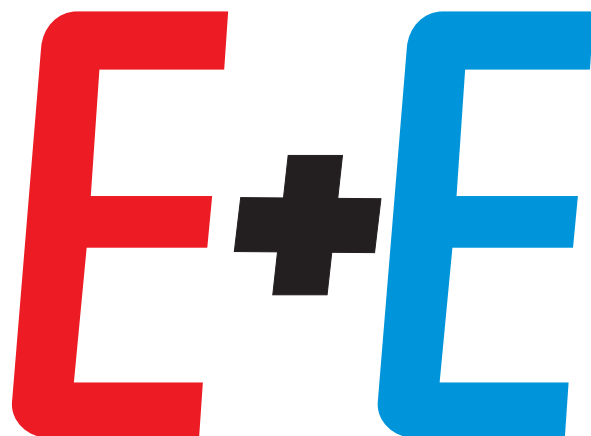


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И ЕЛЕКТРОНИКА

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## **Traffic parameters research of a centralized VoD system**

**Jordan I. Nenkov, Lidia T. Jordanova**

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*Video on demand (VoD) is one of the most popular services provided by the cable TV networks. Ensuring quality VoD service is associated with increased demands on network architecture in terms of necessary transmission bit rate required for transferring of video information to the subscribers. In this article, the results from analysis of the influence of the main traffic parameters over the necessary bit rate in different network areas of a centralized VoD system are shown. Based on statistical evaluation of the collected information some distribution laws and their random parameters involved in the system traffic model are defined. The main field of research are average movie duration, daily traffic and the deviation limits of the following parameters: penetration ratio of the VoD service in a cluster region, average number of attempts for a normal and interactive movie request from a household and average interactive request time of a normal and interactive request for a movie.*

**Изследване на трафичните параметри на VoD система от централизиран тип (Йордан И. Ненков, Лидия Т. Йорданова).** Видеото по заявка (VoD) е една от най-популярните услуги, предоставяни по мрежите за кабелна телевизия. Осигуряването на качествена VoD услуга е свързано с повишени изисквания към мрежовата архитектура по отношение на скоростта, необходима за пренасяне на видеоинформацията до абонатите. В тази работа са представени резултати от изследване на влиянието на основни трафични параметри върху необходимата обслужваща скорост в различните участъци на централизирана VoD система. На базата на статистическа обработка на събрана информация са определени законите на разпределение и техните параметри на няколко случайни величини, включени в трафичния модел на системата. Обекти на изследването са средната филмова продължителност, денонощният трафик и границите на изменение на следните параметри: степен на проникване на VoD услугата в клъстерната област, среден брой опити за нормална и интерактивна заявка на филм от домакинство и средно време за изпълнение на нормална и интерактивна заявка за филм.

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### **Introduction**

Ensuring correct operation of the VoD system for significantly traffic load at different times of the day and year is an important factor that should be taken into account by the cable operators.

When designing the VoD systems aims to achieve optimal distribution of video traffic on the network to ensure maximum efficiency and minimum cost.

There are three basic architectures for building VoD systems on cable television networks - centralized, distributed and hybrid. For a network with a small number of users of VoD service is most suitable centralized architecture, the main advantages over the other two architectures are low cost and easy implementation. Distributed VoD and hybrid architectures are preferred in networks with large number of users, since their video traffic through the central grid is minimized.

Object of study in this work is centralized VoD system. The aim is to establish a model for determining the traffic in different network areas and to analyze the influence of some key parameters of the system on the required service transmission bit rate in these areas.

### **Centralized VoD system architecture**

In centralized VoD system architecture that is chosen to be of the Fiber to the Home (FTTH) type and is shown in Fig. 1 routers are used to direct video information to subscribers [1]. Central VoD router is located at the Head-End and directs requested streams to the cluster router in distribution hub. The cluster router forwards video streams to optical line terminal, which in turn shall forward video content to optical nodes located in close proximity to users. Each optical node can serve a maximum number of 125 households.

