# TESTRANO 600

## Three-phase test system for comprehensive power transformer testing



# One system for multiple tests on power transformers: TESTRANO 600

## Touch-and-Test with TESTRANO 600

TESTRANO 600 is the world's first portable, three-phase test system which supports all common electrical tests on power transformers.

Compared to conventional single-phase test sets the three-phase capabilities of TESTRANO 600 offer several advantages:

> One setup can be used to perform various tests
> The rewiring effort is significantly reduced
> Testing time can be cut down to a third of the time
> Increased safety as less trips up and down are needed

TESTRANO 600 provides you with a convenient way of testing to gain a comprehensive insight into the condition of every part of your power transformer. It can be operated using TESTRANO TouchControl on the integrated display, or by using our Primary Testing Manager™ software on your laptop. This makes it ideal for routine and diagnostic testing onsite or during factory acceptance tests (FAT).







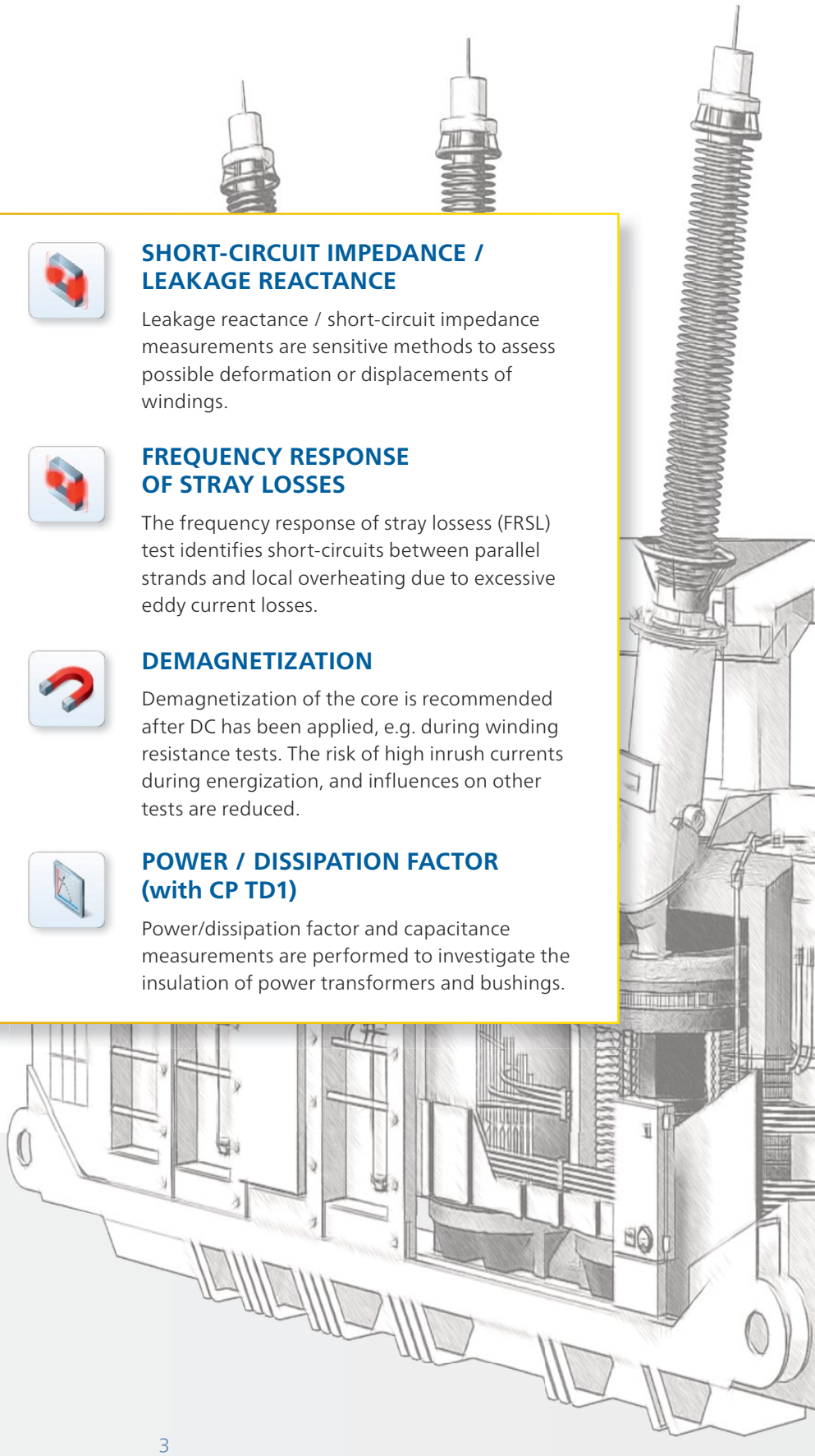


## Your benefits

> True three-phase power transformer test set
> Powerful device with 3 x 33 A DC or 400 V AC
> Reduced wiring effort as same wiring can be used for different tests
> Three times faster testing
> Automatic tap changer control and measurement, no accessory required
> Fast and reliable demagnetization of transformer's core

**www.omicronenergy.com/TESTRANO-600**





## TRANSFORMER TURNS RATIO

Transformer turns ratio (TTR) measurements verify the operating principle of a power transformer to detect shorted turns and open-circuited conditions.

