

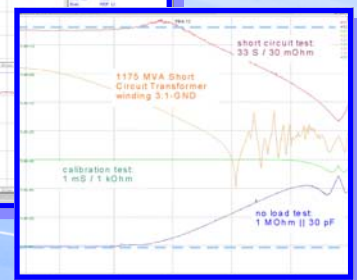
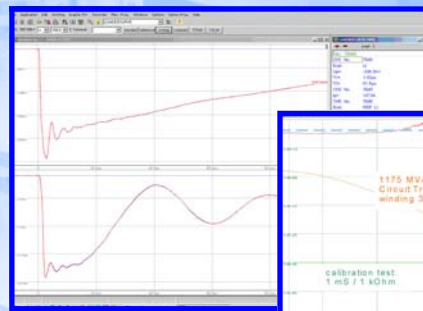
# Impulse Voltage Test Technique

## Measurement – Calibration – Diagnosis



### Measuring Rack MIRA 25

19" TFT Display  
Keyboard with touchpad in drawer  
Color Laser Printer in drawer  
Measuring rack mount with 1 to 4 channels  
Direct input 100 mV to 10 V on front  
Input 10 V to 2000 V on front  
Measuring line bushings to the rear  
suitable for i.v. tests and calibrations in the  
test field with high electromagnetic  
distortions



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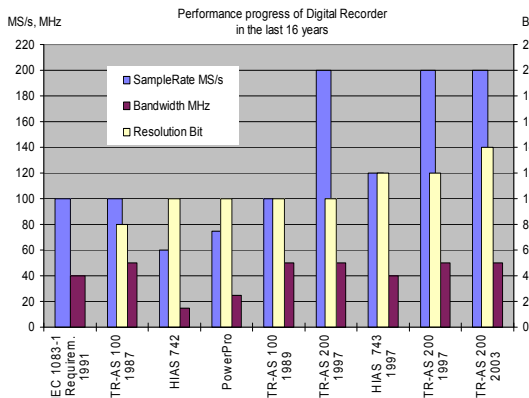
# Digital Impulse Voltage Measuring Systems

## TR-AS® 60-10-12 / 100-8-10-12 / 200-12-14 / 400-12

### Product Overview

**DR. STRAUSS**

Impulse Measurement  
Calibration - Diagnosis  
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### Highest performance with 60 up to 200 MS/s sampling rate and 8 to 14 Bit resolution

Already in 1987, the first TR-AS 100-8 Digital Recorder was delivered to customers for h.v. impulse tests and was therefore the first system with 100 MS/s sampling rate, which fulfilled all requirements of the IEC 1083-1, published later in 1991.

A short time later in 1989 followed the TR-AS 100-10 Digital Recorder as the leading systems with 100 MS/s sampling rate at 10 Bit resolution which fulfilled all requirements of IEC 1083-1 in all respects for comparative measurements, too.

The first competitor system with a sampling rate of 100 MS/s as required in IEC 1083-1 followed with 120 MS/s and 12 Bit resolution years later in 1997, when we finished the design of the TR-AS 200-12 Digital Recorder with 200 MS/s sampling rate and 12 Bit resolution. End of 2002 we presented a new designed system with 200 MS/s and 14 Bit resolution and further significantly reduced noise.

### 200 MS/s reduces measuring uncertainty – 12 to 14 Bit show details of measured waves

The higher sampling rate of 200 MS/s (5ns sampling intervall instead of 8 or 10 ns) show increased accuracy and reduced standard deviations for the front time of full impulses as also for the peak and the time-to-chopping at front chopped impulses during calibration. The influence of the increased resolution from 10 Bit (0.1%) to 12 or 14 Bit (0.006 %) to the resulting overall measuring uncertainty of approx. 0.5% to 0.7% is hereby negligible.



