SCHLEICH
Advanced Test Technologies

MTC3

Multi-purpose winding testers for motor production

SMC
SCHLEICH MODULAR CONCEPT

Made in Germany

〉Expect more.

The MTC3 –
Winding tester without limits

MTC3 winding test systems are fully-automatic high-end testers for a great variety of windings in R&D, production and in the test lab.

According to your requirements, our MTC3 test systems can be configured as desired, offering advanced technology for complex test tasks. With state-of-the-art technology, they analyze coils, stators, motors, generators and transformers from 0.1 W to 500 MW.

The performance of MTC3 test systems is based on the combination of its strengths: usability, precision of measurements, database concept – perfectly matched components following innovative technologies.

Behind every test system, you will find 30 years of experience. With our innovations, we keep setting technological benchmarks for testing electric motors and windings.

According to our philosophy, we design and manufacture nearly all hardware and software here in the Sauerland region in the heart of Germany. SCHLEICH stands for Made in Germany!

- Surge test up to 15 kV
- Rise time starting at 100 ns
- Partial-discharge tests according to standards
- Automatic test method switchover
- Almost unlimited flexibility

HIGH-END SURGE TECHNOLOGY

Made in Germany

KEY FACTS

- Winding tests based on 30 years of experience
- Testing windings from 0.1 W to 500 MW
- Testing automotive products of all kinds
- Test methods
  - Surge test with patented evaluation
  - Automatic partial-discharge analysis according to IEC 61934, EN 60034…
  - High-voltage test up to 6 kV AC according to VDE, IEC, EN…
  - Partial-discharge (PD) test with high voltage AC
  - Insulation-resistance (IR) test up to 15 kV DC
  - Resistance test with 4-wire method from µΩ to 100 kΩ
  - Rotary-field test with static probe
  - Inductance test, LCR inductance measuring bridge
- 3 to 60 test leads for windings and temperature sensors
- Integrated 19" industrial PC with Windows®
- Database for test plans and test results
- Individually configurable print-out of test protocols and labels
- Extensive statistical evaluations
- Integration into local and global company networks
- Data exchange with ERP-systems
- Ideal for OEMs for a fast integration into automated systems
- Option for remote maintenance and remote calibration

Contents

Applications

The MTC3 is perfectly suited to be integrated into your production. It is configured according to the respective requirements. Below typical applications for the MTC3:

Manual test stations

At a manual test station, testing can start as soon as the operator has placed the DUT in the test system and connected it to the test leads.

The test can be started in different ways:

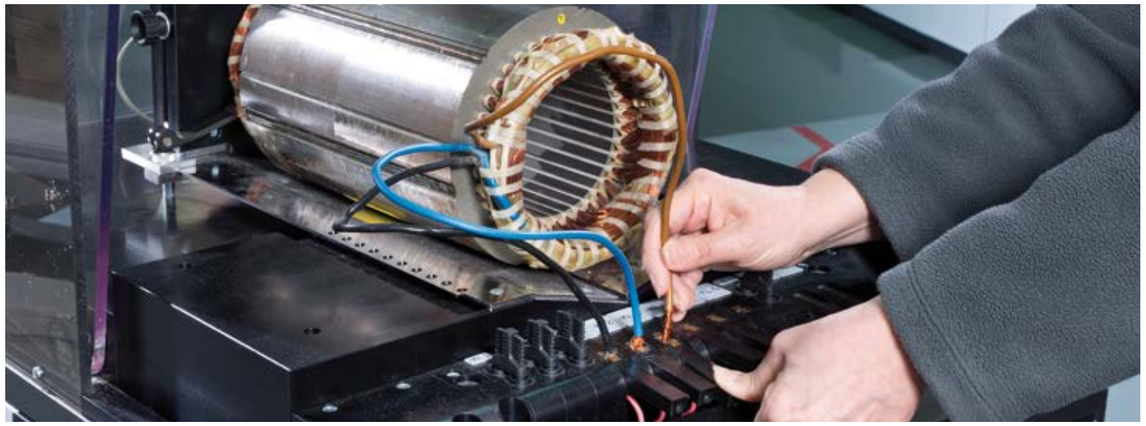
Testing with full protection against accidental contact
The test is started after closing the protection cover.

Testing without protection against accidental contact
The test is started by activating a two-hand start.

Testing without protection against accidental contact – light curtain
The test is started by activating a start button, while the light curtain must not be interrupted.

A red warning light signals that the DUT is energized and must not be touched. Additional result lamps can be installed at the work station.

After the fully-automatic test sequence, the MTC3 test system visualizes the result of the test.



Semi-automatic test stations

Semi-automatic operation combines a fully-automatic process with manual actions. For example, the operator can insert the DUT and start the test process. Now, the MTC3 or an additional PLC will control all cylinder movements required to contact the DUT and start the test sequence automatically.

Fully-automatic test stations

If the MTC3 is integrated into a fully-automatic production line, the tests are performed automatically without any manual intervention. Normally, the MTC3 is operated in one of the below listed modes.

Mode 1:
The MTC3 is completely remote-controlled. The higher-level production control provides all test parameters or selects the test sequence from the test system. The contacting and all mechanical procedures are performed by the system control. As soon as the system control has prepared the test, it triggers the MTC3. After the test, the MTC3 transfers the test results back to the system control.

Mode 2:
The MTC3 or an additional Simatic S7 PLC controls all mechanical procedures in the test cell. On top of that, the MTC3 communicates with a system control or with an MES system.

A deeper look into the winding

The test system MTC3 combines all test methods in one device, which allows you to check windings for all types of faults.

The combination of the test methods with our patented and award-winning innovations guarantees the quality of your production.

1 Surge test

The unique surge test serves for testing the insulation in a winding. It is ideally suited for detecting turn-to-turn and phase-to-phase faults and testing many other winding characteristics. In addition, it can be used to check insulation problems with the core.

2 Partial-discharge test at surge voltage (PD)

The partial-discharge test serves to test and evaluate the insulation system between phases and/or to the core. Especially for motors operated with VFDs, the partial-discharge test is of particular importance.

3 Insulation-resistance test (IR)

The insulation resistance between the phases and/or the core must be equal to or larger than the indicated minimum value.

4 Resistance test

When testing the winding resistance with 4-wire method, the winding resistance must remain within a certain tolerance window. An influence on the test result by the temperature is compensated by the MTC3 with effective methods.

5 High-voltage test AC

The high voltage ensures the dielectric strength between the phases and/or the core.

6 Partial-discharge test at high voltage AC (PD)

The partial-discharge test serves to evaluate the insulation system between the phases and/or to the core. Defects, like e.g. a wire that touches the core can be detected with the partial-discharge test method.

7 Sense-of-rotation test

The MTC3 supplies the stator with 3-phase power. Sensors measure the rotary field without contact and detect faulty circuits.

Basic unit

The MTC3 allows comprehensive and reliable testing of all kinds of windings. This is guaranteed by many innovations and our patented surge test.

The testing device is configured in a way that the test methods exactly match your applications.

For testing and storing we rely on the systematic integration of industrial PCs. Well-proven Microsoft® technology allows an easy operation of the testing device. The MTC3 is well-structured. Your employees learn to operate the MTC3 intuitively.

The screen layout is clearly structured; only key data are indicated.

Quality assurance is supported by numerous statistical analyses. The great number of different test protocols serves your customers as proof for the delivered quality.

- Unlimited number of test leads
- Fully-automatic test process
- Modular design
- Self-test and maintenance concept Industry 4.0

Standard features

Test methods

Standard test methods:
- Surge test 6, 12 or 15 kV – depending on the selected device
- Insulation-resistance test 6, 12 or 15 kV DC
- High-voltage test 6, 12 or 15 kV DC
- Visual examination

Optional test methods:
- Partial-discharge test with surge test
- High-voltage test AC up to 6 kV
- Partial-discharge test with high voltage AC
- Resistance test from µΩ to 100 kΩ
- Ambient-temperature compensation
- Sense-of-rotation test of the rotary field

Communication

- USB-interfaces at front and rear panel
- RS232- and LAN/Ethernet-automation interface
- Digital I/O-interfaces

Optional automation interfaces:
- ActiveX
- EtherCat
- ProfiBus
- ProfiNet
- and more…

Features and technology

- High-performance industrial PC
- Integrated plausibility checks of all parameters
- SQL or ACCESS-database without limits
- Automatic log and management of test-plan history
- Numerous languages

Safety

- Start input
- Two-circuit safety inputs according to EN 50191
- Integrated Emergency Stop and extension for external Emergency Stop
- Outputs for warning and result lamps
- Result output for Pass and Fail
- Counter for operating hours and switching cycles with maintenance instructions
- Status outputs

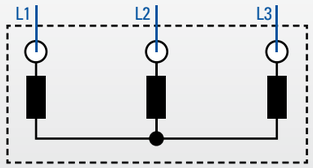
Testing device – standard configuration

The MTC3 is available in various standard configurations and will be composed according to your requirements.

The configurations shown on the pages to follow, give you an example of possible functions, test methods and components.

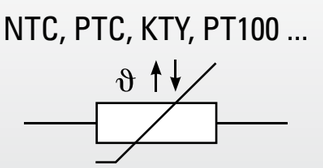
In case you find no match for your specific application, we will be happy to configure a tailor-made solution together with you. Everything you need!

Basis device with standard features



Number of winding leads

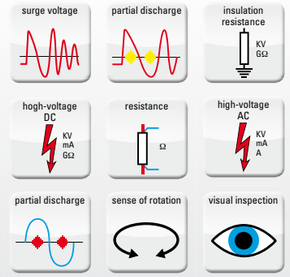
- 3 winding leads
- 6 winding leads
- 9 winding leads
- 12 winding leads



Number of temperature sensors

- 1 temperature sensor
- 2 temperature sensors
- 3 temperature sensors
- 4 temperature sensors
- 5 temperature sensors
- 6 temperature sensors

Note:
When calculating the number of leads, please consider that one temperature sensor always needs two leads!



Selection of test methods

- Surge voltage
  - up to 15 kV
  - 125 joule surge energy
  - 2000 A surge current
- Partial discharge at surge voltage
  - up to 15 kV
  - IEC 61934 and DIN EN 60034-18-41
- Insulation resistance
  - up to 100 GΩ
  - PI | DAR test
- High voltage DC
  - up to 15 kV
- Resistance
  - 1 mΩ to 100 kΩ
- High voltage AC
  - up to 6 kV
  - max. 100 mA
- Partial discharge at high voltage AC
  - up to 6 kV
  - up to 100 mA
- Sense of rotation
  - static test probe
  - 1- and 3-phase motors
- Visual examination

How to calculate the total number of test leads:

Number of winding leads + 2 x number of temperature sensors = number of test leads

Example:
For a motor with 6 winding leads and 2 temperature sensors you need a tester with 10 leads.

6 winding leads + 2 x 2 temperature sensors = 10 leads

The core lead belongs to the standard configuration of the basic device and doesn't need to be considered for calculating the total number of required leads!

Single station without protection devices

3 to 24 leads for windings & temperature sensors

Test system with
3 to 18 leads

Test system with
3 to 24 leads

All test leads are available via a high-voltage-proof industrial socket at the rear panel of the device.
Without test cover, the test system MTC3 is ideally suited for testing large DUTs of all kinds or for the integration into fully-automatic production lines.

The following contactings can be connected at the industrial plug:

Contacting of the core

Test lead with magnet or alligator clip

Automatic contacting

Individual special contactings

Contacting via winding and temperature-sensor leads

Contacting unit, position as required

Kelvin clamps (pluggable at test lead)

› Note: for details on contacting, please refer to page 26

Single station with small test cover

3 to 18 leads for windings & temperature sensors

Test system with 3 to 18 leads and permanently mounted test cover model 1

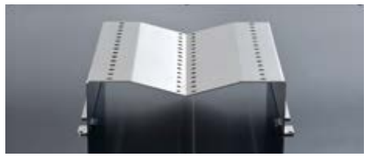
Test system with 3 to 18 leads and separate test cover model 1

The test cover model 1 can be placed directly on the test system or on a separate table.
This is the ideal setup for manual workstations with stators up to size 112.

The test cover model 1 can be extended with the following contacting units:

Contacting of the core

Stainless steel sheet



Prism, 1-piece

Prism, 2-piece

Contacting of the DUT

Contacting unit, permanently mounted

Contacting unit, max. 6 clamps, position as required

Kelvin clamps (pluggable at test lead)

› Note: for details on test covers, contactings and Kelvin clamps please refer to page 22

Single station with large test cover

3 to 24 leads for windings & temperature sensors

Test system with 3 to 18 leads and separate test cover model 10

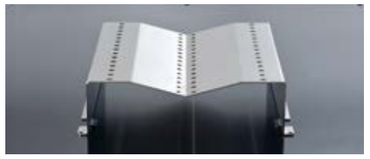
Test system with 3 to 24 leads and separate test cover model 10

The test cover model 10, mounted on a table, is connected to the MTC3 via pluggable test leads.
This setup is ideally suited for manual workstations that have to cover a great number of different stator sizes.

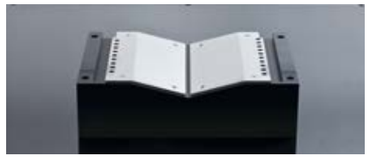
The test cover model 10 can be extended with the following contacting units:

Contacting of the core

Stainless steel sheet



Prism, 1-piece



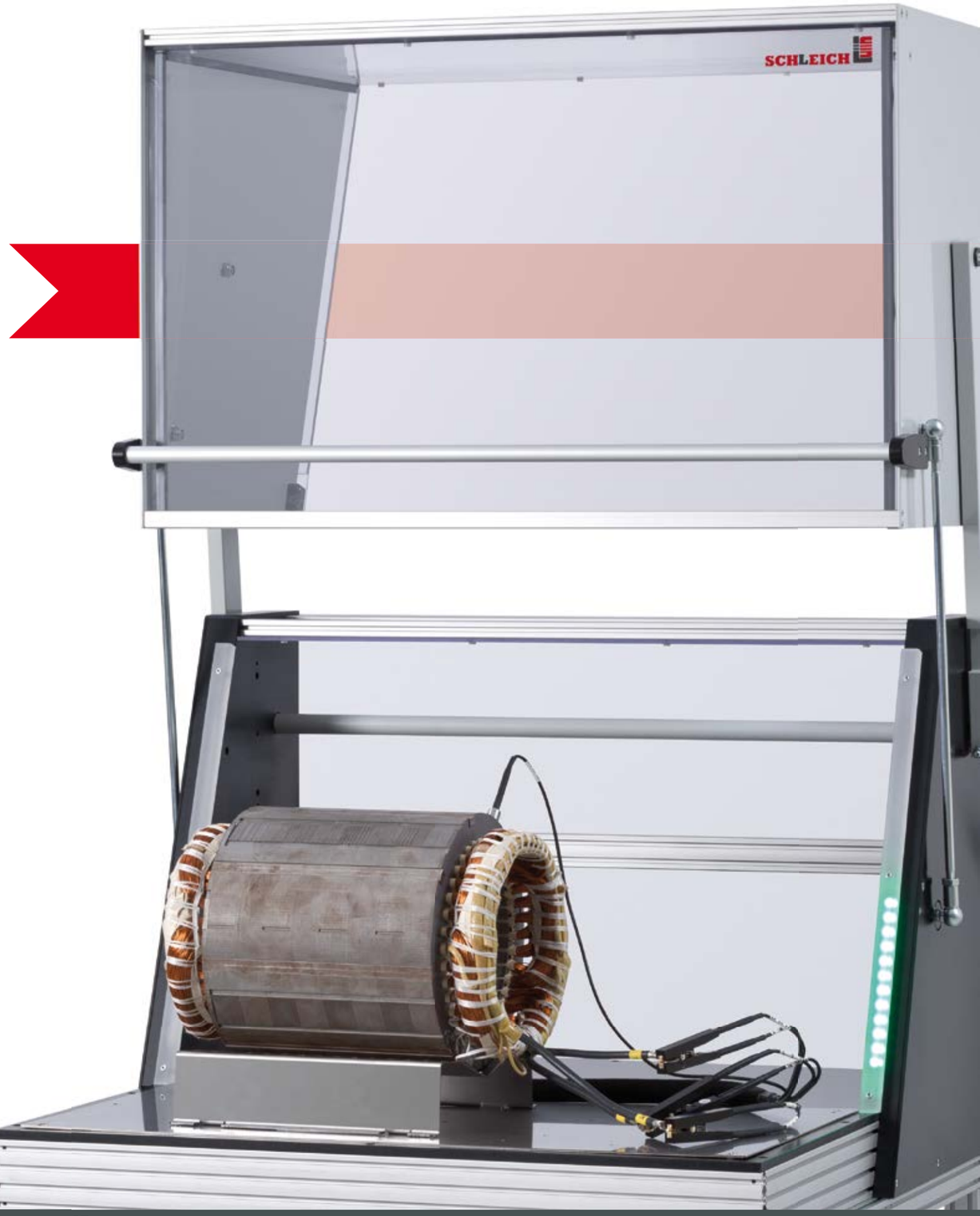
Prism, 2-piece

Contacting of the DUT

Contacting unit, position as required

Kelvin clamps (pluggable at test lead)

› Note: for details on test covers, contactings and Kelvin clamps please refer to page 22



Dual station

3 to 18 leads for windings & temperature sensors

Test system with 3 to 12 leads and permanently mounted dual test cover model 3

Test system with 3 to 12 leads and separate dual test cover model 3

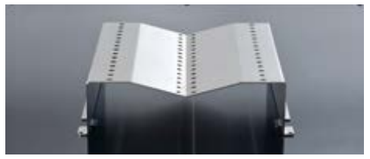
Test system with 3 to 18 leads and two separate test covers model 1

The test cover is normally mounted on a table and connected to the MTC3 via pluggable test leads. Depending on the setup of the test system, it might also be possible to place the test cover on top of the test system (see picture).
This is the ideal setup for manual workstations with stators up to size 112 and low cycle times.

