HIGHVOLT Prüftechnik Dresden GmbH
Marie-Curie-Straße 10
01139 Dresden, Germany
Phone +49 351 8425 700
E-mail sales@highvolt.com
Website http://www.highvolt.com

Data Sheet 12.11/4

Control Firmware iCOS Plus

Classification

The control firmware iCOS Plus is a module of the control system HiCOS. Together with the module HiCO Plus (operator device) it forms the basic control. This allows the manual control of high voltage test systems and the application of automatic test procedures.

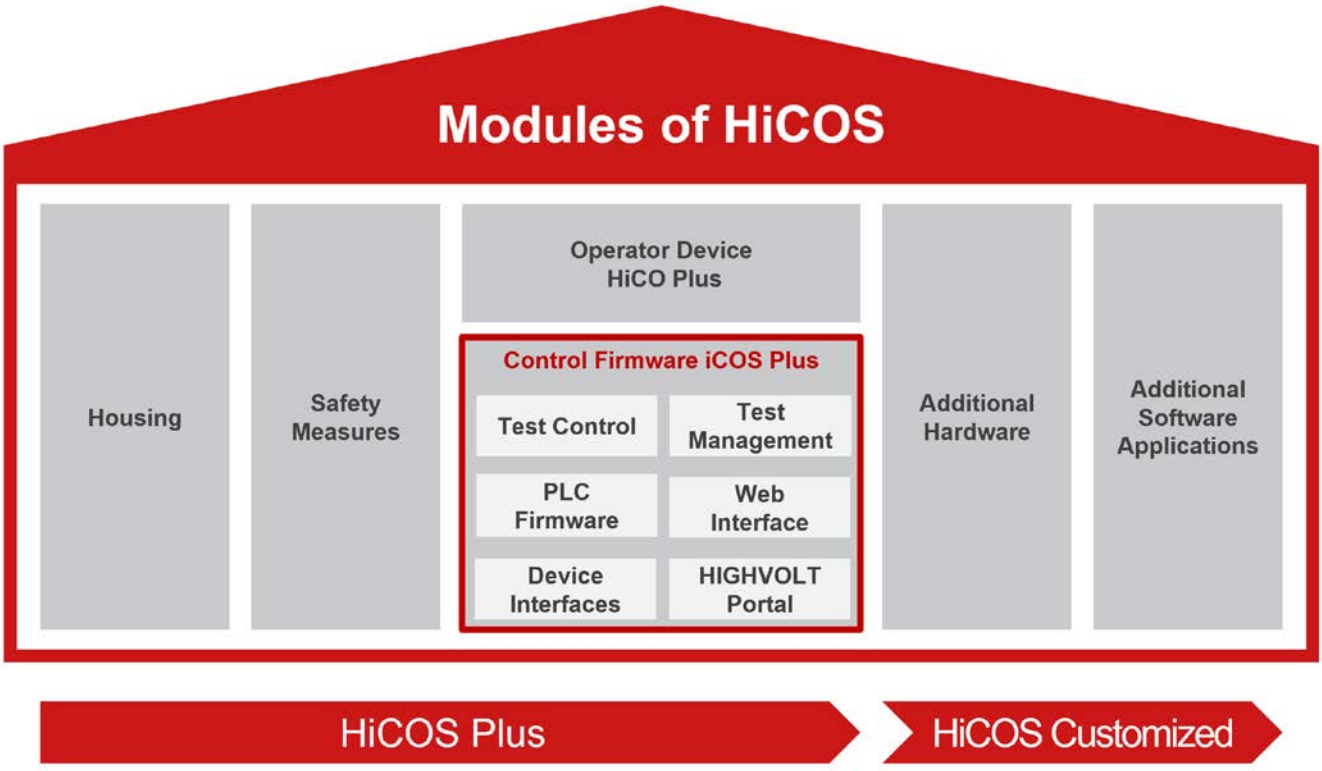


Figure 1: Overview of HiCOS modules – topic of this data sheet: control firmware iCOS Plus

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
The firmware iCOS Plus installed both on the operator device and on the PLC comprises all applications and services required for control and the test management of the test system.

Tests can be performed in manual mode, semi-automatic mode or are automatically controlled by starting user-defined test sequences.

Additional firmware parts (see Table 1) are completing the control firmware iCOS Plus.

Table 1: Additional firmware parts

Name	Description
iCOS Web Interface	The iCOS web interface (see Annex 1) provides access to the local test management of test systems for external devices (e.g. customer PC, customer tablet).
HIGHVOLT Maintenance Portal Interface	The HIGHVOLT maintenance portal interface (see Annex 2) connect test systems with the HIGHVOLT service portal online to provide information about the maintenance status.
Device Interfaces iCOS Inferfaces	The device interfaces (see Annex 3) connect test systems and measuring devices with the firmware iCOS Plus. Additionally to the device interfaces for standard components (e.g. HIGHVOLT test systems and certain OMICRON measuring systems) customized interfaces for other devices can be provided on request.
Remote diagnostic and access module HiCOS RDA	With the help of HiCOS RDA, customer service in shortest possible time is granted by HIGHVOLT within the warranty period. This includes technical support, software updates and trouble shooting. The remote diagnostic and access module is a hard- and software package integrated into the HV control system based on SIMATIC. It enables a direct contact to the HIGHVOLT Service Center via internet. HIGHVOLT is able to check the control system and to promptly react on-line. Remark: The internet access is to be provided by the customer.

