HAEFELY HIGH VOLTAGE TEST

HiAS® 743

High Resolution Impulse Analyzing System

Impulse voltage tests in industry are mainly used to control the quality of any high voltage equipment. Usually the test object is subjected to a fast voltage impulse. A defined impulse wave shape is applied to the test object. Changes in the wave-shape caused by the test object are used for detection of insulation faults. This procedure is commonly used for routine testing of transformers, bushings or other high voltage equipment. The HiAS®743 is an excellent and reliable tool for accurate measurement of all kinds of wave-shapes. Haefely Test AG also manufactures complete impulse voltage test systems to meet most requirements. This impulse generation capability plus impulse measurement offers a complete solution to modern testing needs.
HiAS®743 incorporates many of our own experiences in the high voltage business, plus those of our customers.
Since many years our R&D group continuously develops further the system software. Therefore this system has the most proven software in the market. Curve evaluation for example is based on databank containing hundreds of real curve data, measured in different environment and test setups all over the world.
Compatibility to previous Impulse Analyzing Systems HiAS®743 / HiAS®742 and new control systems does save your investment. Old measurement data is not lost.
HiAS®743 can be fully integrated into HAEFELY controls. The engineering team guarantees support, calibration etc. now and in the future.

Capturing the complete impulse enables to obtain information about the test object faster and in more detail. HiAS®743 is the tool, which utilizes latest technology high amplitude and fast time resolution to perform this task. The HiAS®743 is a multi-channel precision digital impulse analyzing system of the highest performance class. Measurement evaluation and analysis of impulse voltages and currents can be performed according to IEC 61083, IEC 60060, IEC 60076, IEC 60099, and IEC 60230, the relevant standards for High Voltage Impulse Testing. Automatic evaluation of the impulse shapes specified in the above standards, as well as a manual evaluation mode are available.

The HiAS®743 is ready for integration in a complete impulse voltage test system. The system can be fully controlled by a host computer via standard interfaces or, to reduce interference effect, via an optical link.

FEATURES

- 12 bit real vertical resolution at 120 MS/s
- 128k memory point depth (for 12 bit data)
- Automatic evaluation of all common impulse shapes and their parameters
- Loaded with functionalities: Difference, Parameter Tolerance, FFT, Transfer, Coherence, Comparison, Step response, Smoothing, Advanced Evaluation and many more
- Fulfils IEC 61083-1 & IEC 61083-2 standards
- Clear documentation and reporting including, Test information, notes, grouping, etc.

BENEFITS

Easy, intuitive understandable and useable graphic user interface (GUI)

Automatic test report generation from the integrated reporting tool with user definable layout, logo insertion, etc.

Manual re-evaluation tool for all impulse parameters.

Automatic hardware calibration with additional calibrator RIC422-4 (option)

Easy re-calibration and **system upgrade** due to modular and independent hardware design.

DKD certified calibration of measuring channels available.

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APPLICATIONS

testing of:
- Power Transformer
- Switchgears
- Surge Arrestors

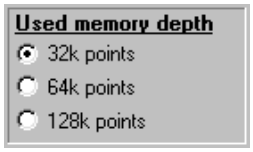
- Research & Development
- National High Voltage Laboratories
- Universities

etc.

MEASUREMENT (DIGITIZING) FEATURES

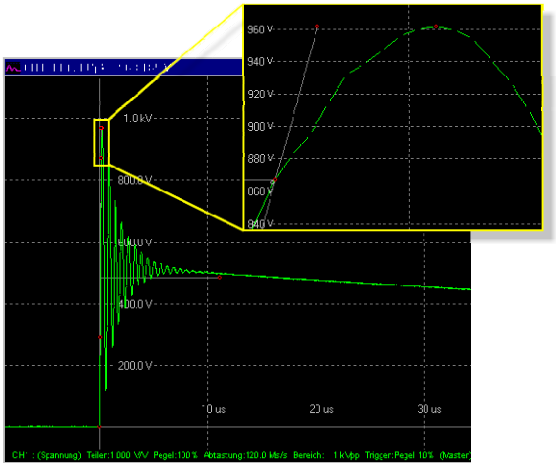
Real 12 bit amplitude resolution, a factor of 4 better compared to a common 10 bit system. Together with the powerful software analysis tools very detailed impulse diagnostics are possible. The effect of amplitude resolution on measurement accuracy is shown for 8, 10 and 12 bit recorders using a signal with 2 % full scale deflection. The difference between the original signal and a 12 bit recorder is negligible.