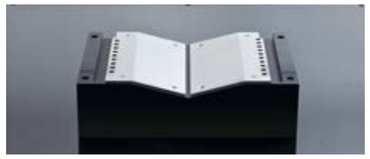
The test covers model 1 and 3 can be extended with the following contacting units:

Contacting of the core

Stainless steel sheet



Prism, 1-piece



Prism, 2-piece

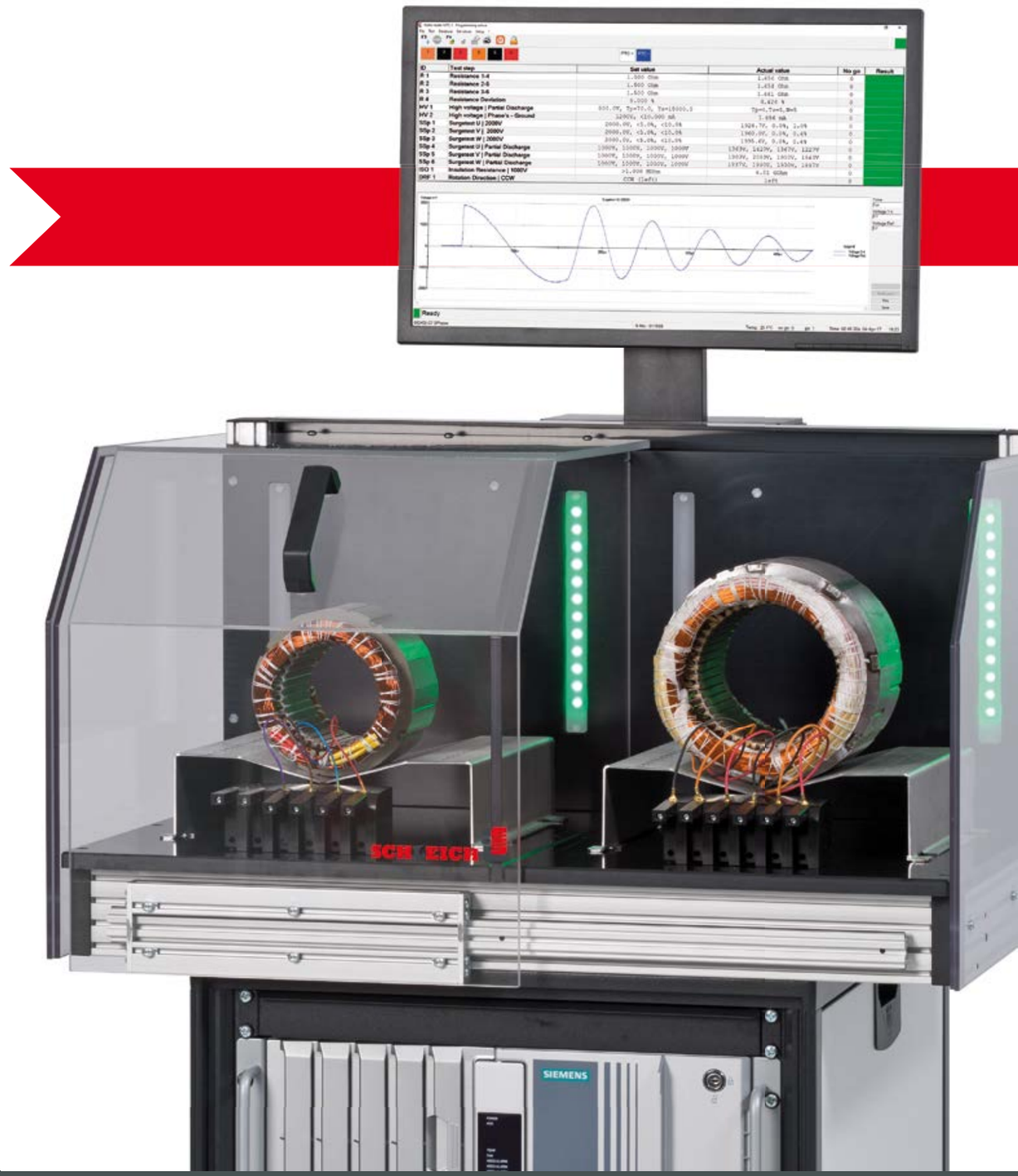
Contacting of the DUT

Contacting unit (max. 18 clamps), permanently mounted

Contacting unit, position as required

Kelvin clamps (pluggable at test lead)

› Note: for details on test covers, contactings and Kelvin clamps please refer to page 22



You need more?

Customized test systems

Based on the SCHLEICH MODULAR CONCEPT, MTC3 test systems offer many different options to combine different winding, safety and function test methods. You can chose the test methods required for your test task from a large pool of test features.

For example, your MTC3 can be a pure surge tester or configured for more complex test tasks with a combination of several test methods.

The SCHLEICH-MODULAR-CONCEPT allows you to put together exactly the testing device you need. And this is not realized by simply installing different individual testers into a large test rack, but by integrating all tests into a compact modular enclosure. The size of the enclosure depends on type and number of the required tests.

Your applications can be installed, for example, in a 19”-container or in a 19”-industrial control cabinet. To ensure proper and safe installation, we are using tailor-made components from renowned manufacturers as well as components from our own production.

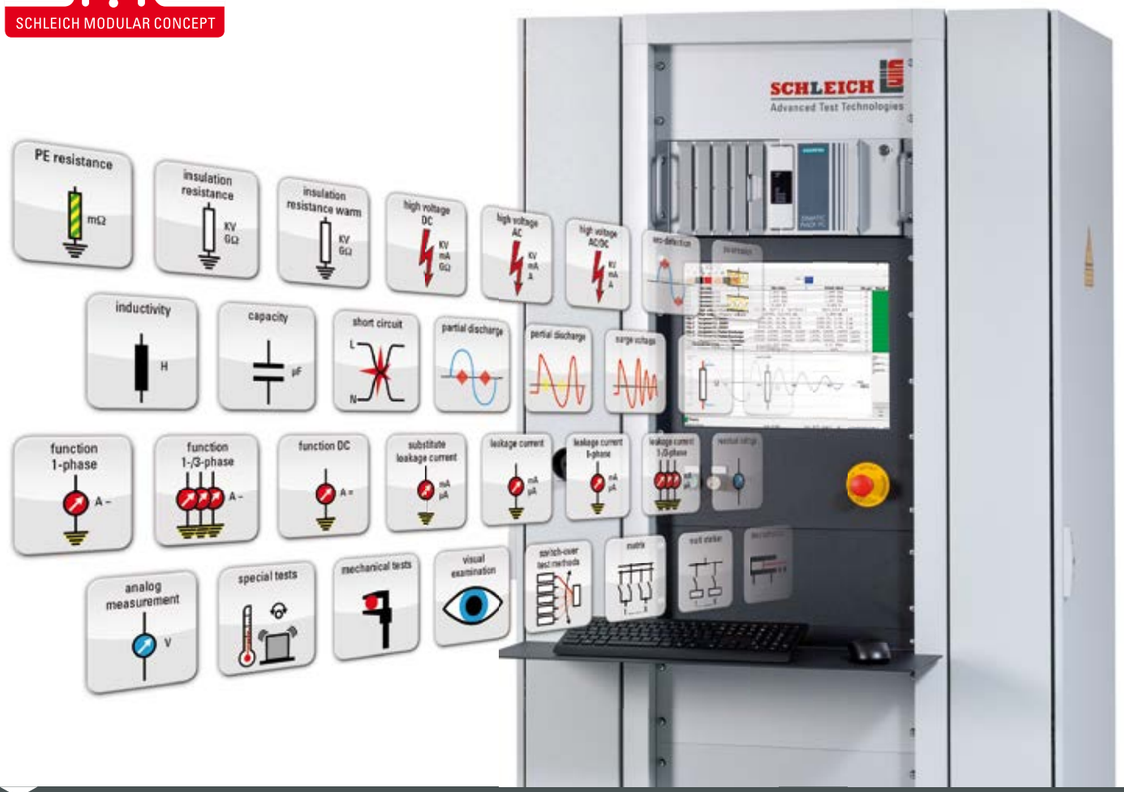
The MTC3 is very flexible when it comes to the configuration of the enclosure and the arrangement and number of connection sockets. As the connection sockets can be placed on all sides of the testing device, you can react to all challenges concerning the required space.

Behind every single testing device, you will find the experience of thousands of installations. The SCHLEICH team uses this experience consistently and with passion.

This is “customer-based technology”.

〉 User-configurable test systems – perfectly matching your requirements!

SMC
SCHLEICH MODULAR CONCEPT



Single test covers according to EN 50191/VDE 0104

Protection against dangerous voltages

Testing does not start before the test cover has been closed. Thus, the test cover is ideally suited for a safe workstation with full protection against accidental contact.

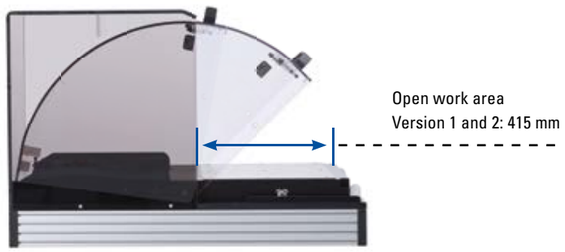
As soon as the test cover is closed, the signal of the two-circuit safety limit switch starts the test process. If the test cover is opened while the test is in process, the test is interrupted immediately, the voltage is switched off and the DUT is discharged. This guarantees an optimum protection of the operator.

The fully-insulated test cell is mounted on a frame made of aluminum profiles.

The test area is protected by a swivel-mounted protection cover made of break-proof transparent plastic.

A bright red and a green LED, well visible at the front of the test cover, serve for indicating the test result.

Single test cover model 1



Inner dimensions	Width	Depth	Height
Version 1	502 mm	730 mm	305 mm
Version 2	702 mm	730 mm	305 mm
Outer dimensions			
Version 1	546 mm	775 mm	520 mm
Version 2	746 mm	775 mm	520 mm
Further details			
Height of the bottom frame	75 mm		
Swivel range of the test cover	close to 90° mechanical		
LED result lamps	GO and NO GO		
Test voltage	max. 8 kV AC		
Load capacity	15 kg		
Interlock during the test	yes (optional)		
Automatic opening	yes (optional)		

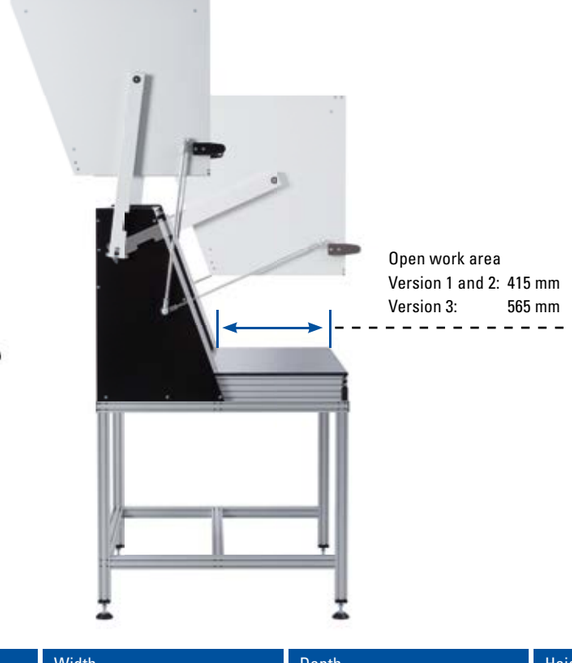
Special design for single test cover model 1

The test cover model 1 can be extended with a permanently mounted contacting unit with max. 18 contacting modules for the leads.

Both, the order of the contacting modules and the type of clamps can be arranged as required. With this compact and modular contacting unit, the test cover can be optimally adapted to contact any DUT.

› Note: for details on contacting units please refer to page 26

Single test cover model 10



Inner dimensions	Width	Depth	Height
Version 1	800 mm	730 mm	510 mm
Version 2	900 mm	730 mm	510 mm
Version 3	900 mm	880 mm	510 mm
Outer dimensions			
Version 1	950 mm	880 mm	630 mm
Version 2	1050 mm	880 mm	630 mm
Version 3	1050 mm	1030 mm	630 mm
Further details			
Overall height (open cover)	1300 mm		
Height of bottom frame	80 mm		
Swivel range of the protection cover	close to 90° mechanical		
LED result lamps	GO and NO GO		
Test voltage	max. 6 kV AC		
Load capacity	15 kg optional extension to 150 kg		
Interlock during the test	yes (optional)		
Automatic opening	yes (optional)		

Special designs for single test covers model 1 and model 10

› For contacting units for windings and temperature sensors see page 26

› For contacting units for cores see page 28

Dual test covers according to EN 50191/VDE 0104

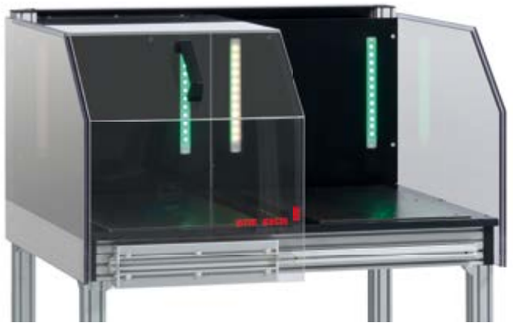
Short cycle times – twice the output

The dual test cover has two test stations, in which the tests are performed alternately. While testing in one station, you can remove the DUT from the other station and insert the next DUT. This is even possible when the test stations are run with different test plans.