For each type of test systems, different firmware versions are available.

Table 2: Firmware versions

Name	Application
iCOS Plus T	AC test system with transformer
iCOS Plus V	AC resonant test system with variable frequency
iCOS Plus R	AC resonant test system with variable inductance
iCOS Plus TT	AC test system based on static frequency converter for transformer testing
iCOS Plus DT	AC test system based on static frequency converter for distribution transformer testing
iCOS Plus H	high-current test system
iCOS Plus G	high-voltage DC test system
iCOS Plus I	impulse voltage test system
iCOS Plus M	module test system

The following descriptions explain the functions of the firmware versions.

iCOS Plus T

Table 3: Main functions iCOS Plus T

- main/operating switch on/off
- status indication of main/operating switch
- warning and error messages of the test system
- voltage increase/decrease
- preselection of test voltage and test time
- preselection of two regulating speeds
- display of voltage and current limits for system protection
- operation of compensation (optionally)
- password protection of essential system settings

Table 4: Extended functions iCOS Plus T

- Local test management:
  - Creation, parameterization, and storing of test sequences
  - The following test types are available to choose from:
    - „Manual test“ for manual performance of a test
    - „Step test“ for automatic performance of a test sequence
    - „Up-and-down test“ for automatic performance of an up-and-down test
  - Recording, evaluation, and storing of measurement values
- Interfaces for embedding measuring devices
- Web interface accessing the local test management from the customer’s equipment (e.g. PC, tablet)
- Creation of test reports (Excel) on the customer’s equipment
- Interface (REST-API) for database access via e.g. customer’s equipment or ERP system

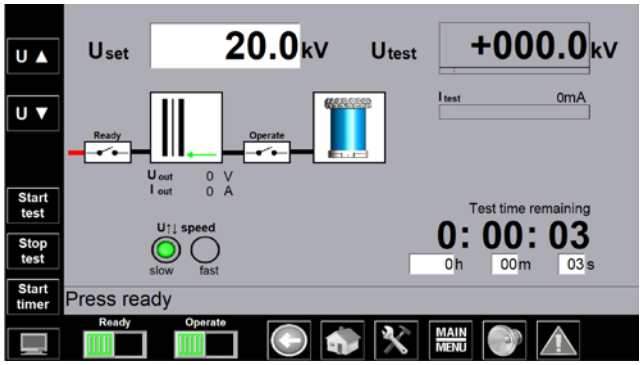


Figure 2: Data display during a test in manual and semi-automatic mode

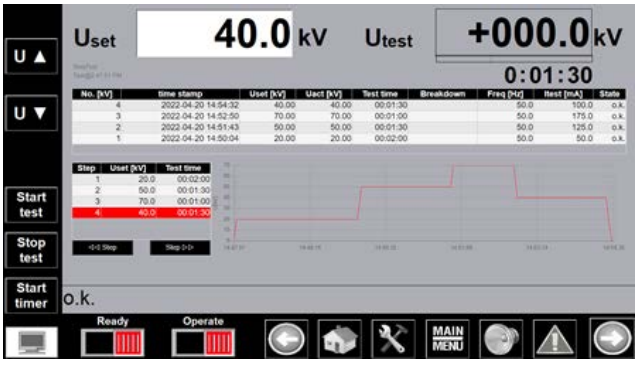


Figure 3: Data display during an automatic test sequence

iCOS Plus V

Table 5: Main functions of iCOS Plus V

- main switch on/off
- status indication of main switch
- warning and error messages of the test system
- automatic resonance adjustment
- voltage increase/decrease
- preselection of test voltage, test time and frequency
- display of voltage and current limits for system protection
- password protection of essential system settings

Table 6: Extended functions of iCOS Plus V

- Local test management:
  - Creation, parameterization, and storing of test sequences
  - The following test types are available to choose from:
    - „Manual test“ for manual performance of a test
    - „Step test“ for automatic performance of a test sequence
  - Recording, evaluation, and storing of measurement values
- Interfaces for embedding measuring devices
- Web interface accessing the local test management from the customer’s equipment (e.g. PC, tablet)
- Creation of test reports (Excel) on the customer’s equipment
- Interface (REST-API) for database access via e.g. customer’s equipment or ERP system

