

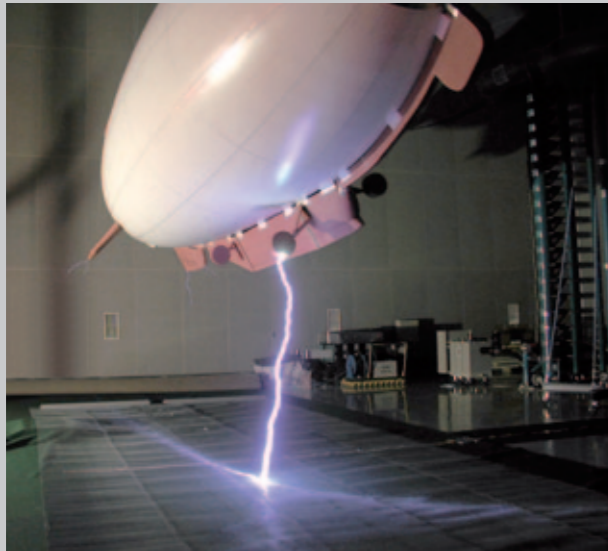
# HiRES – TRANSIENT RECORDER

- Measurement of voltage, current and other values
- Exact measurements even in environments with very strong EMI
- Reliable signal transmission via fiber optic cables
- Sophisticated evaluation of measurement data



# APPLICATIONS

## AEROSPACE TESTING



- Direct and indirect effects of lightning currents
- EMI-safety of components
- Shielding properties of aircraft bodies
- Material tests of aircraft body shell at the lightning striking point

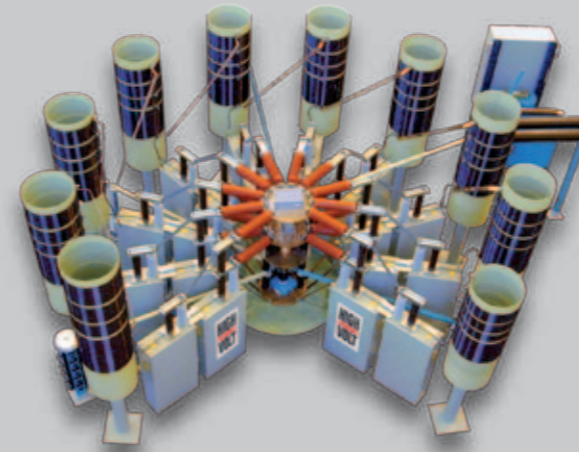
## BREAKDOWN LOCATION IN MV & HV POWER CABLES



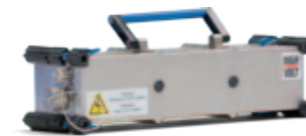
- Precise breakdown location during factory and on-site tests
- Long term monitoring and breakdown location for cables in operation
- Immediate location when breakdown occurs
- For all kinds of HV applications as AC, DC, LI, SI, ...



## SURGE ARRESTER TESTING



- Tests with high impulse currents up to 200 kA
- Precise measurements even when strong EMI are present
- Impulse, AC and DC tests
- Combined AC or DC and impulse voltage tests

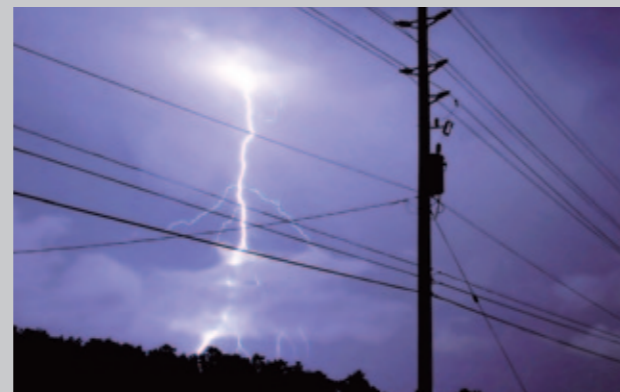


## CIRCUIT BREAKER, SWITCHGEAR AND FUSE TESTING



- Measurement of switching process: voltages, currents, mechanical movements, auxiliary contacts
- Tests with AC, DC and impulse voltages
- Test of open gap with combined voltages
- Direct and synthetic power tests of circuit breakers
- Synchronized (high speed or normal) video, e.g. of arc
- Evaluation according to STL

