

19 MEASURING INSTRUMENTS INVISIBLY CONNECTED

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The purpose of this presentation is to outline the possible future and based on examples, open discussions on some of the possible future problems metrological authorities may come across.

What I have sketched here is a conventional measurement system which may be found in large refineries and chemical plants. There are lot of sensors which are mounted for example in pipelines, and yellow blocks which are flow computers or indicating devices and are connected to sensors for volume measurement which is the primary measurement, and to temperature, pressure, density, etc. sensors to calculate the volume under base conditions or the mass. All the flow computers are connected to printers where tickets are produced to document the transactions. Generally all these plants have automated systems and data-collecting systems and at this moment legal metrology has nothing to do with them.

A few typical characteristics of such a conventional system are the fact that there are dedicated components: volume sensors, flow computers, printers, etc. which have very well described tasks within certain order and which are well known. Because of that it is possible to have a very clear distinction between legal and non legal parts. Also such installation has mechanical seals for inspection officers who are required to be on site to perform their inspection. Proof of the transaction is usually in the form of a printed ticket. Measurement operations require human intervention. All dedicated components are connected to one another using cabling. Cabling may be as expensive as the instrument itself!

Let us now look at a few characteristics which may form the bases for measurement systems in the future.

Power will be locally generated by solar or wind power. This will decrease the need for power supply cabling. Cables for communication will no longer be needed because wireless networks will be installed everywhere.

The devices will be less dedicated that in our conventional systems. PCs or PC systems which can perform many tasks will be used for legal and non-legal activities and it will be difficult to make a distinction between legal and non-legal software.

Proof of the transaction will be available only electronically, via e-mail or SMS-message on a mobile phone.

In the future, the measurement system will comprise a PC network, with a lot of different tasks in it, including Weights and Measures control software, Weights and Measures control settings, Weights and Measures control log-files, to show human intervention or alteration of software settings. Both Weights and Measures Office and the customer are not physically connected to the PC system nor are the various sensors. Communication with both the customer and Weights and Measures authorities is wireless and electronic. This opens the way for Weights and Measures inspectors to perform inspection from a distance: they can call in to the PC system, check if some

settings haven't been altered, if electronic seals are still intact. With on-line reference equipment it will even be possible to perform a calibration-like test from a distance.

Is this science fiction or not? In 1966, the television series Star Trek started with gadgets and technologies invented for that series which were intended to date from around 2100-2200. many of the possibilities of computers thought of then are already now a reality. The communicators from Star Trek strongly resemble nowadays mobile phones.

I think that the future I sketch is not science fiction because here are some developments that are taking place at this moment.

Batteries are getting better and better. Wireless communication is also improving and for new office buildings it is cheaper nowadays to install a wireless network than a cable network. Also most electronic devices are now decreasing in their power consumption, with the possibility to combine data cables and power cables. The performance of solar cells is getting far better.

What could be the problem for us as legal metrology people?

When transmitted through wireless networks which operate on digital communication, measurement signals are, by definition, delayed. The instrument receives it signal, made some calculation to determine how many liters there were and then sends it at a later stage in a sort of a cycle towards the central PC system.

Software sealing is not yet fully harmonized.

There is no clear distinction between legal and non-legal software.

Because of the development of multi-functional devices, huge amount of software may be contained and it would be helpful to know which small part performs the legal operation.

How will we handle the electronic proof of the transaction, via email or SMS message on mobile phone?

Apart from the first analogue to digital conversion inside the instrument, all the measurement characteristics will be determined by software. The performance of the measuring instrument, if you can still define it, will be far less dependant of hardware than it uses to be and you will have a sort of approval document with requirements such as:

- such software,
- running on a PC equipped with Windows 95 Operating System or higher,
- at least 128 MB of internal memory,

and you may guarantee that it will operate.

That is the way to go with the increasing effect of software rather than hardware.

Why would it be a problem for us?

All what we wish as approval authorities or certification people is to offer some form of guaranty about the accuracy of the measurements and the data processing after the approval of the transaction. We need some confidence in the measurement itself and in the registration of the transaction.

We do have some technological features which will help us.

The instruments can be identified using electronic addresses so you know which kind of device you are looking for.

Software modules can still be identified individually and each module may have a check-sum protection so that you can check that it is still intact and that it is the same module that you checked one month ago.

Log- and intervention-files where measurement data are stored or where is stored a proof that somebody has altered some settings are also already there.

By their nature, digital communications may always be checked.

So we have some technological possibilities to help us.

Weights and Measures problems can be solved by technological means but we will need to invest in knowledge of these new technologies and we need international harmonization on, for example, software sealing, to come to a solution for these problems.

Discussion

Comment: In fact the instruments mentioned by Mr. Volmer already exist: there are in certain countries taximeters of which the tariff may change at a distance by radio emission; there are also instruments of which the software may be reloaded at a distance. In addition to the questions evoked in the presentation, it should be noted that, in addition to invisible connections, hidden connections may also exist and may facilitate frauds: legal metrology should be able to detect them.

Reaction: Yes, this is a crucial problem. However, log-files and protections of software should make it possible to check the integrity of software.

Comment: Can you clarify your vision of multifunction non-dedicated systems?

Reaction: This already exists for example in self-service petrol stations where the transaction is finalized in a terminal with a sort of PC which delivers the ticket concerning the purchase of fuel but at the same time delivers the invoice for what has been purchased in the supermarket associated with the petrol station. So where is the distinction between legal and non legal parts of the software operating the PC?

Comment: The transfer of measurement data should create no major problem provided that legal metrology authorities take account of the consumers'

needs concerning the securing of these data. However, it should not be forgotten that, if these data include addresses, invoices, etc. there are rules aimed at consumer protection concerning the confidentiality of such information. These rules go beyond the responsibility of legal metrology and therefore the matter of data securing should not be dealt only by legal metrology authorities and manufacturers.

Reaction: Of course matters of confidentiality will have to be seriously considered by relevant authorities.