# Conductivity cell model for „PSPICE” environment at a frequency method for contact measurement of liquids conductivity

Nikolay B. Nedev

*Modern automated systems allow for the development of various scheme decisions in conductivity, eliminating the need to carry out lengthy and costly experiments in the early stage of development using a conductivity cell model capable of working in "PSPICE" environment and supporting current source with a rectangular form and zero mean value for the conversion of the conductivity of liquids. Presented are known in the literature models of conductivity cells. Experimental studies were carried out with conductivity cell immersed in standard solution of potassium chloride, and the results of the measured voltage were processed and presented in graphical form. Proposed is a conductivity cell model capable of working in a "PSPICE" environment. Presented were also simulation results of the proposed model of an electrochemical conductivity cell and made comparison of the metrological characteristics of the experimental and simulation data using graphs and tables.*

*Модел на кондуктометрична клетка за „PSPICE” среда при честотен метод за контактно измерване на проводимостта на течности (Николай Б. Недев). Съвременните автоматизирани системи дават възможност за разработка на различни схемни решения в кондуктометрията, премахвайки необходимостта от провеждането на бавните и скъпоструващи експерименти в началния етап от разработката, използвайки модел на кондуктометричната клетка пригоден за работа в „PSPICE” среда и опорен източник на ток с правоъгълна форма и нулева средна стойност, за преобразуване на проводимостта на течности. Представени са известни в литературата модели на кондуктометрични клетки. Проведени са експериментални изследвания с кондуктометричната клетка потопена в еталонен разтвор на калиев хлорид, резултатите от измереното напрежение са обработени и представени в графичен вид. Предложен е модел на кондуктометрична клетка пригоден за работа в „PSPICE” среда. Представени са симулационни резултати на предложения модел на електрохимична кондуктометрична клетка и е направено съпоставяне на метрологичните характеристики на експерименталните и симулационните данни, с помощта на графики и таблици.*

## I. Introduction

The importance of using standardized solutions, tempering of an experiment, correction of experimental data towards ambient temperature and observing the conditions for safe operation when working with chemicals, makes the development of means for measuring the conductivity of aqueous solutions, as well as their experimental study a complex and costly operation. Therefore, appropriate is the use of modern automated development tools in electronics, in particular, the widespread programming environment "PSPICE".

One of the main problems with using "PSPICE" in conductivity is related to the application of an appropriate model of conductivity cell. The peculiarity

of this model is that both the configuration and the values of model parameters vary depending on construction, materials used, the operating mode of the cell and solution concentration.

In the direction of solving these problems is the current work aimed at developing of a model of conductivity cell operating in the chain of frequency-modulated source of supporting current [1], [3].

## II. Analysis

There exist models of electrochemical conductivity cell reflecting the flow of electrical and chemical reactions in the measurement of conductivity for different methods, as well as depending on the supporting signal, the type of the cell, solution, etc.

# Multi-channel electronic device for temperature monitoring

Tsanko V. Karadzhov, Ivelina S. Balabanova, Miroslav S. Slavov

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*Temperature monitoring devices have a wide range of applications both in daily round of routines and industrial activities. This necessitates the development of devices with greater scope of functional features. A new type of related electronic device has been developed whose design incorporates a microprocessor system for measuring four temperature ranges by using 8-bit microcontroller PIC18F452. The device employs the principle of temperature-to-voltage conversion and data output is displayed on a LCD alpha-numeric display.*

*Многоканален електронен уред за измерване на температура (Цанко В. Караджов, Ивелина С. Балабанова, Мирослав С. Славов). Схемите и уредите за измерване на температура намират широко приложение в ежедневието на човека и съвременната промишленост. Това налага да се проектират и разработват такива уреди с по-големи функционални възможности. Разработен е електронен уред с микропроцесорна система за измерване на четири температури като е използван 8 битов микроконтролер PIC18F452. Разработеният уред работи на принципа на преобразуване на температурата в напрежение. Информацията се изобразява на двуредов течнокристален буквеноцифров дисплей.*

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## Introduction

Temperature is quantity which characterizes the level of heat accumulated by the objects and is determined by the internal kinetic energy of molecules' chaotic movement. The need to have temperature measured has been present ever since ancient times. Temperature as such cannot be measured directly; its measurement is usually done by comparing more than one heated object whereby certain physical phenomenon, which is dependent on temperature, is used as reference for comparison. Most thermometers make use of the property of bodies to expand with the rise of temperature.

Very often requirements for specific ambience demand that certain temperature value be kept in particular bulk of space. These devices are thermal chambers combined with temperature sensor and heater. Sometimes a single sensor cannot provide uniform temperature throughout the entire chamber which in turn necessitates temperature measurement and monitoring at more than one point inside the chamber. For this purpose there has been developed a multi-channel electronic device incorporating sensor LM35 for measuring four different temperatures.