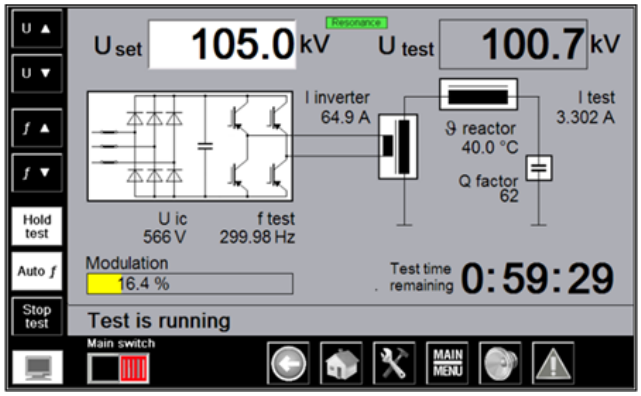


Figure 4: Data display during a test in manual and semi-automatic mode

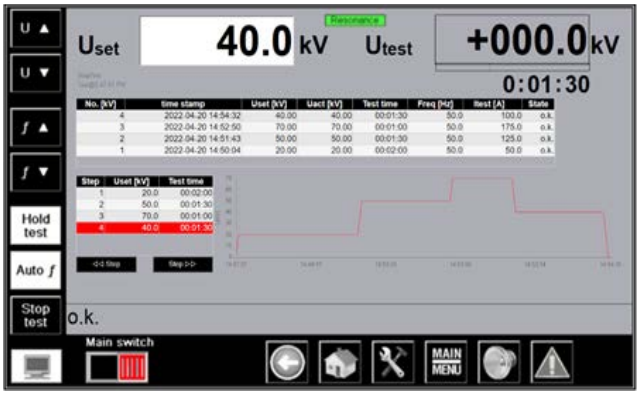


Figure 5: Data display during an automatic test sequence

iCOS Plus R

Table 7: Main functions iCOS Plus R

- main/operating switch on/off
- status indication of main/operating switch
- warning and error messages of the test system
- voltage increase/decrease
- preselection of test voltage and test time
- preselection of two regulating speeds
- display of voltage and current limits for system protection
- operation of compensation
- password protection of essential system settings
- remote control of water conditioning unit (optionally)

Table 8: Extended functions iCOS Plus R

- Local test management:
  - Creation, parameterization, and storing of test sequences
  - The following test types are available to choose from:
    - „Manual test“ for manual performance of a test
    - „Step test“ for automatic performance of a test sequence
    - „Up-and-down test“ for automatic performance of an up-and-down test
  - Recording, evaluation, and storing of measurement values
- Interfaces for embedding measuring devices
- Web interface accessing the local test management from the customer’s equipment (e.g. PC, tablet)
- Creation of test reports (Excel) on the customer’s equipment
- Interface (REST-API) for database access via e.g. customer’s equipment or ERP system

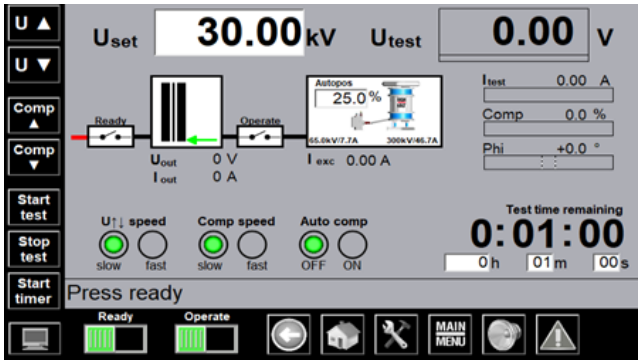


Figure 6: Data display during a test in manual and semi-automatic mode

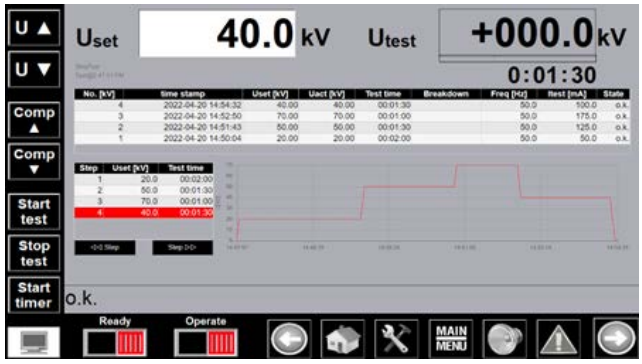


Figure 7: Data display during an automatic test sequence

iCOS Plus TT

Table 9: Main functions iCOS Plus TT

- main/operating switch on/off
- status indication of main/operating switch
- warning and error messages of the test system
- voltage increase/decrease
- preselection of test voltage, frequency and test time
- preselection of regulating speed
- display of voltage and current limits for system protection
- operation of compensation (optionally)
- password protection of essential system settings

Table 10: Extended functions iCOS Plus R

- Local test management:
  - Creation, parameterization, and storing of test sequences
  - The following test types are available to choose from:
    - „Manual test“ for manual performance of a test
    - „Step test“ for automatic performance of a test sequence
    - „Up-and-down test“ for automatic performance of an up-and-down test
  - Recording, evaluation, and storing of measurement values
- Interfaces for embedding measuring devices
- Web interface accessing the local test management from the customer’s equipment (e.g. PC, tablet)
- Creation of test reports (Excel) on the customer’s equipment
- Interface (REST-API) for database access via e.g. customer’s equipment or ERP system