## EXCITING CURRENT

Exciting current measurements are performed to assess the turn-to-turn insulation of the windings, the magnetic circuit of a transformer as well as the tap changer. In order to perform this test with 10 kV, the CP TD1 is required.

## DC WINDING RESISTANCE

DC winding resistance measurements are used to assess contact problems of the windings and tap changers.

## DYNAMIC RESISTANCE

Dynamic resistance measurements (DRM) are used to check the on-load tap changer (OLTC) for poorly maintained and damaged OLTC contacts.

## SHORT-CIRCUIT IMPEDANCE / LEAKAGE REACTANCE

Leakage reactance / short-circuit impedance measurements are sensitive methods to assess possible deformation or displacements of windings.

## FREQUENCY RESPONSE OF STRAY LOSSES

The frequency response of stray lossess (FRSL) test identifies short-circuits between parallel strands and local overheating due to excessive eddy current losses.

## DEMAGNETIZATION

Demagnetization of the core is recommended after DC has been applied, e.g. during winding resistance tests. The risk of high inrush currents during energization, and influences on other tests are reduced.

## POWER / DISSIPATION FACTOR (with CP TD1)

Power/dissipation factor and capacitance measurements are performed to investigate the insulation of power transformers and bushings.

### TESTRANO 600: One system – multiple tests

The newly designed, powerful and compact three-phase power transformer test set, weighing 20 kg / 44 lbs.

# Three-phase solution to speed up and simplify power transformer

**Your advantages of true three-phase testing:**

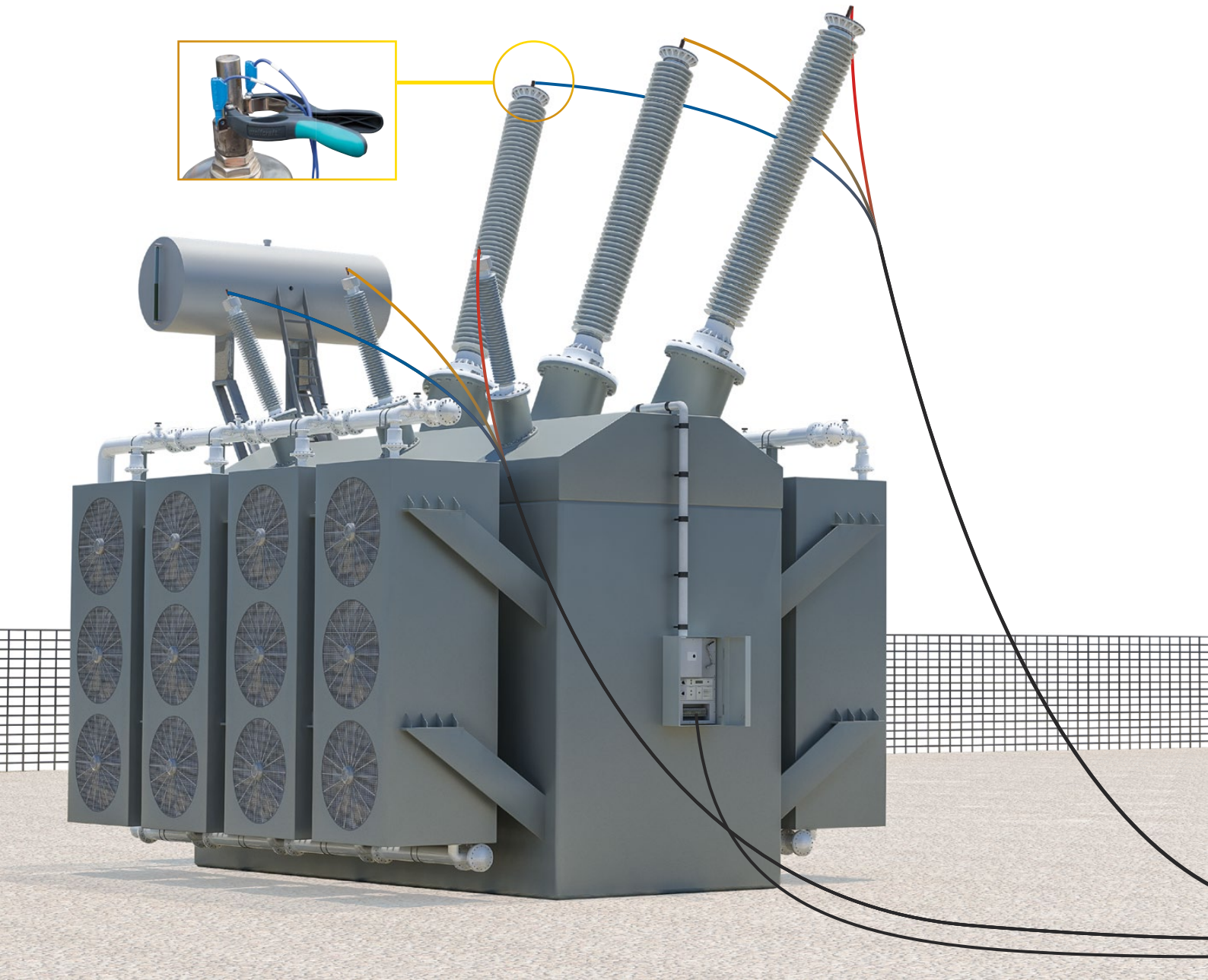
- Rewiring effort is significantly reduced
- Speeds up testing because all three phases are energized at once
- Fully automated control of tap changer during the test
- Verify the phase shift of any winding configuration

## Three wires are all you need

TESTRANO 600 is connected to the high-voltage and low-voltage side of the transformer by using specially designed multi-purpose cables.