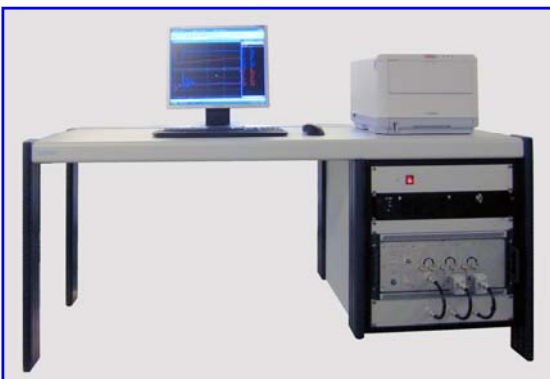
#### Desktop-Housing DERA 6

12" TFT Color Display  
Keyboard with touchpad in drawer  
Measuring rack mount with 1 to 4 channels  
Direct input 100 mV to 10 V on rear  
Input 10 V to 1600/2000 V on rear  
suitable for i.v. tests and calibrations in the test field and on site



#### TR-AS RC Remote Control Housing

for connection via LAN (green) to the host computer (PC or Laptop)  
Measuring rack mount with 1 to 4 channels  
with brackets for building into any 19" measuring rack or for using on the desk  
Direct input 100 mV to 10 V  
Measuring Input 12 V to 2000 V  
suitable for i.v. tests and calibrations in the test field and on-site



#### Working Desk with 19"

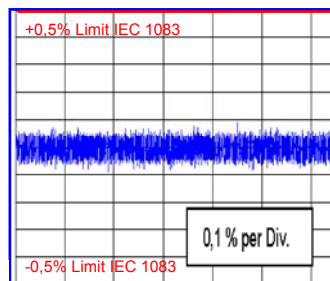
TFT-Display,  
Keyboard, Mouse,  
Laser Printer and a  
separate  
Measuring Rack with  
**TR-AS RC System**  
with 1 to 4 channels  
Direct input 100 mV to  
10 V  
Measuring Input 12 V  
to 2000 V

**Input Connection Unit**  
For easy connection of  
measuring cables and  
terminating resistors

**Industrial PC Control Computer** connected to the TR-AS digital recorder via fibre-optic LAN  
for use in test fields with suitable shielding

The well-established Impulse Voltage Measuring Systems TR-AS, including the digital recorders from our own development and manufacturing, were consequently further developed and now feature improved sampling rates up to 200 MS/s in real-time with 14 Bit resolution simultaneously in up to 16 measuring channels.

The new developed composit A/D-converter hardware system generates raw data with upto 14 Bit resolution together with the highest available sampling rate of 200 MS/s today – and optionally 400 MS/s with 10 to 12 Bit resolution is available for steep i.v. tests.



TR-AS 200-14:  
The static integral non-linearity INL referred to 14 Bit resolution shows at 200 MS/s an excellent lapse and stays significantly inside the required limits of  $\pm 0.5\%$  acc.to in IEC 61083-1.

The INL influences directly the measuring accuracy as also the calibration results. The INL influences directly the measuring accuracy as also the calibration results.

A careful design using sophisticated programmable logic controllers and SMT optimizes the demanding requirements like high sampling rate, small risetime, minimized noise, short settling time, small measuring uncertainty and good long-term accuracy.

This results in nearly smooth waveshapes without visible quantization steps and significantly improves the accuracy of diagnosis using difference method or transfer function.

The patented multi-timebase allows setting of up to 8 individual sampling rates each with a selectable number of samples, so individual time profiles can be generated, e.g. a profile similar to an exponential timebase.

As an option, for multichannel applications in the high power test field, the sampling rate of each individual channel can be selected independently. With this option fast transients and slow events can be recorded with reference to a common trigger event and displayed together on the monitor.

