MIDAS 2881 / 2881G

Mobile Insulation Diagnosis & Analysing System

■ Measurement of insulation losses is performed during periodic maintenance and inspection of high voltage equipment like power transformers, bushings, motors, generators, etc.

The MIDAS is a valuable tool for such measurements especially in the harsh electrical environments experienced in substations and other field locations.

Designed for testing at local power-line frequency (50 Hz or 60 Hz), MIDAS automatically measures and records dissipation factor (tan δ), power factor (cos φ) and all other relevant values of impedances (capacitive, inductive and resistive). Damage to or changes in the insulation material are detected rapidly and reliably.

The rugged construction and large pneumatic wheels make transportation and access to remote locations easy.

Predefined test sequences linked with limiting values (e.g. previous measurements) guide the user automatically through the test sequence and make possible a first assessment on-site. Communication with laptop trough standard interfaces (Ethernet) enable easy data exchange with a host computer for data collecting, reporting, printouts, statistics and advanced analysis.



FEATURES

To analyze the condition and quality of high voltage insulation, the system performs automated measurement of:

- ☑ **Dissipation Factor** (tan δ) and **Power Factor** (cos φ)
- ☑ **Short Circuit Impedance** and **Excitation Current**
- ☑ **Low PD level** Due to the state of the art high voltage power supply with filters.
- ☑ **Additional measuring capabilities** like Capacitance, Quality Factor, Frequency, Voltage, Current, Power, Losses, Impedance, Inductance, Reactance, Spectrum Analyzer, Digital Scope and Data Logger
- ☑ **Trending Analysis** function – get a first graphical on-site assessment
- ☑ **Manual and Automatic** (Sequencer) test operation.
- ☑ Built-in high voltage supply up to **15 kV, 4 kVA**
- ☑ Built-in, long-term stable **standard capacitor**
- ☑ **Rugged, reliable and safe** construction

BENEFITS

Shortest Measuring Time: Shortest equipment set-up and measuring time by an “all in one” unit. High output power allows testing of the biggest class power transformers in the shortest time.

Rotating machines testing: The up to 15kV (2881G) and 4kVA embedded power supply allows measurement of rotating machines of up to 24 kV at nominal voltage (13.85kV). The optional resonating inductors increases the measuring load up to 1,41uF

Easy to operate: Self-explanatory user interface. Manual and Automatic test operation. Software assisted test planning, preparation, execution and first assessment.

Highest Accuracy: The Highest accuracy in field-testing instruments has been achieved by using latest measuring techniques. High long-term stability of system accuracy has been ensured by utilization of a gas-insulated standard capacitor as internal reference arm and self-calibrating measurement sensors.

Advanced interference suppression: Advanced interference suppression (patented) allows measurement at local power-line frequency as recommended in the related standard IEEE/ANSI 57.12.90

Simultaneous partial discharge and tan δ (Dissipation factor) test: The Midas 2881/2881G inherent Low Partial discharge level in combination with a DDX9121b (optional) allows both tan δ (Dissipation factor) and partial discharge tests to be made simultaneously, for example on rotating machines.

APPLICATIONS

- Power Transformers
- Distribution Transformers
- Instrument Transformers
- Rotating Machines
- Liquid Insulation
- Bushings
- Cables
- Capacitors
- Circuit Breakers
- Surge Arrestors

HANDY MECHANICAL DESIGN

Rugged construction and large pneumatic wheels are an advantage for transportation in the back of a van and when measurements must be made in remote, hard-to-access locations.



Test system packed in the back of a station wagon

Easy, one-man transportation-and–loading is possible thanks to the integrated handles. Another great feature of this all-in-one-piece design is the shortest measuring set-up time you can get on the market.

LATEST TECHNOLOGY

The development is based on the latest measurement and electronics technologies.

