

Data Sheet 12.30/2

Additional software applications iCOS Customized

Classification

The additional software tools are a module of the control system HiCOS. They extend the functions of the PC software iCOS Advanced by additional features.

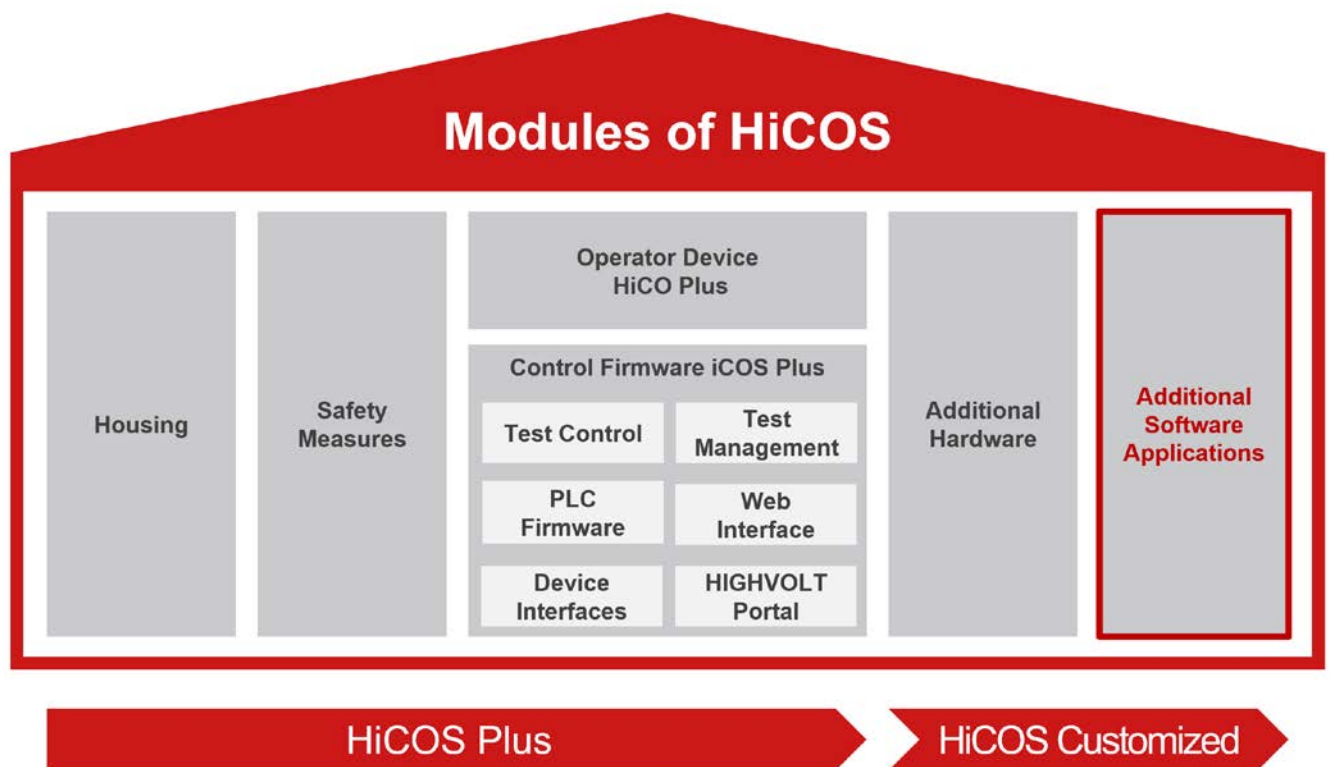


Figure 1: Overview of HiCOS modules – topic of this data sheet: Additional software applications iCOS Customized

The control system HiCOS is a collection of modules to control test systems and to record, manage, evaluate and report the measuring data. It is suitable for mobile and stationary test systems. The modular design of the control system HiCOS even allows further expansions of the functions.

Existing test systems from other manufacturers can be upgraded with HiCOS.

Description

HiCOS Customized extends HiCOS Plus with modular PC software of additional software tools, additional hardware packages and other customized applications according to customer requirements.

