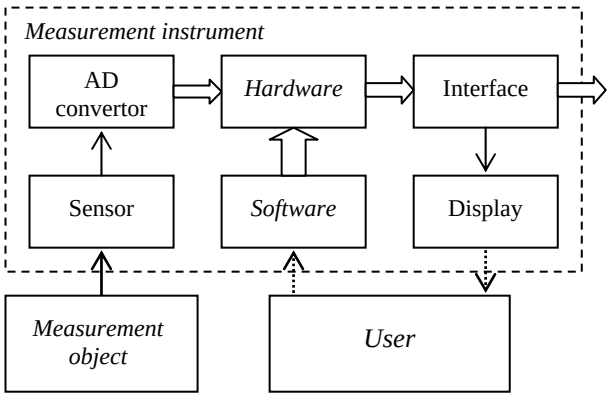

Fig. 1 Simplified block diagram of software controlled measuring instruments

Sensor and analog-digital (AD) convertor transforms the quantitative value of the measured physical value in it digital equivalent. This digital data is processed measuring instrument software that functions in a certain hardware and software environment, after the software algorithm. The current measuring results can be represented on displays for user, written down on data carrier for saving, passed communication channels.

The measuring results of are got before can be counted from a data carrier or got communication channels. A user can manage work of measuring instrument, to change his tuning and others like that. Software in such measuring instrument, not depending on his complication, carries out a basic role in the measuring process.

4. PROPOSED CONCEPT DIAGRAM AROUND SOFTWAWE IN LEGAL METROLOGY

On Fig. 2 shown a proposed concept diagram around concept "*software in legal metrology*", which can be used in new edition of a VIML. *Software* is generic term comprising program code, data, and parameters (OIML D31 3.1.40).

Concept "*software in legal metrology*" has associative relations with concepts: electronic measuring instrument (OIML D11 3.1); software examination (OIML D31 3.1.41); software protection (OIML D31 3.1.45); software interface (OIML D31 3.1.43); software separation (OIML D31 3.1.46); software module (OIML D31 3.1.44); test (OIML D11 3.20); software identification (OIML D31 3.1.42); evaluation of type (VIML 2.5); verification (VIML 2.13); validation (OIML D31 3.1.56); user interface (OIML D31 3.1.55), and legally relevant software part (OIML D31 3.1.31).