- Conventional techniques like mechanical driven compensation are replaced by **real-time electronic compensation**. This is realized by using advanced high-speed data bus technology and powerful software algorithms.
- **Predefined test sequences** for transformers, bushings, generators, cables, etc. together with two measuring inputs reduce set-up and test time and minimize wiring and re-wiring errors.
- Operated through a laptop with **Windows 7™** makes it a powerful tool in the field to make sure maintenance jobs get done fast and accurately.
- Powerful data management allows for an easy and fast trending and comparison analysis. Condition Based Maintenance gets a new quality.
- The automatic report generator minimises the time to complete the test procedure.
- The integrated online help supports the user during the test procedure.

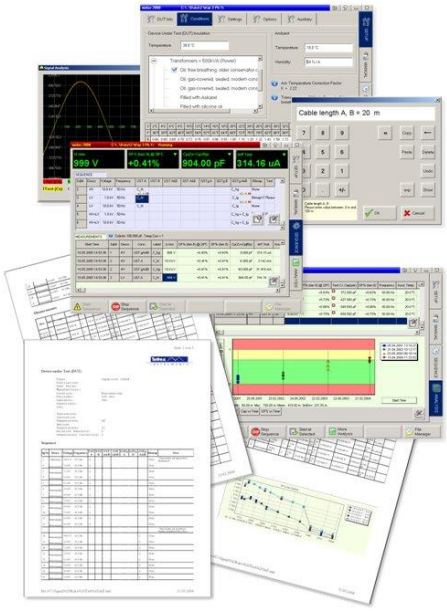
EASY TO OPERATE

MIDAS software incorporates much of our and our customers' experiences in the test business. We designed a very easy to operate and understand, self-explanatory graphical user interface. It allows test planning, preparation, execution and first assessment with just a mouse click. It also means the test equipment is sealed against environmental influences.



MANUAL AND AUTOMATIC

The manual test mode provides quick measurements without lots of definitions or pre-settings while the automatic tests in "Sequence mode" provide complete automated test sequences. This powerful software efficiently performs for field-testing from set-up to sequence definition to automatic operation to a first on-site assessment to the final report.



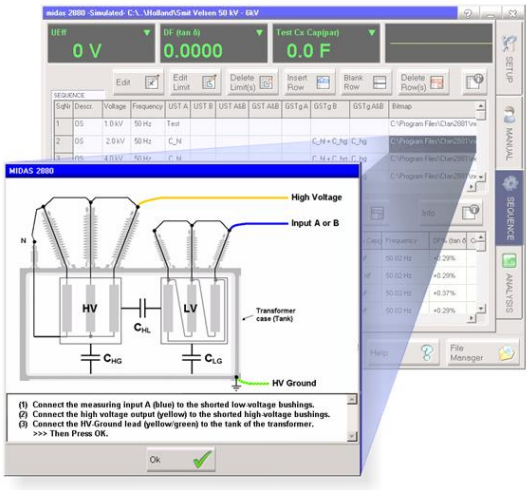
SEQUENCE MODE

Executable test sequences (step macros) can be defined with

- **Set-ups**: Set all configuration values, type of DUT, insulation type, temperature correction function, limits, work order, serial numbers, test personal, location, etc.
- **Test levels**: Set the desired different test levels (voltage and frequency).
- **Connections**: Set the different connections (DUT wiring) e.g. GSTg A+B.
- Measuring values: Define the different values to be recorded. E.g. Voltage, Frequency, PF, Current, Insulation Temperature, PF@20°C, etc.
- **Test instructions**: In every step that requires a rewiring of the test object an instruction box with text and pictures can be defined to provide the test personnel with a step by step guide on how to perform the connection, wiring and the test.
- **Pass/fail levels**: Absolute or relative Limits can be set (based on reference measurements) that will be compared with the measured values and shown in the analysis diagram.

All this can be done on the MIDAS laptop or with the office software package on a separate PC or laptop.

A predefined test sequence then can be performed by junior field personnel. It reduces the set up time in the field and also reduces failures due to lack of knowledge, wrong connections or misinterpretation of measuring values.

