OMICRON

TESTRANO 600

Three-phase test system for comprehensive power and distribution 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 single- and three-phase power and distribution transformers.

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

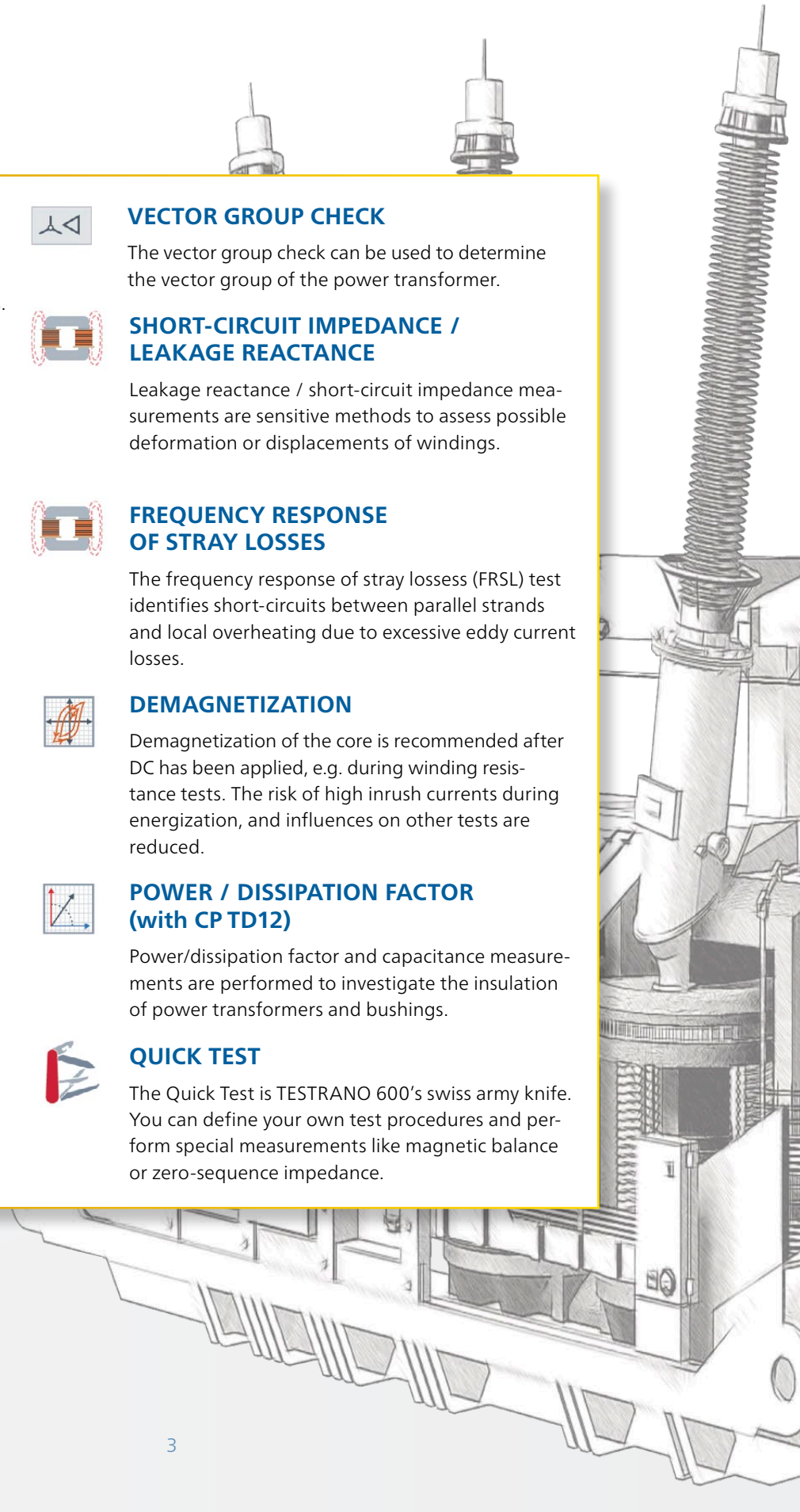
> One setup can be used to perform various tests
> The rewiring effort is significantly reduced
> Testing time can be cut down to a third of the time
> Increased safety as less trips up and down are needed

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. In order to perform this test with up to 12 kV, the CP TD12 and MCA1 are required.

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 TD12 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.

VIBRO-ACOUSTIC MEASUREMENT

The vibro acoustic measurement records a unique vibration pattern during the operation of the on-load tap changer to evaluate the mechanical integrity of the OLTC.

