



# CERTIFICATION OF SOFTWARE OF MEASURING INSTRUMENTS

**IT Issues in Legal Metrology**  
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Article abstracts

In the second half of the 1980's, it became more obvious that instruments could no longer be considered merely as more or less simple pieces of electronic equipment, but that the problems were now of a different nature. Instruments could now accept a number of commands and data from interfaces, several different operating modes could be selected, key metrological parameters could be downloaded to the instrument, software updates and upgrades could also be downloaded, and measurement data could be transferred to external modules.

What possibilities exist to access "protected" data or commands through the operating system, is it possible to capture data from peripherals and sensors without using the software of the instrument, is it possible to install different, alternative software on the same hard disk (software that could use the same user interface and which could easily be confused with the approved original software) - these are questions that the type approval authorities are not yet able to answer correctly.

But it is clear that all these questions are crucial for legal metrology, whose objective is to provide confidence in measurement results which are given by instruments operating without the systematic permanent supervision of a competent third party.

If the security of information technologies is not applied to these instruments, confidence cannot be assured and all the other metrological and technical evaluations carried out by legal metrology are of very limited interest. The work of OIML TC 5/SC 2 Software is therefore crucial for the credibility and existence of legal metrology.

## Legal references

1. GOST R 8.596-2002. GSI. Metrological assurance for measuring systems. General principles. .
2. GOST R ISO/IEC 17025-2000. General requirements for the competence of testing and calibration laboratories;
3. GOST R ISO/IEC 9126-93. Information technology. Software product quality. Quality characteristics and guidelines for their application.
4. GOST R ISO/IEC 12119-2000. Information technology. Software packages. Quality requirements and testing.
5. GOST R (national standard) (draft). GSI. Requirements for software of measuring instruments (to replace MI 2891 – 2004).
6. COOMET Recommendation R/LM/10:2004 Software for measuring instruments. General technical specifications.
7. OIML Recommendation D 31: 2008. General requirements for software controlled measuring instruments.
8. WELMEC 7.1 Information Document. Software requirements on the Basis of the Measuring Instruments Directive.
9. WELMEC 7.2. Software Guide (May, 2004)
10. MI 2174-91 GSI. Certification of algorithms and data processing software during measurements. General principles.
11. MI 2517-99 GSI. Metrological certification of software for measuring instruments which measure characteristics of physical objects and fields using computer programs generating digital test signals.
12. MI 2518-99 GSI. Metrological certification of algorithms and programs which generate digital test signals.
13. MI 2891-2004. GSI. General requirements for software of measuring instruments.
14. MI 2955-2005. Standard certification method for software of measuring instruments and its procedure.
15. R 50.2.004-2000. GSI. Evaluation of characteristics of mathematical models of dependencies between physical values while solving measurement problems..

## Study references

1. Kuderyarov U.A. Certification of software for measuring instruments (study guide). – M.: FSUE «VNIIMS», 2006.
2. Kuderyarov U.A. Metrological evaluation of software (study guide). – M.: FSUE «VNIIMS», 2007.

Federal law of the Russian Federation  
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## On Uniformity of Measurements

Abstracts

### Article 9. Requirements for measuring instruments

1. In the area of federal regulation of ensuring the uniformity of measurements, only those measuring instruments of approved type can be used which have passed calibration in accordance with the articles of this Federal Law, if they also comply with obligatory requirements established by laws of the Russian Federation on uniformity of measurements, including obligatory metrological requirements for measurements, obligatory metrological and technical requirements for measuring instruments, and other obligatory requirements established by laws of the Russian Federation on technical regulation. **Included in the obligatory requirements for measuring instruments, when needed, are also requirements for their constituent parts, software and service conditions of measuring instruments.** When using measuring instruments it is necessary to observe the obligatory requirements for their service conditions.

2. The design of measuring instruments must provide for access restriction to certain parts of instruments (including software) to prevent unsanctioned adjustment or intervention which can lead to distortion of measurement results.

# Features of software for measuring instruments

- 1.** The use of software in measuring instruments (MI) should not lead to the distortion of measuring information; in other words, software may not influence metrological characteristics of MI, or this influence should be brought to a minimum with an ability to evaluate it;
- 2.** Software of MI should be protected from intentional or accidental changes to the program code, measurement information, characteristics that define the type of MI, structural and other characteristics included in software;
- 3.** Software used in each separate MI of the type should be identifiable and fully compliant with software installed in MI during the type approval tests of this MI;

# Requirements for software of MI

## 1. Requirements for documentation

**1.1** Software of MI should be accompanied with documentation which complies with relevant recommendations of GOSTs of the Unified system for program documentation (USPD). Documentation should fully and unambiguously describe the purpose, main functions, structure and other necessary characteristics of software.

## 2. Requirements for software separation and identification

**2.1** For MI used in the area of federal regulation, it is recommended to separate metrologically relevant part(s) of software at the development stage .

**2.2** After the type approval tests of the MI, the metrologically relevant software may not be changed. For each separate MI, only software identical to the approved one must be used

**2.3** To verify that the software used in MI is identical to the one present (documented) during the type approval tests of the MI, and to confirm its integrity and authenticity, software identification should be carried out. To obtain identification data, it is necessary to provide authorized bodies (organizations) with an ability to access the source code of the software's metrologically relevant parts.