## Principle circuit diagram

Different sections of the text must be formatted as described below.

It is shown in fig. 1.

Sensors of the type LM35 are precise temperature sensors in which output voltage is in linear dependence on temperature. Their range of measuring is:

LM35, LM35A	from -55°C to +150°C
LM35A, LM35CA	from -40°C to +110°C
LM35D	from 0°C to +100°C

Output voltage changes by 10 mV/°C.

$$(1) \quad U_t = q \cdot \theta, \text{ V}$$

$$q = 0,01 \text{ V}/^\circ\text{C}$$

Voltage from sensors' outputs is transferred to operational amplifiers LM358 with coefficient of amplification

$$(2) \quad A = 1 + \frac{R_2}{R_1} = 5$$

Thus it is possible to utilize the entire measuring range of the analogue-digital converter of the controller.

$$(3) \quad U_{ov} = 5q \cdot \theta, \text{ V}$$

Device operation is effected by 8-bit microcontroller PIC18F452 which features a 10-bit analog-digital converter. This controller has sufficient number of I/O ports and enough memory capacity to place the control program in it.

# Experimental evaluation of energy efficiency with LONWORKS network application in Building management systems

Todor Ionkov, Hristo Stojanov, Evtim Ionchev

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*A Control strategy, based on a variable pitch control, is designed. The strategy includes two different control structures and switching between the structures dependently on the operating mode. A hardware and software implementation of the control of the intake air flow in building air conditioning systems is proposed. The system is based on LONWORKS network and supervisor level includes a graphical interface, alarm processing, chronological record of the trend-data, log-diary of the system operations, the right to controlled access and data protection. The quality of the system is demonstrated in real experiments in two work modes: normal work mode of the system - the behaviour of regulators is indicated during start-up and fixed/established mode and mode during disruptive external influence - after establishing the system in normal mode an additional heat load is inserted through the fan convectors.*

*Експериментална установка за енергийна ефективност базирана на LONWORKS комуникационна мрежа в системите за сградна автоматизация (Тодор Йонков, Христо Стоянов, Евтим Йончев). Изградена е управляваща логика на базата на регулатор с променлива стъпка. Стратегията обхваща две различни управляващи структури, като превключването по между им е в зависимост от режима на работа. Предложена е хардуерна и софтуерна реализация на управлението на входящия въздушен поток при системите за сградна климатизация. Системата е изградена чрез LONWORKS комуникационна мрежа и супервайзорно ниво, съдържащо графичен работен интерфейс, обработка на аларми, хронологичен запис на тренд-данни, дневник на системните операции, право на контролиран достъп и защита на данните. Експерименталното изследване на системата е направено при два режима на работа: нормална работа на системата – показано е поведението на регулаторите при преходен и установен режим и режим със смущаващо външно въздействие – след установяване на системата при нормален режим на работа се прилага допълнителен топлинен товар чрез вентилаторни конвектори.*

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## **Description of the system controlling of experimental settings in terms of control theory.**

The block diagram of the experimental settings is shown in Fig.1 and includes four interrelated control subsystems:

The subsystem for total air processing in air-conditioned facilities consists of the following components:

Rotary recuperator - by controlling its rotation speed, its productivity is controlled (by an integrated converter - 0-10V control signal), Heating coil – by controlling its flow passing through the heating coil, its productivity is controlled (by a three-way valve - 0-10V control signal), Cooling coil - by controlling its flow passing through the cooling coil, its productivity is controlled (by a three-way valve - 0-10V control signal), Fan –by controlling the fan rotation speed , the speed (flow) of the air supplying the facilities is controlled (by a frequency converter - 0-10V control

signal).

The subsystem for generation and distribution of liquid coolant consists of the following components:

Electric boiler – The heat agent temperature is controlled, Three-way valve for the heating coil of the air handling unit – the heat agent flow is controlled, Circulation pump - maintains a constant flow in the system of heat agent distribution, Three-way valve for the heating coil of the fan coil convectors - the heat agent flow is controlled.

The subsystem for generation and distribution of liquid coolant consists of following components: Water cooling heat pump unit (Chiller) - the temperature of the coolant is controlled, Three-way valve for the cooling coil of the air handling unit - the coolant flow is controlled, Circulation pump – maintains a constant flow in the system for coolant distribution, Three-way valve for the cooling coil of the fan coil convectors - the coolant flow is controlled.