Variable memory depth up to 128k data points.



A maximum of 128'000 samples can be recorded. A variable memory depth allows one to choose a suitable record length and helps to avoid unnecessarily large file sizes.

120 MS/s and an analogue bandwidth of **50 MHz** are more than enough to capture all impulse shapes in high voltage test labs. High frequency signal components usually have very low amplitudes. High amplitude resolution is therefore critical. The highest bandwidth limit is usually determined by the external high voltage divider – higher bandwidths and sampling-rates in the digitizer create spurious higher frequency noise.



↑ Example of single points resolution @ 120 MSPS.

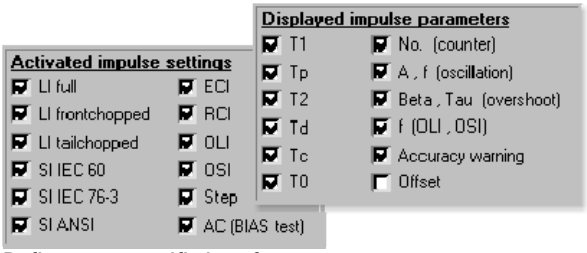
Excellent linearity and low noise level. All tests of this 12 bit system achieve far better results than required by the related standards!

A complete **Record of Performance** is provided with every measuring channel built into a system to ensure highest performance and reliability of the investment.

DKD certified measuring channel calibration is also available on request.

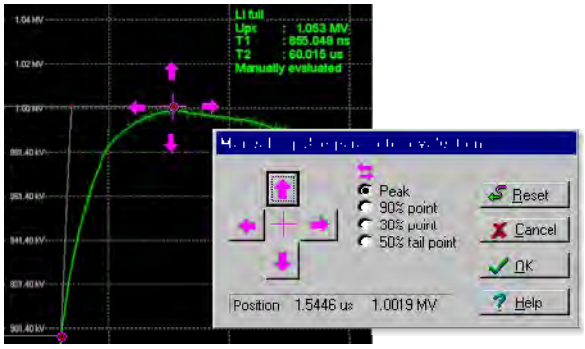
ANALIZING FEATURES

Impulse shapes are analyzed automatically in full accordance with the standards. The HiAS® enables activation of only those impulse shapes and parameters, which are really needed.



Define user specific interface.

Manual evaluation on every newly recorded or re-loaded impulse can still be performed for "special" cases - The best mean curve generator remains the human eye.



The software guides you through the process. E.g. if the peak point (100 %) is moved – the 90 %, 50 % and 30 % points are moved automatically and the influence on all parameters is shown in real-time.

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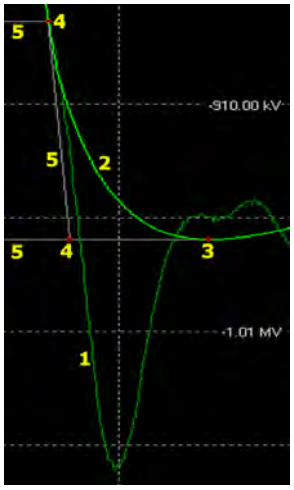
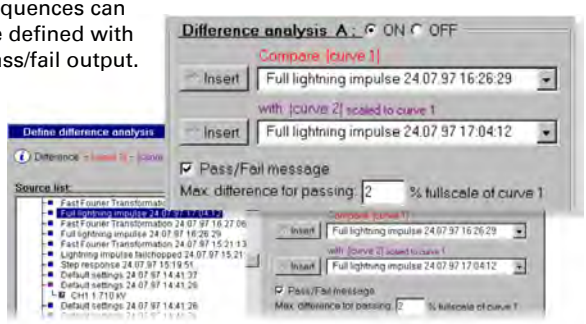
Multi-functional display. Real-curve[1], mean-curve[2], difference (mean - real), all points[3], help-points[4] and lines[5] etc. to calculate the parameters are shown in the curve display. The parameter calculation method is fully transparent. The evaluation of parameters is graphically documented – "what you see is what you get" (WYSIWYG). The display can be zoomed, using the mouse, to resolutions where the individual data points can be seen.



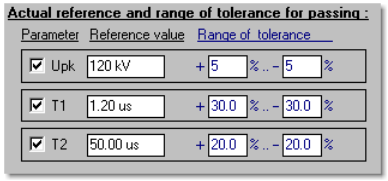
An **Online Toolbox** can be opened by a single click, which gives access to all curve related functions such as: Stepped zooming back, preview printout, print curve, copy to clipboard, recalculation (auto & guided), manual evaluation, signal processing (smoothing), measurement cursors, grid normalization, grid optimization, FFT calculation, edit related curve information, add memos, save complete measurement, save window, save data as ASCII.