The fully-insulated test cell is mounted on a frame made of aluminum profiles. The test area is protected by a swivel-mounted protection cover made of break-proof transparent plastic.

As soon as the test cover is closed, the signal of the two-circuit safety limit switch starts the test process in the test station that is closed. During the test, the protection cover is kept shut by electrical magnets. If the test cover is opened while the test is in process, the test is interrupted immediately, the voltage is switched off and the DUT is discharged. This guarantees an optimum protection of the operator against electrical voltage.

Dual test cover model 3



Inner dimensions	Width	Depth	Height
Version 1	385 mm	532 mm	345 mm
Version 2	488 mm	532 mm	345 mm
Version 3	588 mm	532 mm	345 mm
Version 4	688 mm	532 mm	345 mm
Outer dimensions			
Version 1	800 mm	588 mm	445 mm
Version 2	1000 mm	588 mm	445 mm
Version 3	1200 mm	588 mm	445 mm
Version 4	1400 mm	588 mm	445 mm
Further details			
Height of bottom frame	100 mm		
LED result lamps	GO and NO GO per station (optional)		
Test voltage	max. 6 kV AC		
Load capacity	15 kg		

Special designs for dual test covers model 3

› For contacting units for windings and temperature sensors see page 26

› For contacting units for cores see page 28

Customized test covers

Examples for tailor-made special solutions

Dual station consisting of two separate test covers model 1

Dual station consisting of two separate test covers model 10

Dual test cover model 3 installed at 19”-cabinet

Test cover with light curtain in a customized solution

Special test cover with Faraday cage

Single test cover model 10 with drawer cabinet

Large test cage with front door and pull-out table

Large test cage with roller belt, light curtain and pneumatically controlled side doors

Large test cage with light curtain

Contacting

Connecting windings and temperature sensors

For connecting free cable ends of windings and temperature-sensor leads, we offer an extensive range of standard contacting devices.

Kelvin clamps

Kelvin clamps are used for measuring with 4-wire technology. They are ideal for an accurate measurement of low resistances. The 4-wire measurement compensates the contact resistances between the terminal points.

The unique design of our Kelvin clamps guarantees high contact reliability, a solid grip and minimal wear in rough operating conditions.

Contacting units composed of individual contacting modules

These modules are ideal for a fast connection of winding and temperature-sensor leads.

With various contacting modules, you can configure individual contacting units. The configuration is always adapted to the requirements.

The order and the amount of contacting modules as well as the type of the modules can be selected as required. The amount normally corresponds to the number of test leads of the MTC3 test system.

Due to its compact, modular design, the test cover or the workstation can be adapted to any application.

A contacting unit that can be moved within the test cover can have a maximum of 12 contacting modules.

Kelvin clamps | robust design

Type	small	medium	large
Opening width	10 mm	20 mm	33 mm
Pressure force	20 N	30 N	100 N
4-wire method	yes	yes	yes
Test lead pluggable	yes	yes	yes
Dimensions (L x H x W)	90 x 35 x 13 mm	165 x 41(65) x 20 mm	255 x 95 x 25 mm

› The test leads can be connected to the Kelvin clamps!

› Advantage: if the leads of your products have many different cross sections, you can adapt to them quickly by means of the three different sizes of Kelvin clamps.

Contacting modules 23 mm

Type	Kelvin clamp	spring-terminal clamp	laboratory socket
4-wire method	yes	no	no
Width of contact point	6 mm	15 mm	4 mm (for laboratory plugs)
Clamp width	23 mm	23 mm	23 mm
Pressure force	20 N	10 N	-

Contacting modules 35 mm

Type	Kelvin clamp (small)	Kelvin clamp (large)	spring-terminal clamp	laboratory socket
4-wire method	yes	yes	no	no
Width of contact point	6 mm	12 mm	15 mm	4 mm (for laboratory plugs)
Clamp width	35 mm	35 mm	35 mm	35mm
Pressure force	20 N	30 N	10 N	-

Contacting

Core

To test the insulation between the winding and the temperature sensors to the core, it is necessary to have a good and reliable contacting.

For reliable results, all test methods related to the core, therefore, require a connection check.

Only the connection check secures that the test is performed correctly. For most applications, the connection check can be effected through the existence of a minimum current to be exceeded.

Magnetic contact

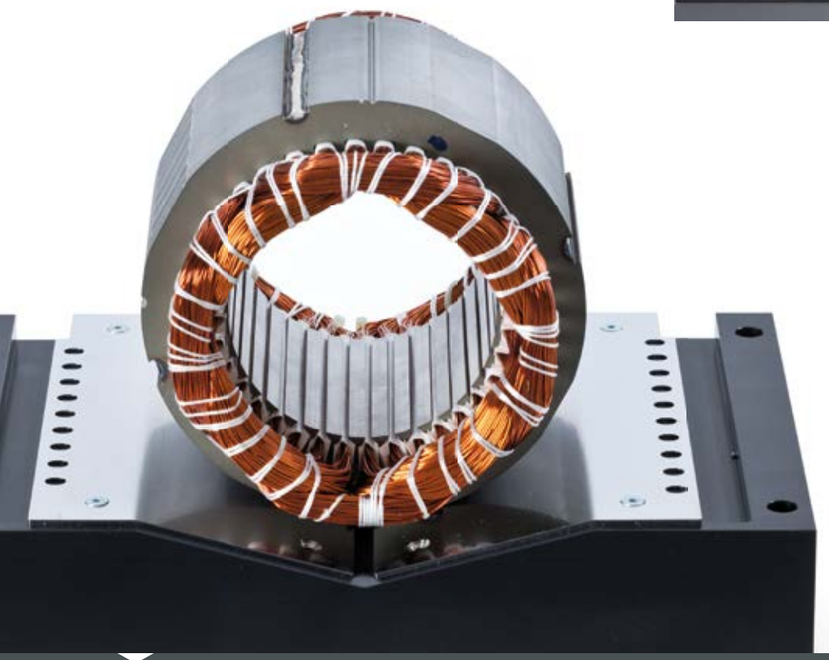
Contacting the core with a magnet is the most simple and flexible way of contacting. It is particularly suited for testing without protection cover.

As an alternative to the magnet, the test lead can be attached to an alligator clip.

Stainless steel plate

Another way of contacting the core, is placing the DUT on a steel sheet.

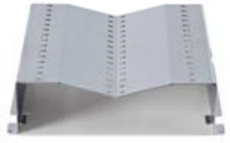
However, round DUTs could roll away. In this case, we recommend to use a prism for contacting.



Prism

The core is contacted by placing the stator on the prism. The electrical connection between the core and the test lead of the MTC3 is established via the metal surface of the prism. Due to the V-shaped outline of the prism, the stator is placed in the center, prevented from moving by accident. This facilitates the connection of the winding leads and additional sensors a lot.

The two-piece prism (the left and right side of the V-shaped design are electrically insulated from each other) represents an additional active connection check. This allows to check reliably, whether the core of the stator has been contacted. Testing is only possible, if the core connects both sides of the V-shaped prism.



Type	1-piece prism, low	1-piece prism, high	2-piece prism
Dimensions (W x D x H)	300 x 300 x 34 mm	300 x 300 x 76 mm	300 x 200 x 79 mm

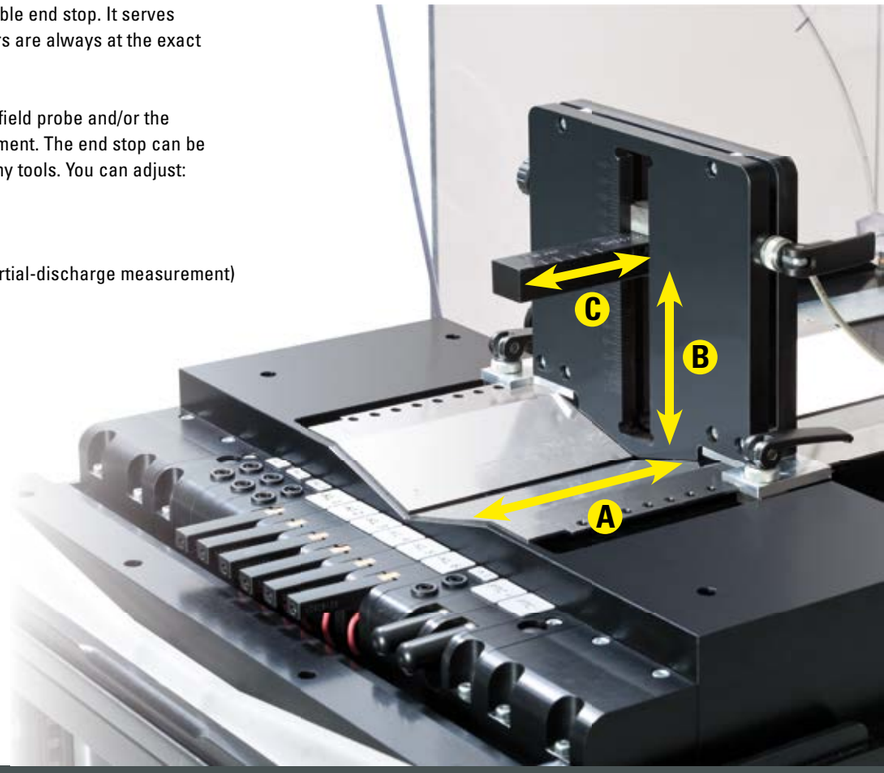
› Our tip: if the leakage current of the high-voltage test AC is < 2 mA, we recommend to use the 2-piece prism.

Extension prism contacting

The prism can be extended with an adjustable end stop. It serves to fix the loading position, so that the stators are always at the exact same position.

At this end stop, you can attach the rotary-field probe and/or the antenna for the partial-discharge measurement. The end stop can be adjusted to the respective stator without any tools. You can adjust:

- **A** Depth of end stop
- **B** Sensor level
  (for rotary-field probe & antenna for partial-discharge measurement)
- **C** Sensor depth



Special contactings

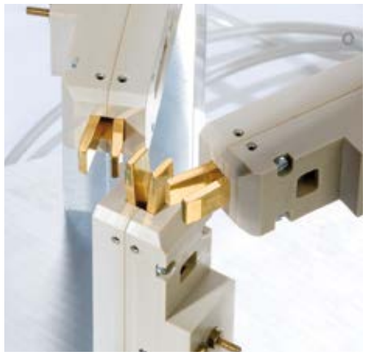
The mechanical adaptation of DUTs and their special contacting units is one of SCHLEICH's key strengths. The testing device and the respective mechanics are manufactured to match your test task. For this purpose, we often use pneumatically controlled, very small Kelvin clamps or spring-loaded contacts from our extensive range of modules.

The design is done at our own 3D-CAD work stations. With state-of-the-arte CNC machines, our mechanics department guarantees the production of high-quality components at low prices.

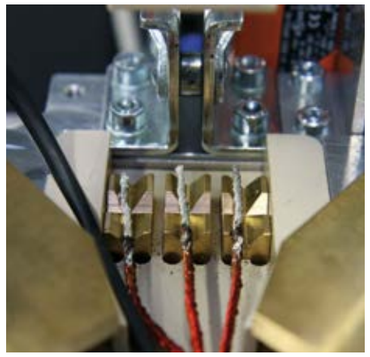
KEY FACTS

- Solid and durable design
- 2-wire or 4-wire contacting
- High-current contacting
- Special solutions for manual contacting
- Special solutions for automatic production lines
- Contactings for handling systems
- Overhead Kelvin clamps for automatic contacting
- Spring-loaded contact pins for 2-wire and 4-wire method
- Motor-terminal-block connectors with 2-wire and 4-wire method
- Quick exchange of wearing parts

Contacting contact pins with Kelvin clamps

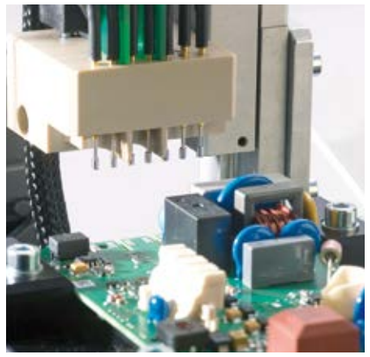


Contacting with pneumatic Kelvin clamps

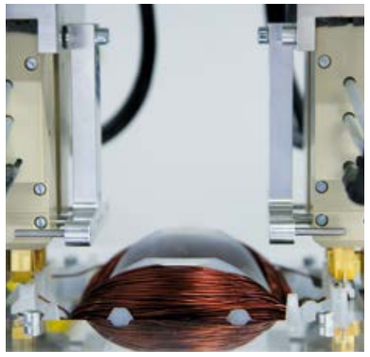


Contacting motor-leads via centering prisms

Contacting a DUT from the top



Contacting a PCB with spring-loaded contact pins



Contacting contact pins with Kelvin clamps

Motor-terminal-block connectors

The time-consuming contacting of the motor terminal block is an issue for every manufacturer of electric motors. Without the respective contacting, however, the motor cannot be tested. SCHLEICH offer a number of different contacting methods, which have the potential to save you a lot of time.

To realize a faster and more user-oriented contacting of the motor terminal block, we have developed special motor-terminal-block connectors. With collets, they connect to every single bolt of the motor terminal block to assure a safe contacting. After the connector has been attached to the bolts of the motor terminal block, a clamping lever secures the collets. The contacting of the frame is also integrated in our motor-terminal-block connectors.

We make motor-terminal-block connectors for any number of connecting bolts with various dimensions. For the most accurate measurement of very low resistances, we also offer unique motor-terminal-block connectors with 4- wire method.

