

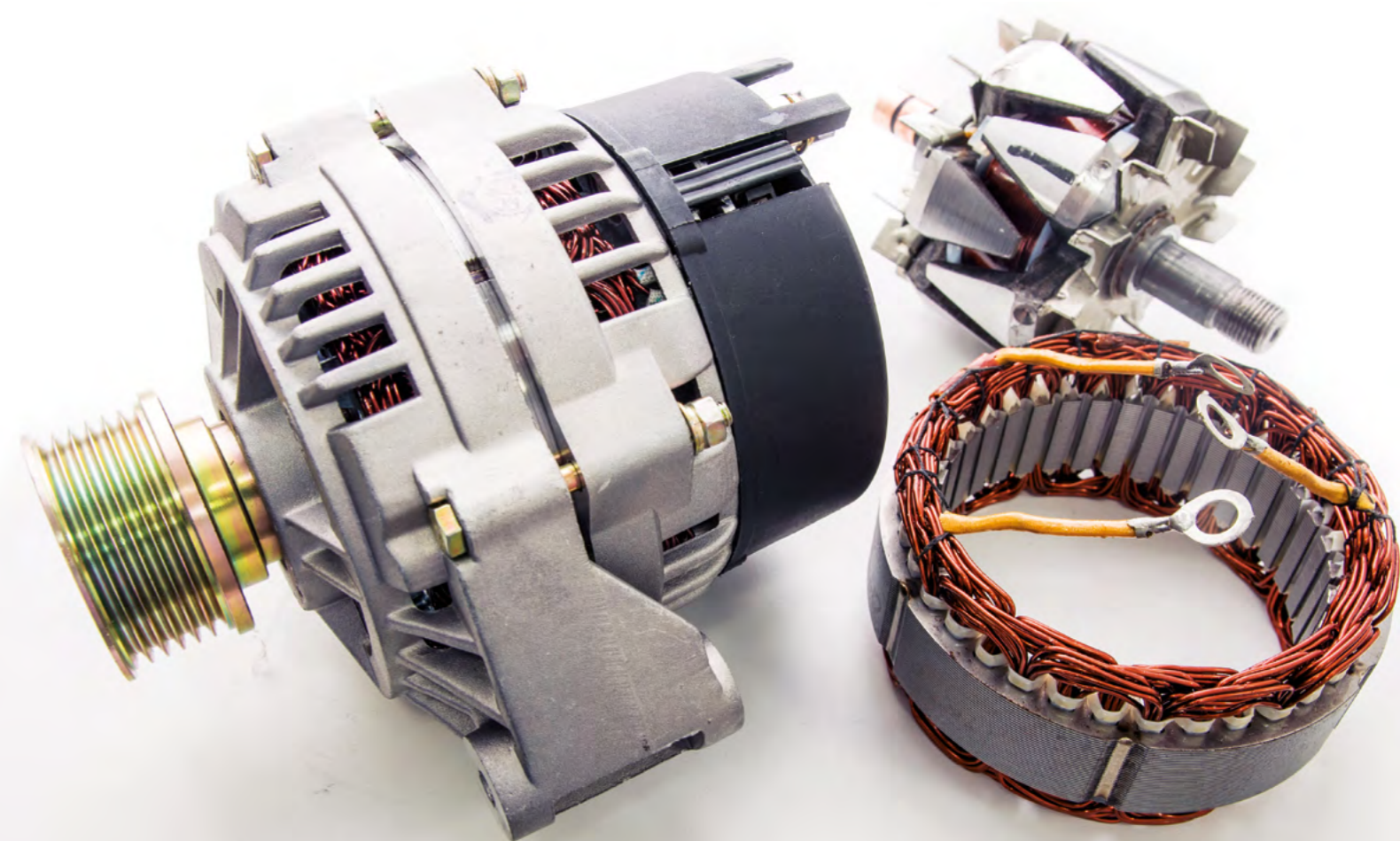


STA Advanced Series

PARTIAL DISCHARGE MEASUREMENT SYSTEM

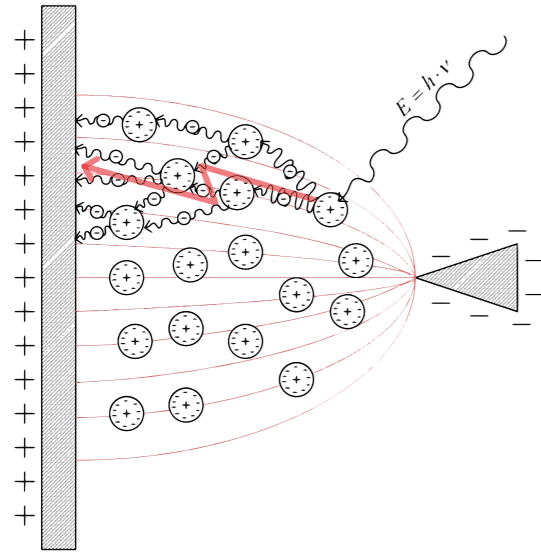
DEEP INSIGHTS INTO WINDING INSULATION

Partial discharge measurements pave the way to higher quality and durability of electrical motors and other winding goods by detecting quality faults in insulation.



Partial Discharge Basics

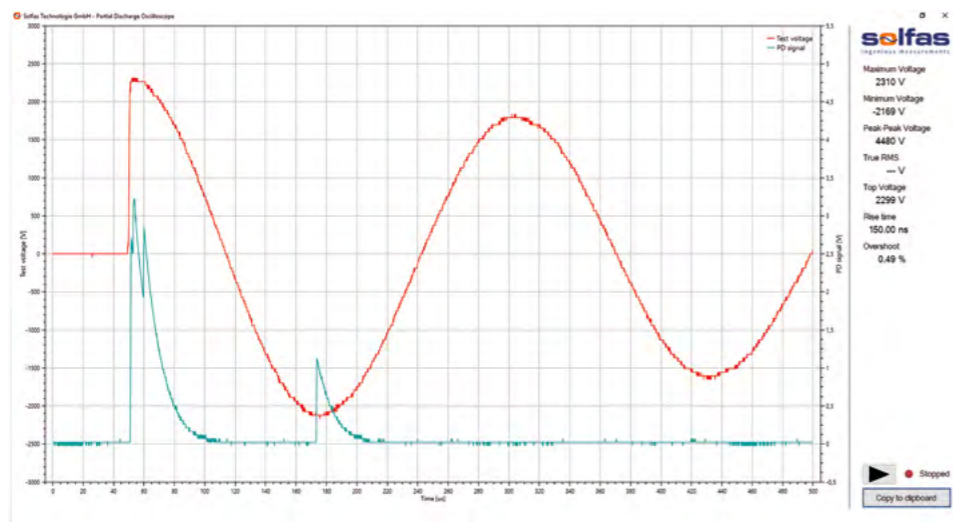
Partial discharges are a result of local electrical stress concentrations in the insulation or on the surface of the insulation which lead to electron movements.



Schematic representation of the formation of a partial discharge in a tip-plate electrode assembly caused by incident radiation

Motivation for PD Measurements with Impulse Voltage

The PWM inverter operation of today's drive systems cause higher stress to the motor insulation. Short voltage rise time together with the use of long motor cables and breaking operation can result in much higher peak overvoltages than in conventional 50/60Hz mains operation. PD measurements with impulse voltage can reproduce this stress to the motor and allows testing the insulation in the configurations phase-phase, phase-ground and turn-turn.