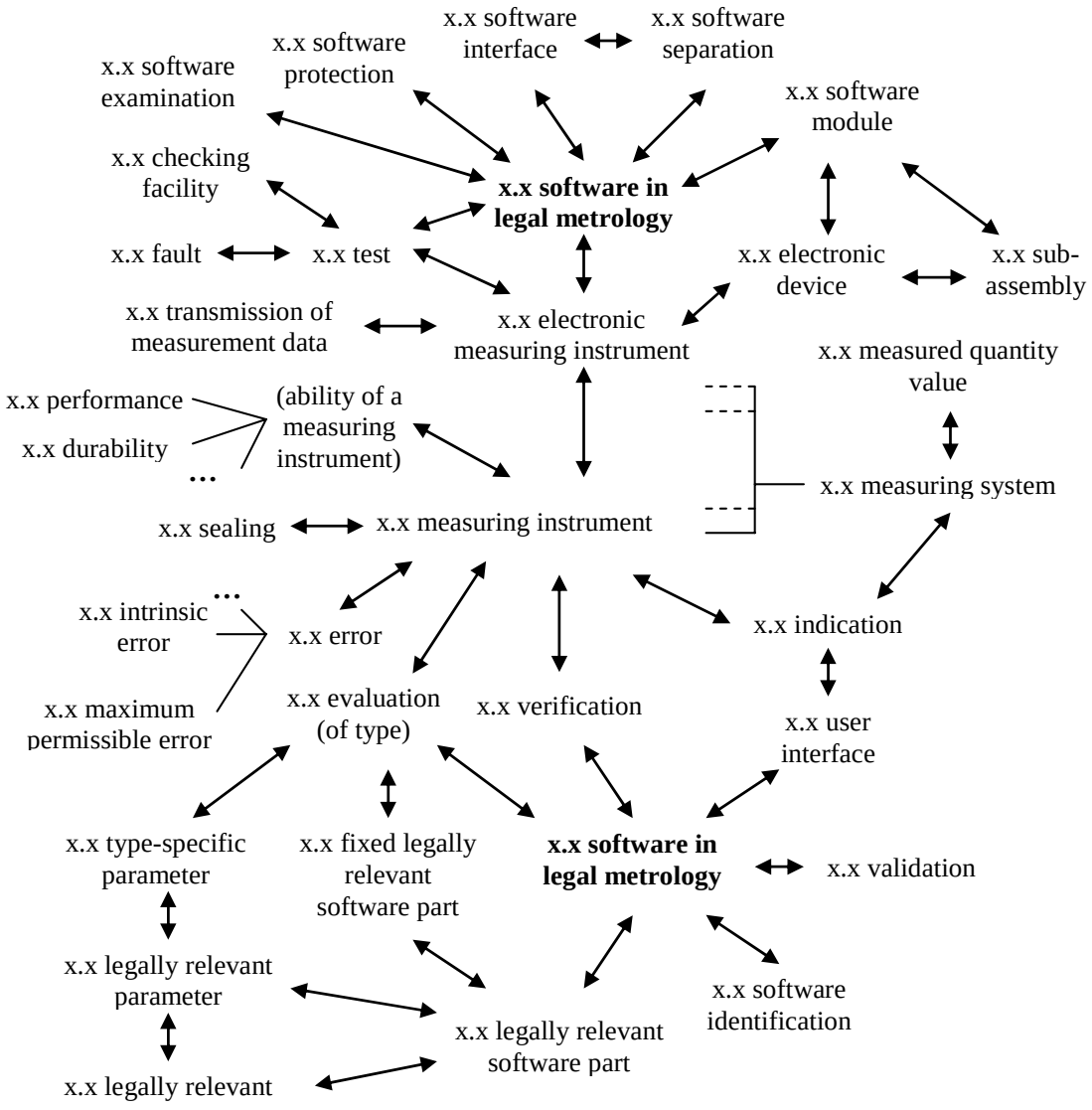

Fig 2 Proposed concept diagram for VIML around "software in legal metrology"

The considered concepts (except indicated in a Table 1) have next determinations (OIML D31):

- *software examination* is technical operation that consists of determining one or more characteristics of the software according to the specific procedure (e.g. analysis of technical documentation or running the program under controlled conditions);

- *software protection* is securing of measuring instrument software or data domain by a hardware or software implemented seal (the seal must be removed, damaged or broken to obtain access to change software);

- *software interface* is consists of program code and a dedicated data domain; it receives, filters, or transmits data between *software modules* (not necessarily legally relevant);

- *software separation* is software in measuring instruments/electronic devices/sub-assemblies can be divided into a *legally relevant part* and a legally non-relevant part (these parts communicate via a *software interface*);

- *software module* is logic entities such as programs, subroutines, libraries, and objects including their data domains that may be in relationship with other entities (the software of measuring instruments, electronic devices or sub-assemblies consists of one or more software modules);

- *software identification* is sequence of readable characters (e.g. version number, checksum) that is inextricably linked to the software or *software module* under consideration (it can be checked on an instrument whilst in use);

- *validation* is confirmation by examination and provision of objective evidence (i.e. information that can be proved true, based on facts obtained from observations, measurement, test, etc.) that the particular requirements for the specific intended use are fulfilled;

- *user interface* is interface that enables information to be interchanged between a human and the measuring instrument or its hardware or software components, e.g. switches, keyboard, mouse, display, monitor, printer, touch-screen, software window on a screen including the software that generates it;

- *legally relevant software part* is part of all *software modules* of a measuring instrument, electronic device, or sub-assembly that is legally relevant.

Concept "*legally relevant software part*" has associative relations with concepts: legally relevant (OIML D31 3.1.29); legally relevant parameter (OIML D31 3.1.30), and fixed legally relevant software part (OIML D31 3.1.24).

The considered concepts have next determinations (OIML D31):

- *legally relevant* is software/hardware/data or part of the software/hardware/data of a measuring instrument which interferes with properties regulated by legal metrology, e.g. the accuracy of the measurement or the correct functioning of the measuring instrument;

- *legally relevant parameter* is parameter of a measuring instrument, electronic device, or a sub-assembly subject to legal control;

- *fixed legally relevant software part* is part of the legally relevant software that is and remains identical in the executable code to that of the approved type.

The following types of legally relevant parameters can be distinguished: type-specific parameters and device-specific parameters. *Type-specific parameter* is legally relevant parameter with a value that depends on the type of instrument only (OIML D31 3.1.53); *device-specific parameter* is legally relevant parameter with a value that depends on the individual instrument (OIML D31 3.1.53).

Device-specific parameters comprise adjustment parameters (e.g. span adjustment or other adjustments or corrections) and configuration parameters (e.g. maximum value, minimum value, units of measurement, etc.).

Fixed legally relevant software part is responsible for monitoring the software update (loading software, authentication, integrity checking, installation and activation.

Concept "*electronic measuring instrument*" has associative relations with concepts: software in legal metrology; measurement instrument (VIM 4.1); electronic device (OIML D11 3.2); test (OIML D11 3.20), and transmission of measurement data (OIML D31 3.1.52).

Transmission of measurement data is transmission of measurement data via communication networks or other means to a distant electronic device where they are further processed and/or used for legally regulated purposes.

Concept "*electronic device*" has associative relations with concepts: electronic measuring instrument (OIML D11 3.1); software module (OIML D31 3.1.44), and sub-assembly (OIML D11 3.3).

Sealing is means intended to protect the *measuring instrument* against any unauthorized modification, readjustment, removal of parts, software, etc (OILM D31 3.1.38). It can be achieved by hardware, software or a combination of both.

For proposed concept diagram within documents and marks on legal metrology the hierarchical and non-hierarchical relations was set on the basis of analysis of International Documents and International Recommendations of the OIML, VIM, and VIML.

5. CONCLUSION

In preparing the new edition of the VIML appropriate need to develop specific concept diagram around concepts "software in legal metrology" It is necessary to improve the perception of relations of modern concepts in the field of legal metrology, which are widely used now.

6. REFERENCES

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