## MEASURING OF FAST PROCESSES



- Lightning research
- Experimental and particle physics
- Military research

## ANALYZING ELECTRIC DRIVES AND GENERATORS



- Measurement of electrical and mechanical data
- Analyzing power and efficiency

## POWER AND DISTRIBUTION TRANSFORMER TESTING



- Tests with AC, DC and impulse voltages
- Switching impulses, full and chopped lightning impulses
- Tap changer testing

## EMI/EMC TESTS



- Analyzing shielding properties
- Both small and large test objects
- Testing and measuring in extreme EMI conditions

## THE FEATURES OF HIRES

- CHANNELS FOR ELECTRICAL AND MECHANICAL MEASUREMENTS

- COMBINATION OF SLOW AND ULTRA FAST SIGNALS
- POTENTIAL FREE MEASUREMENT

- EXACT MEASUREMENTS DUE TO OPTICAL SIGNAL TRANSMISSION
- ABSOLUTELY EMI PROOF

- WIDE RANGE OF SAMPLING RATES (1 S/s – 250 MS/s)
- WIDE INPUT RANGE (50 mV – 2000 V)

# BASE DEVICES



Fig. 1 Digital transient recorder base devices HiRES S6 Base (left), HiRES S4 Base (center) and HiRES S4D Base (right)

## FACTS IN BRIEF

### Features and main application

The new HiRES family of transient recorders incorporates latest technique of digital signal processing. The recorders have a modular, expandable design allowing the combination of different types of measuring channels in one device to support simultaneous measurements of

- Analog signals with various sampling rates
- Digital signals such as state of switching elements
- Mechanical movements (way or angle)

Each base device contains a state-of-the-art industrial PC with MS Windows® operating system on which the HiRES measuring software is installed. Various measuring channels and adapted measuring hardware combined with our comprehensive test and evaluation software provide solutions for all kinds of application as

- Long time recording and capturing of fast transient signals
- Even combination of both long time and fast transients at the same time
- Integration of modules for automation of testing process
- Emission of control signals to the test arrangement, e. g. to release switching processes

Following application-oriented basic versions of the transient recorder HiRES are available:

- HiRES Transfo for impulse voltage and current measurements on power transformers
- HiRES Switch for measurements of electrical and mechanical variables when testing power switches or disconnectors
- HiRES Datalogger for long term measurements
- HiRES Cable for impulse voltage measurement on power cables
- HiRES Locator for breakdown location on power cables
- HiRES EMI for measurements in the framework of EMI and EMC tests
- HiRES Arrester for impulse current and voltage measurements when testing MOA or SPD
- HiRES Kit for use with the HIGHVOLT Module Test System

## BASE DEVICE VERSIONS

There are different versions of base devices available, depending on the number and type of measuring channels used:

- HiRES S4 is a compact, portable system for mobile application providing space for a maximum of 8 respectively 16 measuring channels
- HiRES S6 is a larger rack-mountable version that provides space for configurations with up to 24 measuring channels per device
- HiRES S4D is a base device for up to 4 electrical and 4 optical measuring channels including input voltage dividers for up to 2000 volt. It is a well shielded base device suitable for applications where also the base device is subjected to strong EMI

### Combinations and control

In case more channels are necessary multiple base devices can be combined and synchronized. Different channels can be operated at different sampling rates fully synchronous at the same time.

Measurements can be conducted remotely via Gbit Ethernet connection or locally via laptop or screen, keyboard and mouse connected to the base device. Larger measuring systems can be formed by connecting multiple base devices.