FUNCTIONS

Difference Function to subtract two wave-shapes includes auto-fitting and auto-zooming. Curves can be selected from the database or auto-calculation sequences can be defined with pass/fail output.

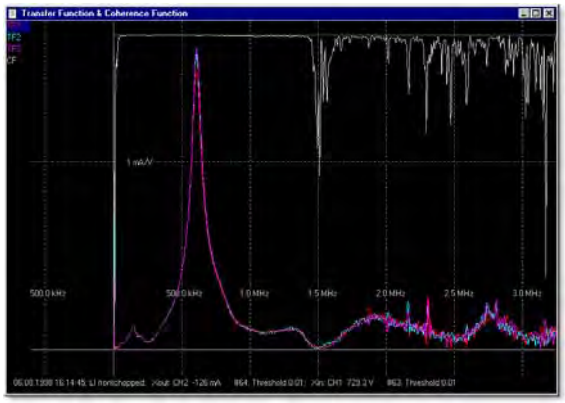


Parameter Tolerance Analysis to enter a max. limit on evaluated parameters (e.g. U_{pk} ± 5 %). Define automated tolerance calculation sequences with pass/fail output.



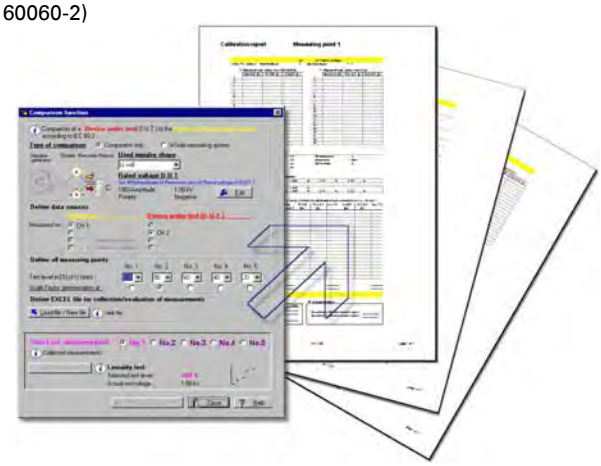
Sequence Function (option) enables full test sequences to be automated for applications such as distribution transformer production without system operators.

Transfer Function (option):
advanced analysis e.g. for transformer testing. Additional information is available (paper E1-73 Malewski et al). colored curves



Coherence Function (option): white curve
Comparison of impulses performed at a reduced test level with those taken at full test level. This allows more sophisticated diagnostics of test objects or complete test fields. Additional information is available (paper E1-82 Malewski et al)

Comparison Measurements (option; supplied with DKD certified measuring channels). Determination of the assigned scale factor, reference method: *"The assigned scale factor and dynamic behavior of the measuring system shall be determined by comparison with a reference system"* (IEC 60060-2)
The linearity test: *"Values of the scale factor of the measuring system shall be measured at the minimum and maximum voltages (or currents) of the operating range and at three approximately equally spaced voltages or currents between these extremes.*
The reference method is by comparison with a reference measuring system."
(IEC 60060-2)



The HiAS®743 REF supports comparison measurements series with all required calculations, visualization and reporting (with automated export to Excel™)

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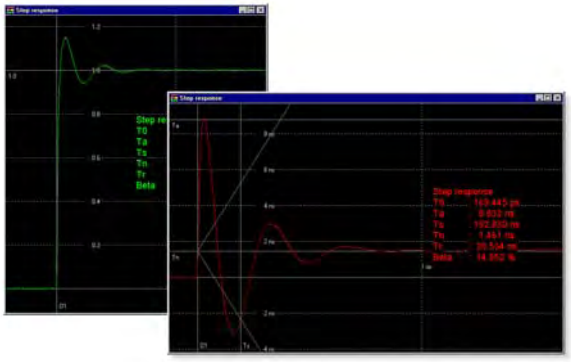
Step response evaluation. Internal measurement including random interleaved sampling (RIS) and external measurements (e.g. from a giga sample scope) can be loaded and analyzed

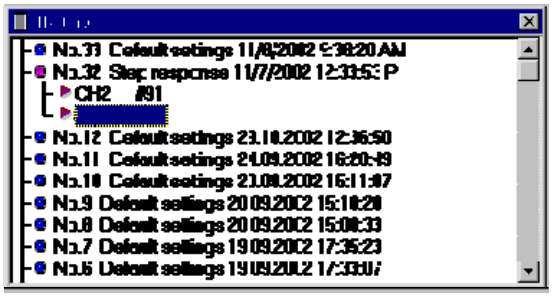


Measurement & test information, user notes, grouping & sub-grouping, headers for clear documentation and reporting of saved impulses. Information can be added to a specific pulse and saved in a clear, customized data structure.