**Application:** Precise Measurements in large High Voltage and High Power Testfields, Monitoring in Substations, On-Site-Measurements and Diagnosis

# Measurement and Calibration Product Overview

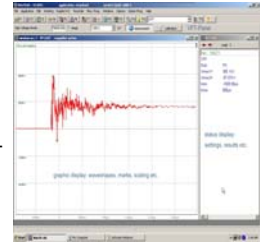
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## Very Fast Transient Measurement System for GIS



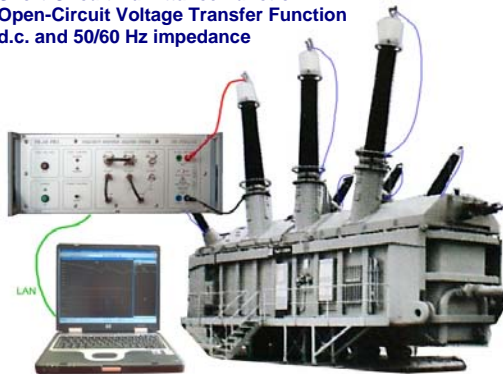
Digital Recorder with 200 MS/s sampling rate and 12 Bit resolution, remote controlled by external Notebook or (Industrial) Computer  
The VFT-Measuring System TR-AS RC for VFT is specially designed for high bandwidth and allows measurements of very fast transients (VFT) in a frequency range from power frequency up to 100 MHz directly with help of capacitive sensors, e.g. PD-sensors which are often already installed in Gas-Insulated Switchgear (GIS).  
Additionally to this measurement of lightning and switching impulse voltages as also A.C. measurements on the finally installed GIS can be performed.



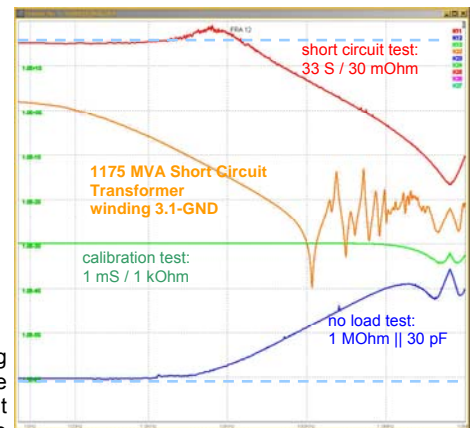
## High Resolution Frequency Response Analyses System (FRA)

For measurement of  
**Short-Circuit Admittance Function**  
**Open-Circuit Voltage Transfer Function**  
d.c. and 50/60 Hz impedance

The Frequency Response Analysis (FRA) on power transformers is used for diagnosis at works, after putting into operation and for maintenance on-site. The frequency-dependent admittance is determined and recorded as object's fingerprint.  
The test object is connected as a 2-pole to the connection unit with inbuilt step voltage impulse generator with up to 350 V peak voltage and sufficient energy without additional measuring lines and shunts.



The phase-synchronous averaging technique improves the signal to noise ratio of the recorded data significant corresponding to 16 to 24 and more



Bit. Because the instant of the step voltage excitation is not correlated to external electromagnetic fields, e.g. caused by power transformers, switchgear or radio stations, their influence is reduced corresponding to the number of accumulations applied.

## Impulse Calibration Systems KAL 1000 / RIG 1000



**KAL 1000 Reference Impulse Calibrator**  
Basic device with electronically controlled charging unit  
STEP-voltage 10 to 1000 V  
TIME-mark generator 20 ms  
**Impulse shapes**  
LI 0.84/60 / LI 1.56/60 / SI 20/4000 / SI 250/2500  
available for pulse calibration

**Chopping time** selection of for all shapes from 0.5  $\mu$ s to some ms.  
**Calibration** acc. to IEC 61083 / IEEE 1122 is automatically performed with calibration software TRAS-KAL including generation of calibration certificate together with TRAS digital recorders.  
**Light weight design:**  
with approx. 15 kg easy to handle



**RIG 1000 H Unit Step Voltage Generator**  
for determination of the impulse scale factor and the response parameters of the impulse measuring system including h.v. divider according to IEC 60060-2 / IEEE 4.

**Application:**  
The generator is placed on the floor or wall in the h.v. test field and connected to the h.v. divider. Measurement and determination of response parameters is automatically performed with calibration software TRAS-TEIL together with help of TR-AS® digital recorders.