## BENEFITS

- FLEXIBLE SYSTEM FOR MULTIPLE MEASURING APPLICATIONS
- UP TO 24 MEASURING CHANNELS PER BASE DEVICE
- AVAILABLE SOLUTIONS FOR LAB AND MOBILE ON-SITE USE

# PROBES AND MEASURING CHANNELS

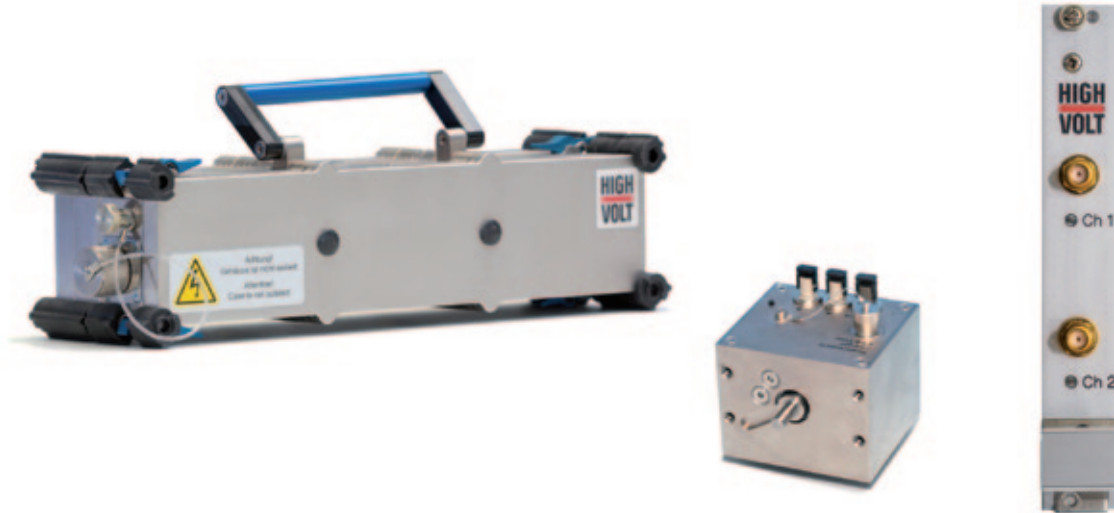


Fig. 2 External HiRES Probe (left), HiRES Rotary Encoder (center), internal measuring channels (right)

## EXTERNAL HiRES PROBES

For exact measurements on HV potential, in situations with strong EMI, or if the operator needs to be far away from the test site our external HiRES Probes are used.

### Design

- Very rugged, extremely well shielded probe for use directly at the signal source
- Measurement and digitization directly in the probe
- Fiber-optic transmission of digital signal to base device
- Battery-powered for up to 16 hours of measurement

### Advantages

- Potential free measurements with probes connected via fiber optical cables, no ground loops
- Very low disturbances due to digitization very close to signal source
- Automatic signal transmit time compensation for synchronized measurements even with long connections
- Failure-free signal transmission up to distances of more than one kilometer
- Well suited for measuring in hazardous environments

The absence of an electrical connection between signal source and operator room increases safety.

## BENEFITS

- POTENTIAL FREE MEASUREMENT
- DISTURBANCE FREE FIBER OPTIC PROBE CONNECTION
- RUGGED DESIGN OF PROBES
- ABSOLUTELY EMI PROOF

## INTERNAL MEASURING CHANNELS

For applications not requiring the external probes internal measuring channels are available. Both can be combined in one system. The wide range of sampling rates (1 S/s up to 250 MS/s) and input voltages (50 mV – 2000 V) make them suitable for a wide variety of applications.

### Specifics

- Internal precision voltage source for exact measurements
- No battery required, long-term measurements
- Input voltage dividers for up to 2000 V signals

## HiRES ROTARY ENCODER

### Application

Mechanical movements are measured by the HiRES Rotary Encoder, which can be flanged directly to a shaft of a motor drive or any moving part of the test object, e.g. circuit breaker.

### Measurement

- Up to 2048 steps per revolution
- Rotation speed, acceleration or linear movement
- Potential free due to fiber optic connection
- Battery for more than 8 hours of measurement

- FLEXIBLE COMBINATION OF EXTERNAL PROBES AND INTERNAL MEASURING CHANNELS
- 50 mV UP TO 2000 V INPUT RANGES, UP TO 250 MS/s