### **3. Requirements for software structure**

**3.1.** Metrologically relevant software should be developed to be unsusceptible to distorting influence through user (or other) interfaces.

**3.2** Data exchange between metrologically relevant and irrelevant parts of software should pass through a protected interface which embraces the interactions between these parts, as well as data passage.

### **4. Requirements for the software influence on the metrological characteristics of MI**

**4.1** Software influence on metrological characteristics of MI must be evaluated.

### **5. Requirements for protection of software and data**

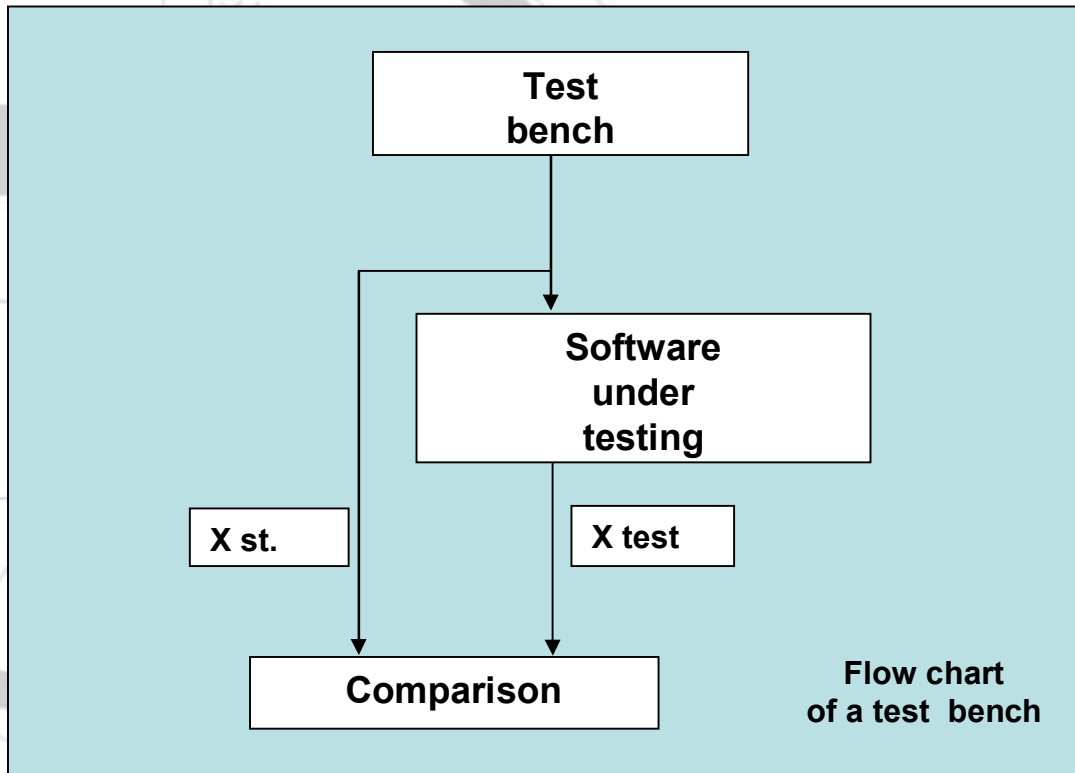
**5.1** Software of MI must include means of detection, identification and/or elimination of errors (functional defects) and distortions which violate software and data integrity.

**5.2** Metrologically relevant software of MI must be protected from accidental or unintentional changes.

**5.3** Metrologically relevant software of MI and data must be protected from unsanctioned modifications.

### **6. Special requirements for software**

**6.1** Software of MI should comply with the requirements of this standard if it employs such information technologies as downloading, long-term storage, transfer and separation.



### Test bench configuration:



- special form signal generator «SFG-2000/2100»



- multifunctional calibrator «Martel 3001»





- oscilloscope «TDS-2024B»



- resistance box «2090  
PROGRAMMABLE RESISTANCE  
BOX»

### **Abstract from GOST R 8.596**

«Programs using computing components must be metrologically certified in accordance with MI 2174 if they influence the measurement results and errors and if they are not used for experimental calibration of measurement channels during tests of measuring systems (MS) or a complex component or if there is a way to modify these programs during the use of MS. Programs must be protected from unsanctioned access.

In any case, technical documentation for the MS or complex component presented for type approval tests should contain a description of the algorithm used to process measurement information, the identification of the program (version number, size, etc.). If the program is modified by the developer or during its use in the part involved in processing measurement information, a new version of the program must be presented for metrological certification to the organization that tested the MS (complex component) for its type approval».

**GOST R 8.                      – 2009**  
**NATIONAL STANDARD OF THE RUSSIAN FEDERATION**

**State system for ensuring the uniformity of measurements**  
**REQUIREMENTS FOR SOFTWARE**  
**OF MEASURING INSTRUMENTS**  
**Main principles.**

Effective date « \_\_\_\_ » \_\_\_\_\_ 2009 г.

**1.SCOPE OF APPLICATION**

This standard establishes requirements for software of measuring instruments (MI), and is caused by a need to evaluate software influence on the metrological characteristics of MI and to protect processed information (including measurement information) from unintentional or intentional modifications.

The standard applies to:

- software of measuring instruments, including measuring and information-measuring systems;
- software of automated systems which function with the use of measuring instruments or components of measuring systems;
- software of controllers and computing units which are not part of measuring systems, as well as technical systems and devices with measuring functions which process and present measurement information.