Table 1: Available software tools

Component	Description
Customized software applications	Development of software applications according to customer requirements
Central Data Manager	The Central Data Manager allows the access to the central data base (iCOS Data Base), the organization of test objects, the preparation of tests and the generation of a central report with data from different control systems. The Central Data Manager can be installed on any PC.
Statistic Module	The Statistic Module is applicable to the evaluation of measured data in high-voltage, high-current or lifetime testing for research work or product development. It can also be used for any kind of manual data input. The module includes the following parts • statistical analysis of impulse voltage tests (e.g. Multiple-Level Method) • statistical analysis of increasing voltage stress (e.g. Progressive-Stress Method) • statistical analysis of lifetime characteristics (e.g. Maximum Likelihood Method) System requirements • MSOffice® Word • MSOffice® Excel
Compensation Wizard	The Compensation Wizard is a special PC software for an easy and failsafe parameterization of the High-Voltage Capacitive Compensation (HVCC) unit. Based on three parameter inputs (test voltage, test current and test frequency) all relevant adjustments and settings will be calculated for the required compensation power of the test object. The Compensation Wizard is adapted to the specific design of the respective HVCC unit, its manual or automatic operation and its protection system. The parameter inputs and all calculated data will be shown on one summary page. The connection scheme of the HVCC unit, all capacitors and their connection states during the short-circuit or temperature-rise test will be displayed (states: IN OPERATION or SHORT CIRCUIT). Depending on the test voltage, the required connection state of the interlink disconnectors for the series connection of the capacitor modules will be displayed as well. In addition, all capacitors of the HVCC unit, their notation and the connection state for the needed compensation power are clearly listed in a table. In order to improve the safety level and to avoid operational errors due to incorrect connected capacitors or parameterization errors of the protection relay, all relevant connections and settings can be rechecked using the resulting summary page as a check list. For automatic HVCC units only: The calculated configuration scheme can be transmitted directly to the control system to start the automatic disconnector.

Description of the Statistic Modules

1. Statistical analysis of impulse voltage tests

(Multiple-Level Method, Constant-Voltage Method)

This part is designed for high-voltage testing with the Multiple-Level method which means a test with discrete incidental values. That test procedure is described e.g. in the IEC Standard 60060-1, Appendix A. As an example, Figure 4 shows the graph of the evaluation of a multiple-level test on a Gauss distribution scale. It is subdivided into 3 main sections:

A) Data input and recording

The sections of the module operation are supported by comprehensive help routines.

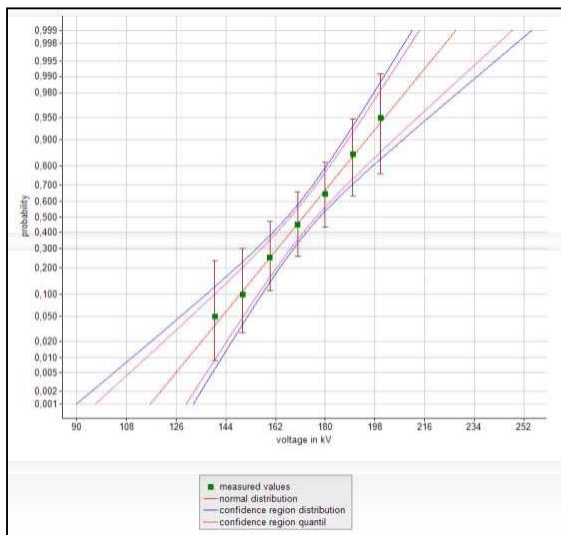


Figure 2: Evaluation of a multiple-level test by the maximum-likelihood method

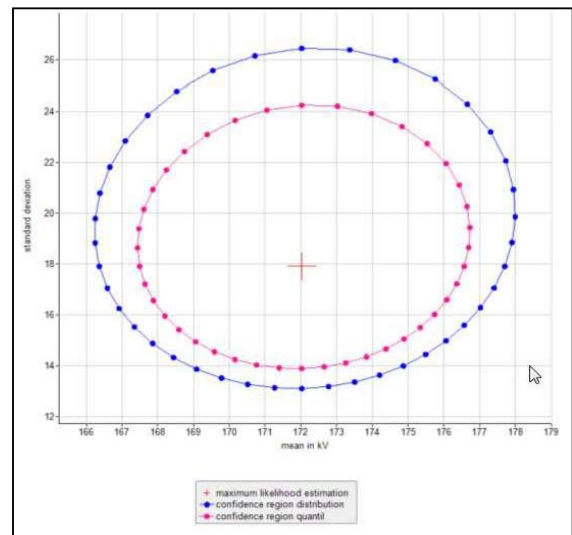


Figure 3: Regions of confidence for the quantiles and the Gauss distribution estimated according to the maximum-likelihood

B) Examination of the measuring results

Examination of homogeneity and independence of all single results of measurements series by five different statistical tests.

C) Evaluation according to both, momentum and maximum likelihood method (Figure 5).