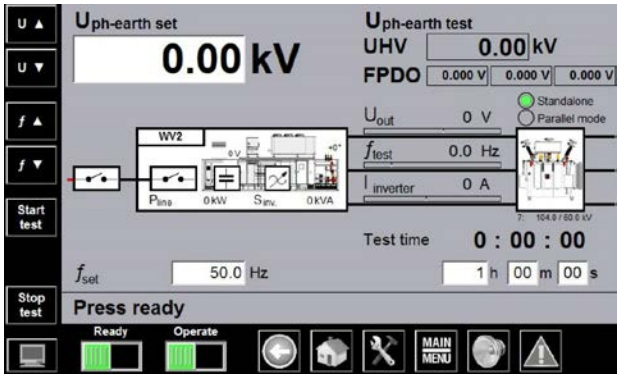


Figure 8: Data display during a test in manual and semi-automatic mode

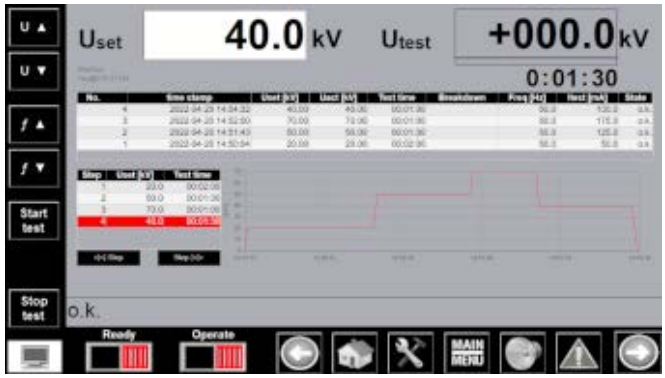


Figure 9: Data display during an automatic test sequence

In addition to the standard test types (see Table 10) the iCOS applications transformer package can be installed optionally. The following applications are provided within this transformer package:

Table 11: Main functions iCOS Plus TT

- Applied Voltage Test
- Induced AC Voltage Test
- No Load Loss And Current Test
- Short Circuit Impedance And Load Loss Test
- Zero Sequence And Impedance Test
- Temperature Rise Test

Note: The iCOS applications transformer package is not accessible via the web interface.

iCOS Plus DT

Table 12: Main functions iCOS Plus DT

- main/operating switch on/off
- status indication of main/operating switch
- warning and error messages of the test system
- manual voltage/current/power increase/decrease
- predefined test sequences for standard tests
- display of measuring results of the power-loss measurement
- visualization of the necessary connections between test object and test system
- automatic set-up of the test system (tap changer, compensation, measurement)
- manual mode for free configuration of the test system
- display of voltage and current limits for system protection
- storage of measured data
- export of test reports to PC/USB stick
- password protection of essential system settings

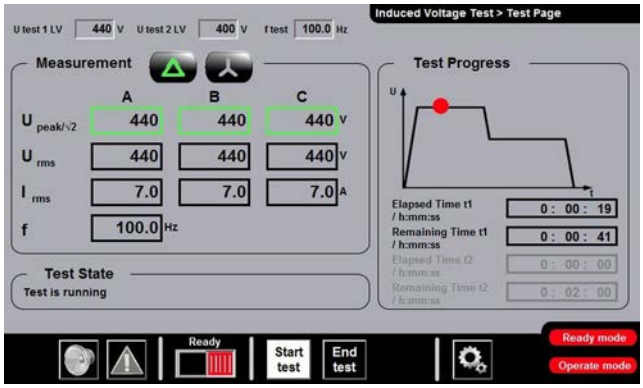
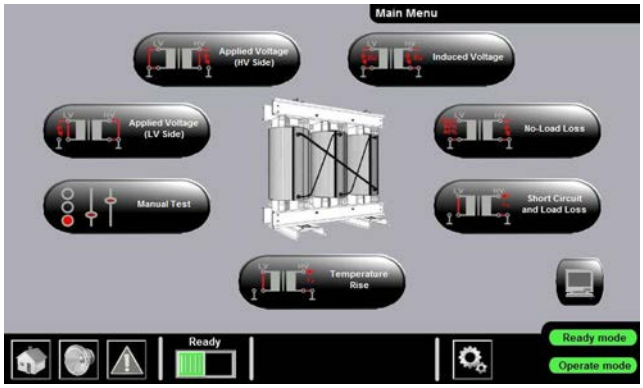