Motor-terminal-bock connector with 2-wire or 4-wire method

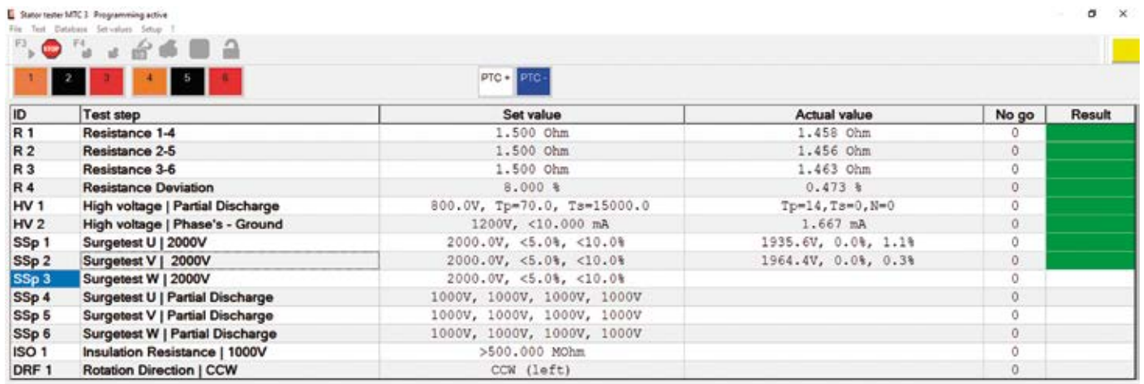
Kelvin clamps for motor-terminal blocks

Test software

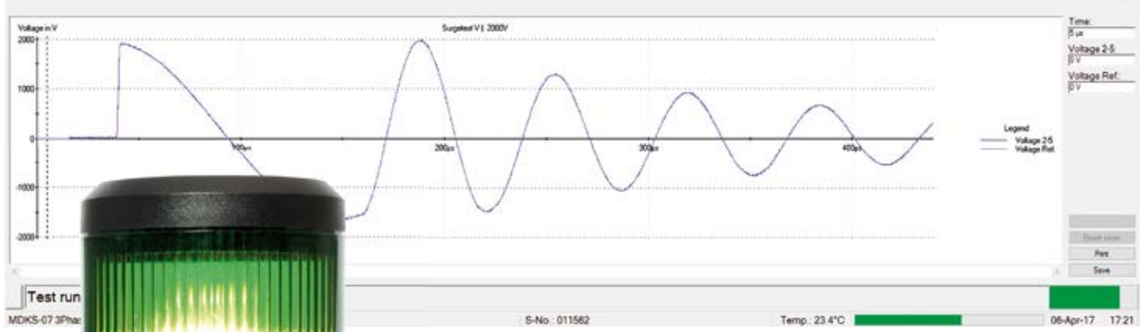
Our software is based on the operating system Microsoft Windows®.
Optimized user interface allows to access

- testing
- creating test plans
- printing test protocols
- statistical evaluation of the tests

Test process



ID	Test step	Set value	Actual value	No go	Result
R 1	Resistance 1-4	1.500 Ohm	1.458 Ohm	0	
R 2	Resistance 2-5	1.500 Ohm	1.456 Ohm	0	
R 3	Resistance 3-6	1.500 Ohm	1.463 Ohm	0	
R 4	Resistance Deviation	8.000 %	0.473 %	0	
HV 1	High voltage | Partial Discharge	800.0V, Tp=70.0, Ts=15000.0	Tp=14,Ts=0,N=0	0	
HV 2	High voltage | Phase's - Ground	1200V, <10.000 mA	1.667 mA	0	
SSp 1	Surgetest U | 2000V	2000.0V, <5.0%, <10.0%	1935.6V, 0.0%, 1.1%	0	
SSp 2	Surgetest V | 2000V	2000.0V, <5.0%, <10.0%	1964.4V, 0.0%, 0.3%	0	
SSp 3	Surgetest W | 2000V	2000.0V, <5.0%, <10.0%		0	
SSp 4	Surgetest U | Partial Discharge	1000V, 1000V, 1000V, 1000V		0	
SSp 5	Surgetest V | Partial Discharge	1000V, 1000V, 1000V, 1000V		0	
SSp 6	Surgetest W | Partial Discharge	1000V, 1000V, 1000V, 1000V		0	
ISO 1	Insulation Resistance | 1000V	>500.000 MOhm		0	
DRF 1	Rotation Direction | CCW	CCW (left)		0	

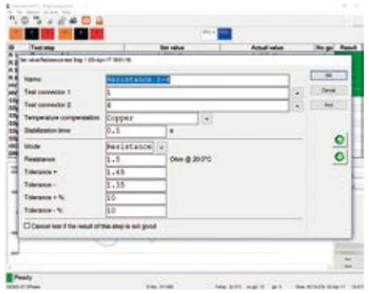


In the automatic mode, all tests are performed fully-automatically. During the test, the results are continuously indicated and evaluated. A clear GO/NO GO notification visualizes the automatic evaluation.

Test plans can be edited by simply adding or deleting test steps. This way, test plans can be perfectly adapted to different tasks. By double-clicking, every test step can be edited in a test-step window.

The integrated user management ensures that changes can only be done by authorized personnel. Together with the operating instructions, the MTC3 is a tester perfect for testing according to ISO 9001.

Input



By simply double-clicking the test step, you can change parameters and adapt the tests without having to use an extra editor for the test plans. Every operator can view the settings. Changes, however, can only be done by authorized personnel. All changes are stored in the history management and in the log.

KEY FACTS

- Intuitive operation
- Clear and simple user interface
- Testing without special know how
- Input of test parameters without test-plan editor
- Clearly structured input of test parameters
- Integrated operator and setup messages
- Plausibility check of all inputs
- Based on the latest version of Windows®
- Ideal for integration into company networks
- High data security and long-term storage of data
- Connection to CAQ- and/or ERP-systems
- Highly configurable
- Integrated user and rights management
- Lifetime free updates for your MTC3

Data

Test plans and test results are stored by the MTC3 either locally or in an SQL-database in the network. We would always recommend to network your testing devices. Advantages:

- All testing devices connected to the network access the same database for test plans and test results.
- All testing devices perform the tests according to the same specifications.
- A central database for all test systems in a global network allows you to ensure the quality of your products worldwide in a global network, regardless of the location.
- From one or several locations, you can access the test results from all sites around the world.
- Through simple connection to ERP-, PPS- or CAQ-systems, the testing devices can ideally be integrated into factory planning and production control.

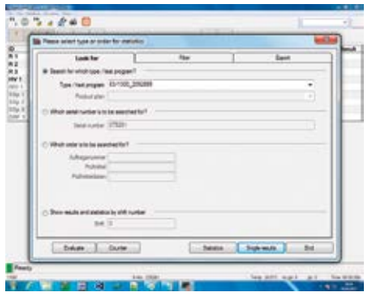
Statistics

Based on a large amount of test results, it is possible to create informative statistics. For the development of the MTC3 we have, therefore, put great emphasis on a useful and well-structured storage of the test results over a long period of time. Via search filters, which the user can configure as needed, all relevant data can be found in the database quickly and easily. Individual evaluations or summaries of the test results over a long period of time followed by a statistical evaluation are possible.

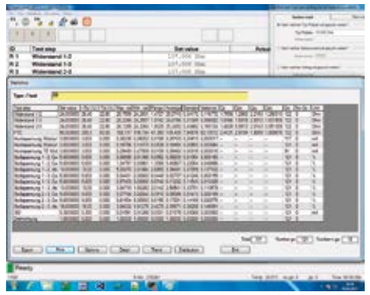
Trend displays and Gaussian distributions give clear information about the quality of production. The MTC3 can store your data on a daily, weekly or monthly basis. They can be evaluate and displayed related to orders or batches.

By means of the integrated extensive export functions, the user can extract data from the database and export them into other databases or process them in Excel®. This allows you to create your own evaluations.

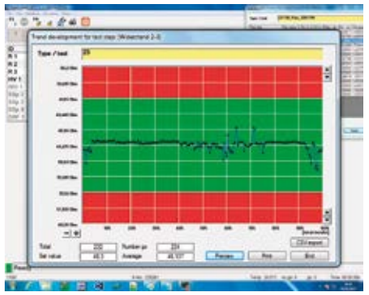
The database can be based on SQL or ACCESS®. For large amounts of data or for operation in networks, we recommend to use Microsoft® SQL.



Filter function



Result overview



Diagram

The test protocol

All test results can be printed on the modern standard protocol either directly after the test or later.

Before printing, you can select the language of the protocol. Standard languages: German, English, French, Dutch, Spanish, Italian and Russian.

You can print the protocol in different ways as required:

- Creating PDF-files
  If requested, the MTC3 creates a PDF-file that is stored on a USB flash drive, the internal hard disc or in a network directory.
- Creating CSV-files
  After the test process, the MTC3 can also create a CSV-file and store it in a network directory. The data exported to the CSV-file can be configured as desired and adapted to your requirements.

Editable field with your company logo and address

General motor data, date and time, etc.

Overview of all test results

Test protocol

Sample Inc.
Any Street 89
12345 Any City

Your logo

Test system	Testsystem Entwicklung | SCHLEICH MTC2-12kV | 4590
Test program	Triangle test complete
Result	PASS
Serial number	35601
Test date	28.02.2014 13:51:46
Job no.	1010
Customer	Hermes
Manufacturer	Schleich

Summary

Resistance 1-2	76.52 mOhm (25.2°C)	*PASS*
Resistance 2-3	76.41 mOhm (25.2°C)	*PASS*
Resistance 3-1	76.48 mOhm (25.2°C)	*PASS*
Deviation	0.148 %	*PASS*
Surge PD	PDIV: 1394V, RPDIV: 1583V, RPDEV: 1509V, PDEV: 1509V, Background noise signal: 31,25mV, Detection system noise signal: 31,25mV	*PASS*
Surge 1-2	1033V, EAR=0.0%, Cor.=0.1%, Attenuate=0.0%, Inductance=1.65mH	*PASS*
Surge 2-3	1056V, EAR=8.1%, Cor.=0.3%, Attenuate=4.9%, Inductance=1.67mH	*PASS*
Surge 3-1	1062V, EAR=5.7%, Cor.=0.1%, Attenuate=5.1%, Inductance=1.63mH	*PASS*
Compare	1014V, EAR=6.0%, Cor.=0.2%, Attenuate=0.7%	*PASS*
Insulation test	2214V, 6.503 GOhm (40,0°C), 18.139GOhm (25,2°C), Imax1=35.953µA, Imax2=0.122µA	*PASS*

Details: resistance

Resistance test

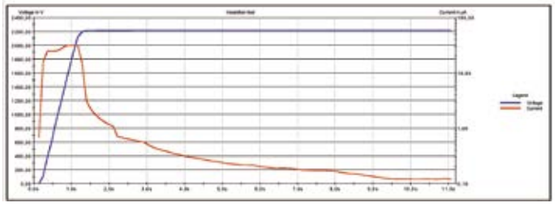
Test step	Set value(s)	Real value(s)	
Resistance 1-2	76.00, (68.40 - 83.60) mOhm	76.52 mOhm (25.2°C)	PASS
Resistance 2-3	76.00, (68.40 - 83.60) mOhm	76.41 mOhm (25.2°C)	PASS
Resistance 3-1	76.00, (68.40 - 83.60) mOhm	76.48 mOhm (25.2°C)	PASS
Deviation	5.000 %	0.148 %	PASS

- Phase resistances compensated to 20° C / 68° F
- Winding temperature
- Deviation
- Set values

Details: insulation resistance

Insulation test DC

Test step	Set value(s)	Real value(s)	
Insulation test	2000V, 1.000 MOhm	2214V, 6.503 GOhm (40,0°C), 18.139GOhm (25,2°C), Imax1=35.953µA, Imax2=0.122µA	PASS

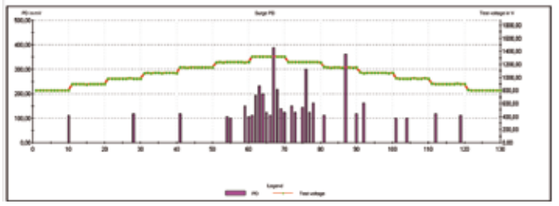


- Signal characteristics:
  Voltage-current | resistance-current | resistance-voltage
- Insulation resistance at measured temperature
- Insulation resistance compensated to 40° C | 104° F
- Set values

Details: partial-discharge test

Surge test

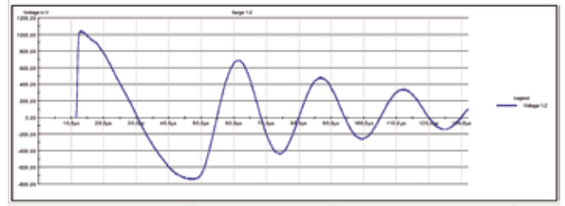
Test step	Set value(s)	Real value(s)	
Surge PD	PDIV: 800V, RPDIV: 1500V, RPDEV: 1400V, PDEV: 1000V, Detection threshold: 300 mV	PDIV: 1394V, RPDIV: 1583V, RPDEV: 1509V, PDEV: 1509V, Background noise signal: 31,25mV, Detection system noise signal: 31,25mV	PASS



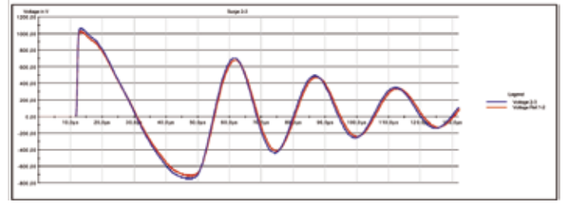
- Logging according to IEC 61934
- Measured values:
  PDIV | RPDIV | RPDEV | PDEV
- Background interference level
- Detection-system interference level
- Set values

Details: surge voltage

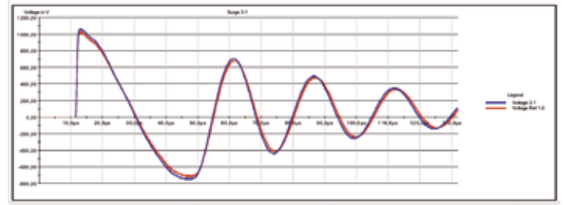
Test step	Set value(s)	Real value(s)	
Surge 1-2	1000V, EAR=15.0%, Cor.=10.0%, Att.=15.0%, Inductance=1.00mH	1033V, EAR=0.0%, Cor.=0.1%, Attenuate=0.0%, Inductance=1.65mH	PASS



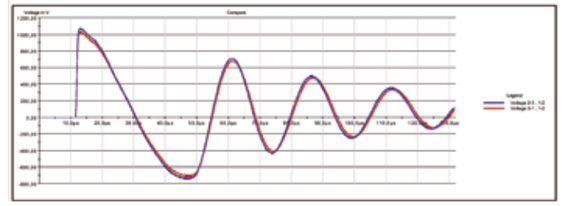
Surge 2-3	1000V, EAR=15.0%, Cor.=10.0%, Att.=15.0%, Inductance=1.00mH	1056V, EAR=8.1%, Cor.=0.3%, Attenuate=4.9%, Inductance=1.67mH	PASS



Test step	Set value(s)	Real value(s)	
Surge 3-1	1000V, EAR=15.0%, Cor.=10.0%, Att.=15.0%, Inductance=1.00mH	1062V, EAR=5.7%, Cor.=0.1%, Attenuate=5.1%, Inductance=1.63mH	PASS



Compare	1000V, EAR=15.0%, Cor.=10.0%, Att.=15.0%	1014V, EAR=6.0%, Cor.=0.2%, Attenuate=0.7%	PASS



- Signal characteristics of all three phases in one diagram
- Display of the symmetry of all 3 phases one below the other
- Deviation to the reference coil in percent
- Set values

KEY FACTS

- Editable protocol with your company data and your logo
- Printing on Windows®-compatible printers
- Creating PDF-files
- Test protocols in various languages

The MTC3 in a network

Test plans and test results can be stored locally or alternatively on a server. This guarantees high data security and an optimum data exchange between different test systems.

Even with the standard features, the MTC3 can operate in all network infrastructures. This is the ideal platform to collect, manage, analyze and distribute information.

Proven and widely-used Microsoft®-technologies are the basis for the databases.

The testing devices can ideally be networked with ERP-, PPS- and CAQ-systems. For every application, we offer reliable and user-oriented standard solutions.

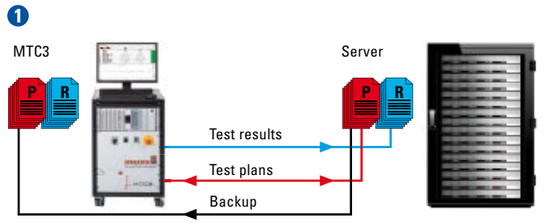
Microsoft SQL Server

Microsoft SQL Server Express

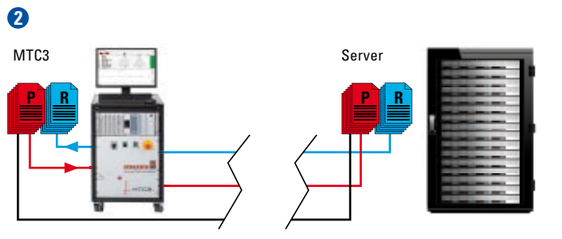
Microsoft Access

KEY FACTS

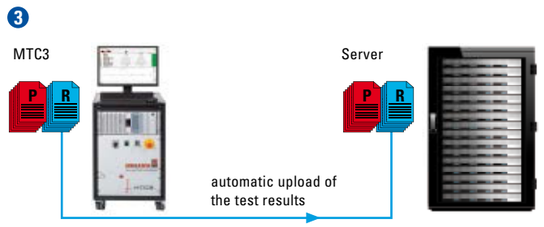
- Central storage of test plans
- Local editing of test plans at the MTC3 or at workstations
- Central storage of test results
- Local evaluation of test results at the MTC3 or at workstations
- Working in global networks
- Storage in Microsoft SQL®, Access®, …
- Automatic local storage in case of network failures
- Automatic data exchange after the failure
- Fast statistical calculations on the server
- Ideal options for remote maintenance



1 In order to be able to keep operating in the event of a network failure, every testing device automatically creates local copies of the latest test-plan database of the server.



