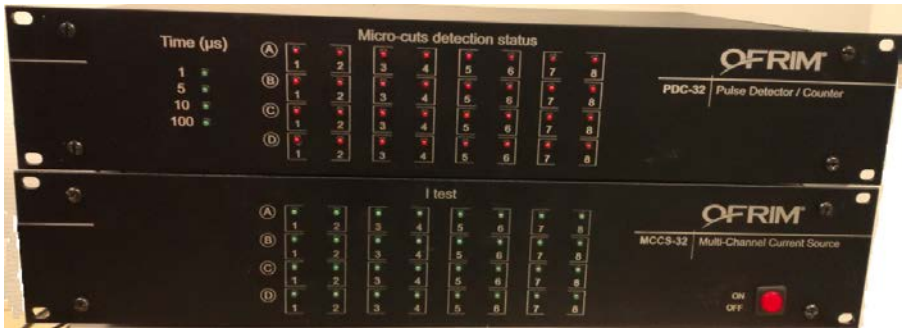
µVar

Micro-variations detection system of electrical signals

- Flexible and scalable structure: multi-channel power supply type c.c. with 8 or several channels, model MCCS and multi-channel detector-counter for the micro-variations of the electrical signals, model PDC;
- The multi-channel source for common test current, the same for all test circuits, model MCCS or different from one test circuit to another, set-up software, model MCCSV;
- The performance in semiautomatic or manual mode of the tests regarding the detection of the micro-variations of the electrical signals;
- Software package, TestVar, for semiautomatic computer-assisted operation;
- Connection to PC by USB 2.0 or 3.0 interface type of the electrical signal micro-variations detector-counter, PDC, instrument;
- Easy acquisition, processing and interpretation of the test results;
- Possibilities of command and control of some additional optional equipment.



The system for the detection and counting of the micro-variations of the electrical signals, **µVar** (Electrical Signal Micro-variations Detection and Counting System), with 8 or a multiple of 8 testing channels, allows the manual or semiautomatic performance of certain reliability tests with respect to the detection of the occurrence of micro-variations of some electrical signals. The activity for the detection of micro-variations is performed in a continuous manner and in the same time for all the measurement channels which form the entire system.

The electrical input signals in the **µVar** system can represent different measures of a phenomenon or process and the physical significance of the tested electrical signals is not limited to a certain scientific or industrial domain. The micro-variations of the electrical signals which are measured continuously could provide very important information with respect to the quality of the processes represented by the electrical signals which were measured. This type of testing is essential in order to provide maximum safety conditions for the interconnection systems in the telecommunications, auto, aero-spatial and medicine industry.

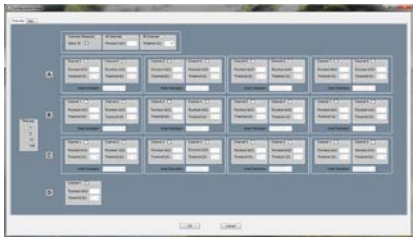
The **µVar** system provides the possibility to obtain several information with respect to the quality of the process or of the object which is subject to testing, for example the presence and the number of micro-interruptions, called „micro-cuts", of the electrical resistance of contacts related to a pair of connectors which exceed certain thresholds with respect to their duration and maximum value.

The µVar system includes the following components:

1. Detector and counter of micro-interruptions („micro-cuts") – instrument with a modular and scalable structure, which includes one or several modules with 8 input channels, model OFRIM Engineering **PDC – 08** (Pulse Detector and Counter, 8 channels), for the continuous detection of the micro-cuts of the electric input signals and their count, maximum value: 256. The PDC instrument is connected to a micro-computer, PC, for the performance of the exchange of data and commands between the instrument and the PC by means of an interface type USB 2.0.

2. The constant current multi-channel source is a modular and scalable supply source, c.c. power type, which includes one or several modules with 8 channels, of the type model OFRIM Engineering **MCCS-08** (Multi-Channel Current Source, 8 channels), which provides a constant testing current, of 100 mA, the same for each testing channel.

Configuration of test parameters



Display of the test results

Main Test Parameters

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µVar

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The **MCCSV-08** variant provides a constant testing current with selectable values, for example 5, 10, 100 and 200 mA, for each of the testing channels.