COOLDOWN TEST

The cooldown test is performed to determine the winding temperature at the end of the heat run procedure by means of a winding resistance measurement.

VECTOR GROUP CHECK

The vector group check can be used to determine the vector group of the power transformer.

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 TD12)

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

QUICK TEST

The Quick Test is TESTRANO 600's swiss army knife. You can define your own test procedures and perform special measurements like magnetic balance or zero-sequence impedance.

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:

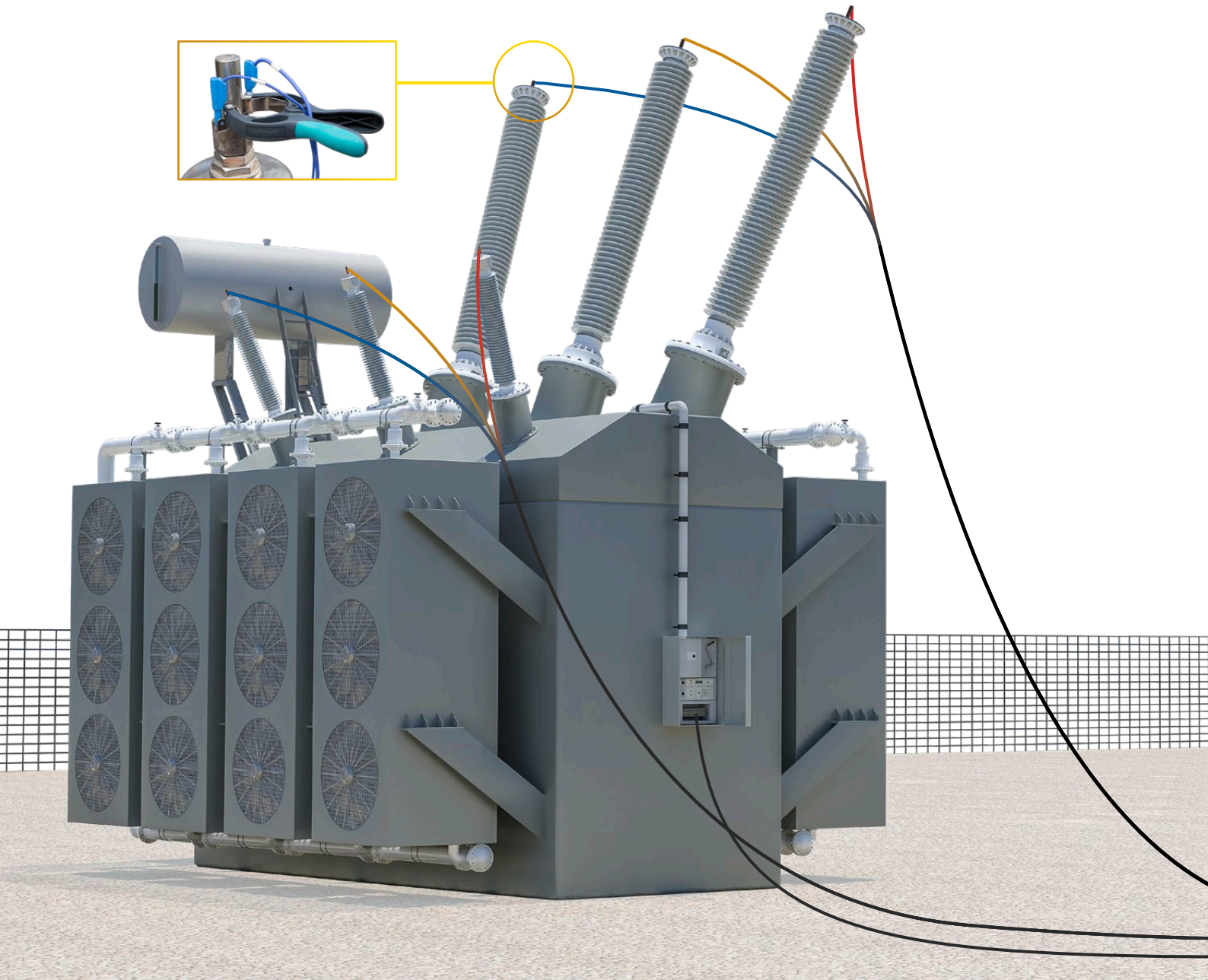
- Rewiring effort is significantly reduced
- Speeds up testing because all three phases are energized at once
- Fully automated control of tap changer during the test
- Verify the phase shift of any winding configuration

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 16 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 TD12*, 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 TD12 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:

> Primary Test Manager™ Standard is the default software and offers basic functionality on your laptop.