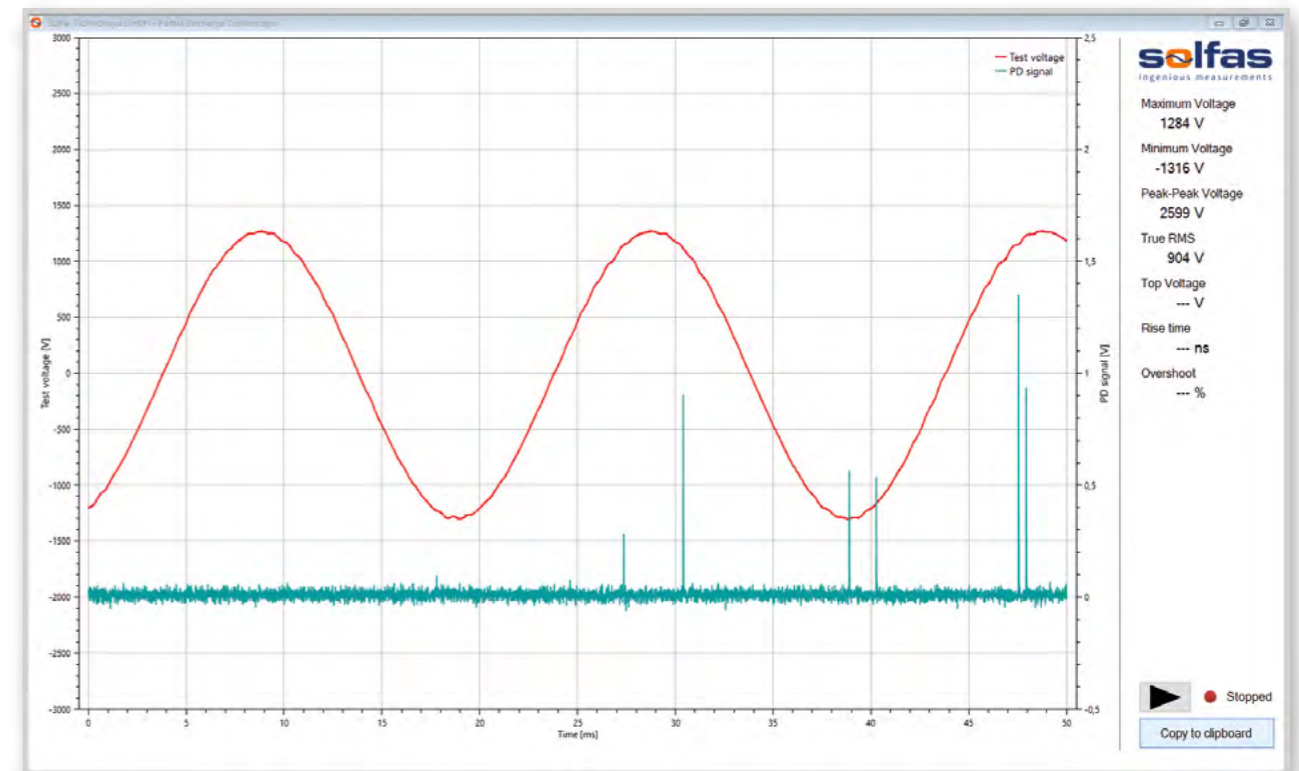


This oscilloscope view shows the partial discharge activity at a stator winding during a surge voltage impulse with a peak voltage of 2310V.

Advantages of PD measurements at stators

With partial discharge measurement the insulation quality can be evaluated even better than with conventional methods. It offers several advantages:

- The measurement of Partial Discharge Inception Voltage (PDIV) and Partial Discharge Extinction Voltage (PDEV) shows the voltages at which PD activity starts and stops
- This gives measurable values for the quality of insulation
- If the number of PD is monitored and limited during the test, there will be no damages to the insulation



Partial discharges at a stator during sinus test voltage.

Standards for PD measurements with impulse voltage

IEC/TS 60034-27-5

Off-line partial discharge tests on winding insulation of rotating electrical machine during repetitive impulse voltage excitation

IEC/TS 61934

Electrical insulating materials and systems – Electrical measurement of partial discharges (PD) under short rise time and repetitive voltage impulses.

IEC 60034-18-41

Partial discharge free electrical insulation systems (Type I) used in rotating electrical machines fed from voltage converters – Qualification and quality control tests

“The technical specification IEC60034-27-5 provides guidelines for the off-line partial discharge tests on stator and rotor winding insulation in rotating electrical machines driven by voltage converter. The STA Advanced Series follow these guidelines under consideration of best practices in PD measurements.”

Made of Solfas Components

The Solfas STA Advanced Series are modular test instruments combined together to a full integratable system for routine testing in production environment or laboratory use.

STA Voltage Sources



Sinus

Sinusoidal high voltage with 50 or 60 Hz
For PD measurements and AC high voltage test (dielectric withstand test)
Solfas GHV series