The cables, which support a 4-wire (Kelvin) connection, only have to be connected once at the transformer's terminals. Then all test outputs and measurement inputs are automatically controlled by TESTRANO 600 without the need to change the connection again.

To automatically switch between different tap positions of an on-load tap changer (OLTC), a multiplug cable can be connected. This cable can also be used to record motor current and voltage of the OLTC.



## Three powerful sources

The compact and powerful design with three integrated sources enables you to perform high accuracy measurements in a fraction of the time required by other solutions:

- 3-phase transformer turns ratio with 400 V L-L
- 3-phase winding resistance with 33 A
- 3-phase short-circuit impedance / leakage reactance
- Fast demagnetization with 30 A

## A wider frequency range

Standard power / dissipation factor measurements at line frequency can only detect the effects of moisture and aging at an advanced stage.

By combining TESTRANO 600 with CP TD1*, you can perform measurements across a frequency range from 15 Hz to 400 Hz. This increases the sensitivity of the test and enables you to detect problems much earlier than with the standard measurement.

* CP TD1 is an optional accessory to the TESTRANO 600.
See more details on page 11.

## Active discharge and fast demagnetization

The active discharge function (patent pending) of TESTRANO 600 automatically discharges the winding within a matter of seconds, e.g. after resistance measurements have been performed. This speeds up testing time and increases the safety for the tester

With TESTRANO 600, you can quickly demagnetize the transformer's core before and after testing. This reduces the risk of high inrush currents during energization and of influences of a magnetized core on other tests.

## Safety first

TESTRANO 600 follows the "safety first" principles and fulfills the highest safety standards by providing an emergency stop button as well as safety and warning lights.

Another example are the custom-designed connector plugs which prevent you from connecting the wrong outputs. In addition, the simple wiring concept with labeled connection leads, leaves almost no room for errors.

## Rugged and compact design

With TESTRANO 600 you get all the required components in just one box. This makes testing quite comfortable and the system, weighing only 20 kg / 44 lbs, easy to transport. The rugged design makes it ideal for on-site testing as well as in rough environments.

The intuitive side panel and color coded cables of TESTRANO 600 make it easy to connect the test set for safe and reliable measurements.



# TESTRANO TouchControl – Easy test preparation and fast test execution

TESTRANO 600 can be operated in multiple ways:

> TESTRANO TouchControl, using the integrated touch display for fast and easy test workflow on the device

> Primary Test Manager™ software on your laptop for guided test workflow including easy data management and automatic result assessment.

Both solutions support all diagnostic tests on power transformers.

TESTRANO TouchControl features an integrated, high-resolution, multi-touch display.

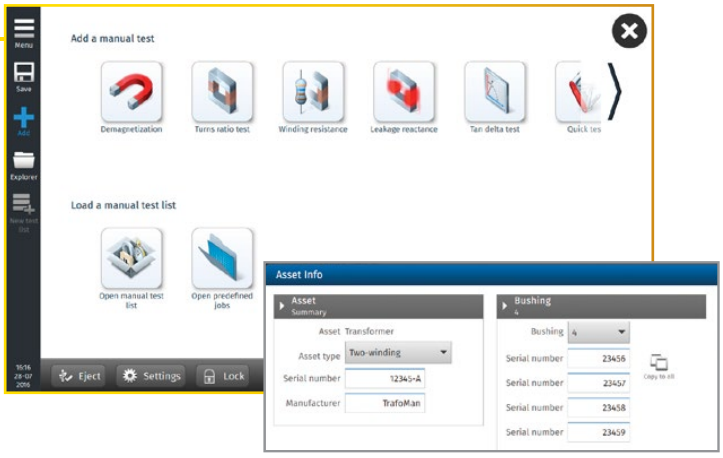
The high contrast of the 10.6" display ensures good visibility even in bright sunlight.

This allows fast, flexible and easy testing without bringing a laptop PC onsite.



The USB interface can be used to import and export test files to and from TESTRANO 600.

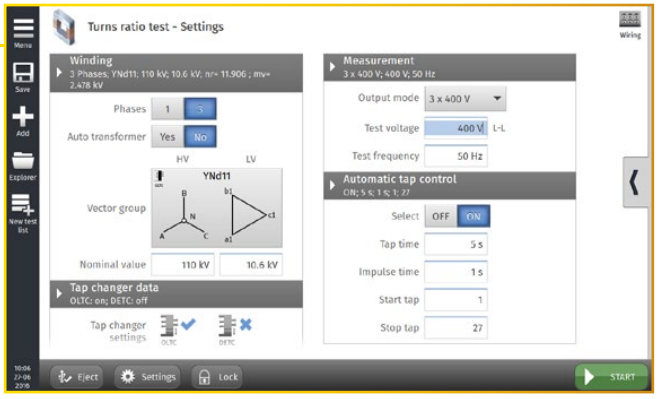
This can be used to prepare complex tests in advance and just import them onsite.