Operating principle

The identification of the micro-cuts is performed with the model **PDC** equipment. A micro-variation of an electrical signal is defined in case of this instrument as an electric voltage micro-variation, U (mV), between 2 measuring points of an electric circuit transited by a certain test current, I_{test}. The estimated shape of a micro-variation is presented in figure 1. In addition, a micro-variation of an electrical signal in order to be considered within the detection process as being a signal type micro-interruption, "micro-cut" or an operational defect, must simultaneously fulfil 2 conditions or technical characteristics as follows: it must have a certain duration in time (the condition related to duration) above a certain threshold value (the condition related to amplitude).

In figure 1 a graphical description of the micro-cut signals is presented and the specific parameters are defined. The value of the U_0 power represents the threshold value for defining within the amplitude a micro-cut signal type and the T_1-T_0 time range represents the minimum time range related to the duration of a micro-cut signal above a threshold value U_0.

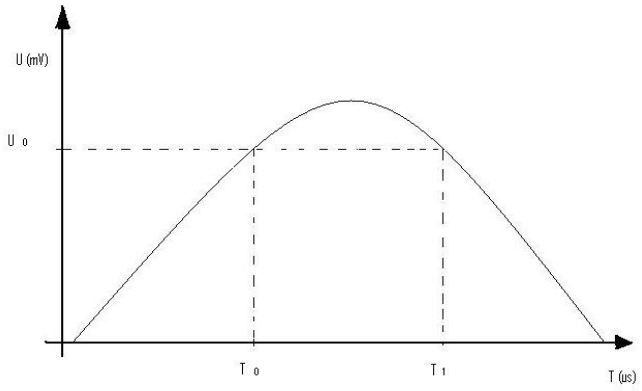

Figure 1. Description of the micro-variation type signals

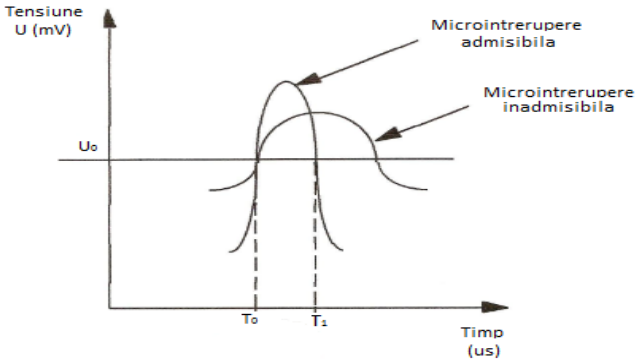

Figure 2-2. Description of the „micro-cuts" type signals

Any value of the power between the test points above the U_0 value for a time range which exceeds the imposed T_1-T_0, constitutes a micro-disruption type signal, also called micro-cuts or an operational defect

The model **PDC** equipment detects and counts, up to a maximum value of 255, for each channel, any time the value of the electrical power between the testing points exceeds a certain threshold value defined by the user or the testing standard for a time range which exceeds the initially imposed time range, for example of 1, 5, 10 or 100 µs. this process of detection is developed continuously, by means of a process of processing of the analogic input signal and not by means of a process of digital processing of the signal, with a certain rate of sampling, processing which would include an analogic-to-digital conversion of the information for each sample. Practically, the analogic detection procedure which is used by the **PDC** instrument provides a continuous processing and interpretation of the input signal without any possibility of losing micro-disruption signals due to the duration of the sampling process, to the analogic-to-digital conversion and to the digital processing.

The **PDC – 32** multichannel instrument can count up to 255 events (micro-disruptions) for each channel, the total number of processed input channels amounting 32. On the front panel, in front of each channel, there is a red LED, error indicator / ERR, which is lit when the instrument has detected a micro-disruption. This indicator is very useful for the tests in which only one micro-disruption is sufficient so that the product which was considered as being non-complaint would not pass the test or would not be classified.

With a model PDC instrument different assessments can be performed with respect to the variation of the value of the contact resistance of some electric contacts performed by means of adhesion, crimping or direct mechanical contact.

Within a testing procedure or within the acceptance procedure of an electric contact from a connector, relay or contactor, one or several threshold values can be defined for the electrical resistance of the contact above which the manufacturer or the users considers that the value of the electrical resistance represents a defect for the tested contact. According to the Ohm Law, U = R x I, for a threshold value of 1Ω and a test current of 100 mA, the value of the threshold power is 100 mV, and for the threshold value of 2Ω and a test current of 100mA, the value of the threshold power is 200mV.

