MODERNIZED UNIVERSAL MEASURING DEVICE FOR MECHANIC

MODERNIZĒTS UNIVERSĀLS MĒRĪŠANAS LĪDZEKLIS SCB MEHĀNIĶIEM

V. Karev, M. Mezitis

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Annotation

This article is about approach for universal measuring device design. The universal measuring unit is necessary for mechanics for the measuring in automatic and remote objects on the railway. The measuring device modernizing is necessary for fast and safety electrical parameters measuring in automatic system elements. The article is evaluated approach for parameters measurement using data acquisition concept.
The article is considered real condition in measurement for relay automatic elements. The article is consider safe approach realization for measurement processing in hardware and modernized measuring device internal structure.

Introduction

The accepted technology in the railway automatic complex servicing and failure detection suppose the technical state of elements notification after electrical parameters measurement. The appropriate level of service is not possible without unfailing measurements. The railway automatic servicing specificity is expected any special measurement. We have in this moment many different devices for measuring. As well, in servicing time is possible measuring device failure. In this article is analyzed measuring devices failure origin and what is necessary for devices safe from failure.

Measured rate in relay automatic devices

In the relay automatic devices are measured physical, electrical, time rate for parameters. Commonly used measurement and this precision next.
Physical rate:

- Temperature ± 2%
- Resistance ± 1%

Electrical rate:

- Direct current ± 1.5%
- Direct current voltage ± 1.5%
- Alternate current ± 2.5%
- Alternate current voltage ± 2.5%

Time rate:

- Frequency ± 0.5%
- Impulse or interval duration ± 0.5%

For this rate measurements use many deferent units. In Latvian Railway much relay automatic devices and measurement equipment are manufactured in Russia. This equipment is not qualitative and is not from low cost segment.
For the electrical rate use special designed Ц-type combined unit (fig.1). This unit is basic for railway automatic service mechanics.

With this unit is following problems:

- The precision is low
- The protection from failure is low
- Overall dimensions and weight is high
- The measuring safety is low
- The human engineering is not accepted
- The special measurements is not included

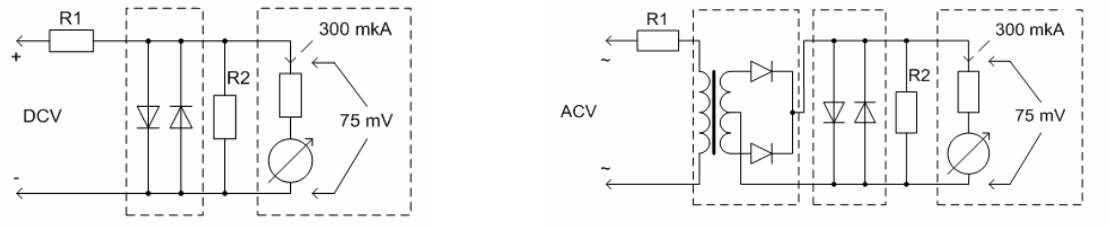

Fig.1. Ц type combined unit design

The digital multimeter is possible use for the application in relay automatic parameters, but they too some problems:

- The majority of digital multimeters is for commercial use
- The protection from failure is low
- The human engineering is not accepted
- The reparability is low
- The price is not low
- The special measurements is not included

Measurement failure

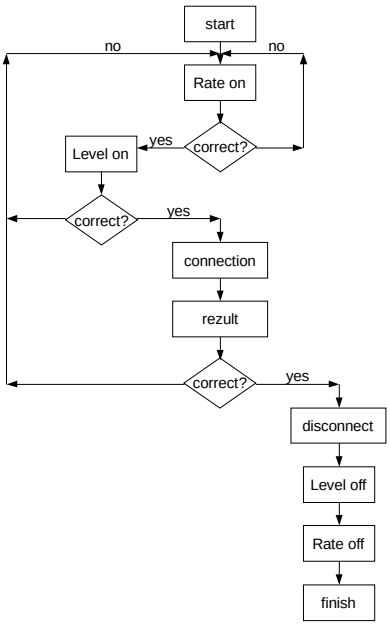

Fig. 2. Measuring approach for mechanics

The failure for measurement device is this state, when is not possible receive true rate from tested circuit. This failure is evaluate from the device construction defects or from the user movement.