## **Contact properties of aluminium alloy bolted busbar joints with longitudinal slots**

**Raina Tzeneva**

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*Various cases of high power bolted busbar joints (straight, angle and T-type) are investigated. The busbars are made of aluminium alloy T6101- T61 and are shaped by one or three longitudinal slots in order to increase the real contact area and improve the reliability of performance. Finite element (FE) models are generated to analyze the contact pressure and penetration of the contacting busbars. More than five cases of slotted (classic design) and unslotted (new design) busbars are discussed and compared. The new designs include cases of one, two and three longitudinal slots in the busbars. A certain raise in the contact pressure  $P$  and the contact penetration  $\mu$  is observed within the busbar interface in the new designs. Additionally, copper and aluminium joints with the same characteristics are compared. Detailed tables and illustrations are provided to clarify the explanations.*

***Контактни свойства на болтови шинни съединения с надлъжни прорези от алуминиева сплав (Райна Т. Ценева).** Изследвани са различни модели на болтови шинни съединения (насрецини, ъглови и от T-тип). Шините са изработени от алуминиевата сплав T6101- T61 и в тях има оформени един или три надлъжни прореза с цел да се увеличи реалната контактна повърхност и да се подобри надеждността им при работа. Създадени са модели по метода с крайни елементи за да се анализира контактното налягане и контактното проникване между контактуващите шини. Изследвани са и са сравнени повече от пет случая на съединения с прорези (нов дизайн) и без прорези (класически дизайн). Новият дизайн включва случаи с един, два или три надлъжни прореза в шините. Установено е значително увеличение на контактното налягане и контактното проникване в контактната зона при новия дизайн. Допълнително са сравнени тези характеристики при медни съединения и такива от алуминиевата сплав. Детайлни таблици и илюстрации изясняват изложението.*

---

### **Introduction**

It is well known that bolted joints are characterized as packed in, efficient and reliable and could be easily adopted for connecting copper and aluminium busbar conductors into power joints. However, the contact pressure of bolted joints is distributed in a slightly uneven manner in contrast to clamped plate joints.

Another recognized certainty is that connection design, material properties and environmental influence could be outlined as the primary factors affecting the power joint performance reliability. Numerous literature sources may be cited in support of this and some of them, [1] and [2], have even analyzed a variety of factors to evaluate the performance and the degradation mechanisms of power joints.

### **Theoretical background**

In practice, there is no such a concept as a perfectly smooth surface. All surfaces have imperfections

and when speaking of metallic surfaces in contact, it is these imperfections that interrupt the smoothness and lead to the formation of localized metallic contacts, known as  $\alpha$ -spots. These spots act like cold welds that are the only current conducting regions of the entire joint and the higher the contact force, the more and the larger the  $\alpha$ -spots. Integrating these spots, it is possible to get notion of the dimensions or the real contact area.

The overall dimensions of the contacting parts help determine the apparent contact area, but the problem is that the real contact area, also known as the conducting area, is quite small, usually less than 1% of the apparent contact area.

So, it is obvious that a sufficiently large real area of the contact is a predominant requirement for good connector performance.

Various attempts have been made in direction of increasing the real contact area. One example is the

## **Best practices in cloud computing security**

**Anatoly T. Peshev**

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*This paper (1) outlines security issues and considerations in cloud computing and (2) provides an overview of the best practices in cloud computing security. The paper presents scientific research within the framework of the currently running projects in R&D Laboratory on eLearning Technologies and Standards at the Technical University – Sofia. Cloud computing has led to a shift in how people think about IT systems architecture. Many organizations today are either implementing cloud-based solutions, or evaluating which cloud-based solutions they will be implementing in the future. This shift in architecture from an enterprise-based traditional server-based system to a cloud-based system will have associated costs of entry and risks, but it can result in enormous benefits in savings and in IT and business agility. While there is a pressure on organizations to consider moving to the cloud-based services, security issues continue to be one of the largest concerns that organizations have about this move. Many organizations will need to apply best practice security standards that are far in excess of those that they currently implement with their on-premise systems. Data storage in the cloud also requires particular consideration. The regulatory environment within which many industries operate may generate particular issues with cloud-based data storage, such as legislation on data access.*