Within a testing cycle, the software component of the **µVar** system, the software product called **TestVar**, determines the variation field of the resistance of each channel /contact during the test and reads from the **PDC** instrument, for each channel, the number of signals type „micro-cuts" or defects in operation detected during a test, test which could include both cycles of tests at different values of temperature and humidity as well as test cycles at different vibration values. In the end, it is established whether the test is successfully passed (PASS) or not (FAIL) by the device which was subject to the testing process, for example, the connector or the individual contacts of the connecter. At the end of the test, the operator can notice directly on the front panel of the **PDC** instrument if any of the error indicators is lit (red LED). A report of the tests with different date regarding the experiment is optionally generated by the **TestVar** software product.

Operation and configuration

For the performance of a testing cycle, the **µVar** system is connected, channel by channel, to the testing points.

The connection is performed by pasting of the 2 wires of each of the testing circuits or contact subject to testing, DUT, eliminating in this manner the possibility that parasite and false signals might occur, due to some contacts from the connectors at the level of the connexions terminal. In the same connexions terminal the measurement wires of the **PDC** instrument and the current injection wires of the MCCS source get.

The **TestVar** software product provides the operator several options and work stages, as follows:
- System configuration;
- Making test cycle;
- Test report generation;
- Representation and storage of experimental data.

Within the system configuration stage, the operator defines globally, for all the testing channels, or locally, for each and every testing channel, the parameters of the testing cycle, meaning the threshold values for defining the micro-disruption, the duration and the amplitude, the number of cycles and the duration of a cycle.

Within the stage related to the performance of the testing cycle, the operator can introduce a description of the test and starts the running of the test. During the running of the test, the **TestVar** software product displays the occurrence of certain micro-disruptions and their number at each moment of time. In the same time, if a micro-disruption was detected, on the front panel of the **PDC** instrument, the red LED, error indicator / ERR, is lit, correspondent to the channel which detected the micro-disruption. This LED remains lit during the entire duration of the test irrespective of the number of the micro-disruptions detected.

During the representation and storage of experimental data, upon the finalisation of the test the channels which have detected micro-disruptions are marked and the total number of micro-disruptions detected is specified and it is also specified if the test was successfully passed (PASS) or not (FAIL) by the device which was subject to the testing process. A report of the attempts with all the data obtained during the testing process can be optionally generated.

If, during the basic configuration of the **µVar** system the **Opt-2750** option is added, a multichannel data acquisition system will be also added to the system with a resolution of 6 ½ digit, model Keithley 2750, which will be able to include a number of maximum 5 modules type multiplexor, model 7700, 20 channels, function of the number of channels of the **µVar** system.

The **Opt-2750** option will allow the system to monitor during the entire testing cycle the values of all measures which are measured between the contact points as well as the value of the temperature of the environment and/or of the device or contact subject to testing. In this case, the system will be additionally provided with one or several temperature sensors type RTD.

The **Opt – 8/16/24/32V** option provides the system the possibility to generate test currents with different values, which can be selected from a wide range of hardware defined values, but which can be configurable form a software point of view, for each channel of testing. So, the possibility to integrate and test the DUT within the same test with different technical parameters is provided.

Main technical characteristics

PDC – 08, Pulse Detector and counting device
- Number of channels: 8, extensible to 32, opt 32
- Input signal: 20 mV – 1.000 mV
- Sensitivity of the amplitude: up to 20 mΩ
- Level of input signal: programmable, can be set through a software
- Number of values of the signal level: programmable, unlimited, can be set through a software
- Duration of the threshold value: 1 µs, 5 µs, 10 µs and 100 µs or any other.
- Sensitivity of the duration: 100 ns
- Type of value – duration: fixed, can be set through a software
- Number of values-duration: 4, fixed through hardware
- Counter: 0 .. 255 / channel
- Interface: USB 2.0
- Supply: +5V c.c.

MCCS – 08, Power supply source – continuous current (c.c.)
- Number of channels: 8
- Output signal: 100 mA/channel, standard
- Type of current value: unique, fixed through hardware for all the input channels.
- Supply: 220V c.a. (alternative current)

MCCSV – 08, Power supply source – continuous current (c.c.)
- Number of channels: 8
- Output signal: 5, 10, 100 and 200 mA
- Type of current value: selectable, fixed through software for each input channel.
- Supply: 220V c.a. (alternative current)

TestVar
- Performant software package dedicated to the acquisition, procession and storage of experimental data
- Generates reports and statistical analysis with respect to the micro-disruption signals

Note. Any other number of channels according to the specifications provided by the beneficiary is possible

Information for ordering:
- **µVar-08**, µVar, 8 channels, 4 threshold values for the amplitude and duration, 100 mA/channel test current, USB
- **Opt - 2750**, DAQ/DMM Keithley 2750/7700, IEEE488 interface
- **Opt – 16/24/32**, 16/24/32 input channels and 16/24/32 constant test current sources, 100 mA/channel
- **Opt – 8/16/24/32V**, 8/16/24/32 input channels and 8/16/24/32 constant test current sources, values 5, 10, 100 and 200 mA /channel, software selectable for each input channel.