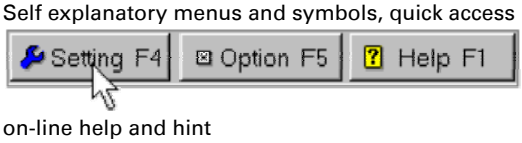
ADDITIONAL FEATURES

Useful items such as: loading external files (scope, .tdg, 742 data, stepdata, ASCII, .txt), impulse counter, pre-setable normalized and/or optimized scaling, hardware check information, etc. are implemented in the control software.

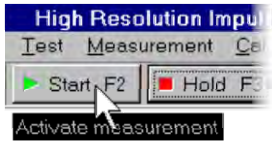
History stack to search non-saved measurements. The last 10 complete measurements are saved in dynamic memory. For instant recall open history and click on the required pulse.



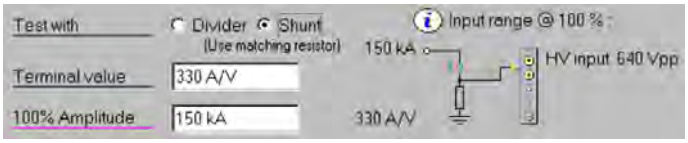
All **standard Windows features** are included.
Self explanatory menus and symbols, quick access buttons,



on-line help and hint texts for all functions, graphically supported dialogue boxes.



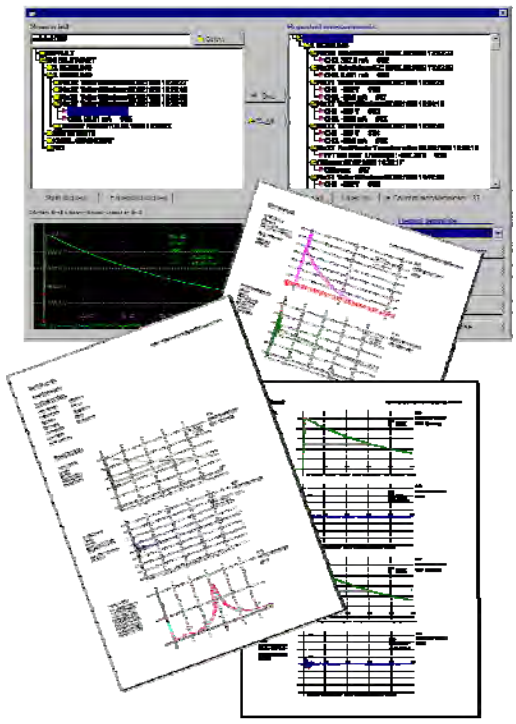
E.g. select “Shunt” and enter a terminal value of 330 A/V. A measuring circuit image, the chosen input range and the correct input connector are indicated as well as the hint to use a matching resistor.



Office software (option) for training or analysis. Identical software that runs without the HiAS®743 hardware enables off-line analysis on a computer out of the lab. This can also help for staff training.

Cut & Paste. The HiAS®743 software runs under the Windows platform. This ensures state-of–the-art performance. Pictures of measurement curves are saved as WMF (Windows Metafile) that allows cut and paste functionality between other programs such as Microsoft Word.

Reporting tool enables selection and combination of any impulse measurement in the HiAS® database. To assist in evaluating the correct impulse the actual measurement curve for the selected data is displayed before starting report generation.
Predefined report templates can be chosen or a template can be modified to create a customer specific report layout.