Surge Impulse

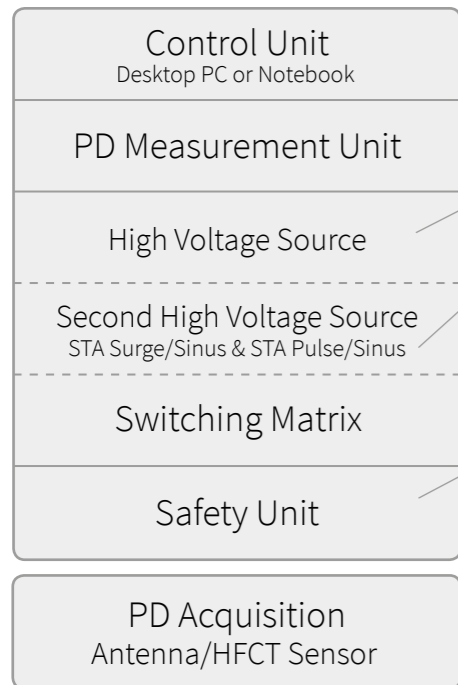
High voltage capacitor discharge into winding
For PD measurements and surge voltage test
Solfas GWS series



Rectangular Impulse

High voltage inverter voltage (PWM)
Bipolar or unipolar impulses with variable width and frequency
Switchable rise time 150ns/500ns
Solfas GRP series

System Architecture



Voltage Source as the distinctive feature

Choose the right STA model for your applications. There are 4 models with 3 different voltage sources available.

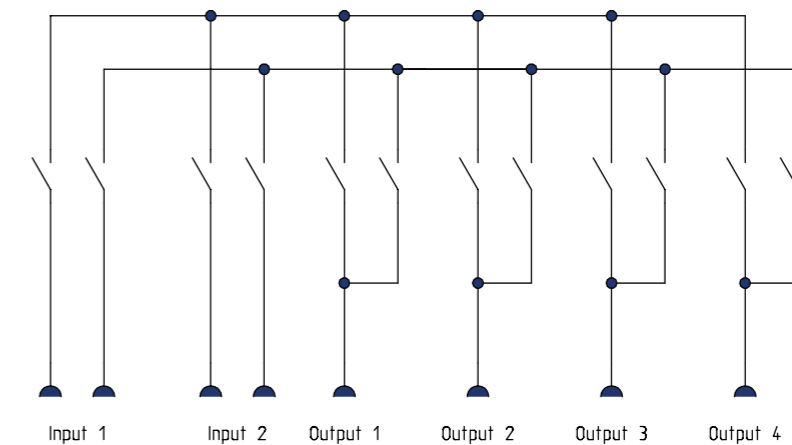
Basic, Advanced or Custom Safety

All models are equipped with basic safety features. The Advanced Safety Unit is recommended for the monitoring of a single external safety guard. Custom safety integrations are available to meet any other requirements.



Equipped with High Voltage Switching Matrix

The Switching Matrix allows the automatic switching of the different voltage sources and output connection configurations for various tests. Several test steps can be performed automatically without manual reconnection or reconfiguration of the test setup. This highly increases comfort, safety and testing speed.



Features

- + Control via system software
- + For automatic test sequences
- + Switchover for all voltage sources
- + 4 or 7 output terminals for stator connection
- + Connection configuration via test plans
- + For high voltage up to 6kV
- + Allows automatic test sequences
- + Allows several stator test configurations
- + Phase - Ground Insulation
- + Phase - Phase Insulation
- + Turn - Turn Insulation

Clear, simple and intuitive

The Solfas Test Suite

Automatic Tests

Solfas Test Suite uses test plans for each test object. Test plans allow the creation of individual test procedures by combining single test steps which include parameters, limits and connections. Testing can be done automatically or manually.

Network Support

Store testplans and results on network drives. In the event of a network failure a fallback to local operation is possible without data loss. Test plans can be remotely created and modified on other PCs in the network instead of working directly at the test system.

Reporting & Test Certificates

Create comprehensive test certificates in PDF or export test results into XML, CSV or other formats. Reports are available in several languages and custom designs.

System Integration

Solfas Test Suite can run stand-alone but can also be integrated into an existing server or cloud environment running **mySQL server**, **Microsoft SQL Server** or **Oracle Database**. The integration with ERP systems is an available option.