Figure 10: Data display during a test



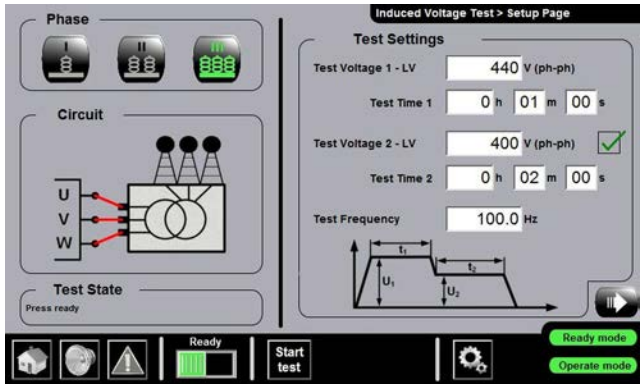


Figure 11 and 12: Preselection of parameters

In addition to the main functions (see Table 12) the advanced control software iCOS advanced for DiTAS can be installed optionally. This software is designed for automated routine testing of distribution transformers using HIGHVOLT test equipment.

Table 13: Features of iCOS advanced for DiTAS

- Automated test sequence operation of the test system
- Definition of test programs for timesaving, error preventing and comfortable transformer testing
- Includes creation of test-sequences for routine testing of distribution transformers
- Includes definition of parameters for test automation
- Recording and display of the values of the loss measuring system LiMOS MS (voltages, currents, power)
- Export of recorded data for easy report generation
- Modern, easy-to-use software interface
- Robust, central data-storage for data safety

Note: iCOS advanced for DiTAS is not accessible via the web interface.

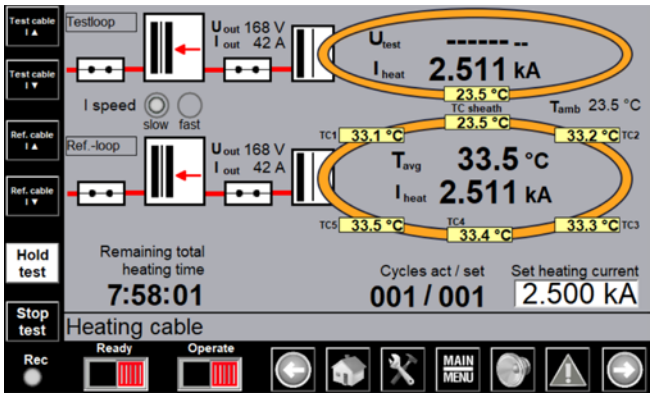
iCOS Plus H

Table 14: Main functions iCOS Plus H

- main/operating switch on/off
- status indication of main/operating switch
- warning and error messages of the test system
- current increase/decrease
- preselection of test temperature or test current and test time
- preselection of two regulating speeds
- display of temperature and current limits for protection of tested cable
- synchronization with HIGHVOLT AC test system
- password protection of essential system settings

Table 15: Extended functions iCOS Plus G

- Local test management:
  - Creation, parameterization, and storing of test sequences
  - Recording, evaluation, and storing of measurement values
- Interfaces for embedding measuring devices
- Web interface accessing the local test management from the customer's equipment (e.g. PC, tablet)
- Creation of test reports (Excel) on the customer's equipment
- Interface (REST-API) for database access via e.g. customer's equipment or ERP system



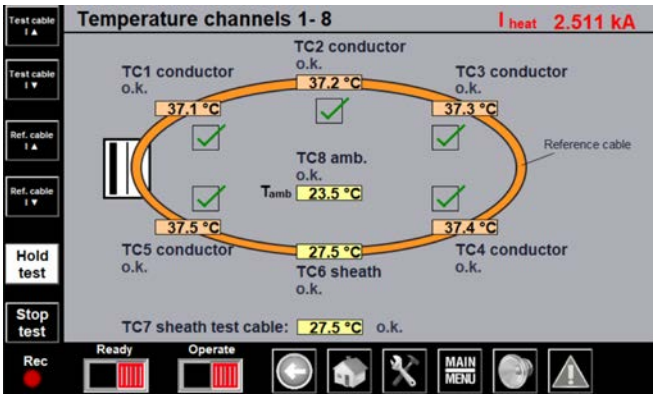


Figure 13 and 14: Data display during a test

iCOS Plus G

Table 16: Main functions iCOS Plus G

- main/operating switch on/off
- status indication of main/operating switch
- warning and error messages of the test system
- voltage increase/decrease
- preselection of test voltage, polarity and test time
- preselection of two regulating speeds
- display of voltage and current limits for system protection
- operation of earthing
- operation of discharging resistor (optionally)
- password protection of essential system settings

Table 17: Extended functions iCOS Plus G

- Local test management:
  - Creation, parameterization, and storing of test sequences
  - The following test types are available to choose from:
    - „Manual test“ for manual performance of a test
    - „Step test“ for automatic performance of a test sequence
    - „Up-and-down test“ for automatic performance of an up-and-down test
  - Recording, evaluation, and storing of measurement values
- Interfaces for embedding measuring devices
- Web interface accessing the local test management from the customer’s equipment (e.g. PC, tablet)
- Creation of test reports (Excel) on the customer’s equipment
- Interface (REST-API) for database access via e.g. customer’s equipment or ERP system