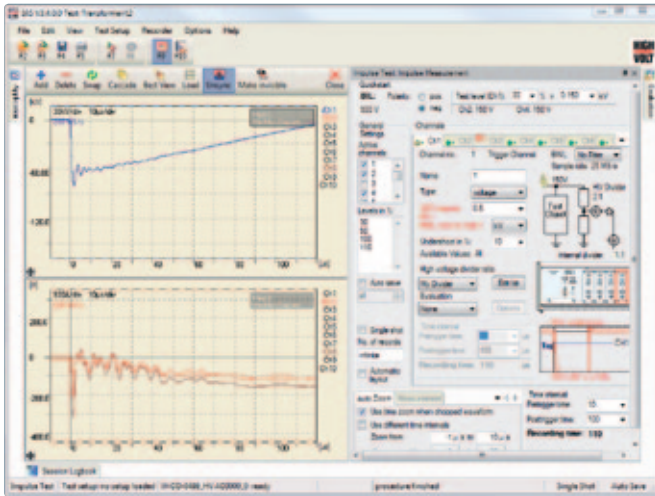


Fig. 3 Software HiRES IAS: Evaluation of measurement data

## HiRES IAS

HiRES IAS is a software solution made for the day-to-day lab use. It allows time-saving measurement, evaluation and test documentation. In order to reduce complexity and error rates only a minimum amount of settings is required for each measurement. Settings can be stored for future measurements.

### Main software module HiRES IAS

The main software module provides all means for operation, data handling and storage, results display and protocol generation and impulse voltage evaluation according to IEC 60060-1 and 2 (IEEE Std 4). It is sufficient for impulse voltage tests on cables, for example, and basis for further software modules.

### Additional software modules

For each test object specific software modules provide well-adapted, easy-to-use measurement setups, display options, evaluation routines and protocol templates:

- HiRES IAS TRA for transformer tests
- HiRES IAS ARR for surge arrester tests
- HiRES IAS CAP for capacitor tests
- HiRES IAS CAL and HiRES IAS R for transient analyzer and HV divider calibration

## BENEFITS

- EASY TO USE, JUST THE SETTINGS YOU NEED
- ONE TAILOR-MADE APP FOR EACH TEST CASE
- INTEGRATED DATA BASE

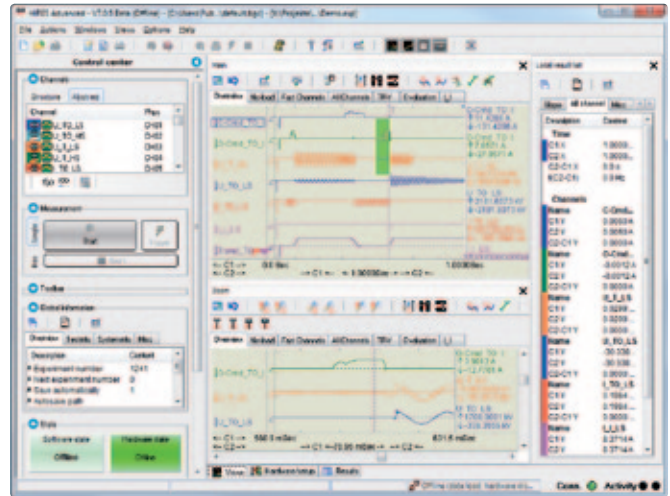


Fig. 4 Software HiRES Advanced: Main software module

## HiRES ADVANCED

HiRES Advanced is a powerful research and analysis tool with comprehensive functions for hardware control, data acquisition and processing. It is designed for in-depth test analysis, test failure investigation and research, and allows the adaptation of virtually every measurement parameter.

### Main software module HiRES Advanced

The main software module handles measurement hardware, display functions and data storage. Transient analyzer, oscilloscope and long-time recorder modes are available. It provides the environment for further software modules.

### Additional software modules

Each module adds specific functionality to the main module:

- HiRES Advanced STL for standardized evaluation of switchgear tests according to IEC 60060-1 and 2 (IEEE Std 4), IEC 62475 (IEEE Std 4/IEEE 1122) and draft IEC 61083-4 (IEEE 1122)
- HiRES Advanced Math for comprehensive mathematical functions, mathematically derived channels, etc.
- HiRES Advanced AutoFlow and HiRES Advanced CustomEdit as graphical or ObjectPascal programming interface
- HiRES Advanced Video for synchronization of normal or high speed video sequences and test data
- Excel & Word interfaces, version for offline analysis, etc.