## Easy handling during test preparation

During operation with TESTRANO TouchControl, you can choose between creating a new, manual test or loading an already prepared test.

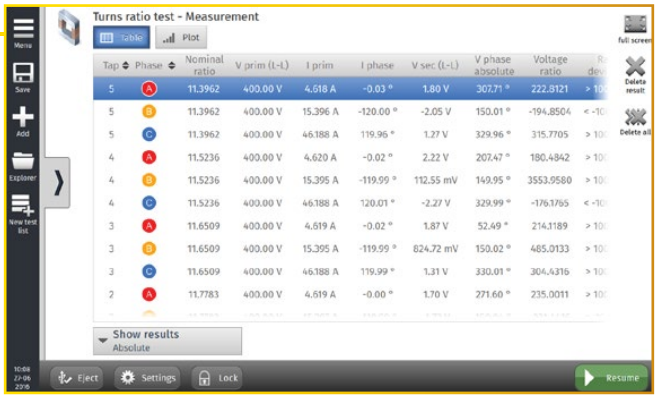
In order to identify your asset and keep your testing results organized, you can enter basic transformer nameplate information before starting your test.




## Best possible support during test preparation and execution

Each test follows an intuitive two-step workflow. You can set the measurement parameters on the “Settings” screen and press “Start”. You can then review the results on the “Measurement” screen.

Pre-configured wiring diagrams, that depend on the selected vector group of your power transformer, assist you with setting up the test equipment in the correct manner. This minimizes the likelihood of measurement errors and speeds up your testing process.




## Handy features for comparison and detailed analysis

Test results are available as a table and in graphical form to provide you with the best possible overview on your test results.

You can easily re-order the lines of the table when making phase-to-phase or tap-to-tap comparisons. You can also switch between different result plots, e.g. one showing the absolute values and another showing the deviation to nameplate values.

In order to create customized reports, you can export tests to our Primary Test Manager™.

# Primary Test Manager™ – Guided testing with easy data management

The Primary Test Manager™ (PTM) is the ideal software tool for the diagnostic testing and condition assessment of your power transformers.

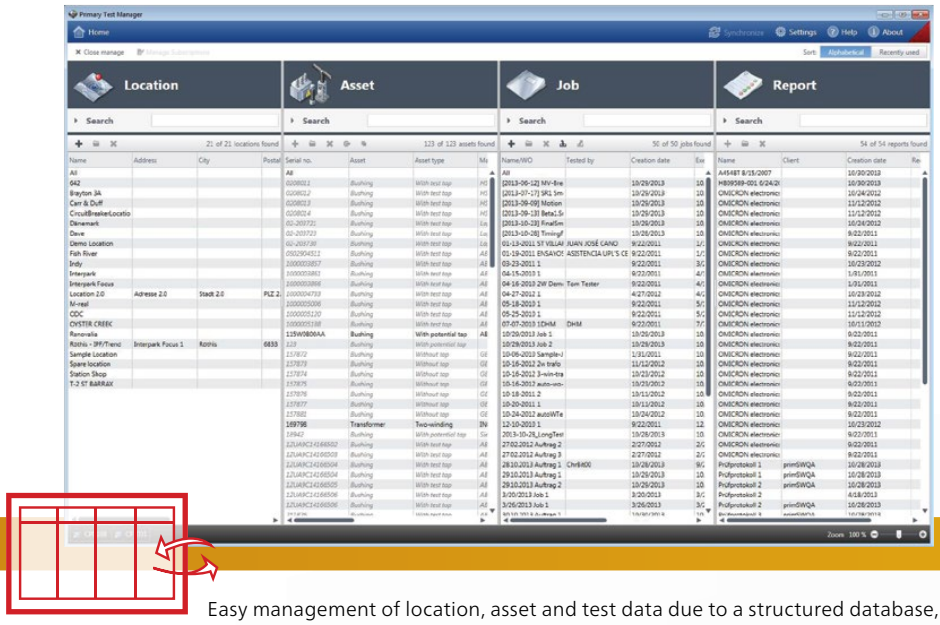
It supports you in performing measurements and guides you step by step through the entire test procedure, in order to make testing faster, easier, and safer.