> Primary Test Manager™ Advanced offers a guided test workflow, easy data management and automatic result assessment on your laptop.

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

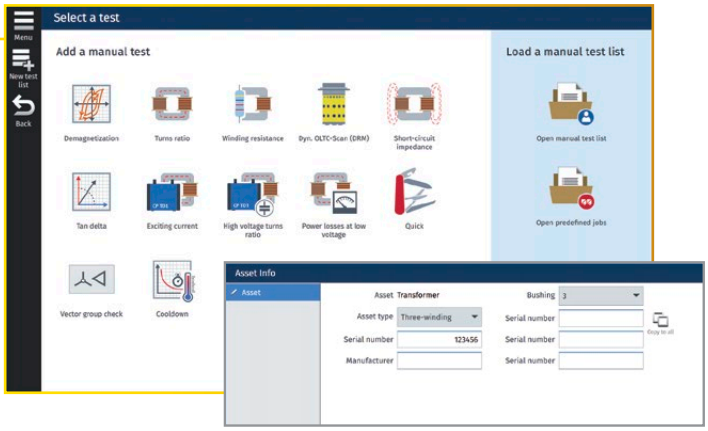
All three options support all diagnostic tests on power and distribution transformers.

TESTRANO TouchControl

TESTRANO TouchControl is an optional control option and 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.

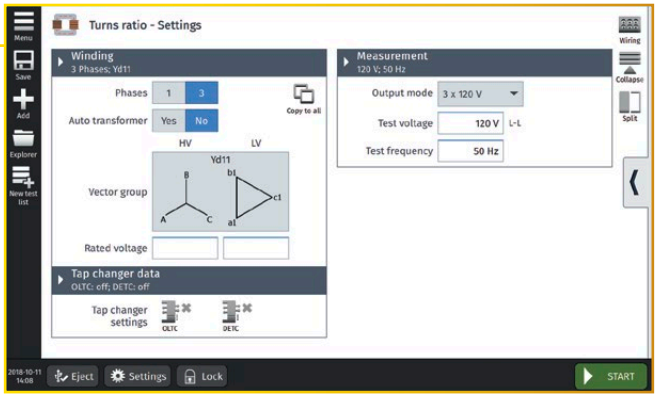
This can be used to prepare complex tests in advance and just import them onsite.



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.

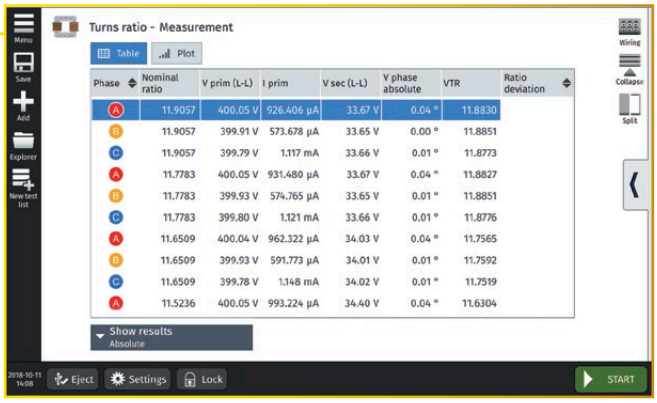
In order to identify your asset and keep your testing results organized, you can enter basic transformer nameplate information before starting your test.



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, providing different PTM licenses depending on your needs:

> Primary Test Manager™ Standard is the default software and offers basic functionality on your laptop.

> Primary Test Manager™ Advanced offers a guided test workflow, easy data management and automatic result assessment on your laptop.

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.