- Selection of the best function for approximation (standard distribution, logarithmic standard distribution, double exponential distribution and Weibull distribution with 2 or 3 parameters).
- Point estimations of and confidence limits for the parameters of the selected function for approximation. Estimation of confidence for the function of behaviour (Figure 4).
- Estimation of confidence for the voltage quantiles (Figure 4).

2. Statistical analysis of increasing voltage stress

(Progressive-Stress Method, Test with increasing Voltage or Continuous Stress)

The module is specially designed for high-voltage testing for the statistical evaluation of continual incidental values (see also IEC 60060-1, Appendix A) as breakdown voltage or time.

The structure of this part is almost identical with that of the part for statistical analysis of impulse voltage tests.

Figure 6 shows the empirical distribution function, the best possible approximation and the confidence range of the latter.

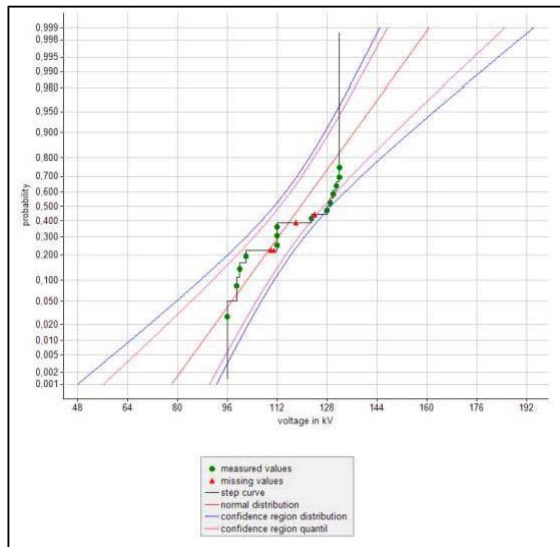


Figure 4: Evaluation of a test with continuously increasing voltage (progressive stress) by the maximum likelihood method.

3. Statistical analysis of lifetime characteristics (LTC)

With checking of the lifetime of solid-state insulations, the test objects are often stressed by different constant voltages up to a disruptive discharge. The times up to the disruptive for a constant voltage are commonly displayed by a Weibull's distribution with the parameters t_{d63} and c .

The relation between the voltage range (voltage U_d) and selected quantiles of the time to disruptive (in most cases the expected value t_{d63}) can be approximated by the well-known formula on the life duration with the constant K_d and the exponent $(-1/n)$.

Consideration of the parameters of the Weibull's distributions for the voltage ranges had been performed in most cases independent from these single ranges.

In the next step, the constant K_d and the lifetime exponent n are estimated by means of the equalizing straight line in a double-logarithmic diagram of disruptive voltage versus disruptive time.

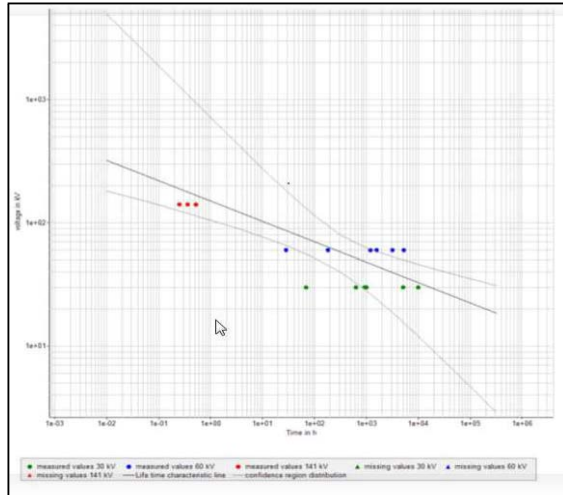


Figure 5: Lifetime characteristic with its confidence limits

An improved evaluation is possible by means of the maximum likelihood method. Under the presupposition that the mechanism of ageing will not be dependent on the voltage, we get the generalized function of distribution of the time until disruption:

$$F(t_d, U_d) = 1 - e^{-\left(t_d^* \left(\frac{U_d}{K_d}\right)^n\right)^c} \quad (1)$$

As a maximum likelihood estimation for the unknown parameters (K_d , n , c) where the likelihood function shows its maximum there will be the triplet (K_d^* , n^* , c^*). In this evaluation, also incomplete tests can be included, e.g. test objects which had no disruptive discharge at the end of the test.

The LTC includes the numerical estimation of the parameters and the confidence ranges of the generalized distribution function as well as the graphical output of the results. A possible form of representation is the lifetime characteristic for a distinct quantile of the distribution (as a rule the 63 % quantile) with the confidence ranges (Figure 7).