The user factor in failure is with high probably. The measuring approach is depended from measurement device design. The combined unit or digital multimeter use in this view is similar (fig.2). The failure is most probably when rate or level is not correct and connection on circuit enabled. The checking for correct rate and level is not time saving. The result from this user mishandling can bring device hardware failure. The hardware failure enabled with mishandling and is depended from user.

Modernized universal measuring device

The approach for the modernized measurement unit design based or following summary: "the measurement device is subsystem from automatic system and include this attribute" (fig. 3). From this is necessary, the base of device is the industrial electronic component, with minimum user action and full information displaying, specials are included. This design way can solve problems with measuring unit for relay automatic. It is an information analyzer and displayer.

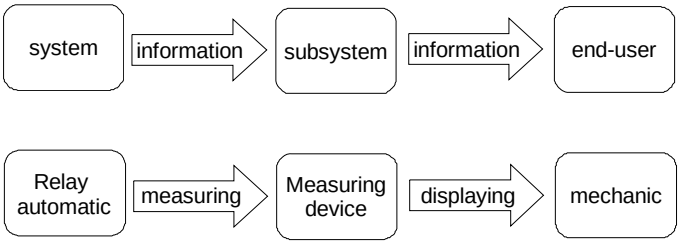

Fig. 3. Design approach term

The user factor may be lost if is changed accepted measuring approach to safe (fig.4). The approach is safe if realize human engineering terms in device. This approach is very helpful if user is not enough qualified.

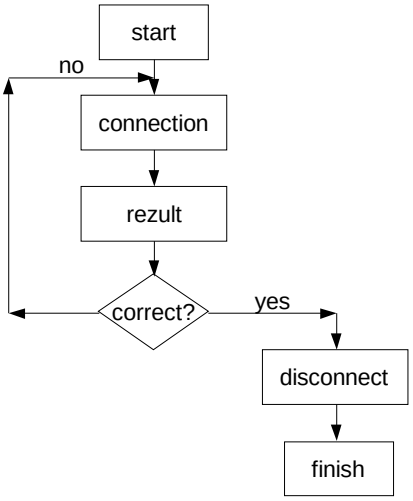

Fig. 4**.** Safety measuring approach for mechanics

Universal modernized measurement device

The figure 4 is showed functional realization for modernized device.

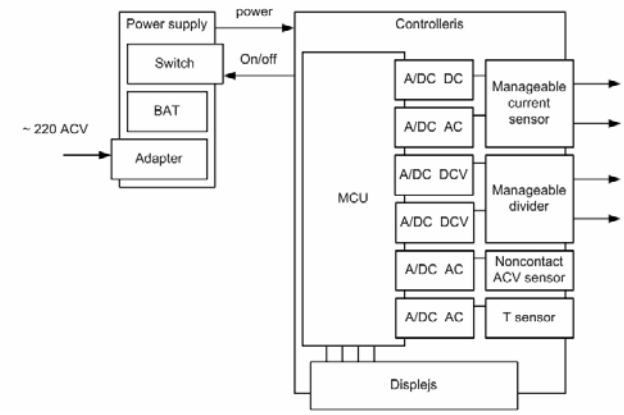

Fig. 5. The functional circuit for universal measurement device

As showed in functional circuit, the device is a subsystem with own UPS, MCU, data channel and user interface.