Features

- Automatic test sequences
- Automatic reports and certificates
- Multi-language support
- Network-compatible
- User management
- Data exports
- Barcode scanner support

System requirements (in case of purchase without control unit) : Windows 7 or higher (Windows 10 recommended), Core 2 Duo or Athlon X2 at 2.4 GHz, 4 GB RAM, 1 GB of free space, TFT Monitor with 1280x1024 resolution (1920x1080 recommended), 100MBit LAN adapter (2x GBit LAN recommended)

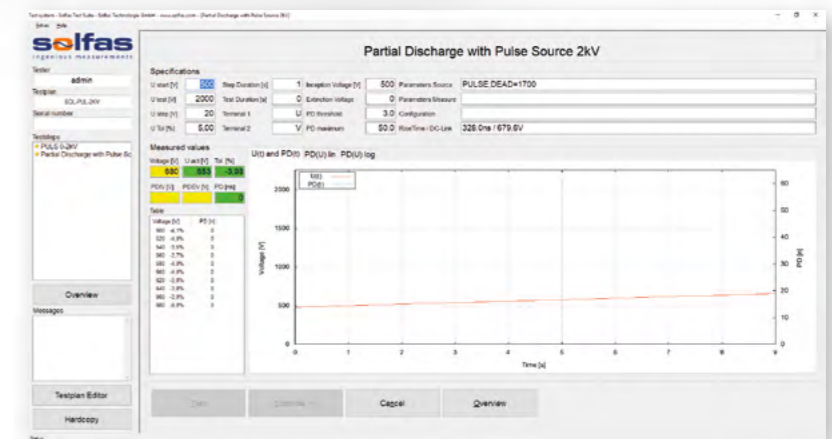


Team Collaboration

Solfas Test Suite supports different roles and access rules to coordinate test teams. Test plans can be created by a qualified engineer while test operation is done by technicians without access to the test plan settings.

PD Tests

Test sequences with switch matrix configuration and step-by-step voltage increase can be easily created, configured and tested.



The measurement of PDIV, PDEV, RPDIV and RPDEV in all stator phases is performed automatically. The measured voltage and PD are clearly shown in a diagram. The PDIV and PDEV are displayed and checked for the specified limits.

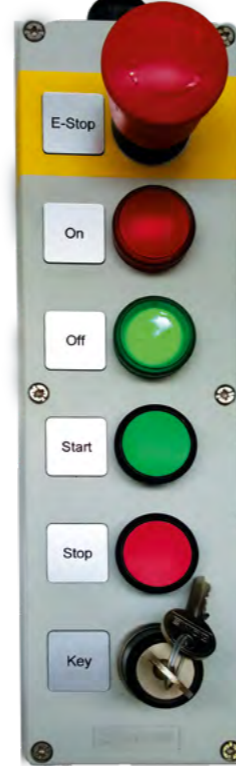
Solfas Test Suite is based on the operating system Microsoft Windows®. The Software only supports Solfas certified hardware. 1 License is scope of delivery.

Safety First

Each STA Advanced model is equipped with Basic Safety Features.

For monitoring of external safety guards like test cabins or safety doors the Advanced Safety Unit SCU05 is available.

More complex safety requirements with many sensors can easily be fulfilled by our Custom Safety Unit SCU10, which offers a programmable safety control that can be easily adapted to custom requirements in production environments.



Partial discharge acquisition

For PD acquisition two options are offered. At open stators the measurement is done with a HF antenna which is placed inside or near to the stator. For mounted motors our multi-terminal coupling unit with HFCT is used. Both offer the advantage of isolation to the high voltage. Partial discharges are measured

in the UHF range with high sensitivity. The attenuation against interference in the frequency range below 100MHz is very high, which allows measurements with various test voltages.



Control Unit

All STA models are shipped with the control unit of your choice (Microsoft Windows 10 64-bit PC or Notebook) with the installed and pre-configured **Solfas Test Suite**. The setup is configured to run out-of-the-box but can also be integrated into an existing server or cloud environment.



All-in-one PC
21.5" TFT Display
Windows 10
Intel Core i5
Pre-installed and pre-configured Solfas Test Suite

	Meets highest safety requirements EN954-1 Cat. 4 EN ISO 13849-1 PL e	Meets highest safety requirements EN954-1 Cat. 4 EN ISO 13849-1 PL e
BASIC	ADVANCED	CUSTOM
Rack internal only	for external safety guard	for special requirements
Emergency Stop	Emergency Stop	Emergency Stop
Start & Stop Buttons	Start & Stop Buttons	Start & Stop Buttons
Warning Lights	Warning Lights	Warning Lights
Interface to external safety circuits	1 external Safety Guard	up to 5 External Safety Guards
-	External Emergency Stop	External Emergency Stop
-	External Operation Panel	External Operation Panel
-	Dual channel sensor inputs with earth fault and short circuit detection	Dual channel sensor inputs with earth fault and short circuit detection
-	-	Customizable
Allways included	Safety Unit SCU05	Safety Unit SCU10