- IN-DEPTH TEST ANALYSIS
- FULL CONTROL OF MEASUREMENT
- USER PROGRAMMING INTERFACE
- CONTROL SIGNALS FOR TEST SYSTEM AND TEST OBJECT

# ACCESSORIES

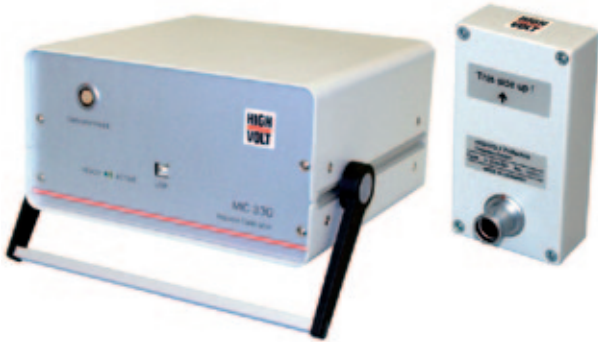


Fig. 5 Impulse Calibrator MIC 330 with Calibrator Head MICH LI 0.84/60



Fig. 6 Resistive and capacitive voltage dividers, impulse current shunts

## IMPULSE CALIBRATOR MIC 330

The Reference Impulse Calibrator MIC 330 can be used for precise calibration of impulse voltage and impulse current measurement equipment such as digital recorders, peak voltmeters and similar. It offers both calibration methods according to IEC 61083-1 (IEEE 1122) and IEC 60060 by pulse calibration and by a separate calibration of voltage with a step voltage calibration.

### Hardware

MIC 330 is a calibrator with an output voltage of up to 330 V for calibration of all measuring ranges used by digital recorders. The base device consists of the voltage source and the control unit. Furthermore, lightning impulse (LI), switching impulse (SI), chopped lightning impulse (LIC) and step voltage (STEP) calibration heads are available.

### Software

The MIC 330 is controlled by a computer via USB bus. It is possible to use the standalone MS Windows® software ICS (Impulse Calibrator Software) to control the MIC 330. This allows easy handling.

In the digital recorder software application HiRES IAS CAL an interface is integrated for the automatic control of the MIC 330. Thus, it is possible to perform a quick fully automatic calibration.

## BENEFITS

- CALIBRATION OF ALL TYPES OF DIGITAL RECORDERS
- EASY HANDLING
- SYSTEM EXPANDABLE WITH VARIOUS VOLTAGE WAVE SHAPES

## VOLTAGE DIVIDERS, CURRENT SHUNTS

In addition to the measuring system HiRES a comprehensive range of measuring voltage dividers, shunts and instrument transformers are offered. Together with the digital recorder HiRES complete, well adapted measuring systems from a single source are available. Calibrations for the complete system instead of component calibrations ensure extraordinarily low measuring uncertainties.

### Available voltage dividers

- Low damped capacitive dividers, type SMC, suitable for impulse and AC voltage
- Capacitive voltage dividers, type WMC, for AC voltage
- SF<sub>6</sub> insulated capacitive voltage dividers, type WCG with low voltage part, suitable for AC voltage
- Resistive voltage dividers, type GMR, for DC voltage

### Additional reference voltage dividers

- Available for AC, DC and impulse voltages, even front chopped lightning impulses

### Current measurement

- Shunt resistors for AC, DC and impulse currents
- Current transformers for AC and impulse currents