2 In the event of a network failure, the tester uses the local test plans and stores the test results locally in the testing device.

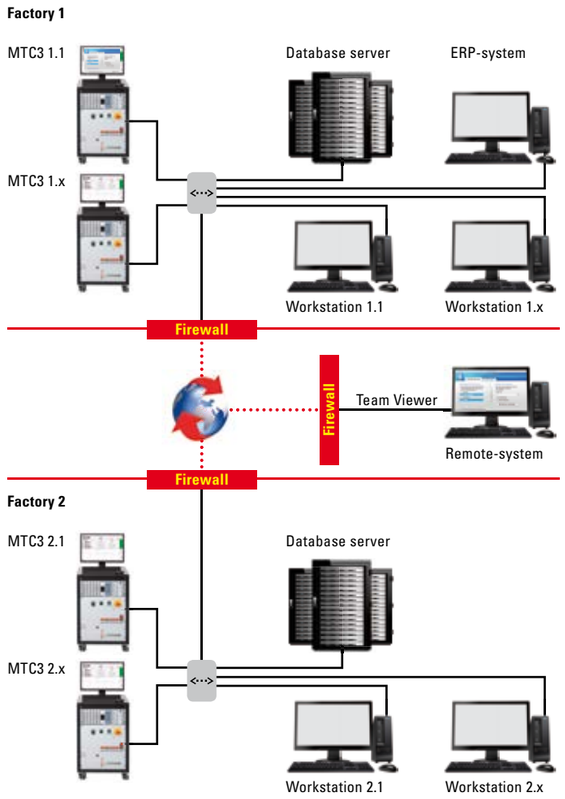


3 After the network connection has been reestablished, the testing device automatically uploads the test results to the server to update the server database.

P Test plans

R Test results

Complex global network



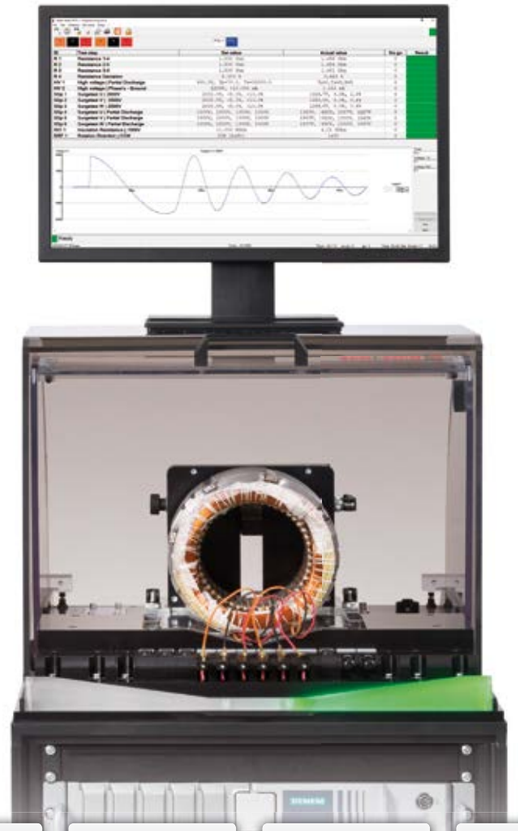
Our Windows®-based MTC3 testers can be operated in complex network topologies. You can install any number of testing devices at various sites all over the world and have them work in a central server database for test plans and test results. With our extensive experience in networking our testing devices globally, we guarantee that you can offer the same quality of your product no matter where it has been produced.

It goes without saying that any work connected with editing test plans, printing labels and statistics can also be carried out at the individual testing devices. In order not to interfere with the production process, networks allow to do this kind of work at separate workstations. These workstations use the same software as the testing devices allowing the most convenient operation.

You can also store labels centrally on a server. The testing device loads the label matching the respective test plan and, after the test, sends the data to a thermal transfer printer. The labels can be designed as required.

In the event of remote maintenance we can temporarily log on to your network and directly access the respective testing device. If you grant us access, we can use mouse and keyboard and view the screen contents of your testing device. Of course, this kind of work will only be done together with you and requires a separate access from your part.

Data exchange with IT-systems



SAP · Microsoft Dynamics · PROALPHA · ORACLE · Q-DAS · MES

KEY FACTS

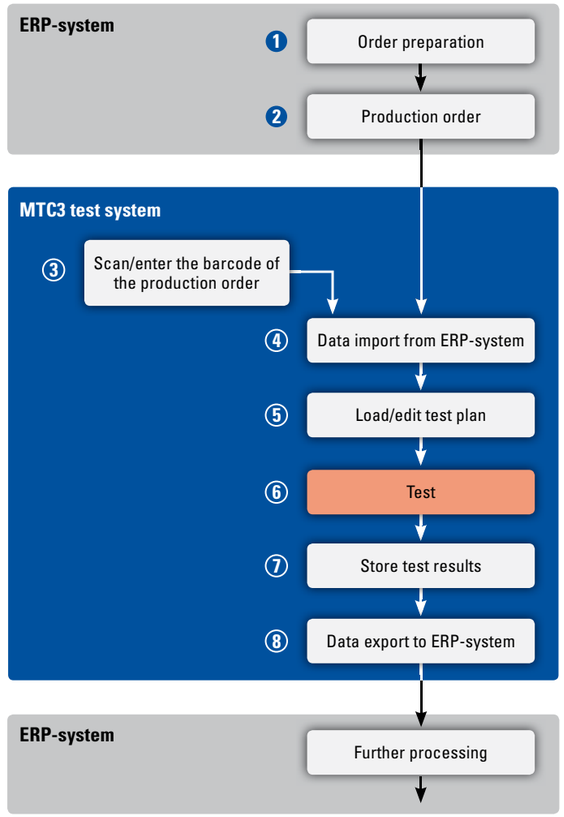
- Bidirectional communication with
  - ERP-systems
  - MES-systems
- Exporting data to
  - CAQ-systems
  - Databases of your choice
  - CSV-files
  - Excel®
- Data import and export via XML
- Configurable tools for
  - Data import
  - Data export
  - …

The data exchange between the MTC3 and other IT-systems is based on well-proven solutions.

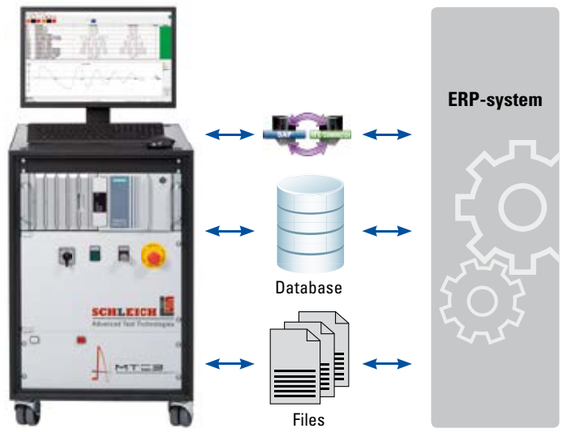
Typical requirements

- Importing production orders from ERP-systems
- Automatic and dynamic creation of test plans according to production orders and parts lists
- Automatic generation of serial numbers from the data of the production orders
- Communication of results to ERP-systems
- Traceability of the complete production chain
- Receiving data for printing labels
- Filtering and transmitting data to statistical evaluation systems/ CAQ
- Transfer of the test results to long-term archiving systems/ product liability
- Communication with special systems of automotive industry

By means of our standard software modules, the MTC3 can be integrated into an IT-system with little effort.



Typical ways of communication



1. The customer order is planned in the ERP-system.

2. The ERP-system creates a production order and adds data required by the testing device.

   For example:
   - test plan definition
   - serial numbers
   - quantities
   - label information
   - parts lists
   - product characteristics

   The MTC3 can access these data directly or indirectly. For example with SAP, indirect access takes place via an RFC.net connector. For indirect access, the ERP-system stores the data either in a separate database or in special files in the network.

3. At manual test stations, the operator scans the number of the production order (confirmation number) from the working documents. For example via a barcode or data matrix. At automatic test stations, this information might also come from the production line controller, from mobile data carriers (RFID) or other systems.

4. On the basis of the production order, the MTC3 now imports the information relevant for the test.

5. The respective test plan is automatically loaded out of the test-plan database of MTC3. Depending on the parts-list information of the ERP-system, the test plan can consist of several sub test plans.

   The ERP-system can transfer further test parameters and tolerances that are added to the respective test steps of the test plan. This creates an automatically generated test plan exactly matching the production order, without the operator having to make any inputs.

6. The MTC3 starts the test based on the valid test plan.

7. The detected test results are stored either locally or in the network. The test results can either directly be printed as test protocol or automatically generated and stored as PDF file.

   In addition, automatic label printing is possible. The label will contain the test result and, if applicable, data from the ERP-system.

8. Finally, completion reports, test results, date/time, operator name, quantities, etc. are sent to CAQ or MES- systems for further evaluations and analyses.

Data exchange in automation

The MTC3 is ideally suited to be integrated into automatic systems. It offers a huge variety of different interfaces for communicating with the higher-level automation systems.

Typical requirements:

- Controlling complete processes and components
  - Processing inputs, signal transmitters, scanners, RFID-readers, …
  - Setting outputs, e.g. for cylinders, …
  - Controlling motors and drives, …
- Exchanging start-, stop- and result signal
- Direct communication with a PLC-control
- Bidirectional communication
  - Receiving test plans and test parameters
  - Sending test results
  - Transfer of raw data
- Communication with robots, cameras, …

This is done by our configurable standard software modules, which reduce the effort for an integration of the MTC3 into automation systems to a minimum.

KEY FACTS

- Digital input/output interfaces
- Various interfaces directly to a PC
- Interfaces based on field busses
- Interfaces based on industrial Ethernet systems

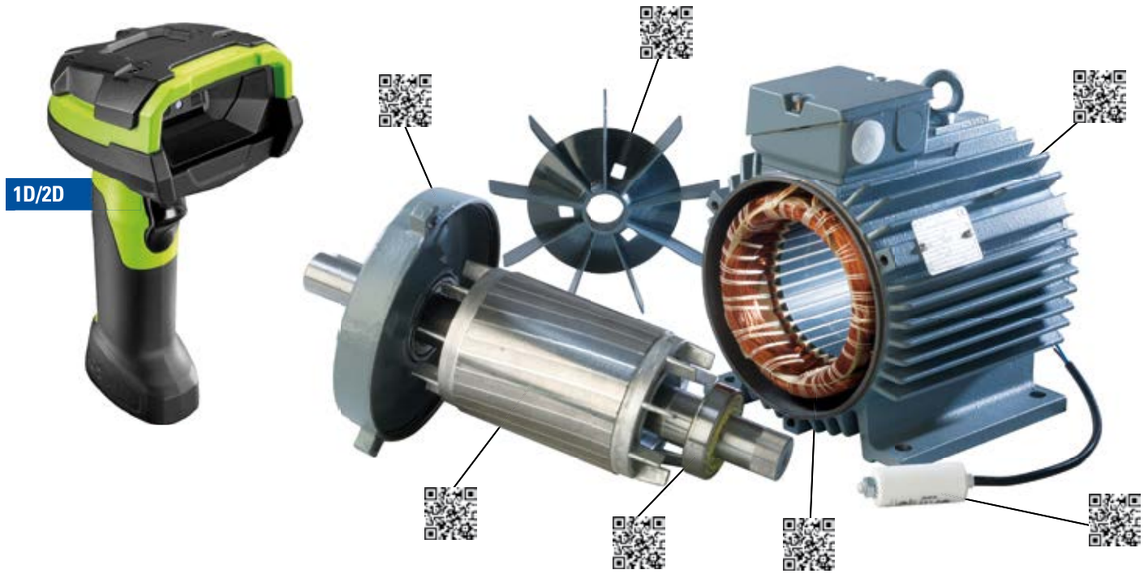
EtherNet/IP · Modbus TCP · PROFINET · PROFIBUS · Modbus · activeX · Microsoft .net · OPC Foundation · ETHERNET POWERLINK · CAN · IO Communication · DeviceNet · CANopen · USB Universal Serial Bus · RS 232 485 · EtherCAT · Ihr Feldbus

The indicated logos are registered trademarks of the respective companies.

Traceability

The MTC3 can store characteristics and further information of the DUT in the database.

In the event of variations in quality, marking components, modules and final products with a unique number gives you clear information about the complete manufacturing process. Traceability puts you in a position to react to production problems in a fast and targeted manner.



KEY FACTS

- Embedded in Industry 4.0
- Free configuration of the information to be scanned
- Free configuration of additionally stored order data
- Storage of traceability data
  - in the result database of the testing device
  - in an ERP- or MES-system
- Traceability without additional IT-system
  - searching for the stored information
  - detecting the products in question

Marking and labeling

After the test, the DUT normally needs to be marked or labeled.

This is a process that takes place automatically after the test, so that no manual intervention is required.

To control marking or labeling devices, the MTC3 is equipped with the following interfaces:

- Ethernet
- USB
- RS232

The MTC3 can also load and print various layout data. The layout can be provided by a higher-level ERP-system.

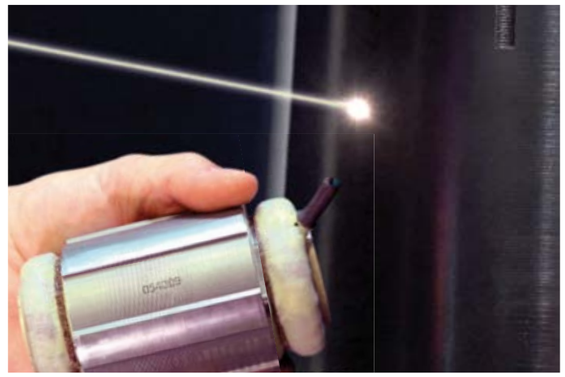
Possible marking and labeling:

- Marking of good or bad by means of an impact punch
- Marking of good or bad by means of color-marking system
- Laser marking of the serial number after passing the test
- Label print-out incl. contents of the test and serial number
- Printing of name plates
- Printing of NO GO labels
- Printing labels for packaging

  …

Laser marking

Laser marking is extremely durable and allows to mark nearly all types of materials. The laser changes the color of the material without changing the surface.



KEY FACTS

- Durable and long-lasting
- High contrast
- Wear-free
- No consumables

Label printing

Thermal transfer label printers are used for marking the DUT after passing a test. The printer creates labels that are attached to the product, e.g. as a name plate.