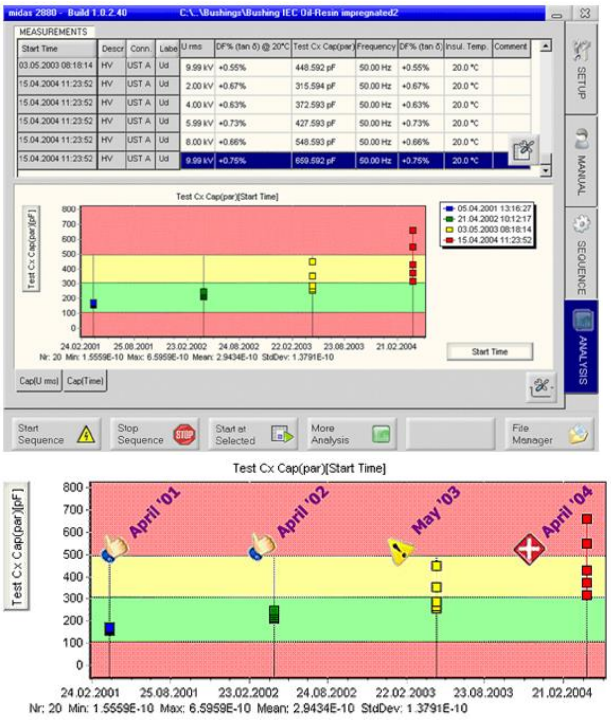


The pop-up test instruction window with a connection diagram picture and below the corresponding instruction text

The Sequence mode is the perfect tool to repeat maintenance measurements. If you have already done one complete measurement you can reload it, perform an identical test, collect the additional measurements and display the new trending. As easy as that!

ANALYSIS FUNCTION

As an immediate on-site assessment one can compare the latest measurements with stored data sets and see how the insulation values have changed over time (trending), using the analysis diagram. Also comparison of measurements captured at different voltages and different frequencies can be observed.



The ANALYSIS window with the list of stored measurements (top) and the corresponding diagram window (bottom)

Both axis of the analysis diagram are freely definable and the collected sets of different measuring data can be sorted as selected. So almost any dependency can be shown and displayed.

If the Pass/Fail criteria are set they are shown in the diagram as a green “Pass” band, a yellow “Attention” band and a red “Failed” section. So one can immediately identify a possible problem in the insulation.

HIGHEST ACCURACY

Due to the technology used for this advanced test equipment we reached the highest accuracy in the market. **The built-in reference is a standard gas capacitor**, developed in-house, proven over 60 years, used as a calibration standard for high voltage laboratories and metrology national institutes. This guarantees the highest long-term stability unbeaten by any other reference standard. Because of the design of our standard capacitor, the stability and the accuracy is independent of temperature, air pressure and humidity of the environment so there is no need for additional verification. It’s all built-in already and all calibrations are done automatically as part of the self-test at boot-up. That’s “accuracy by design”.

ADVANCED INTERFERENCE SUPPRESSION

The built-in ***A***daptive ***D***ynamic ***N***oise ***S***uppression (ADNS) eliminates the external interferences from the measuring signal.

With ADNS we have successfully developed an advanced interference suppression method (patented) that allows measurements at the real power-line frequency!

For environments polluted with high noise the system switches into an Extended Noise-Suppression mode to measure stable and accurate values even in the most difficult locations.

WIDE RANGE OF APPLICATIONS

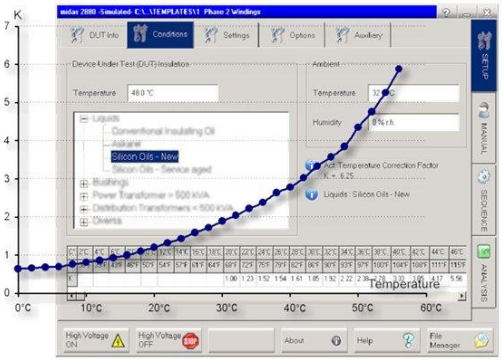
The built-in 15 kV and 4 kVA high voltage- high power source is unique. The 15 kV output voltage (MIDAS 2881G) together with the mobile resonating inductor 5289 allows testing of generators up to 26 kV ($U_N/\sqrt{3}$) according to IEC 60034 or IEEE 286 recommendation.