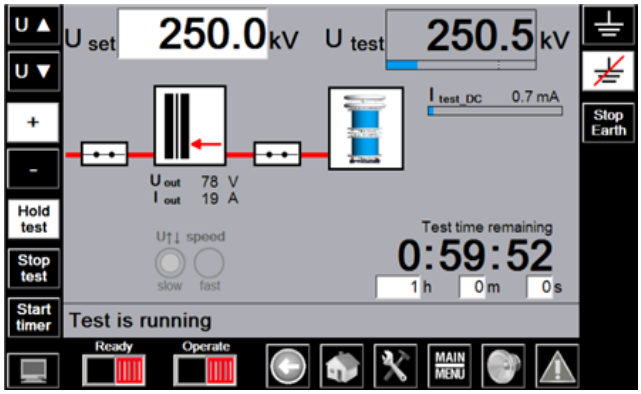


Figure 15: Data display during a test in manual and semi-automatic mode

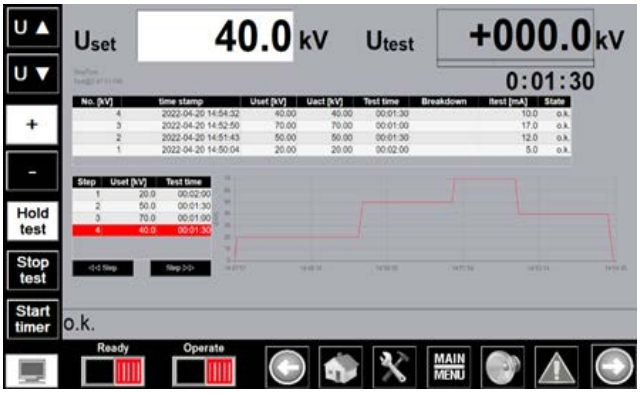


Figure 16: Data display during an automatic test sequence

iCOS Plus I

Table 18: Main functions iCOS Plus I

- main/operating switch on/off
- status indication of main/operating switch
- warning and error messages of the test system
- operation of polarity, earthing and automatic charging
- softkey for triggering of sphere gap
- preselection of charging voltage per stage and charging time
- preselection of impulses
- impulse counter
- password protection of essential system settings

Table 19: Extended functions iCOS Plus I

- Local test management:
  - Creation, parameterization, and storing of test sequences
  - The following test types are available to choose from:
    - „Manual test“ for manual performance of a test
    - „Step test“ for automatic performance of a test sequence
    - „Up-and-down test“ for automatic performance of an up-and-down test
    - "Constant voltage test" for automatic performance of a constant voltage test
  - Recording, evaluation, and storing of measurement values
- Interfaces for embedding measuring devices
- Web interface accessing the local test management from the customer’s equipment (e.g. PC, tablet)
- Creation of test reports (Excel) on the customer’s equipment
- Interface (REST-API) for database access via e.g. customer’s equipment or ERP system

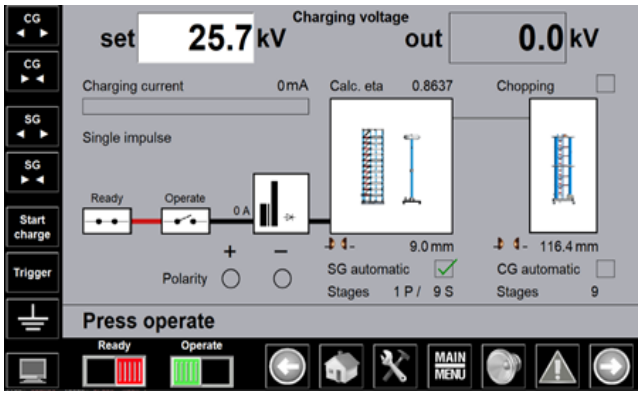


Figure 17: Data display during a test in manual and semi-automatic mode

Figure 18: Data display during an automatic test sequence

iCOS Plus M

Table 20: Main functions iCOS Plus M

- main/operating switch on/off
- status indication of main/operating switch
- warning and error messages of the test system
- voltage increase/decrease
- preselection of test voltage and test time
- preselection of two regulating speeds
- display of voltage and current limits for system protection
- password protection of essential system settings

Table 21: Extended functions iCOS Plus M

- Local test management:
  - Creation, parameterization, and storing of test sequences
  - The following test types are available to choose from:
    - „Manual test“ for manual performance of a test
    - „Step test“ for automatic performance of a test sequence
    - „Up-and-down test“ for automatic performance of an up-and-down test
  - Recording, evaluation, and storing of measurement values
- Interfaces for embedding measuring devices
- Web interface accessing the local test management from the customer’s equipment (e.g. PC, tablet)
- Creation of test reports (Excel) on the customer’s equipment
- Interface (REST-API) for database access via e.g. customer’s equipment or ERP system