The printer comes with a label-design software, which allows an individual label design. After the test, variables are entered in the respective place holders by the testing device.

cab ZEBRA SATO

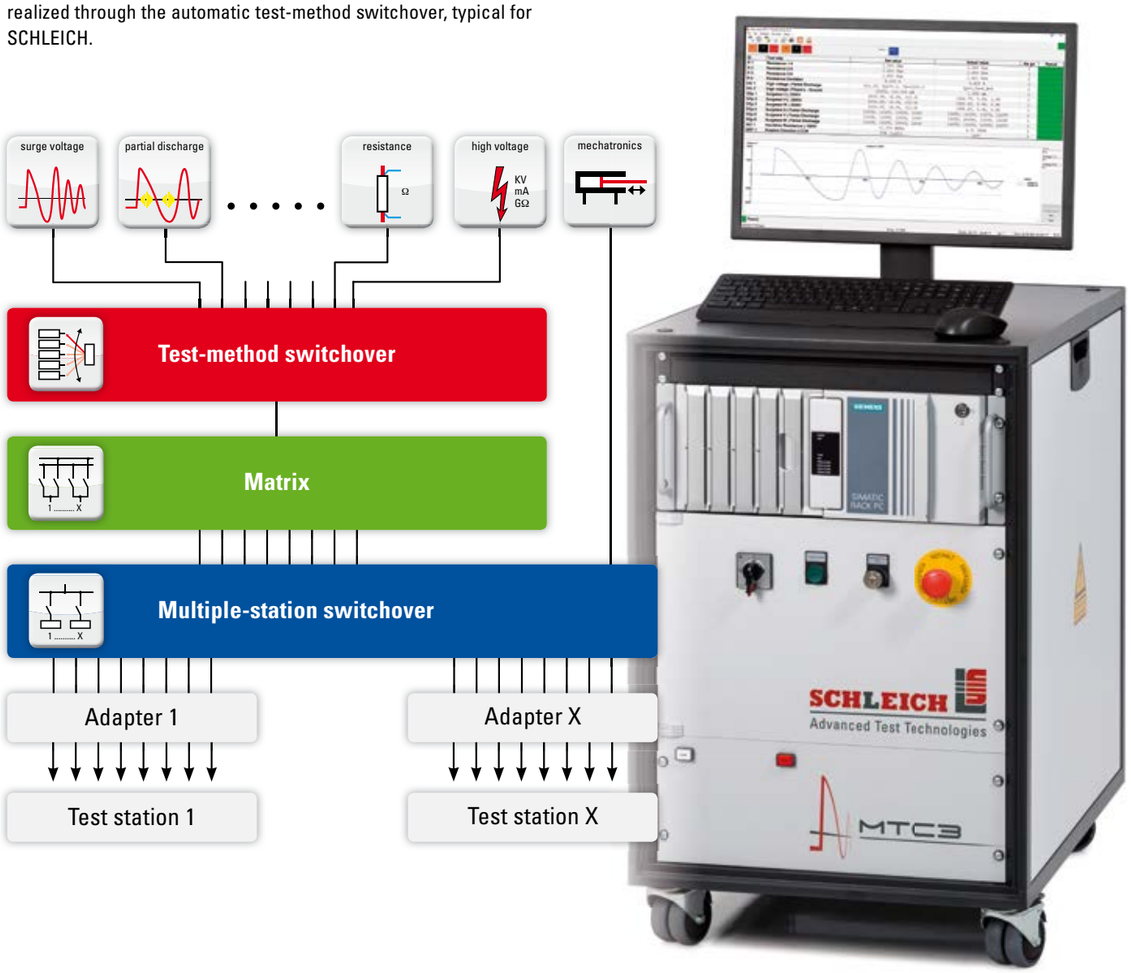
KEY FACTS

- Universal use owing to a great number of available label materials
- Simple integration into the testing process
- Easy operation

Test-method switchover and mechatronics

In day-to-day use, testing technology made by SCHLEICH has been proven in thousands of applications. These products belong to the most reliable on the marked offering high utility due to outstanding performance and accuracy.

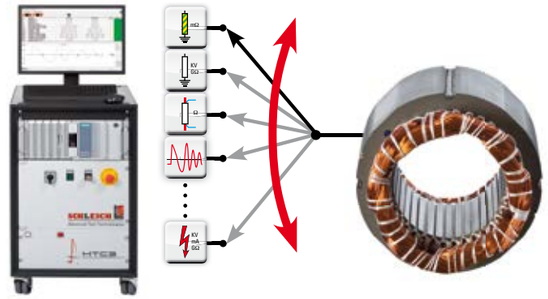
In order to save time, all leads of the DUT can be connected by means of a contacting adapter. After this, the testing device performs all tests fully automatically, without any manual intervention. This is realized through the automatic test-method switchover, typical for SCHLEICH.



For DUTs with several leads it is more efficient to connect all leads of the DUT directly to the testing device. The testing device will perform all tests between all connection points fully automatically. This procedure reduces the required cycle time and thus the costs for a test. For the switchover between the individual leads we are using flexible switchover matrices.

To keep the time for connecting a DUT with many leads as short as possible, we often use dual or multiple test stations. While one station is unloaded and loaded, the DUTs in the other stations are being tested. This way, even complex test tasks allow economic results.

Test-method switchover

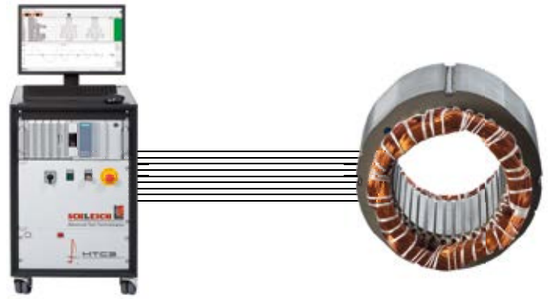


We offer a great number of different switch overs, matching type and extent of the test methods. They allow fast, automatic changing between the individual test methods. As the voltage differences between the test methods can be very large, safety is top priority for all switchovers. For the protection of your staff and your DUTs, a resistance test with 3 V will be connected to the DUT as reliably as a high-voltage test with 6000 V. Without compromise! This is why we are using only tried and tested, high-quality components from our own production or from well-known manufacturers for the production of switchovers and matrices.

Station switchover

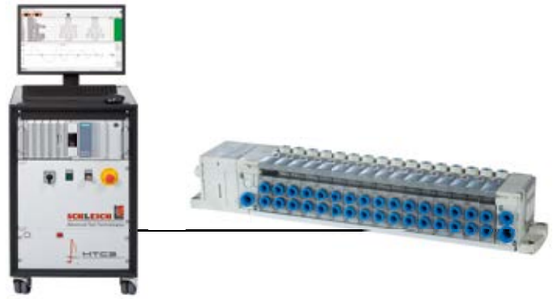
Instead of using two or more testing devices, station switchovers can be a cost-efficient alternative. They are also subject to the highest safety standards. While tests are performed in one station, the other station is loaded or unloaded. During this work, the operator inevitably touches the clamps and the leads. Touching clamps and leads might be hazardous. For this reason, the test leads going to the stations where no test is in progress, must be disconnected securely. On top of that, it is recommended to ground the leads going to the DUT.

Matrices



For almost every task, we can offer the matching relay matrix. Matrices vary in the number of test leads or connection points and in the level of the test voltage to be connected. A matrix must connect or isolate 6000 V as securely and reliably as millivolt signals. This is what our engineers have developed the matrices for. They are designed for two-wire and four-wire applications. They can be combined as desired in order to increase the number of leads. Matrices with more than 100 connection points are quite common. For matrices the same applies as for our test-method switchovers: using only the highest quality.

Mechatronics | Script control



Next to the hardware, our software offers enormous flexibility, as well. Owing to integrated script commands, it is possible to realize additional PLC-functions in the tester. You can interrogate inputs, set outputs and create logical functions – exactly like with a PLC.

The economic advantage is the direct control of mechatronic functional processes. You can switch valves, interrogate limit switches, evaluate test values and much more. I.e. the testing device is able to generate additional functional procedures before, during and after the test. This is ideal for your own test setups or for the integration into an automatic production process.

The surge test

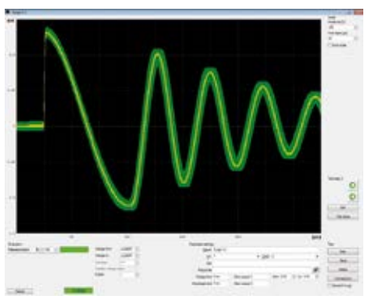
With the excellent evaluation methods of the MTC3, you are able to detect even the smallest faults. The range of evaluation methods, which can be combined in any way you like, allows a detailed and very accurate fault analysis. This reduces misinterpretations to a minimum.

The parameterization to the signals to be evaluated takes place almost automatically. In order to achieve maximum sensitivity, the tester autonomously selects the most favorable settings for the signal. In addition, the MTC3 has an automatic voltage correction. Depending on the respective DUT, the test voltage is always perfectly adjusted. These features significantly facilitate the fault analysis and allow a reliable evaluation of the DUT.

The evaluation is based on a reference signal which has been taught-in before or on an automatic comparison between all three phases.

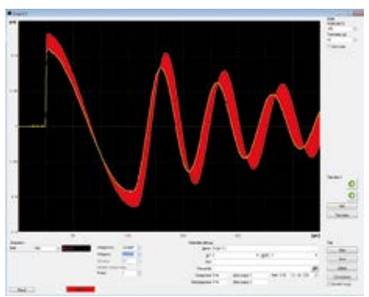
- Test voltage max. 6, 12 or 15 kV
- 12 joules surge energy
- Rise time from 100 ns
- Patented evaluation method
- Bipolar surge pulse

Tolerance band



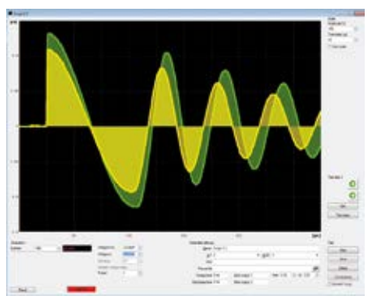
The tolerance band belongs to the more simple evaluation methods, where an envelope is placed around the signal. The surge wave must be within a defined tolerance band.

Error area | EAR



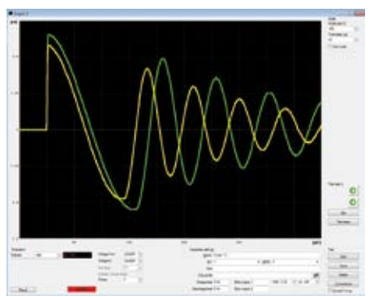
The error area is the differential area between 2 signals (surge waves). The difference in area between reference surge wave and currently measured surge wave is automatically detected and the deviation is indicated in percent.

Difference in area



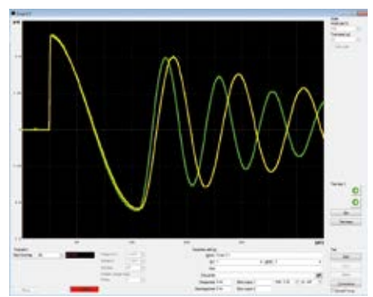
The difference in area is the subtraction of the individual areas below the two surge waves. The result leads to a deviation in percent compared to the reference area.

Correlation (patented by SCHLEICH)



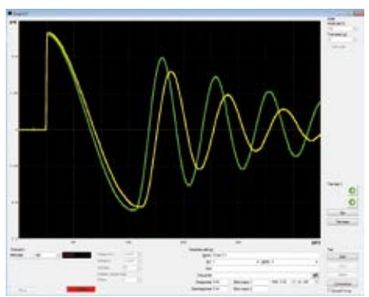
The relation between reference surge wave and currently measured surge wave is detected automatically and the deviation is indicated in percent.

Frequency



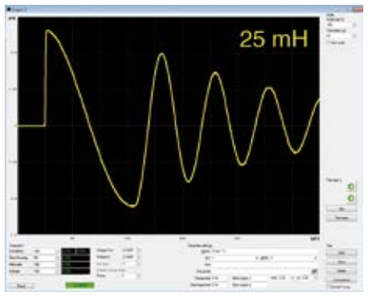
The difference in frequency between reference surge wave and currently measured surge wave is detected automatically and the deviation is indicated in percent.

Attenuation



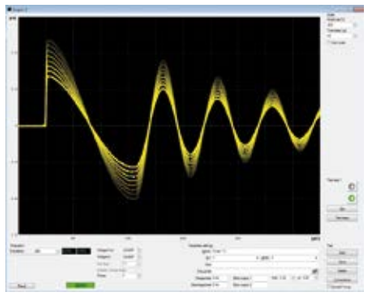
The difference of the attenuation curve between reference surge wave and currently measured surge wave is detected automatically and the deviation is indicated in percent.

Inductance | mH



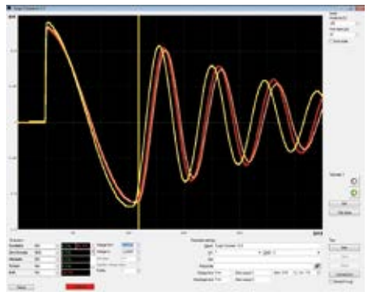
The inductance is calculated with the signal from the surge voltage test. The result is indicated in “H”.

Peak-to-Peak



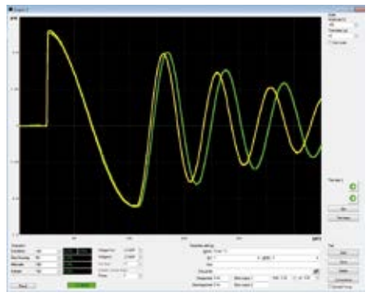
For the peak-to-peak method, the test voltage is increased step by step. If there is a larger deviation from one step to the next, the test is interrupted. The deviation from step to step is indicated in percent.

Phase comparison



For the phase comparison, all three phases of a motor are automatically compared with each other and displayed in a diagram. This way the symmetry can directly be detected and evaluated. This method is normally used in the motor repair sector.

Reference comparison



The comparison to a reference is possible, provided a good DUT has been taught-in before. This method is typically used in production.

Partial-discharge test

for surge voltage according to IEC 61934 and DIN 60034-18-41

The partial-discharge test (PD) serves to detect quality defects at windings that cannot be found with the standard high-voltage or surge test alone.
Even if there is no complete breakdown in the insulation, part of the insulation can already show partial breakdowns. This is the partial discharge that needs to be measured.

The partial discharge is detected with a PD-antenna or a PD-measurement coupler integrated in the test leads. The remaining partial-discharge measurement technology is integrated in the MTC3.

Due to the high-frequency measuring and filtering technology, the test system is extremely fail-safe. Therefore, the partial-discharge test is well suited to be used in production environments.

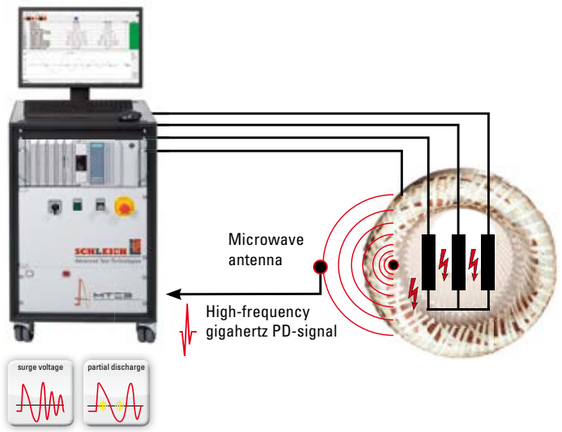
PD-tests at stator windings are performed with robust measurement antennas. For PD-tests at completely closed motors, special lead couplers are used. Both measurement variants can be used individually, together or in combination.

KEY FACTS

- Determination of the inception and extinction voltage according to IEC 61934
- Very high repetition accuracy due to special filtering technology
- Special coupling technology for measuring completely assembled motors
- Extremely fail-safe due to special, high-frequency filtering technology
- No shielding of the test area required
- Partial-discharge test 6, 12 or 15 KV – depending on the surge voltage
- Rise time possible starting at 100 ns
- Qualification of enameled copper wire (twisted pair), enamel insulation and impregnation method

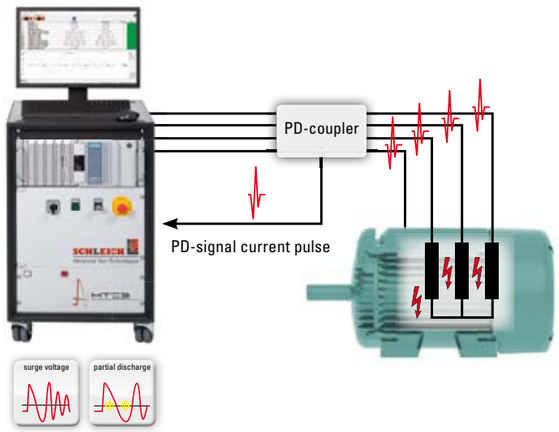
Partial-discharge tests at open stator windings

Partial-discharge measurements at open stator windings are performed with an antenna, which is placed inside the DUT or in its vicinity. It is a great advantage that the antenna has no directivity whatsoever.