Note. The software TestVar and TestVar/2750 products are delivered free-of-charge together with the µVar systems, respectively µVar/2750.

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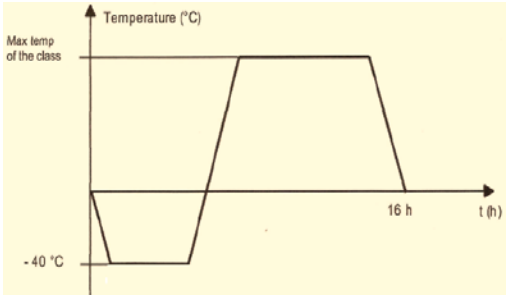
Examples of applications.

Testing the connectors of the auto-vehicles lamps.

The connectors of the front and rear lamps of auto vehicles must be stress tested with the use of different cycles of temperature and vibrations.
The level of vibrations at which the lamp connector is tested must be complaint with different testing classes; these classed being selected according to the beneficiary's requests. Different types of test can be executed. For examples, the connectors are fixed on a vibrant table, as in the right image, and are subject to the variation cycle of temperature which is detailed below, for the entire duration of the vibration cycle. The temperature of the room and the vibrating table could be managed by the own control unit, but also, could be controlled by the PC of the **µVar** system. A complete cycle of testing includes 3 vibrating cycles, one for each axes, and 1 or 2 cycles of temperature and humidity. During these cycles, **µVar** continuously detects the presence of micro-disruptions and counts the occurrences on each channel.

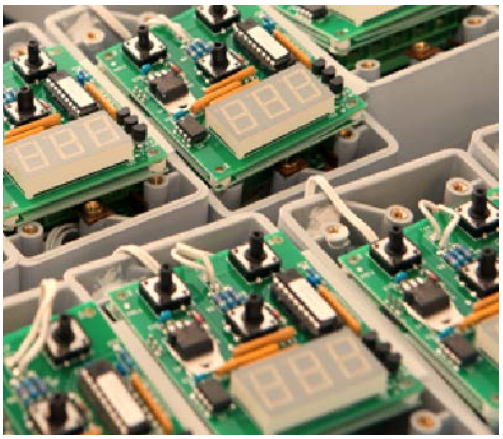
In case of this application, the **µVar** system includes maximum 8 channels, meaning 1 x PDC-08 and 1 x MCCS-08. If the acquisition of the values of the electrical resistances of the connectors contacts of the lamps is also desired, at the **µVar** system a multichannel instrument is added, model Keithley 2750 / 7700. This will measure at programed time by the operator the values of the electric resistances of the contacts. In the end, the operator can store and display the report of the experiment which provides data with respect to the presence and the number of micro-disruption as well as the values of the temperature during the test.



Testing of the electro-mechanical assemblies.

The portable or the mobile equipment during their operation are subject to difficult regimes of vibrations and temperatures.

The electro-mechanical assemblies or modules, which comprise different groups of relays or contactors, are, sometimes tested at different regimes of temperatures and vibrations. During these testing cycles, the contacts of the relays or contactors must observe certain conditions among which some related to the variation in time of the electrical contact resistance.



In case of this application, the **µVar** system could include 32 channels, 4 x PDC-08 and 4 x MCCS-08, and, based on this complex structures, different types of relays and contactors can be verified.

Specific for such an application is the number of values of the testing current for the input channels which, in general, are different from one testing channel to another. Because of this, the structure of the **µVar** system includes the module of the MCCSV-08 source which allows the selection of a value of the test current from a given range of values, for example, 5, 10, 100 and 200 mA.

In the case of this type application, the threshold values for the duration and amplitude for each channel are defined by the operator. The values of the testing current for each channel depend on the type of electro-mechanical device which is subject to testing and on its operating conditions.

The condition for the acceptance of the module or of the electro-mechanical assembly is zero micro-disruptions during the test but also acceptance conditions with values different than zero for micro-disruptions are possible.

The test report provides data with respect to each type of tested device, the technical test parameters such as the duration, the amplitude, and the value of the test current, the presence and the number of micro-disruptions as well as the values of the temperature during the test, if this value was monitored or recorded by the operator.

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