The powerful supply and measuring capabilities make sure that one can test even the biggest class of power transformers in very short time.

Measurements can be carried out on solid insulation such as cables, distribution-, voltage & current-transformers, motors, bushings, capacitors, etc.

With the optional test cell 6835 all kinds of liquid insulation samples can be tested as well.

TEMPERATURE CORRECTION



Built-in temperature correction curves for different insulation materials are used to recalculate the measured results to reference conditions (20°C, 68°F). The method of correction depends on the type of insulation and the relevant standard, and the predefined set of curves can be easily expanded or changed by the user.

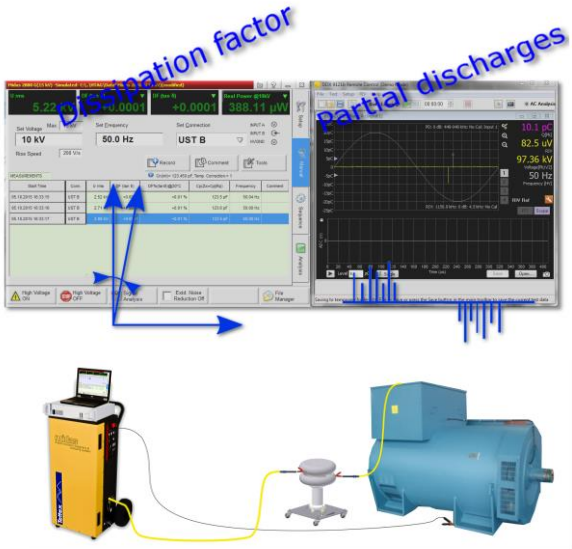
REPORTING AND DATA HANDLING

All measurement results and test object data are saved in XML and CSV, which allow an easy transfer to database applications, MS Word™, MS Excel™, MS Access™, MS PowerPoint™ or even a simple text editor. Printing of the test reports can be done after transferring the data to a PC using the Ethernet interface or a USB memory stick.



SIMULTANEOUS PARTIAL DISCHARGES AND DISSIPATION FACTOR (TAN δ)

The combination of the high power and low PD level MIDAS 2881/2881G with a PD detector type DDX9121b allows **simultaneous partial discharge and dissipation factor testing** on rotating machines, reducing the measurement time drastically



TECHNICAL SPECIFICATIONS

HV Power Supply

	MIDAS 2881	MIDAS 2881G
Output Voltage	Up to 12 kV	Up to 15 kV
Output Voltage Regulation	± 1 % rdg ± 1 V	± 1 % rdg ± 1 V
Output Frequency @ Nom Volt	45Hz …. 70 Hz	45Hz …. 70 Hz
Output Frequency @ 5kV	15 Hz … 1000 Hz	15 Hz … 1000 Hz
Output Current [1] @ Nom Volt	115 mA $_{continuous}$, > 275mA $_{max\ 1\ min.}$	115 mA $_{continuous}$, > 275mA $_{max\ 1\ min.}$
Output Current @ 10kV	165 mA $_{continuous}$, > 400mA $_{max\ 1min.}$	165 mA $_{continuous}$, > 400mA $_{max\ 1\ min.}$
Output Power$^{1}_{max}$	> 4000 VA	> 4000 VA
Output PD level$^{2}_{max}$	≤ 500 pC	≤ 500 pC
Duty cycle	≤ 1650VA 1650 .. 2000 VA	2001 .. 3000 VA ≥3001
	continuous 30 min. ON / 1h	5 min. ON / 1h 1 min. ON / 1h