Partial-discharge tests at completely assembled motors

At completely assembled motors, the measurement cannot be performed via antennas, because the high- frequency signals are shielded by the closed motor housing (Faraday cage). In this case, the measurement is performed via a special coupler which is integrated into the test lead.



High-accuracy voltage measurement

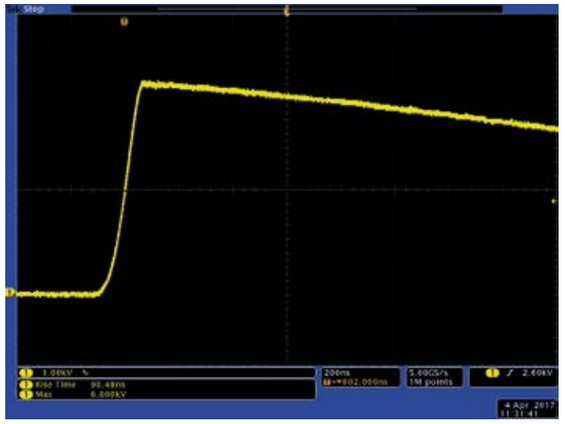
In case of long leads, fast voltage rises can lead to voltage peaks. These voltage peaks typically occur when a motor is operated by a VFD via a long lead. Exactly this effect can be simulated and accurately measured with the MTC3 in combination with the surge test.

For this purpose, SCHLEICH also offers the VoltageAnalyzer, which allows high-accuracy voltage measurement directly at the DUT.

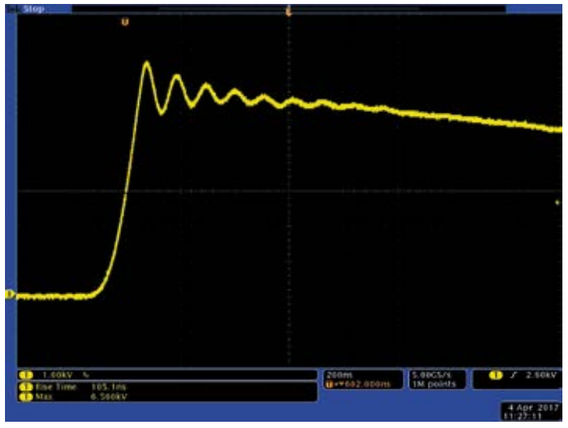
During the partial-discharge test, thus the inception voltage can be accurately determined.

The following values are detected per phase:

- Peak value
- Peak-to-peak value
- Rise time of the surge pulse



Surge pulse without overshoot

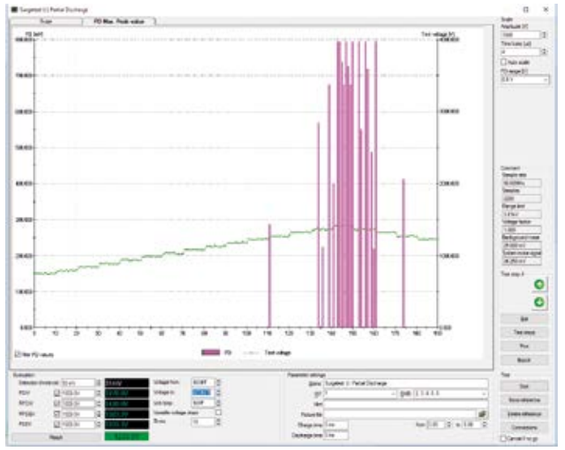


Surge pulse with overshoot

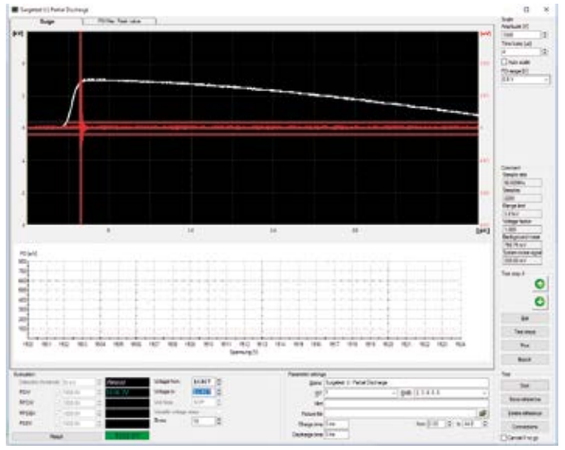
Partial-discharge test according to IEC 61934

The test is performed fully automatically at all three phases and is integrated into the normal test process. The following values are detected per phase:

- PDIV (inception voltage)
- PDEV (extinction voltage)
- RPDIV (repetitive inception voltage)
- RPDEV (repetitive extinction voltage)



Test process according to IEC 61934



Surge pulse with 150 ns rise time and PD-effects

High-voltage test AC

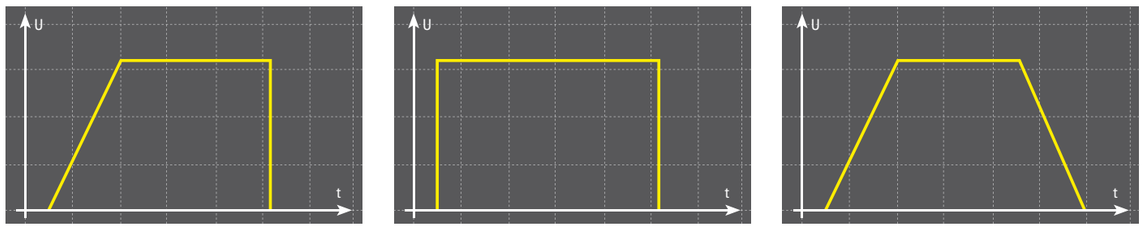
The high-voltage test AC (alternating voltage) serves for testing the electric insulation capability and voltage proof of clearance and leakage paths at windings according to national and international regulations. The insulation system between the motor phases and the core is of particular importance.

The MTC3 automatically connects the test voltage to the desired test leads. These are the same test leads as used by the other test methods. The switch-over is performed fully automatically inside the testing device. A manual reconnection of the test leads while the test is in process is, therefore, not necessary.

The level of the test voltage, the maximum allowed current as well as further test parameters can be configured as desired.

KEY FACTS

- High voltage 6 kV AC
- Test current up to max. 500 mA
- Electronic high-voltage adjustment
- Adjustable quick stopping
- Freely adjustable ramps
- Connection check via minimum current
- Cable-break monitoring with 4-wire method



Testing with or without voltage-ramp profile

The following insulations can be tested fully automatically:

- All phases against the core
- Individual phases against the core
  (only possible at non-connected machines)
- Phase against phase
  (only possible at non-connected machines)
- Temperature sensor against winding
- Temperature sensor against core
- Setting jumpers between temperature-sensor leads

Partial-discharge test

for high voltage AC

The partial-discharge test (PD) serves to check the quality of windings. The test is performed in connection with the high-voltage test AC. The test serves to detect quality defects at windings that cannot be found with the standard high-voltage test alone. Possible defects:

- the enameled copper wire touches the core
  (at the winding head or in the slot)
- missing or faulty phase separator
- missing or faulty slot insulation
- faulty impregnation procedure (air inclusions)

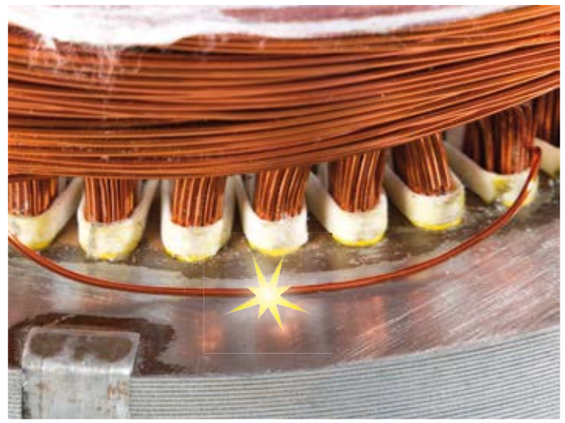
The evaluation of the insulating system is facilitated to a great extent, because the test in combination with the high-voltage test AC is performed fully-automatically. Furthermore, the measurement of inception voltage and extinction voltage (PDIV & PDEV) can be realized within production fully automatically.

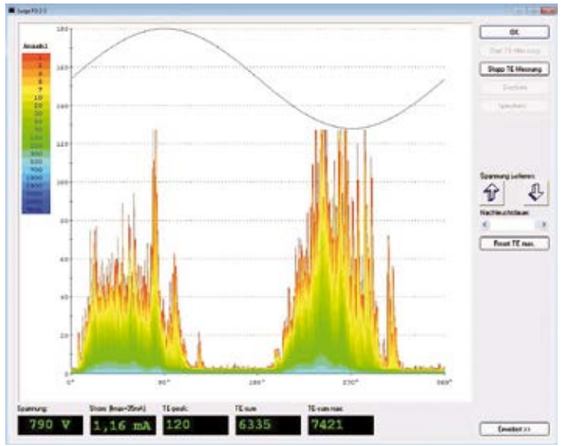
The MTC3 goes through a voltage-ramp profile, during which the test voltage is increased step by step. As soon as partial discharges occur, this voltage will be stored as PDIV (inception voltage). Now, the test plan reduces the voltage until the partial discharge has vanished completely. This voltage is determined as PDEV (extinction voltage) and will also be stored.

To guarantee fast testing during production, the intensity of the partial discharge can also be determined for a fixed test voltage. This allows a quick identification of “good” and “bad”.

KEY FACTS

- Automatic measurement of inception and extinction voltage
- Detection of quality problems
- Evaluation in mV or pC
- Fully-automatic evaluation





Long-time PD-test

Resistance test

The resistance test allows to test the phase resistances of the winding fully automatically.

The MTC3 automatically connects the test to the desired test leads. These are the same test leads as used by the other test methods. The switch-over is performed fully automatically inside the testing device. A manual reconnection of the test leads while the test is in process is, therefore, not necessary.

The evaluation is either based on defined set values or on the symmetry ratio (deviation) of all three phases.

Resistance test at a 3-phase machine
- automatic testing of all three phase resistances
- evaluation of the deviation

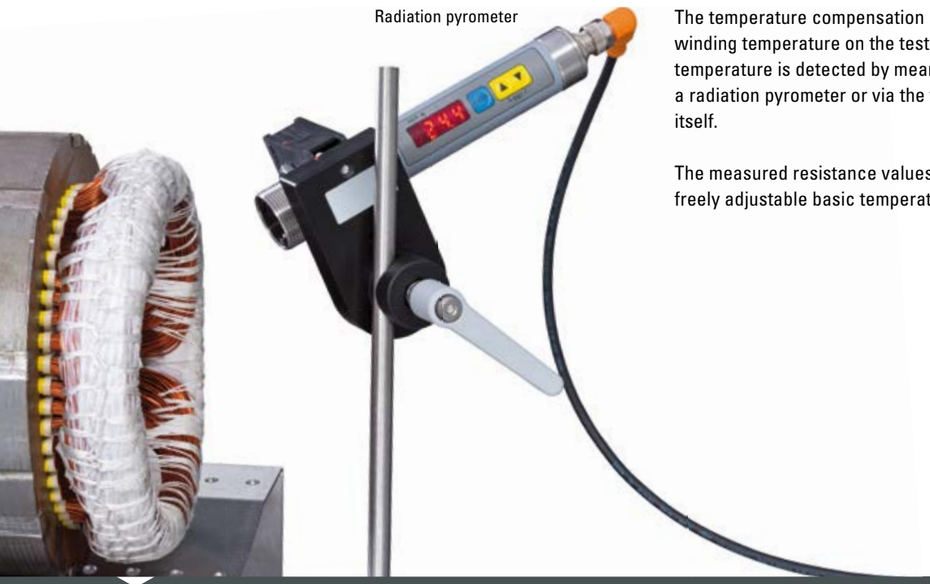
KEY FACTS

- High-accuracy resistance test with 4-wire method
- Automatic connection to the DUT
- Fully-automatic resistance test
- Automatic GO / NO GO evaluation
- Fixed determination of set values possible
- Temperature-sensor test
  (PTC, NTC, PT100, PT1000, KTY83, KTY84…)
- Ambient-temperature compensation via
  - ambient-temperature sensor
  - radiation pyrometer
  - thermo camera
  - temperature sensor which is placed in the winding to protect the motor from overheating

Temperature compensation

The temperature compensation balances the influence of the winding temperature on the test result. For this purpose, the winding temperature is detected by means of an ambient-temperature sensor, a radiation pyrometer or via the temperature sensor in the winding itself.

The measured resistance values are automatically compensated to a freely adjustable basic temperature.



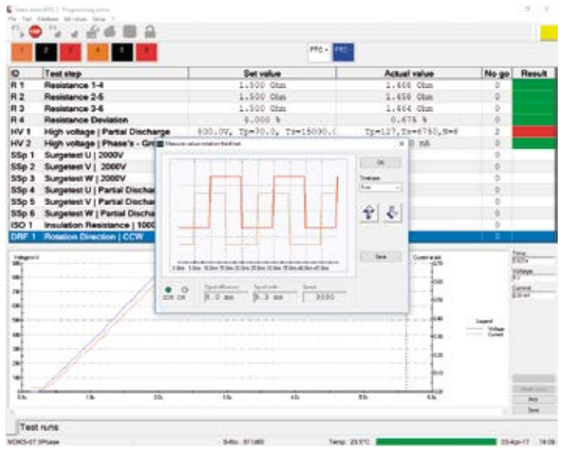
Radiation pyrometer

Rotary-field test

The rotary-field test serves to measure and evaluate the rotary field of a stator. The test is performed contactless by means of a rotary-field probe, which is inserted into the stator or attached to a DUT holder.

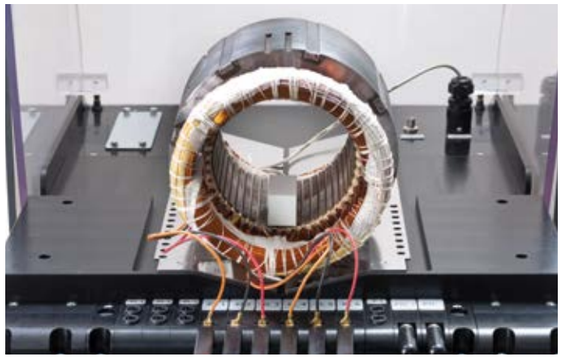
The rotary field is created by a connected current-limited low-voltage rotary field, which simulates the 3-phase supply of the motor. With this test, coil-connection errors in production can be detected before the motor is assembled.

Non-connected stators can automatically be connected as star or triangle. Thus, the MTC3 can test and evaluate almost any type of stator.