***Добри практики за изграждане на защита при изчисления в облак (Анатоли Пешев).** В тази статия се (1) прави преглед на основните проблеми при изграждане на защитните механизми при изчисленията в облак и се (2) описват добрите практики при реализацията на тези механизми. Статията описва извършените научни дейности в рамките на научно-изследователските проекти в лабораторията Технологии и стандарти за еОбучение към Технически университет – София. Концепцията за изчисления в облак доведе до изцяло ново разбиране за архитектурата на информационните системи. Много организации вече са изградили инфраструктура за изчисления в облак или правят проучвания как да ги внедрят в близко бъдеще. Този преход от системи, базирани на сървъри в рамките на организацията към системи, реализирани в облак е съпроводен от съответните разходи и рискове, но може да доведе до значително намаление на разходите в краткосрочен и дългосрочен план. Един от основните рискове е осигуряване на високата защита на тази инфраструктура. Изискванията към защитата са значително по-големи в сравнение с класическите архитектури, като трябва да се определи и къде ще се съхраняват данните. Регулаторните органи в много индустрии имат и специфични изисквания за съхранението на лични данни.*

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Security is one of the major concerns in cloud computing. To mitigate security risks while still gaining benefits from cloud computing, organizations can choose to focus on on-premises solutions (private cloud). Moving to a cloud-based platform requires a change in mindset for IT security professionals. Traditional security models include, among an essentially limitless array of security systems, physical security, firewalls, anti-virus software, identity and authorization systems and perimeter networks (DMZs). They can also be applied in the private cloud

model.

By taking a fresh look at security when moving to a cloud-based model, security practices will evolve to include the unique requirements imposed by the cloud, which do not map precisely with traditional on-premises approaches. In spite of the differences in approach, it should still target security levels which are at least as high existing on-premises solutions, as the opportunity for architecting security into the cloud-based solution is optimal when changing the core of your IT architecture from traditional on-



## UTI-data logger for reading the gypsum blocks resistance

Georgi G. Stoimenov, Boris I. Vichev

*An UTI-data logger for reading the gypsum blocks AC resistance is proposed. The UTI-unit functions in its potentiometer mode. In order to enlarge the dynamic range of the data logger three different techniques are realized: (i) three voltage followers are used; (ii) two referent resistors are connected using a relay with its coil being controlled by a micro-controller; (iii) a special software program is written with different linear equations for the separate ranges of measured resistance. The experimental results of measured resistance vs. referent resistance show a dynamic range within 3½ decades with an error of +1.5/-2.5 %. Such an error is sufficient for estimating the soil moisture content using gypsum blocks.*

*Устройство за събиране на данни със схема UTI за отчитане съпротивлението на гипсови блокчета (Георги Г. Стоименов, Борис И. Вичев). Предложено е устройство за събиране на данни със схема UTI за отчитане съпротивлението на гипсови блокчета. Интерфейсната схема UTI функционира в потенциометричен режим на работа. Благодарение на три повторители на напрежение, два опорни резистора, свързани с контактите на едно реле, и специален софтуер с различни линейни уравнения в отделните подобхвати на измерваното съпротивление се разширява динамичният диапазон в рамките на 3½ декади с грешка от +1.5/-2.5 %. Подобна грешка е достатъчна за оценка на съдържанието на почвената влажност с използване на гипсови блокчета.*

### Introduction

Agricultural water management decisions can be improved by precise observations of soil moisture. During the last several decades the gypsum blocks have proved their capabilities for determining the soil moisture of terrains [1, 2]. A more detailed description of gypsum block principles, installation, calibration and use is presented in [3]. Their advantages are: low cost, allowing many replicates, can be left in field to monitor continuously, long history of reliable measurements, simplicity of installation by the grower, and well understood characteristics. Different electronic devices are designed for measuring the AC resistance of gypsum blocks, whose resistance varies in proportion to soil moisture or fluid conductivity. The gypsum blocks are often read manually with a hand held reader (data logger). The reader should be small, light weight, battery powered and should have a digital readout. Such a reader usually consists of an AC bridge and a converter for direct input of the data logger peripheral. Another technique of measuring the AC resistance could be examined using the Universal Transducer Interface (UTI) [4].

The main goals of this paper are: (i) to propose a low-budget UTI-data logger with a broad dynamic range for AC resistance of gypsum blocks; (ii) to present some experimental results proving its advantages.