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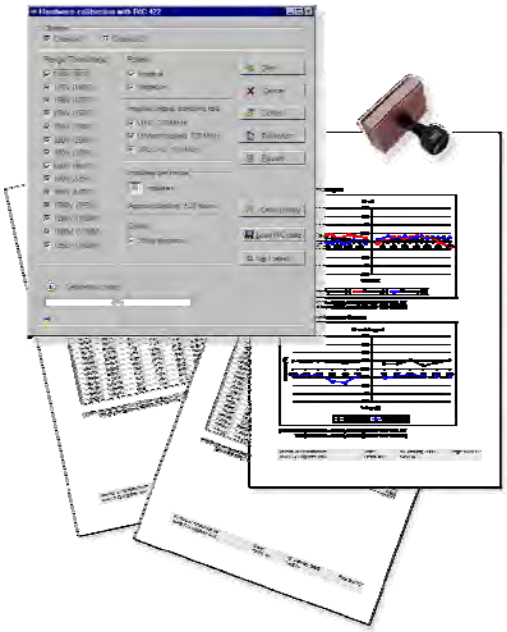
CALIBRATION & STANDARDS

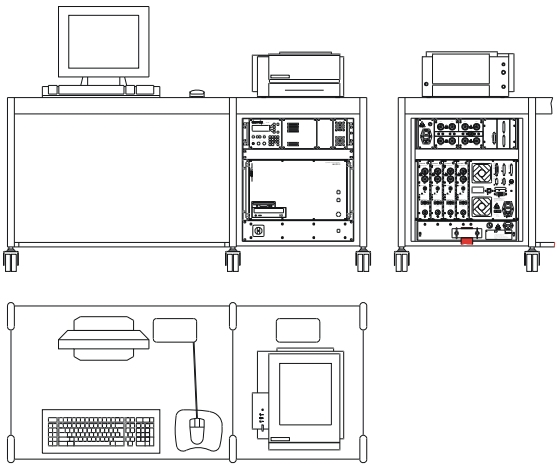
Fully automatic calibration together with a (optional) Haefely reference impulse calibrator RIC 422. Full range IEC 61083 calibration with automatic reports, overnight – without further manual operations, is possible. Amplitude deviations can be entered to provide automatic correction against a nominal standard calibrator.
As a result the best achievable accuracy is obtained without any further calculation.



Standards
HiAS® fulfils and surpasses the requirements of
→ **IEC 61083-1** - A printed Record of Performance (for hardware) is shipped with every measuring channel
→ **IEC 61083-2** - A printed Record of Performance (for software-algorithms) is shipped with every software package. Performance check function is integrated in the standard software as well.
→ **IEC 60060, IEC 60076, IEC 60099, IEC 60230, IEC 60517, ANSI C 57.12.90, IEEE Std 4** - Based on these standards the complex parameter evaluation software of the HiAS® has been developed.

SYSTEM DESIGN

HiAS®743 System consists of a main unit, containing the system CPU, control computer, power supplies, data storage, interfaces and 4 slots for the **measuring channel inserts (digitizers).** All accuracy sensitive elements are combined in one small unit per channel. Also supplied are **peripheral devices** printer, monitor, keyboard and mouse. Main unit and channel inserts are normally mounted in a desk console. Special shielding against EMC disturbances as well as a power supply are included.



The advantage of this modular design is that a single measuring channel insert (digitizer) can be easily pulled out and send back for re-calibration while the system works with the other channels. So there is **no down time** on the system due to factory re-calibration.

Easy re-calibration: Pull out, send and receive back a measuring channel insert.

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TECHNICAL SPECIFICATIONS

System

Number of channels	1...4
Printer	Laser printer black & white; Color laser printer optional
Monitor	Desktop TFT flatscreen 19"
System controller (build-in)	≥PentiumIII, ≥256 MB RAM
Internal operating system	Windows XP (Office Software package runs under: Windows 98, 2000, XP)

Analogue Part

	High voltage input	Low voltage input
Connections	LEMO (RA4250)	BNC
Input divider	1 : 200	1 : 1
Input voltages	100 Vpp .. 1950Vpp	640 mVpp .. 11 Vpp
Input ranges	14 (factor 1.26)	14 (factor 1.26)
Overvoltage protection	2 kV	15 V
Overvoltage tested	6 kVpp (1.2/50 µs, 10/700 µs)	-
Input impedance	2 MOhm // 20 pF	100 kOhm // 20 pF
Analogue bandwidth (-3dB)	50 MHz	
Triggering	internal on slope or level external on slope and level	

Data Acquisition / AD-Conversion

Amplitude resolution	Real 12 bit (4096 LSB)
Sampling rate	120 MS/s, 60 MS/s, 30 MS/s ... 117 kS/s
Memory depth	max. 128k data points (with 12 bit resolution)
Resulting measuring time	220 µs, 450 µs, 900 µs, ... 280 ms

Data Handling

Internal data exchange	buffered AT-BUS
Storage medium	Floppy 1.44 MByte, 3.5"
	Harddisk ≥40 GByte
	CD RW Drive
Remote control	RS232, (optional optical converter)
On request	Ethernet, IEEE488