## Management of location, asset and test data

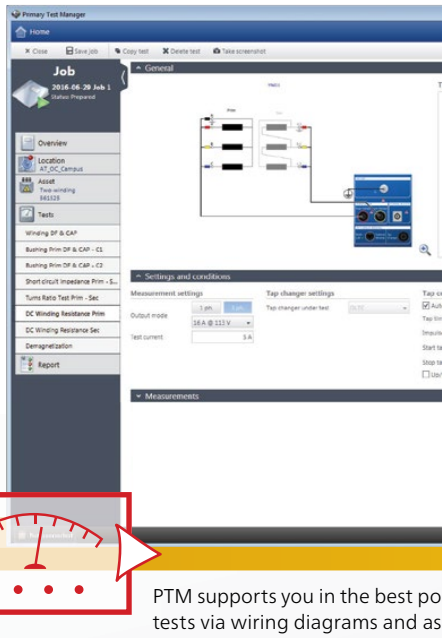
PTM provides a well-structured database for managing all related transformer data to get a comprehensive overview of your asset's condition. You can define and manage locations, assets, jobs and reports in an easy and fast way.

### Data synchronization and back-up

During on-site testing, data is often generated by multiple testing teams. With the 'PTM DataSync' module, you can synchronize all data to a central database hosted on premises or in the cloud. In doing so, data synchronization and storage becomes safer and more convenient. You can select the relevant locations in order to keep the local database small.




Easy management of location, asset and test data due to a structured database, implemented search and filter functions and automatic data synchronization.




PTM supports you in the best po
tests via wiring diagrams and as
international standards.

# and automatic result assessment

## Execution of diagnostic tests

PTM enables you to control and operate the connected test set directly from a computer. In order to assist you during testing, PTM helps you in defining your transformer with type-specific nameplate views.

### Customized test plans

Based on the nameplate values, PTM generates a customized test plan according to current standards and guidelines for each asset. Thereby, PTM provides you with a comprehensive test plan to thoroughly assess the condition of your asset.

By selecting or de-selecting individual tests, you can tailor the test procedure to your specific needs with minimum effort. At the same time, test plans can be configured in advance to enable fast and effective measurements.

## Result analysis and reporting

Results are automatically stored and organized in the database on your PC and are available for analysis and reporting. Each test can be automatically assessed according to international standards and guidelines or based on your individual limit values.

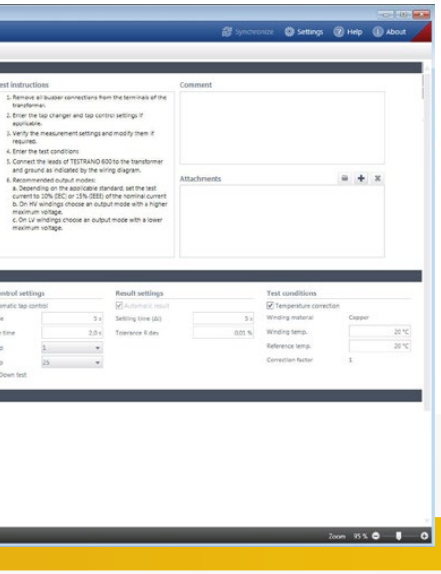
### Comparison tools for detailed analysis

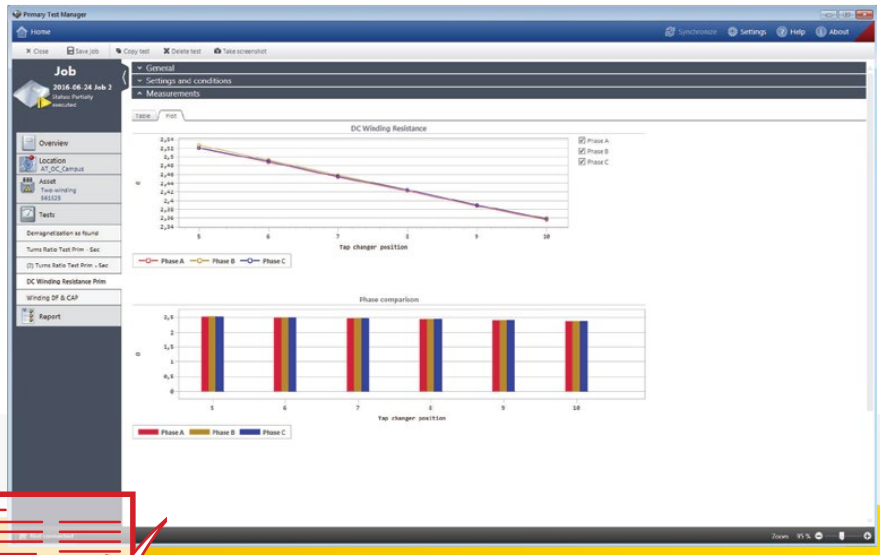
The measurement result can be visualized in tables and plots for easy review and assessment. Additionally, they can be compared with previous results and historical trends, allowing further in-depth analysis.

### Customized, individual reports

PTM automatically generates reports including all asset-related information and performed tests. This gives you a comprehensive overview of the test object, test results and assessment.

You can easily adapt test reports, for example, by choosing from different types of result tables and diagrams and by providing comments on every test. Furthermore, you can incorporate your company logo, photos and other test results.






ssible way during execution of diagnostic set-specific test plans according to

For a comprehensive analysis, PTM offers automatic result assessment and comparison as well as customized reporting.