Technical Specifications



Model	STA Sinus	STA Surge
Sinus Output	5kV - 100mA - 500VA	---
Surge Output	---	3kV 0.45J 6kV 1.8J with Option -S6K
Pulse Output	---	---
Output rise time	---	---
Output Terminals	4 / 7 with Option -7OT	
PD Sensor	High Frequency Current Transformer (HFCT) or HF Antenna	
PD Detection	Frequency range 200 ... 400MHz, Measurement range -60 ... 0dBm	
Safety Features	Basic Features: emergency stop button, red and green warning lights, start and stop button, safety interlock connector	
Interface	Ethernet	
Power Supply	80-260VAC, 45-65Hz, IEC C14 connector	
Form Factor	19" 12U	19" 12U
Dimensions HxWxD	589mmx533mmx600mm	589mmx533mmx600mm
Weight	48 kg	38 kg

Model	STA Sinus/Pulse	STA Sinus/Surge
Sinus Output	5kV - 100mA - 500VA	---
Surge Output	---	3kV 0.45J 6kV 1.8J with Option -S6K
Pulse Output	±2.5kV uni-/bipolar	---
Output rise time	150ns/500ns selectable	---
Output Terminals	4 / 7 with Option -7OT	
PD Sensor	High Frequency Current Transformer (HFCT) or HF Antenna	
PD Detection	Frequency range 200 ... 400MHz, Measurement range -60 ... 0dBm	
Safety Features	Basic Features: emergency stop button, red and green warning lights, start and stop button, safety interlock connector	
Interface	Ethernet	
Power Supply	80-260VAC, 45-65Hz, IEC C14 connector	
Form Factor	19" 16U	19" 16U
Dimensions HxWxD	767mmx533mmx600mm	767mmx533mmx600mm
Weight	63 kg	61 kg

APPLICATIONS

Industrial production of electrical motors
Stator tests
Quality control
Research & Development

KEY FEATURES

PD measurements with pulse, sinus or surge voltage
Modular and customizable

KEY BENEFITS

Deep insights into winding insulation
Reproducible partial discharge test sequences
Automatic tests for production
Product quality improvement

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System Upgrades

Surge Voltage 6kV Upgrade

This option extends the range of the surge voltage test from 3kV to 6kV.



Switch Matrix Upgrades

This option extends the number of switching matrix output terminals from 4 to 7. This allows the connection of stators with 6 terminals and frame. Switch matrix configurations with custom number of terminals are available on request.

Optional Extensions

ECM Extension

With this calibrated instrument the environmental air temperature, humidity and pressure are measured and included in the test report.



Temperature	-25°C ... +70°C ±0.5% of value ±0.1°C
Relative Humidity	0.0% ... 100.0% RH ±2.5% RH Accuracy (at 11%-90% RH)
Air Pressure	10.0 ... 1100.0 mbar ±1.5 mbar (at 750-1100 mbar)

WRM Extension

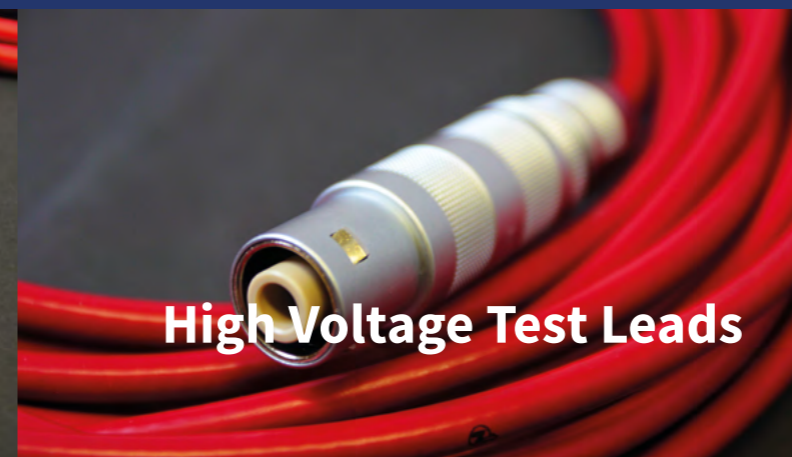
The WRM Option adds a precision winding resistance measurement to the system. This extends the STA to a full-featured stator test system.