1 Can be expanded with optional Resonating Inductor

2 Can be reduced with additional filters on coupling capacitor

Measuring Unit (MIDAS 2881 & MIDAS2881G)

	Range	Resolution	Accuracy
Test Voltage	< 1MV	1 V	± 0.2 % rdg ± 1 V
Dissipation Factor (tan δ)	0 … 10'000.%	0.001%	± 0.5 % rdg ±0.01.%
Power Factor (cos φ)	0 ... 100.%	0.001%	± 0.5 % rdg ±0.01.%
Quality Factor	0.01 ... 10000	0.0001	± 0.5% rdg ± 0.0001
Capacitance		0.01pF	± 0.2 % rdg ± 0.2pF
Inductance		0.1mH	± 0.5 % rdg ± 0.5 mH
Test Current $_{Input\ A,\ B\ \&\ HVGND}$	20.uA … 15 A	0.1 uA	± 0.1 % rdg ± 1 uA
Ref Current $_{Input\ Cn\ ext}$	20.uA … 300 mA	0,1 uA	± 0.1 % rdg ± 1 uA
Test Frequency	15 Hz … 1000 Hz	0.01 Hz	± 0.1 % rdg ± 0.1 Hz
Apparent Power S	≤ 1 MVA	0.1 mVA	± 0.8 % rdg ± 1 mVA
Real Power P	≤ 1 MW	0.1 mW	± 0.8 % rdg ± 1 mW
Reactive Power Q	≤ 1 Mvar	0.1 mvar	± 0.8 % rdg ± 1 mvar

Accuracy @ frequency 15Hz…100Hz ; In & Ix > 20µA ; Ix/In: 0.01 .. 10'000 ; With Internal Cn

Internal reference capacitor

Capacitance	100 pF
tan δ	< 0.00002
Capacitance constancy	< 0.01.% / year
Temperature coefficient	< 0.01.% / K
Mains Power supply	
Voltage / Frequency	90 VAC … 264 VAC / 50 … 60 Hz
Input Power	1 kW
Environmental	
Operating Temperature	-10 .. 50 °C
Storage Temperature	-20 .. 70 °C
Humidity	5 .. 95 % r.h.
Protection classes	IP22, IEC 61010, CE mark, general IEC 61326-1, IEC 61000-4-X, 61000-3-X, EN 55011, ANSI/IEEE C37.90
Safety Specification	VDE 0411/part 1a , IEC/EN 61010-1:2002

Mechanical

Weight & Dimensions	Instrument	58 kg	(128 lbs)34 x 47 x 104 cm (13.5" x 18.5" x 41")
	Trolley	11 kg	(25 lbs) 33 x 68 x 112 cm (13" x 26.8" x 44")

General

Control unit	Lap top Computer Windows 7 based.
Measuring unit	With Internal and external Power supply and nominal capacitor
Interfaces	Ethernet connection to external laptop
Recorded Values	DF(tan δ), DF(tan $\delta)_{@20°C}$, DF%(tan δ), DF%(tan $\delta)_{@20°C}$, PF(cos φ), PF(cos $\varphi)_{@20°C}$, PF%(cos φ), PF%(cos $\varphi)_{@20°C}$, QF (quality factor), QF (quality factor) $_{@20°C}$ C_P (Z_X= C_P || R_P), R_P (Z_X= C_P || R_P), C_S (Z_X= C_S + R_S), R_S (Z_X= C_S + R_S), L_S (Z_X= L_S + R_S), R_S (Z_X= L_S + R_S), L_P (Z_X= L_P || R_P), R_P (Z_X= L_P || R_P), Standard capacitor Cn, U_{RMS}, U_{RMS} √3, $I_{Test\ eff}$, $I_{Ref\ eff}$, I_m, I_{Fe}, Impedance Zx, Phase-angle φ (Zx), Admittance Yx, $Frequency_{Test}$, $Frequency_{Line}$, App. Power S, Real Power P, Reactive Power Q, Real Power @2.5 kV, Real Power @10 kV, $Temperature_{Ambient}$ [5], $Temperature_{Insulation}$ [5], Rel. Humidity [5], Temp.Corr.Factor K, Connection mode, Settings, all Notes and Comments, Time, Date
Software	Windows 7
Data format	XML, CSV