# Technical data and possible accessories

## TESTRANO 600

### Outputs

#### HV & LV outputs – power

| | | | |
|---|---|---|---|
| Frequency | DC/1 mHz … 599 Hz | | |
| Power | $V_{mains}$ | $P_{30s}$ | $P_{continuous}$ |
| | > 100 $V_{RMS}$ | 1500 W | 1000 W |
| | > 190 $V_{RMS}$ | 4000 W | 2400 W |

#### HV & LV outputs – voltage

| Source | Range | $I_{max, continuous}$ | $I_{max, 30s}$ |
|---|---|---|---|
| 3-phase AC (RMS) | 0 ... 230 V (LN) | 300 mA | 12 A |
| | 0 ... 80 V (LN) | 16 A | 20 A |
| | 0 ... 40 V (LN) | 33 A | 40 A |
| 1-phase AC (RMS) | 0 ... 240 V | 16 A | 20 A |
| | 0 ... 120 V | 33 A | 40 A |
| 3-phase DC | 0 ... ±113 V | 16 A | - |
| | 0 ... ±56 V | 33 A | |
| 1-phase DC | 0 ... ±340 V | 16 A | - |
| | 0 ... ±170 V | 33 A | |

#### HV & LV outputs – current

| Source | Range | $V_{max, continuous}$ |
|---|---|---|
| 3-phase DC | 0 ... ±33 A | 56 V |
| | 0 ... ±16 A | 113 V |
| 1-phase DC | 0 ... ±100 A | 56 V |
| | 0 ... ±33 A | 170 V |
| | 0 ... ±50 A | 113 V |
| | 0 ... ±16 A | 340 V |
| 3-phase AC (RMS) | 0 ... 33 A (LN) | 40 V |
| | 0 ... 16 A (LN) | 80 V |
| 1-phase AC (RMS) | 0 ... 100 A | 40 V |
| | 0 ... 33 A | 120 V |
| | 0 ... 50 A | 180 V |
| | 0 ... 16 A | 240 V |

#### On-load tap changer input/output

| | |
|---|---|
| Voltage | 300 $V_{RMS}$ |
| Accuracy AC (50 / 60 Hz) / DC | 0.07 % rd + 0.07 % fs |
| Current clamp input | 3 $V_{RMS}$ |
| Tap up/down switch | Current[1]: 300 $mA_{continuous}$<br>9 A for 0.7 s |
| | Voltage[1]: 300 $V_{RMS}$ |

### Inputs

#### HV & LV inputs – voltage[2]

| Input | Range | Accuracy[3] |
|---|---|---|
| AC (RMS) | 0 ... 300 mV | 0.01 % rd + 0.003 % fs |
| | 0 ... 3 V | 0.01 % rd + 0.003 % fs |
| | 0 ... 30 V | 0.01 % rd + 0.003 % fs |
| | 0 ... 300 V | 0.012 % rd + 0.003 % fs |
| DC | 0 ... 42.4 mV | 0.022 % rd + 0.032 % fs |
| | 0 ... 424 mV | 0.01 % rd + 0.017 % fs |
| | 0 ... 4.24 V | 0.007 % rd + 0.012 % fs |
| | 0 ... 42.4 V | 0.01 % rd + 0.017 % fs |
| | 0 ... 424 V | 0.007 % rd + 0.012 % fs |

#### HV & LV inputs – current[4]

| Input | Range | Accuracy[3] |
|---|---|---|
| AC (RMS) | 0 ... 0.4 $A_{RMS}$ | 0.017 % rd + 0.0033 % fs |
| | 0 ... 4 $A_{RMS}$ | 0.036 % rd + 0.0033 % fs |
| | 0 ... 40 $A_{RMS}$ | 0.023 % rd + 0.013 % fs |
| DC | 0 ... 0.56 $A_{DC}$ | 0.1 % rd + 0.023 % fs |
| | 0 ... 5.6 $A_{DC}$ | 0.037 % rd + 0.026 % fs |
| | 0 ... 56 $A_{DC}$ | 0.008 % rd + 0.01 % fs |

### Combined values

#### DC resistance measurement

| Current | Range | Accuracy[3] |
|---|---|---|
| 30 $A_{DC}$ | 1 ... 10 Ω | 0.037 % rd + 0.017 % fs |
| | 0.1 ... 1 Ω | 0.04 % rd + 0.027 % fs |
| | 0.01 ... 0.1 Ω | 0.033 % rd + 0.017 % fs |
| | 0.001 ... 0.01 Ω | 0.037 % rd + 0.027 % fs |
| | 0.0001 ... 0.001 Ω | 0.05 % rd + 0.043 % fs |
| 3 $A_{DC}$ | 10 ... 100 Ω | 0.1 % rd + 0.18 % fs |
| | 1 ... 10 Ω | 0.1 % rd + 0.267 % fs |
| | 0.1 ... 1 Ω | 0.1 % rd + 0.18 % fs |

#### Ratio measurement

| Range | Accuracy[3] |
|---|---|
| 1:1 ... 10 | 0.03 % rd + 0.043 % fs |
| 1:10 ... 100 | 0.027 % rd + 0.043 % fs |
| 1:100 ... 1000 | 0.027 % rd + 0.043 % fs |
| 1:1000 ... 10 000 | 0.027 % rd + 0.043 % fs |

1 Only AC permitted
2 Typical phase accuracy at 50 / 60 Hz, V > 30 % of fs: 0.017°
3 Accuracy at 23 °C ± 5K
4 Typical phase accuracy at 50 / 60 Hz, I > 30 % of fs used range: 0.025°
5 From 2 000 m to 5 000 m altitude CAT III compliance only with half voltage
6 From 2 000 m to 5 000 m altitude only CAT II compliance or CAT III compliance with half voltage
7 Signals below 45 Hz with reduced values possible.
8 Recommended system requirements marked in bold
9 Graphics adapter supporting Microsoft® DirectX 9.0 or later is recommended.
10 Installed software required for the optional Microsoft Office® interface functions.