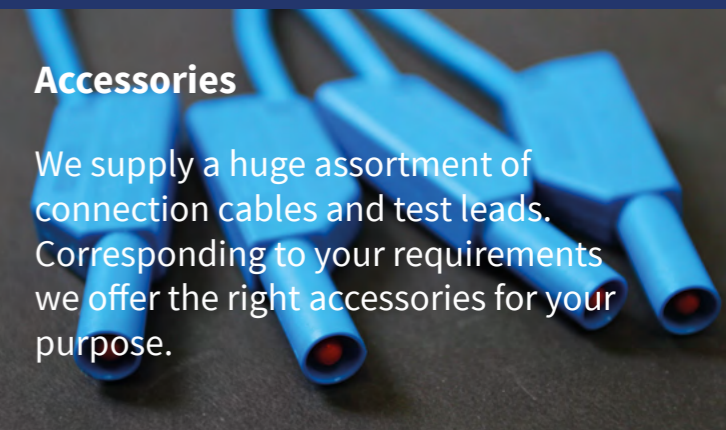
Kelvin Test Leads



Safety Test Leads



High Voltage Test Leads

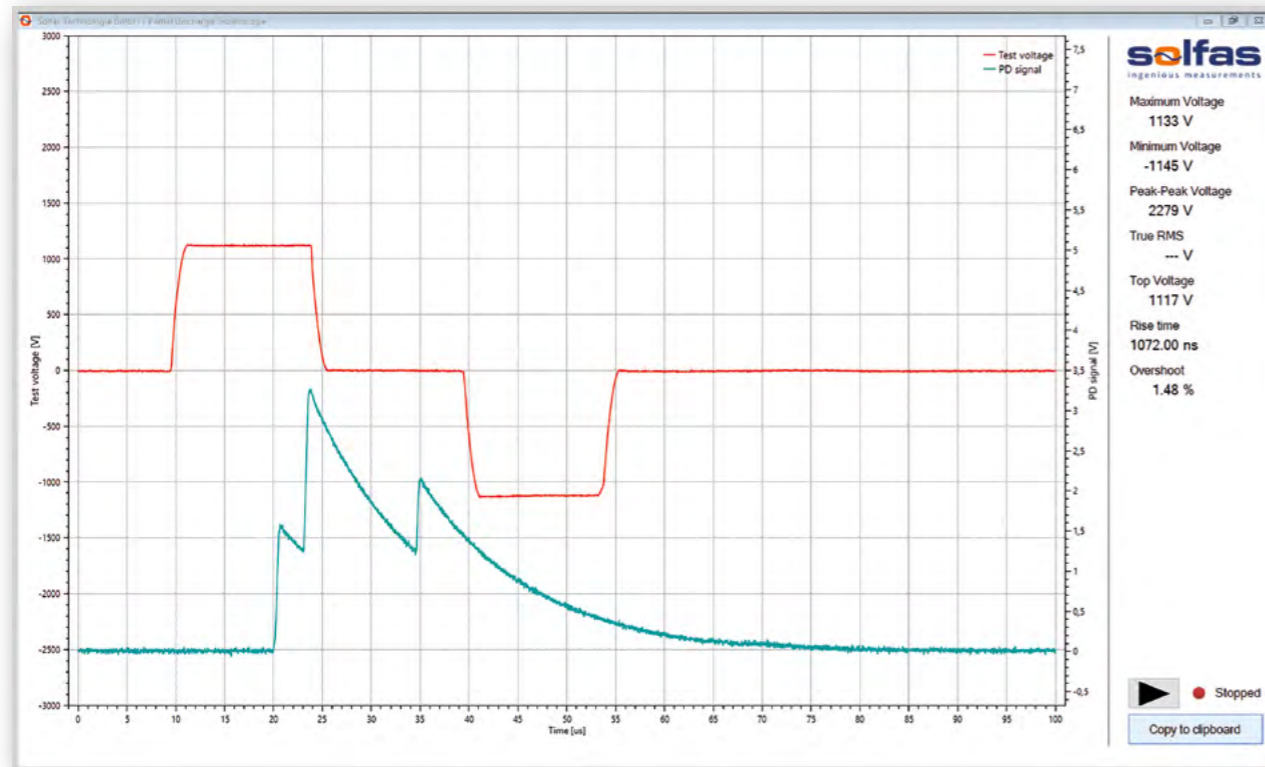


Accessories

We supply a huge assortment of connection cables and test leads. Corresponding to your requirements we offer the right accessories for your purpose.