### Block diagram

The simplified block-diagram of proposed UTI-data logger is presented in Figure 1. It consists of a micro-controller unit MC, an UTI-unit IC1, three voltage followers IC2-IC4, referent resistors  $R_{ref1}$ ,  $R_{ref2}$  and a relay RL1. The universal transducer interface UTI functions in its potentiometer mode of operation  $R_x/(R_x+R_{ref})$ . In order to enlarge the dynamic range of the data logger three different techniques are proposed and realized: (i) the voltage followers IC2, IC4 decrease the output resistance and IC3 increases the input resistance of the UTI-unit; (ii) two referent resistors  $R_{ref1}$ ,  $R_{ref2}$  are connected using the relay RL1 with its coil being controlled by MC; (iii) a special software program is written with different linear equations for the separate ranges of measured resistance to improve the accuracy of the system.

# Optron voltage transducer for high voltage

Vanjo T. Gourgoulitsov

*In this paper a DC voltage transducer's scheme for high voltage is proposed. The scheme is implemented using optocouplers and it grants sufficiently good and reliable galvanic isolation between the high voltage and the low voltage parts. The converter is meant to be used in measurement and monitoring systems, as well as in systems for automatic control, used in transmission and distribution electrical networks.*

*Оптронен измервателен преобразувател за високо напрежение (Ваньо Гургулицов). В статията се предлага схема за постояннотоков измервателен преобразувател за високо напрежение. Схемата е реализирана на базата на оптрони и гарантира достатъчно добро и надеждно галванично разделяне на високоволтовата и нисковолтовата части. Предназначена е за използване в измервателни следящи системи и в системи за автоматично управление и регулиране, използвани в преносната и разпределителната енергийни мрежи.*

## 1. Introduction

Often high voltage (above 100V) DC and AC signals have to be monitored / measured or/and to be controlled in practice. The AC signals are also often with wide harmonic spectrum. Besides the fact that the high voltage is not appropriate to be processed by the control systems, which are low voltage circuits as a rule, the high voltage is also dangerous for the employees. Therefore it has to be transformed in low voltage having the identical dynamic characteristics as the high voltage.

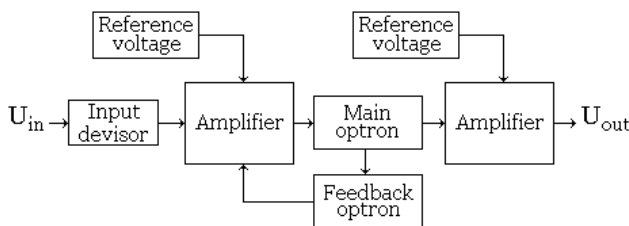


Fig. 1.

One of the possibilities is to use isolated operational amplifiers produced by several companies, for example Analog Devices. Some companies, for example LEM and ABB, produce and offer measuring voltage converters, but the bigger part of their nomenclature is for AC signals [1], [2].

The electrical circuit of a similar galvanic-isolated converter as the above mentioned ones proposed in this paper is distinguished for its simplicity and use of comparatively popular elements.

## 2. Electrical Circuit

The block diagram of the converter is shown in Fig.1. The circuit has shifted zero of the X-axis and characteristic in the first and second quadrants. Thus, the proposed schematic is implemented to transfer DC voltage having the opportunity to change its polarity.

The electrical circuit is shown in Fig.2. The input resistor divider R1-R2-R5-R6 rates the voltage needed to be measured and then passes the obtained voltage to the operational amplifier U17. The values of the divider elements shown in Fig.2 are calculated for the input voltage within the range of -30 to 30V. If other values of the voltage have to be monitored, the divider has to be rescaled. Using optical transmission the signal is passed towards the output amplifier U19. Optocouplers U15 and U16 are used for galvanic isolation [3].

From the electrical circuit of the proposed transducer it is seen that widely used elements are implemented in it. The scheme does not require special adjustment except for the input resistor divider adjustment regarding the requirements of the next-connected elements in respect to their sensibility and permissible peak to peak voltage values.

The proposed converter may be used to measure the mains characteristics of transmission and distribution electrical networks. Also, it may be implemented as a voltage feedback in the control systems of active power filters used to improve power quality of the consumed electrical power or in the control of DC-DC converters.

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