Using example

Self-diagnostic (fig. 5)

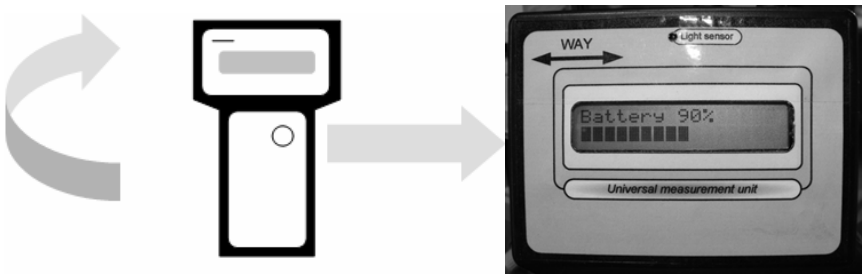

Fig. 6. Self-diagnostic

Full information displaying (fig. 6, fig. 7)

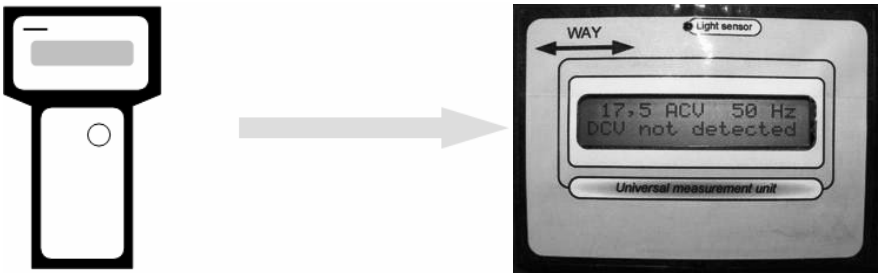

Fig. 7. The result from VAC measuring

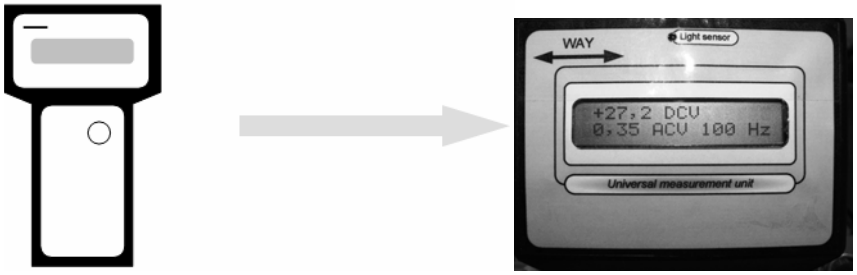

Fig. 8. The result from VDC measuring in accumulator battery

Special measurement in railway track circuit via non-contact sensor (fig. 8)

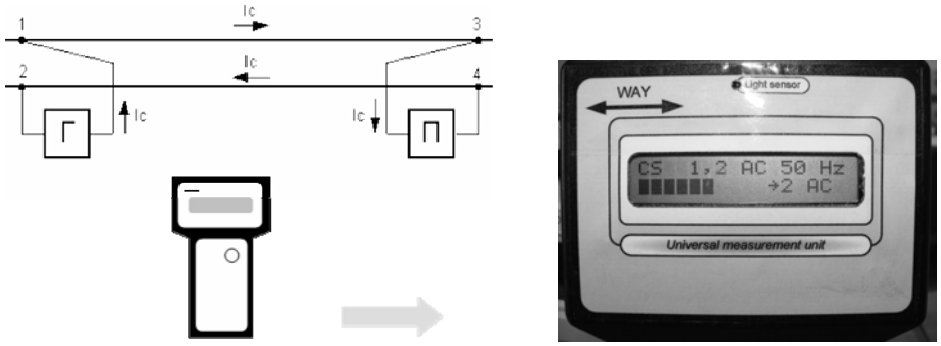

Fig. 9. Measuring result to railway track circuit

Summary

The approach can allowed safe measurement for electrical parameters in existing relay system. The displaying with full information is accepted human engineering terms. This design way solve problem for Ц-type measuring unit replacement. Also, the user factor in the failure is minimized or lost.
The positive effect from this universal modernized device using is high level measuring support in automatic servicing time.