- COMPLETE MEASURING SYSTEM FROM ONE SUPPLIER
- WELL ADAPTED COMPONENTS
- SYSTEM CALIBRATION WITH LESS UNCERTAINTY

# DIGITAL RECORDER HIRES

## TECHNICAL PARAMETERS

Table 1 Technical parameters of digital recorder HIRES

Measuring channels		
Measuring channel	Internal	External
Max. sampling rate	up to 250 MS/s	up to 250 MS/s
Precision	14 bit	14 bit
Connection of probe to base device	built-in (electrical connection)	fiber optic connection
Input impedance	1 M $\Omega$ / $<$ 25 pF for 250 MS/s, $<$ 50 pF otherwise	
ADC Analog Digital Converter		
Sampling rate	250 MS/s down to 1 S/s	250 MS/s down to 1 S/s
Resolution	14 bit	14 bit
Input voltage (channel direct)	$\pm$ 50 mV ... $\pm$ 10 V	$\pm$ 50 mV ... $\pm$ 10 V
Overtoltage protection	$\pm$ 300 V	$\pm$ 300 V
Filters, Coupling, Connectors		
Available filters	anti-alias up to 70 MHz, low pass 1 MHz and 200 kHz	
Coupling	DC/AC/GND	DC/AC/GND
Connector	SMA	BNC or SMA
Input voltage dividers		
Input voltages	1000 V, 2000 V	1000 V, 2000 V
Connector	N type	N type
DC measuring uncertainty		
50 mV range	$\pm$ 0.5 % of full scale	
100 mV – 5 V ranges	$\pm$ 0.2 % of full scale	
Base device		
Sample points	up to 120 MS memory per channel	
Total sample clock jitter	$<$ 15 ps (rms)	
Triggering	edge (1 level/2 level), window (edges/levels), pulse width, slope (disturb), level, manual, external for all channels triggers allow logical operations AND and OR	
Accessories		
Battery pack	n/a	approx. 16 h of continuous measurement
HiRES Rotary Encoder	measurement of position, angle, speed, etc. up to 2048 increments per revolution fiber electric connection to base device	
Impulse Calibrator MIC 330	fully automatic calibration 330 V output voltage calibration heads for LI, SI, LIC and STEP	
HV voltage dividers	low damped capacitive divider SMC capacitive divider WMC resistive divider GMR universal resistive/capacitive reference divider MCR ... ref	
Current shunts	impulse current shunts SMW and ISM	

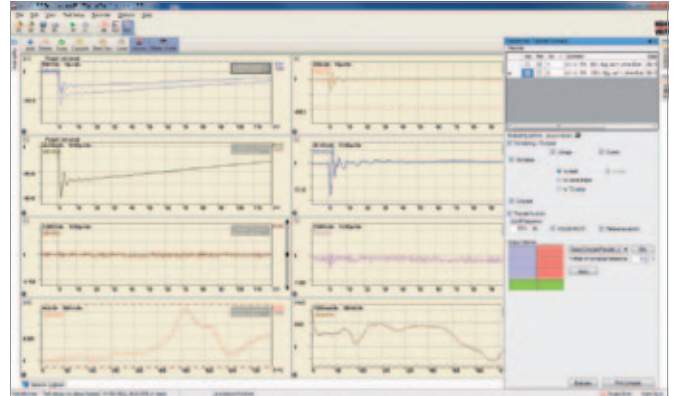


Fig. 7 IAS TRA – Screenshot of software module for transformer testing HiRES IAS TRA

The software HiRES IAS TRA is an additional software package of the main software HiRES IAS for testing of power transformers. Special dialogs and menus allow an easy and convenient application for both type and routine testing of transformers.

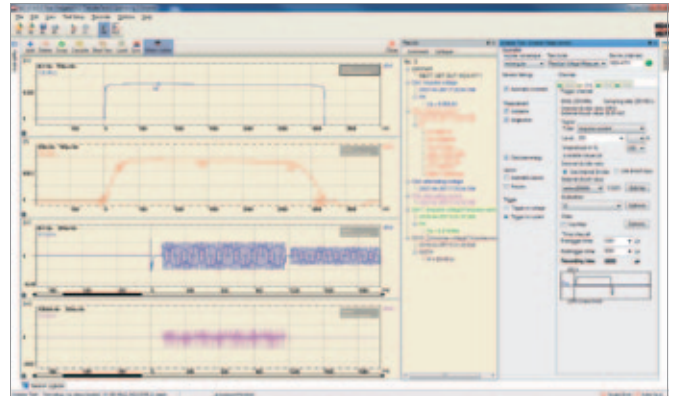


Fig. 8 IAS ARR – Screenshot of software module for arrester testing HiRES IAS ARR

The software HiRES IAS ARR is an additional software package of the main software HiRES IAS for testing of arresters. The IAS ARR is prepared to perform measurements under simultaneous application of impulse current plus AC voltage and enables the control of two transient recorders.

For further information please contact:

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