5 measured by external temperature/humidity probe

SCOPE OF SUPPLY







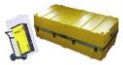
MIDAS 2881 System with laptop as system controller. Max. output voltage 12 kV

MIDAS 2881G System with laptop as system controller. Max. output voltage 15 kV

Rugged cable case including:

- HV supply cable double shielded 20 m or 30 m with clamp and hook
- ground cable 20 m with clamp
- 3 shielded Measuring cables 20 m /30 m with clamps,
- 2 Mini clamps,
- Safety switch with cable 10 m,
- USB memory stick,
- Instruction manual and Test Certificate.

OPTIONS

	2881/SW	Office Software. Can be used for PC test preparation, data visualisation and staff education
	2881/SAFE	Safety Strobe Light with magnetic base for mounting e.g. on a transformer tank, providing visual warning of high voltage presence.
	2881/HCB	Set of hot collar straps for bushings measurements
	288x/CASE	Additional rugged field case for safe transportation of MIDAS 2881

POWER AND CURRENT EXTENSIONS

	5287	Current Booster for inductance testing, especially for short circuit impedance testing of power transformers acc. IEC60076 to diagnose transformer winding deformation
	5288a	12kV, 40 kVA Manual Resonating Inductor for testing high capacitance values up to 1uF. *For additional information see the 5288a datasheet*
	5289	15kV, 100kVA Automated Resonating Inductor for testing high capacitance values up to 1.41uF. E.g. for testing of large power generator windings *For additional information see the 5289 datasheet*

ACCESSORIES

	6835	Test cell for on-site measurements on liquid insulation samples.
	TEMP	Laser infrared, contact-less Thermo/Hygrometer. For determination of: tank (oil) temperature, air temperature and air humidity

PARTIAL DISCHARGE MEASUREMENTS

	DDX 9121b + 9230/30/9-MIDAS + KAL 9310	Package to measure partial discharge on rotating machines together with the MIDAS, includes the DDX 9121b, 30 kV coupling capacitor with HV filter and a partial discharge calibrator. *For additional information see the DDX 9121b datasheet*

OTHER DEVICES FOR SIMILAR APPLICATIONS



☑ **WA 2293**

Automatic Transformer Winding Analiser

The WA2293 is an automatic winding analyser. It combines winding resistance, turns ratio, dynamic resistance, core demagnetisation, transformer type detection, magnetic balance, short circuit impedance and heat run test in the fastest single instrument solution on the market.



☑ **TTR 2795 / TTR 2796**

Transformer turns ratio meter with 100/250 V test voltage

Onsite testing of turns and voltage ratio, phase displacement and excitation current. Automatic winding connection identification and vector group detection. Remotely controllable via USB.



☑ **OC60E**

Oil Cell Tester

A digital liquid break down voltage test set designed to reliably and accurately test the dielectric strength of insulation liquids.

☑ ***MIDAS MICRO 2883***

Mobile Insulation, Diagnosis & Analysing system

The MIDAS micro 2883 is the smallest and most compact insulation diagnosis set on the market. The weight of only 25 kg / 55 lbs and the one box design makes it the ideal tool for power / dissipation factor / tan δ on transformers



☑ **FRA 5310**

Frequency Response Analyser

Used for detection of winding movements and mechanical failures of transformers. Active probing assures reliable and repetitive measurement results. Advanced analysis and touch screen operation.



☑ **880PL-DC**

Digital Series - Portable DC Hipot

The 800PL-DC Hipot test the insulation strength of electrical apparatus. Outfitted with a state-of-the-art digital interface and extensive safety features. Equipment can measure also isolating resistance and polarization Index.



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