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Vladimir Karev, doctoral course 1 year, holder of a master's degree, Riga Technical University, Institute of Railway Transport. +371 67232288, vladimirs.karevs@ldz.lv

Mareks Mezitis, Dr.sc.Ing. assoc.professor, Riga Technical University, Institute of Railway Transport, +371 67089682, marek@dzti.edu.lv

KarevsV., Mezitis M. Modernizēts universāls mērīšanas līdzeklis SCB mehāniķiem
Darbā tika apskatīta iespēja universāla mērīšanas instrumenta izveidošanai. Paradīts ka pašlaik izmantojamiem Ц-tipa mērīšanas līdzekļiem ir sekojuši trūkumi: zema precizitāte, zema aizsardzība pret bojājumiem, zems mērījumu drošums, lieli gabarīti un svars, zems ergonomiskums, specialo mērījumu zema precizitāte un nepilnība, augsta izmaksa. Konstatēts, ka citam mērīšanas līdzeklim (multimetri) arī ir savi trūkumi: precizitātes pārpilnība, neatbilstība ekspluatācijas apstākļiem, zema aizsardzība pret bojājumiem, specialo mērījumu nepilnība, daļēja remontējamība, izmantošanas sarežģītība. Tika piedāvāts modernizēts universāls mērīšanas līdzeklis, kas pēc būtības ir kompakta (rokas pārnesāma) datu savākšanas subsistēma. Tādā pieejā ir iespējams realizēt automatizētu un drošu mērījumu veikšanas algoritmu. Operatora rīcības bojājumi ir izslēgti. Subsistēmas koncepcijas izmantošana ļauj paaugstināt mērījumus drošumu un pilnību. Industriālo elementu bāzes izmantošana noņem ierobežojumus pēc ekspluatācijas apstākļiem. Pilnas informācijas atspoguļošana palielina mērījumu informatīvumu un efektīvumu.

Karevs V., Mezitis M. Modernized universal measuring device for mechanic
In work possibility of creation of the universal measuring device is considered. It is shown that devices used TS-type, have following problems: the precision is low; the protection from failure is low; overall dimensions and weight is high; the measuring safety is low; the human engineering is not accepted; the special measurements is not included; It is analysed that other type of devices - digital devices (multimeters) also have lacks: the majority of digital multimeters is for commercial use; the protection from failure is low; the human engineering is not accepted; the reparability is low; the price is not low; the special measurements is not included.
The modernised measuring means which represents compact (handheld) data gathering subsystem is offered. It is shown that the approach allow realized safe and automatic measuring algorithm. The subsystem conception is exclude measurement devices failure from the mechanic movements. The industrial elementary base using is removed limitations for service conditions. The measurement self-descriptiveness and the efficiency grow up via the full information displaying for electrical parameters.

Карев В., Мезитис М. Модернизированное универсальное измерительное средство механика *СЦБ*
В работе рассматривается возможность создания универсального измерительного прибора. Показано, что используемые Ц-типа приборы, предназначеные для проведения измерений на устройствах СЦБ имеют следующие недостатки: низкая точность, недостаточная защита от повреждений, большие габариты и вес, невысокая надёжность измерений, пониженная эргономичность, проведение специальных измерений возможно только частично и с недостаточной точностью, высокая стоимость. Проанализировано, что другой тип приборов - цифровые приборы (мультиметры) также имеют недостатки: избыточная точность, несоответствие условиям эксплуатации, недостаточная защита от повреждений, проведение специальных измерений возможно только частично, частичная ремонтопригодность, сложность использования. Предлагается модернизированное измерительное средство, которое представляет собой компактную (handheld) субсистему сбора данных. Показано, что данный подход позволяет реализовать автоматизированный и безопасный алгоритм проведения измерений, то есть исключается повреждения, вызванные действиями оператора. Использование концепции субсистемы повышает надёжность измерений. Использование элементной базы индустриального назначения снимает ограничение на условия эксплуатации. Отображение полной информации о параметре увеличивает информативность и эффективность измерения.