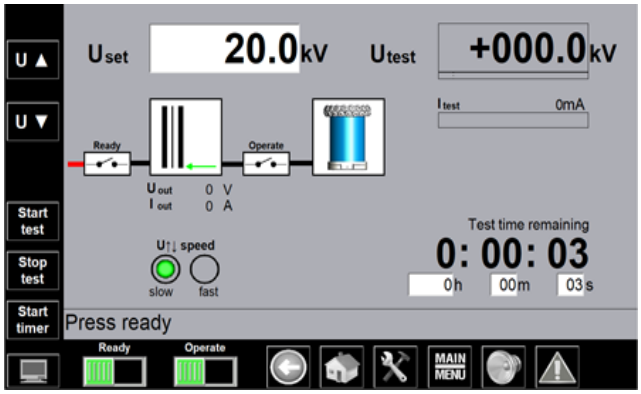


Figure 19: Data display during a test in manual and semi-automatic mode

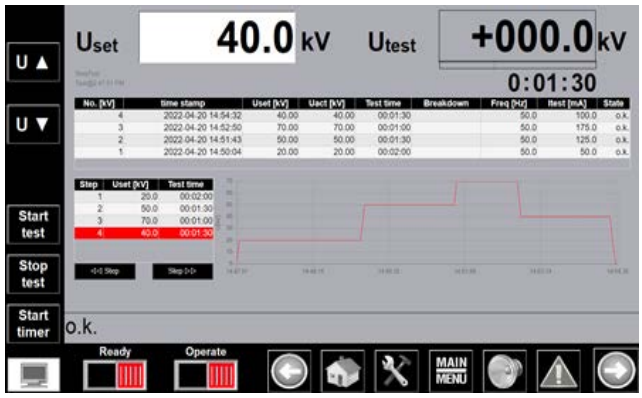


Figure 20: Data display during an automatic test sequence

Annex 1 – iCOS Web Interface

The iCOS Web Interface provides access to the local test management of test systems for external devices (e.g. customer PC, customer tablet). The router integrated into the operator device or control connects the customer's intranet via WLAN or via a wired network interface. The test system is protected by the firewall integrated in the router. For access restriction, the web interface has an authentication service.

In addition to the user-friendly test management, the web interface offers live view to the currently running and is used to create test reports. For safety reasons the web interface only allows the test system to be operated by external devices located in the immediate surroundings (e.g. customer notebook) via the WLAN interface of the operating device or control unit.

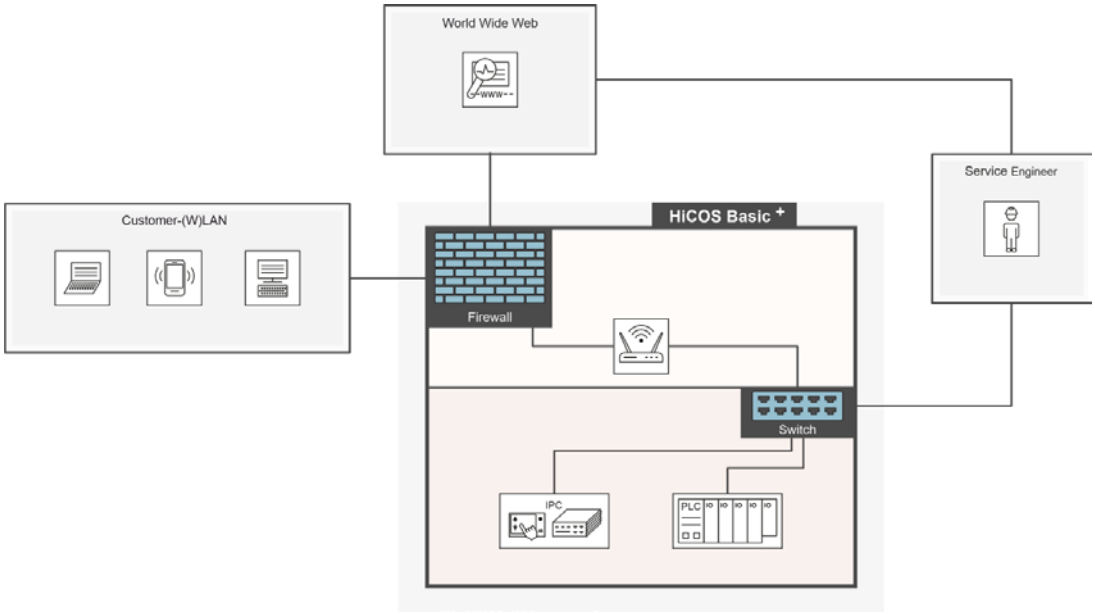


Figure 21: Schematic sketch of the access from external devices to the test system

The web interface is characterised by:

- Access to the local test management via the customer's intranet or (W)LAN of the test system for user-friendly creation, parameterization, and storing of tests
- Connection of the customer's intranet via the router integrated into the operator device or control unit
- Firewall to protect the test system
- Authentication service for access restriction of unauthorised users
- Creation of test reports (Excel) on the customer equipment
- Creation of customer-specific templates (Excel) for test report recording
- Live view of the ongoing test