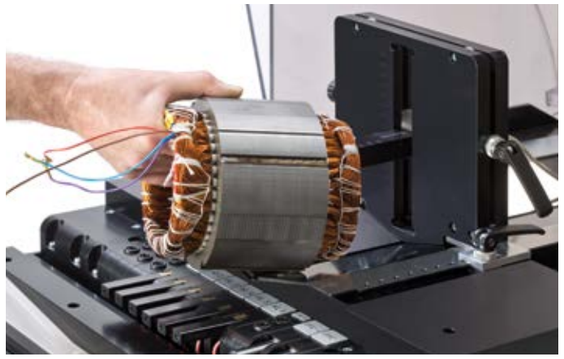


KEY FACTS

- Contactless rotary-field test
- Fully automatic Star/Delta-connection
- Wear and maintenance free
- Short-circuit-proof
- Also suited for single-phase motors



Loose rotary-field probe to be placed in the stator



Adjustable rotary-field probe mounted to the prism

Standard rotary-field probes

25 x 30 x 55 mm (W x H x D)

26 x 20 x 162 mm (W x H x D)

16 mm Ø

Insulation-resistance test

› High-voltage DC
› PI | DAR
› up to 100 GΩ

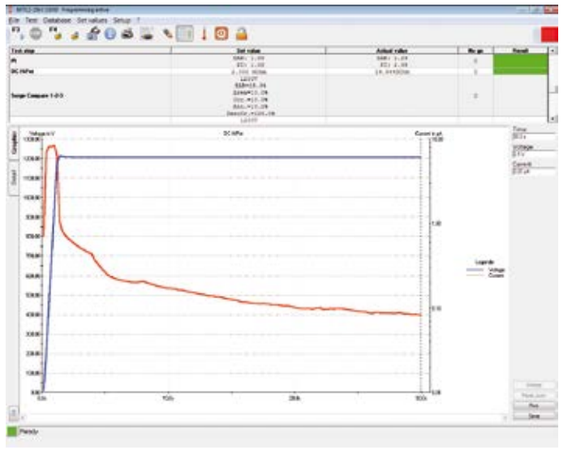
The insulation-resistance test is especially designed for testing windings and belongs to the standard features of the MTC3. During the test, the MTC3 automatically connects the test voltage to the desired test leads. These are the same test leads as used by the other test methods. The switch-over is performed fully automatically inside the testing device. A manual reconnection of the test leads while the test is in process is, therefore, not necessary.

The level of the test voltage, the maximum allowed current as well as further test parameters can be configured as desired.

The following insulations can be tested fully automatically:

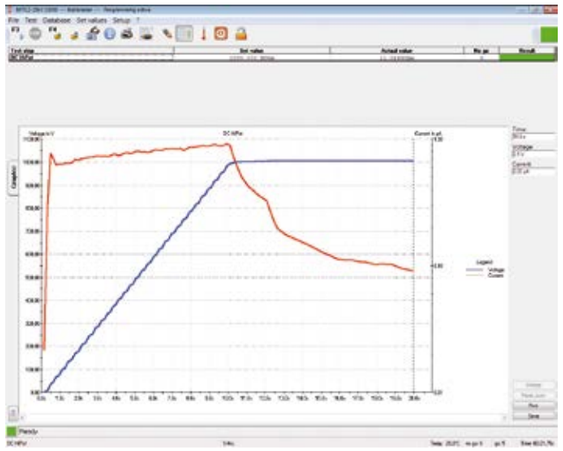
- All phases against the core
- Individual phases against the core (only possible at non-connected mashines)
- Phase against phase (only possible at non-connected mashines)
- Temperature sensor against winding
- Temperature sensor against core
- Setting jumpers at temperature sensors

Insulation-resistance test



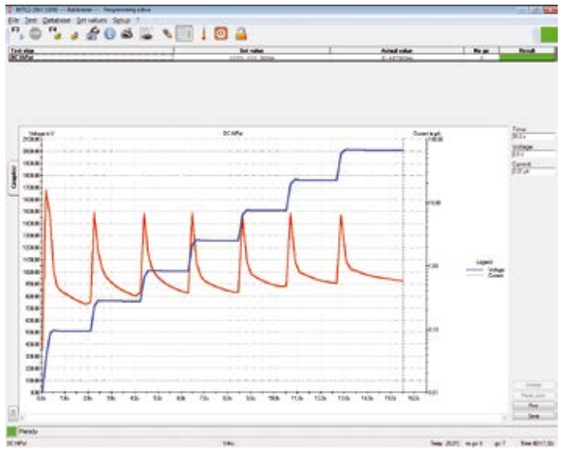
- Adjustable test time

Insulation-resistance test with ramp



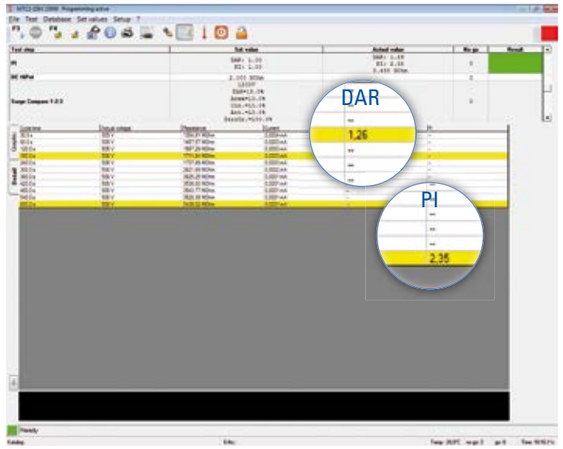
- Adjustable ramp and test time

Step-voltage test



Adjustable step voltage:
- test time per step
- final test time at the last step
- voltage-step size per step
- starting voltage of the first step

PI | DAR test



- recording of measurements every 60 s
- the first two measurements are recorded in an interval of 30 s

KEY FACTS

- Adjustable minimum-current monitoring (connection check)
- With voltage ramp
- Fully-automatic or manual process
- Automatic discharge after the test
- Selectable display variants:
  - voltage and current
  - resistance and current
  - resistance and voltage

Technical data

Test methods

Surge test

Testing with electronically stabilized test voltage.
After the test, the DUT is automatically discharged.

Test voltage max.	max. 6, 12 or 15 kV – depending on the selected device		
Surge capacity	100 nF, optional 200 nF		
Pulse rise time	100 to 500 ns according to IEEE Std 522-2004 & DIN EN 60034-18-41 (faster rise times on request)		
Evaluations	in addition to our patented correlation method, 6 further evaluation methods are included in the tester: tolerance band, EAR, peak-to-peak, …		
Deviation display	in %		
Specification of allowed deviation	in %		
Comparison	phase comparison between the phases or comparison to a reference stator		
Symmetry evaluation	yes – between the 3 phases		
Switchover	automatically between the integrated test methods and the test leads		
Test voltage	6 kV	12 kV	15 kV
Joules	1,8 J	7,2 J	11,25 J
Surge current	800 A	1000 A	1000 A
Capacitor	100 nF	100 nF	100 nF

Partial discharge at surge test

Testing with electronically stabilized test voltage.
After the test, the DUT is automatically discharged.

Test voltage	max. 6, 12 or 15 kV – depending on the max. surge voltage
PD-detector	high-frequency antenna or coupling module (optional)
Frequency range	gigahertz
Inception/Extinction voltage	automatic evaluation method according to standards!
Pulse rise time	100-500 ns according to IEEE Std 522-2004 & DIN EN 60034-18-41 (faster rise times on request)
Switchover	automatically between the integrated test methods and the test leads

High-voltage AC

The insulation is tested with electronically or analogically regulated and constant high voltage. During the test, the test current must not exceed a defined maximum value. If the current exceeds the maximum value, the test is interrupted automatically.
After the test, the DUT is automatically discharged.

Test voltage	max. 6 kV AC
Current	max. 500 mA
Measuring range	0.1 to 500 mA
Power	> 500 VA in case of short circuit – according to VDE regulations
Fast switch-off	adjustable
Minimum-current monitoring	yes, as connection check
Test time	0.1 to 999 s
Switch-over	automatically between the integrated test methods and the test leads

Partial discharge at high voltage AC

The partial-discharge test serves to check the quality of windings. The test is performed together with the high-voltage test AC. This test serves to detect quality defects at windings that cannot be found with the standard high-voltage test alone.
After the test, the DUT is automatically discharged.

Test voltage	max. 6 kV AC
PD-detector	capacitive coupling out
Inception / Extinction voltage	yes – fully-automatic measurement
Evaluation in	mV or optional pC
Switch-over	automatically between the integrated test methods and the test leads

High voltage DC

The insulation is tested with electronically regulated and constant high voltage. During the test, the test current must not exceed a defined maximum value. If the current exceeds the maximum value, the test is interrupted automatically.
After the test, the DUT is automatically discharged.

Test voltage	max. 6, 12 or 15 kV DC – depending on the max. surge voltage
Current	max. 3 mA – with safety-current limitation
Test time	0.1 to 999 s
Switch-over	automatically between the integrated test methods and the test leads

Resistance

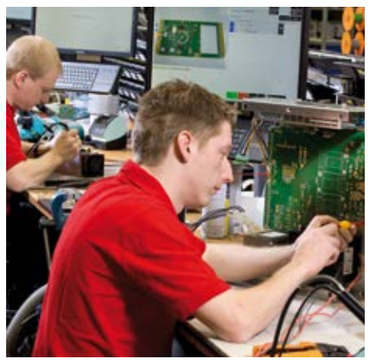
Measuring range	<1 mΩ up to 100 KΩ – very high accuracy
Resistance test	with 4-wire method
Evaluation of deviation	yes – between the 3 phase resistances
Temperature-sensor test	yes
Switch-over	automatically between the integrated test methods and the test leads
Temperature compensation	yes

Insulation resistance

The insulation is tested with electronically regulated and constant test voltage. With the applied voltage and the flowing current, the testing device calculates the insulation resistance. The insulation resistance must not be below a certain minimum resistance defined in the standards. After the test, the DUT is automatically discharged.

Test voltage	max. 6, 12 or 15 kV DC – depending on the max. surge voltage
Current	max. 3 mA - with safety-current limitation
Measuring range	1 MΩ up to 100 GΩ
Resolution	0.001 µA
Fast switch-off	adjustable
Minimum-current monitoring	yes, as connection check
Residual ripple	< 0.01 %
Test time	0.1 to 999 s
Switch-over	automatically between the integrated test methods and the test leads
Temperature compensation	yes

Another word for “Made in Germany”:
SCHLEICH



Comprehensive production facilities allow designing and manufacturing almost all tester components at our site in Hemer.

For example, our measuring and electronic PCBs are produced with an ultra-modern in-line-SMD-placement system, which assures a stable quality of our products.

Modern high-end processors in our testers process the test tasks in a fast, precise and reliable manner. With our modern CNC-machines, we also design and manufacture a great number of accessory components such as test covers, contacting units, workpiece carriers with DUT-holders or robot gripping tools as well as complete automatic production lines.

Whatever you want to test…
…SCHLEICH has the solution!

SCHLEICH is a leading system provider in the area of testing motors and windings. Our extensive range of products allows us to provide you with testers, test systems and complete production lines for almost every test task.

Decades of experience, listening to our customers and satisfying their wishes – facing individual tasks with technical creativity and realize them in a team of highly skilled engineers and designers – this is what we do. This is SCHLEICH.

Every single one of our more than 120 employees works on guaranteeing and optimizing the high quality standard of our testing devices each and every day. Our customers, our sales department, our motivated engineers and manufacturing staff – with their ideas and suggestions for improvement they are all part of the innovation process.

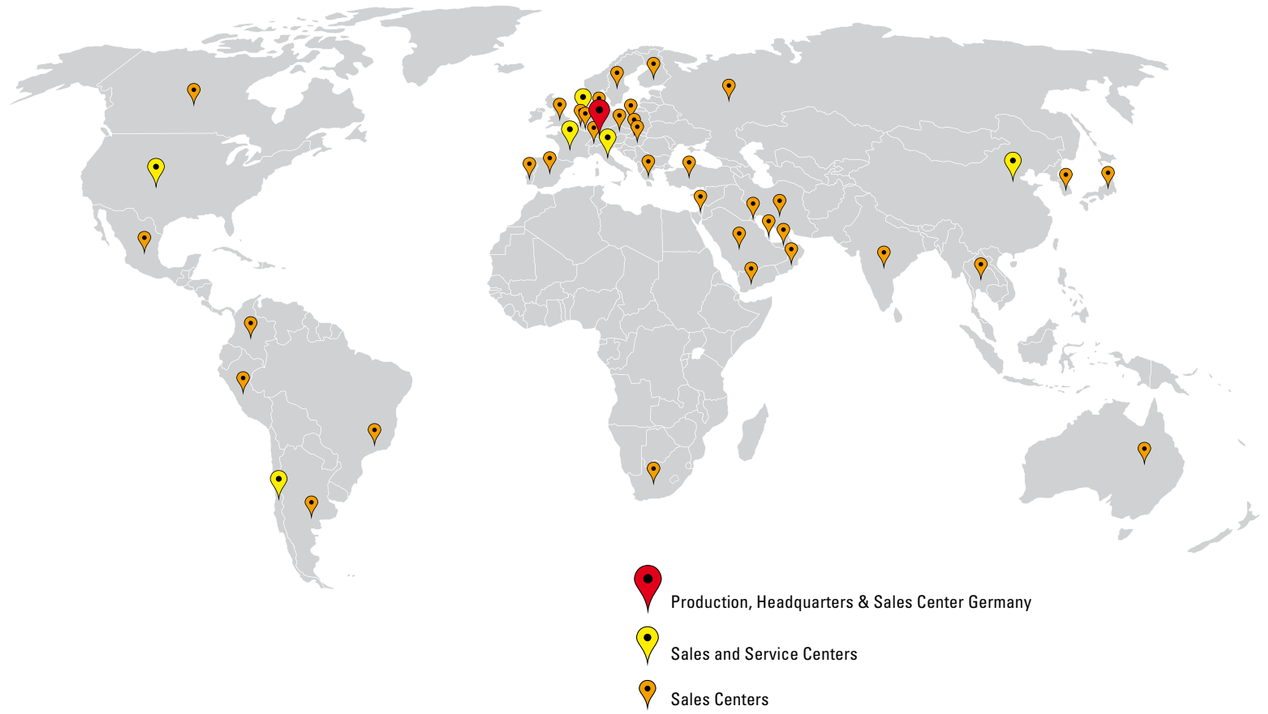
Service without limits.
We are there for you – wherever you are.

First-class customer service is our top priority. From detailed consulting during the planning phase to training and After-Sales-Service – we support you during the entire process.

In training sessions adapted to your requirements, our technicians will teach you the necessary know-how allowing you to avail yourself of the functional variety of our testing devices to the full extent. Should there be questions or technical problems, our technical support team will assist you by phone, on-line or on-site fast and reliably. Constant software updates and extensions make sure that you can always work with state-of-the-art test software. The periodic calibration of test equipment is an essential precondition for quality assurance. We calibrate your test equipment according to standards – on site or via remote maintenance.

It goes without saying that we calibrate in accordance with national and international standards. Our Service Centers support you around the world – with dedication, competence and reliability.

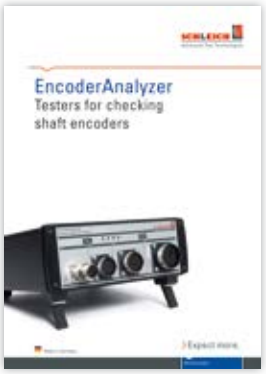
Sales and Service Centers

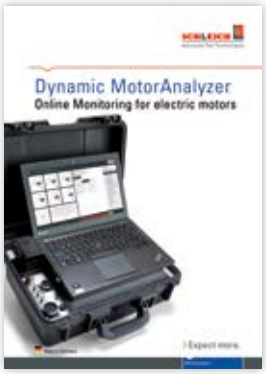


Expect more!

Whatever you want to test, SCHLEICH has the solution! As a leading supplier of electric safety and function test systems as well as motor and winding testers we offer solutions for any task in these sectors. The owner-managed company, founded more than 50 years ago, is present in over 40 countries around the globe.

Testers for electric motors and windings





Electrical safety- and function testers

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Presented by:

› Expect more.