## Power specifications

| | |
|---|---|
| Voltage | Nominal: 100 V ... 240 V AC<br>Permitted: 85 V ... 264 V AC |
| Frequency | Nominal: 50 Hz / 60 Hz<br>Permitted: 45 Hz ... 65 Hz |
| Power fuse | Automatic circuit breaker with magnetic overcurrent tripping at I > 16 A |
| Power consumption | Continuous: < 3.5 kW<br>Peak: < 5.0 kW |

## Environmental conditions

| | | |
|---|---|---|
| Temperature | Operating: | -10 °C ... +55 °C / +14 °F ... +131 °F |
| | Storage: | -30 °C ... +70 °C / -22 °F ... +158 °F |
| Relative humidity | 5 % ... 95 %, non-condensing | |
| Maximum altitude | Operating: | 2000 m / 6550 ft,<br>up to 5000 m / 16400 ft<br>(with limited specifications [5,6]) |
| | Storage: | 12000 m / 40000 ft |

## Mechanical data

| | |
|---|---|
| Dimensions (W × H × D) | 580 × 386 × 229 mm / 22.9 × 15.2 × 9.0 inch<br>(W = 464 mm / 18.3 inch without handles) |
| Weight | Device with display: 20.6 kg / 45.5 lbs<br>Device without display: 19.5 kg / 43 lbs |

## Equipment reliability

| | |
|---|---|
| Shock | IEC / EN 60068-2-27, 15 g / 11 ms, half-sinusoid, each axis |
| Vibration | IEC / EN 60068-2-6, frequency range from 10 Hz to 150 Hz, continuous acceleration 2 g (20 $m/s^2$ / 65 $ft/s^2$), 10 cycles per axis |




# CP TD 1

## High-voltage output

| U/f | I | S | $t_{max}$ | f |
|---|---|---|---|---|
| 0 ... 12 kV AC[7] | 300 mA | 3600 VA | > 2 min. | 15 Hz ... 400 Hz |
| 0 ... 12 kV AC[7] | 100 mA | 1200 VA | > 60 min. | 15 Hz ... 400 Hz |

## Internal measurement of voltage output / current inputs

| Range | Resolution | Accuracy | Conditions |
|---|---|---|---|
| 0 ... 12000 $V_{AC}$ | 1 V | Error < 0.3 % of reading + 1 V | |
| 0 ... 5 $A_{AC}$ | 5 digits | Error < 0.3 % of reading + 100 nA | Ix < 8 mA |
| | 5 digits | Error < 0.5 % of reading | Ix > 8 mA |

## Capacitance Cp (equivalent parallel circuit)

| Range | Resolution | Accuracy | Conditions |
|---|---|---|---|
| 1 pF ... 3 µF | 6 digits | Error < 0.05 % of reading + 0.1 pF | Ix < 8 mA, $V_{test}$ = 300 V ... 10 kV |
| 1 pF ... 3 µF | 6 digits | Error < 0.2 % of reading | Ix > 8 mA, $V_{test}$ = 300 V ... 10 kV |

## Power factor PF / dissipation factor DF

| Range | Resolution | Accuracy | Conditions |
|---|---|---|---|
| 0 ... 10 % (capacitive) | 5 digits | Error < 0.1 % of reading + 0.005 % | f = 45 Hz ... 70 Hz, I < 8 mA, $V_{test}$ = 300 V ... 10 kV |
| 0 ... 100 % (PF)<br>0 ... 10000 % (DF) | 5 digits | Error < 0.5 % of reading + 0.02 % | $V_{test}$ = 300 V ... 10 kV |



# Primary Test Manager™

## System requirements[8]

| | |
|---|---|
| Operating system | **Windows 10™, 64-bit**<br>**Windows 8™ and 8.1™, 64-bit**<br>**Windows 7™ SP1**, 32-bit and **64-bit** |
| CPU | **Multicore system with 2 GHz or faster**<br>Single core system with 2GHz or faster |
| RAM | minimum 2 GB (**4 GB**) |
| Hard disk | minimum 4 GB of available space |
| Storage device | DVD-ROM drive |
| Graphics adapter | Super VGA (1280x768) or higher-resolution video adapter and monitor[9] |
| Interface | Ethernet NIC |
| Installed software[10] | **Microsoft Office® 2016, Office® 2013, Office® 2010, Office® 2007,** or Office® 2003 |