## DKD Calibration Laboratory for Impulse Measurement



was accredited on 06.06.1994 by the Physikalisch-Technische Bundesanstalt (PTB) with DAR registration number DKD-K-11701.

DR. STRAUSS Ltd. is the first company which may calibrate impulse measuring and calibration systems for h.v. impulse tests with traceability to National Standards and

may issue calibration certificates, which realize the physical units of measurement according to the International System of Units (SI).

The laboratory (D-K-15205-01-00) is equipped with Reference measuring standards TR-AS® 200-12, TR-AS® 200-14 and KAL1000, which all come from own production line.

# Measurement and Calibration Product Overview

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## Multichannel Transient Recorder Systems TR-AS 10-12 / 100-10/12



### On-Site Switchgear Test System

Multichannel-System based on TR-AS 10-12 with 3 analogue and 24 digital inputs for measurement of make and break times. The picture shows revision of elder 110 kV compressed air

switchgear. The measuring system is placed inside a transportation car and connected to the interrupter under test which must be switched free from h.v. during the measurement. The triggering of the system follows automatically with help of the releasing coil current, measuring data will be evaluated by hand or automatically and then stored on to harddisk to generate a test record.



### Tapchanger Test System

based on TR-AS 10-12 with 8 analogue inputs for measuring voltage, current and torque and 32 digital inputs for contact events. Software for automatic routine test with verification of test results with given parameters.

## Isolation Amplifier Systems

for applications in the high power test field together with TR-AS multichannel transient recorders



### ISO-VER 2.2

2 or 4 kv a.c. isolation  
1 to 8 channels  
input 1 to 1000 V  
1 MOhm / 30 pF  
output  $\pm 1$  V  
bandwidth 0,1 MHz  
accuracy 1%

A floating current input from mA to kA can be realized using a suitable measuring shunt at the input.



### ISO-VER 12

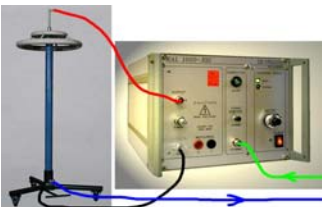
7 kV a.c. isolation  
1 to 8 channels  
input 0.1 to 10 V  
1 MOhm / 30 pF  
programmable  
output  $\pm 2$  V  
bandwidth 2.5 MHz  
accuracy 1%



### Protective Relay Test System

based on TR-AS 10-12 and ISO-VER2.2 with 3 to 8 analogue inputs for voltage and current acquisition and 12 to 32 digital inputs for measurement of contact events.

## STEP Response Measurement RIG 1000H



on h.v. impulse voltage dividers determining ratio and response parameters acc. to IEC 60-2 / IEEE 4

## Probe Calibration System RIG 1000H



using RIG 1000 H h.v.probes can be calibrated with up to 1000 V STEP voltage

## Impulse Current Measuring Shunt ICMS



Impulse current 8/20  $\mu$ s  
1 - 2,5 - 10 - 20 kA  
0,5 - 0,2 - 0,05 - 0,02  $\Omega$   
50 - 280 - 5000 - 18000 A<sup>2</sup>s  
< 30 ns risetime  
flat response, no initial peak  
Temp-koeff <  $10^{-4}$

## Electronic Voltage Transformer EVT



EVT-VC capacitive preamplifier for GIS up to 800 kV, sec 6.5/ $\sqrt{3}$  Volt  
EVT power amplifier for measurement and protection 6.5:100/ $\sqrt{3}$  Volt  
**Adaptation Amplifier**  
Application as adaption amplifier for calibration of electronic (5 or 6.5 Volt)

voltage transformers with conventional ratio bridges with 100/ $\sqrt{3}$  Volt rated voltage. Classes 0.1 and less available.

## Impulse Voltage Generator HIG 7000



Impulse Voltage 7 kV  
Shape 0,1/2000  $\mu$ s  
for non-destructive testing of electronic units  
low energy 1,2 Ws only  
optional shape 1,2/50  $\mu$ s

Technical data and design subject to change without notice. Alternative design on request.