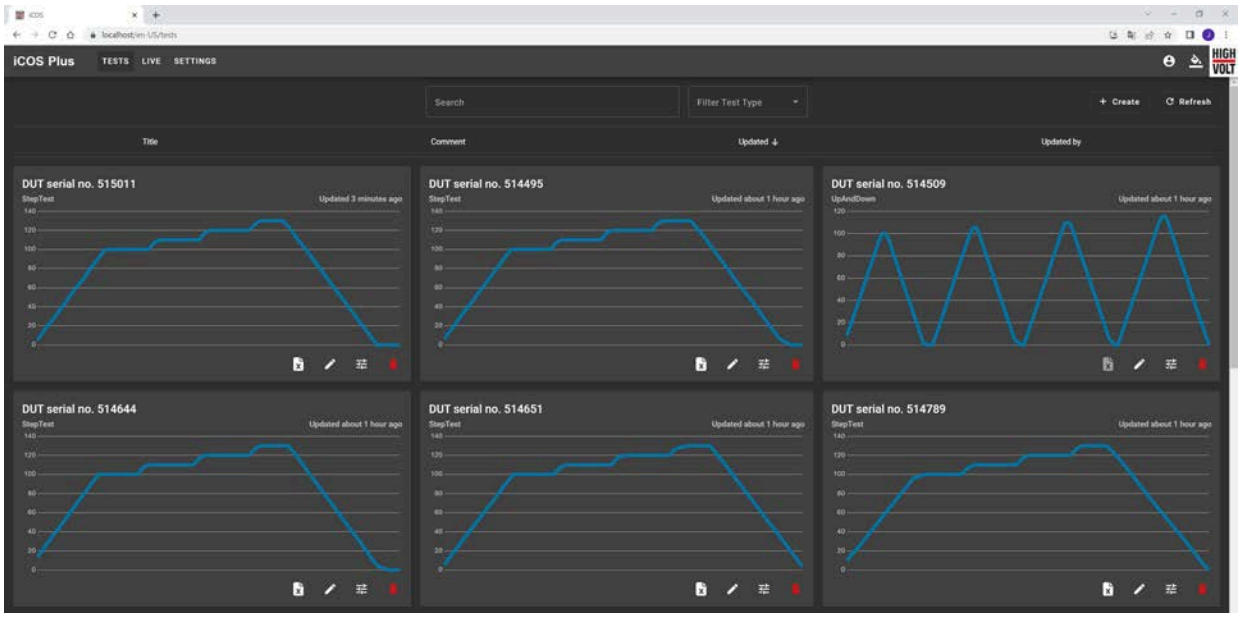


Figure 22: Web site of the web interface for external devices

Annex 2 – HIGHVOLT Maintenance Portal Interface

A key feature of the control system HiCOS Plus is the possibility of online comparison of the test system's operating data with the HIGHVOLT service portal. This is especially useful for components subject to wear and system messages providing information about the maintenance status of the test system. This does not involve the exchange of test results.

The HIGHVOLT Portal provides the customer with an overview of the conditions of its test systems. The user gains access by logging in via the browser of its PC.

With the HIGHVOLT Portal, operating data of the test systems can be evaluated, and specific measures can be taken to avoid operational failures. In addition to the resulting maintenance optimization, aging and defective components can be replaced in time, which avoids downtimes.

Annex 3 – iCOS Interfaces

Device interfaces are used to connect hardware components to the control firmware iCOS Plus. Depending on the hardware, three different types of interfaces are offered available (see Table 22).

Table 22: Types of interfaces

Type	Description
Automatic interface	Automatic interface for direct access to the control of the hardware component and reading out of measurement values
Semi-automatic interface	Semi-automatic interface for reading out measurement values
Manual interface	Manual interface for entering test results in the local database

Customized device interfaces can be provided. The type of the interface results from the specific device design and the requirements of the customer. This also allows the replacement of existing controls of other manufacturers.

Table 23: Customized device interfaces

Name	Description	Manufacturer	Type of interface
LiMOS	Power measuring system	HIGHVOLT	Automatic interface
HiRES (formerly MIAS)	Transient recorder	HIGHVOLT	Automatic interface
MPD 600/800	Measuring of partial discharge	Omicron	Automatic interface
MI	Measuring of tan delta	Omicron	Automatic interface
TANDO 700	Measuring of capacity and tan delta	Omicron	Automatic interface
WT 3000	Measuring of power	Yokogawa	Automatic interface
ATOS	Measurement of winding resistance and turns ratio	Raytech	Automatic interface
LDS-6	Measurement of partial discharge	Doble Lemke	Semi-automatic interface
ICMcompact	Measurement of partial discharge	PDIX/Megger	Semi-automatic interface
MIT	Insulation tester	Megger	Manual input
OTS	Insulation oil tester	Megger	Manual input
DELTA 4110	Insulation power factor/dissipation factor (tan delta)	Megger	Manual input