Operating Conditions

Supply voltage	100 / 115 / 230 V
Temperature range	10 .. 40°C (Laser printer 10..32°C)
Relative Humidity	35 .. 80 %
Warm up time	35 minutes

Mechanical

Dimensions *	157 x 70 x 77.5 cm (62" x 28" x 31")
Weight *	Approx. 150 kg (330 lbs)
	* including table and rack

Overall Uncertainty

Full and chopped impulses (SI, LI)	± 1 % U_{Peak}
Front chopped impulses (LIchopped)	± 1 % U_{Peak}
All time parameters (T1, Tp, Tc, T2, etc.)	± 2 % in time

Standards

Fulfils or surpasses the requirements of IEC 61083-1, IEC 61083-2 and IEC 60060-2

Record of Performance

Full IEC 61083-2 and IEC61083-1 record of performance are supplied with every system respectively channel insert

Calibration

Fully automatic (with optional Reference Impulse Calibrator RIC 422-4, controlled by HiAS® software)

Certification

DKD (Deutscher Kalibrierdienst) calibration and certification of measuring channel inserts optional available

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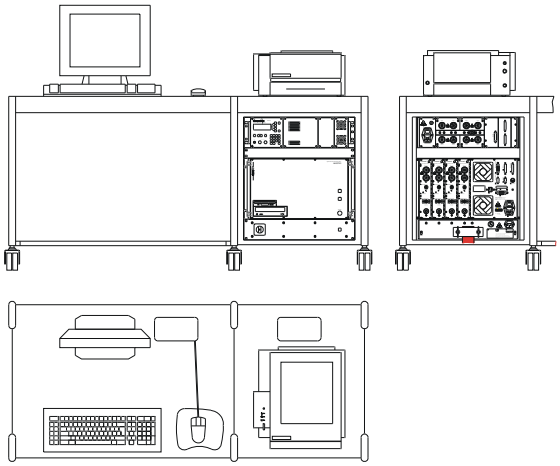
SCOPE OF SUPPLY

E.g. **HIAS 743-4; HS RIC** (4 channel system, mounted in a minirack with desk and built-in RIC422-4 calibrator)

Qty. 1	Desk with mini-rack, main switch, grounding connections, cables
Qty. 1	HiAS®743 mainframe unit with system CPU, supplies, CD RW, Floppy, HDD, channel slots, Interfaces.
Qty. 4	Measuring channel insert (Digitizer) including Record of performance.
Qty. 4	75Ω LEMO termination resistor
Qty. 1	Mouse, ASCII keyboard
Qty. 1	Flatscreen, TFT monitor, 19"
Qty. 1	Laserprinter, 1200dpi
Qty. 1	Set of software backup disks
Qty. 2	All operating manuals (English)
Qty. 1	RIC 422-4 with all connection cables, built into rack. Including Manual, certificate, correction floppy.



ORDERING INFORMATION

System

High Resolution Impulse Analyzing System, minirack & desk, 1 channel	**HIAS 743-1**
High Resolution Impulse Analyzing System, minirack & desk, 2 channels	**HIAS 743-2**
High Resolution Impulse Analyzing System, minirack & desk, 3 channels	**HIAS 743-3**
High Resolution Impulse Analyzing System, minirack & desk, 4 channels	**HIAS 743-4**
High Resolution Impulse Analyzing System, minirack & desk, 2 DKD certified Reference channels, Comparison Test software package (SW option COMP, MS Excel, prepared calculation sheets)	**HIAS 743-2 REF**

Options

Desktop housing instead of desk and rack (→ price reduction; 2 channels max.)	**HS 743 DT**
Channel upgrade (1 additional measuring channel insert)	**HS 743 CHANNEL**
Channel upgrade (1 additional DKD certified Reference measuring channel insert)	**HS 743 CHANNEL DKD**
Sequence recorder software tool	**HS 743 SEQ**
Interfacing software package to allow remote controlling the HiAS, e.g. from a host PC over RS232	**HS 743 REMOTE**
Transfer Function software tool	**HS 743 TF**
Transfer Function & Coherence Function software tool	**HS 743 CTF**
Office Software (OS: Win98, 2000, XP)	**HS 743 OFFICE**
Software Upgrade Package (→ upgrade older HIAS mainframes (Pentium III required) to the newest software package)	**HS 743 SW UP**

Accessories

Reference Impulse Calibrator, 4 channels, IEEE488 & RS232 interface	**HS RIC**

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