# Ordering information

## TESTRANO 600 Packages

| | Description | Ordering No. |
|---|---|---|
| TESTRANO 600 Basic Package | > Package for performing transformer turns ratio, DC winding resistance and demagnetization<br>> Primary Test Manager™ Standard: PC software including Manual Control Mode and report generator | VE000701 |
| TESTRANO 600 Standard Package | > Package for performing transformer turns ratio, DC winding resistance, short-circuit impedance / leakage reactance, frequency response of stray losses (FRSL) and demagnetization<br>> Primary Test Manager™ Standard: PC software including Manual Control Mode and report generator | VE000702 |
| TESTRANO 600 Advanced Package | > Package for performing transformer turns ratio, DC winding resistance, short-circuit impedance / leakage reactance, frequency response of stray losses (FRSL), demagnetization, power / dissipation factor and capacitance<br>> CP TD1 and its accessories<br>> Primary Test Manager™ Standard: PC software including Manual Control Mode and report generator | VE000703 |
| TESTRANO 600 Universal Package | > Package for performing transformer turns ratio, DC winding resistance, short-circuit impedance / leakage reactance, frequency response of stray losses (FRSL), demagnetization, power / dissipation factor and capacitance as well as dynamic resistance measurement (DRM)<br>> CP TD1 and its accessories<br>> Primary Test Manager™ Standard: PC software including Manual Control Mode and report generator | VE000704 |

## TESTRANO 600 Advanced Control Options

| | Description | Ordering No. |
|---|---|---|
| TESTRANO 600 TouchControl | TESTRANO 600 TouchControl featuring an integrated 10.6“ color touch display | VEHO0700 |
| PTM Advanced for TESTRANO 600 | License for PC software upgrade adding Guided Workflow, customized test plans, automatic assessment, graphical comparison and trending | VESM0703 |

## TESTRANO 600 Upgrade Options and Accessories

| | Description | Ordering No. |
|---|---|---|
| "Short-Circuit Impedance / Leakage Reactance" Module | Software license upgrade to perform short-circuit impedance / leakage reactance tests and frequency response of stray losses (FRSL) | VESM0701 |
| "OLTC Scan and Transient Recording" Module | Software license upgrade to perform dynamic resistance measurements (DRM) on on-load tap changers | VESM0702 |
| CP TD 1 Upgrade Option | Upgrade option to expand your exisiting TESTRANO 600 to a power / dissipation factor test system | VE000641 |
| TESTRANO 600 HV Cable Extension Package | 6 m / 19.7 ft extension package for HV cables for large power transformers | VEHK0700 |
| TESTRANO 600 LV Cable Extension Package | 6 m / 19.7 ft extension package for LV cables for large power transformers | VEHK0701 |
| TESTRANO 600 Transport Case for Accessories | Transport case with wheels for TESTRANO 600 accessories | VEHP0076 |

Find detailed ordering information and package descriptions on www.omicronenergy.com.




TESTRANO 600 Advanced Package

# A strong and safe connection

## Welcome to the team

At OMICRON you can always depend on an experienced team that actively supports you and an infrastructure that you can rely on. We always listen attentively in order to understand your needs so that we can offer you the best possible solutions. We strive for lasting partnerships and ensure that you can continue to rely on your product long after you've purchased it. In order to do this, we focus on quality, the transfer of knowledge and unique customer support.

Don, Wenyu and Christoph are able to tell you about the services we have available for you and why it pays to be part of the team.





Don Platts
Application Specialist



## Solutions you can rely on...

... developed with experience, passion and an innovative approach that we use to continually set groundbreaking standards in our industry sector.

We invest more than 15 % of the total turnover in research and development so that we can even guarantee the reliable use of the latest technology and methods in the future.

Our comprehensive product care concept also guarantees that your investment in our solutions – like free software updates – pays off in the long term.





Wenyu Guo
OMICRON Acadamy

## We share our knowledge...

… by maintaining a constant dialogue with users and experts. Some examples of this are our customer events and conferences that take place all over the world and our collaboration with numerous standardization committees.

We also make our knowledge available to you in the customer section of our website in the form of application reports, specialized articles and articles in the discussion forum. With the OMICRON Academy, we also provide a wide spectrum of training possibilities and assist you with Start-up training and free webinars.





Christoph Engelen
Technical Support

## When rapid assistance is required...

… our excellent level of support is always appreciated. You can reach the highly-qualified and committed technicians in our customer support department 24 hours a day, seven days a week – and it's completely free. We deal with repair services and service features in a fair and non-bureaucratic manner.

We can help minimize your downtime by lending you equipment from a readily available plant at one of our service centers in your area. A comprehensive offer of services for consulting, testing and diagnostics completes our range of services.

OMICRON is an international company serving the electrical power industry with innovative testing and diagnostic solutions. The application of OMICRON products allows users to assess the condition of the primary and secondary equipment on their systems with complete confidence. Services offered in the area of consulting, commissioning, testing, diagnosis and training make the product range complete.

Customers in more than 140 countries rely on the company's ability to supply leading-edge technology of excellent quality. Service centers on all continents provide a broad base of knowledge and extraordinary customer support. All of this together with our strong network of sales partners is what has made our company a market leader in the electrical power industry.

For more information, additional literature, and detailed contact information of our worldwide offices please visit our website.

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