AVM Extension

This option brings you the capabilities of a high power oscilloscope to your PC screen. The voltage and partial discharge curves and important measurement values (MIN, MAX, PEAK-PEAK, RMS, RISETIME, OVERSHOT) are clearly shown.



This gives you the ability to measure the required test voltage details and export this data and plots to test reports. The voltage measurement can be connected directly at the stator or motor terminals and is done with a differential probe.

Channels	Voltage + PD
High Voltage differential measurement	up to 6kV
Bandwidth	100MHz
Resolution	14 Bit

GPDC10 Calibrator

The GPDC10 is a calibrator for PD measurements according to the standards IEC 60270 and IEC/TS 61934. It is used for sensitivity checks or reference charge injection, which allows precise adjustments at all STA systems.



Impulse charge	1-2-5-10-20-50-100 pC (Option -A) 10-20-50-100-200-500-1000 pC (Option -B)
Impulse frequency	100 Hz
Impulse rise time	< 2.5 ns
Power Supply	2x AA Battery
Dimensions	115x50x180 mm
Weight	600 g
Output connector type	BNC

Integration & Production

Customized test systems for stators, electrical motors and other winding products

Today's production environments are different from each other for many reasons: There are safety policies, rules for workplace design, material transport needs, electrical contacting requirements and more. For many years Solfas has been offering CUSTOM SOLUTIONS based on our MODULAR SYSTEMS and our enormously grown expertise.



The Solfas Integration Process

1

Client Request

The client describes his idea, problem or concrete requirements and targeted budget. Also the client gives us an idea of the application environment.

5

Quotation

The final concept can now be budgeted precisely. The specification is part of the quotation.

2

Analysis

Solfas engineers analyse the requirements, give feedback and clarify open questions.

6

Production

The test system is now manufactured according to the specification.

3

Conceptual Design

Based on our standard components and custom solutions we create a first concept considering all requirements.

7

Factory Acceptance Test

Test and verification of the system ideally together with the customer. Check for completeness. Delivery.

4

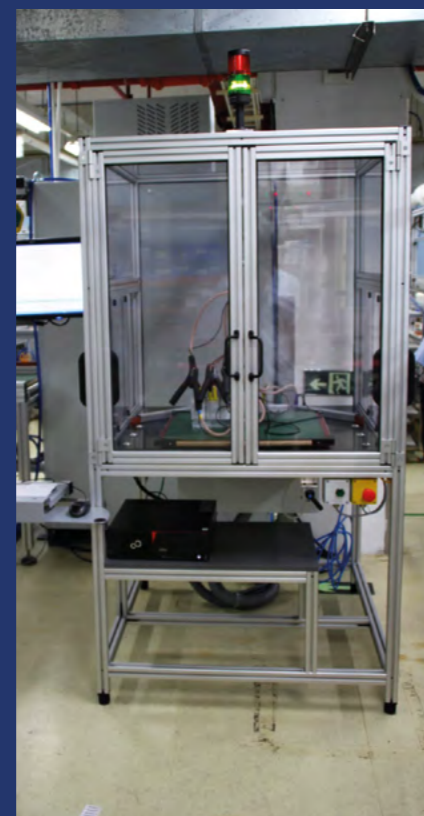
Harmonization

We discuss details, alternatives and feasibility with the client. A specification is the final result of this process.

8


Site Acceptance Test (optional)

On-site integration. Initial operation together with the client.



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WE SPECIALIZE IN THE DEVELOPMENT AND DISTRIBUTION OF TEST SYSTEMS, POWER SUPPLIES AND MEASURING INSTRUMENTS. EXPERTS IN ELECTRICAL TESTING AND AUTOMATION, OUR COMPANY OFFERS A BROAD RANGE OF HIGH-PERFORMANCE FULL-SERVICE TESTING SOLUTIONS AND MEASURING INSTRUMENTS. WE PROVIDE CLIENTS IN THE AUTOMOTIVE, AEROSPACE, ENERGY AND TRADITIONAL INDUSTRY SECTORS WITH THE EQUIPMENT THEY NEED TO TEST HIGH POWER COMPONENTS, SUCH AS CHOKES, TRANSFORMERS AND ELECTRIC MOTORS.