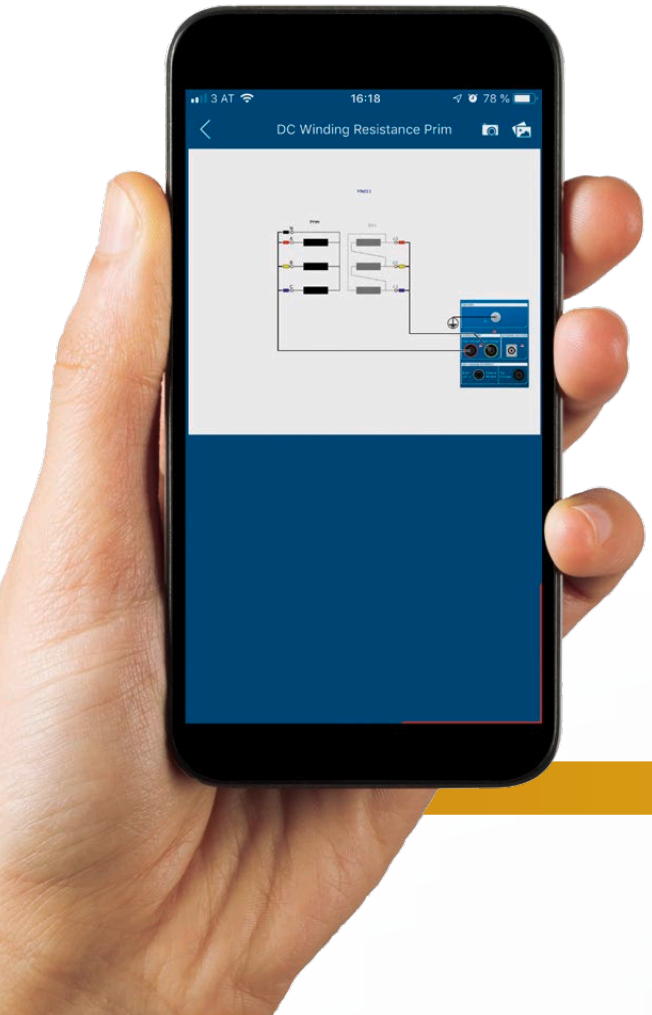
PTMate app – your mobile companion

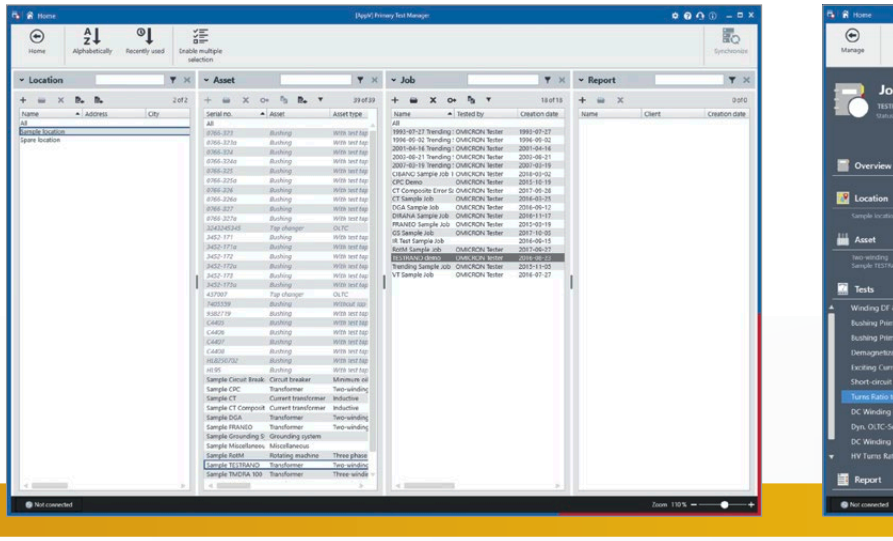
PTMate is our mobile companion for PTM. The app supports you on site and extends the PTM feature set to your smartphone, such as sending images directly, fast and safe wiring for tests as well as a stop button for ongoing measurements.

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.

Get the PTMate app free of charge in the App Store and Google Play Store!





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

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.

Automatic test execution

PTM allows to define a group of tests, which do not require any changes in connection. By the click of a button, all tests within the group are executed automatically in the defined sequence. This reduces testing time and increases convenience.

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.

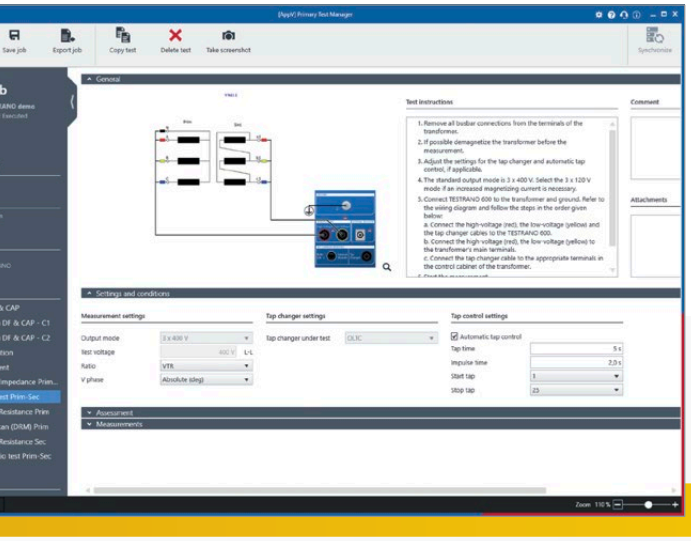
Comparison tools for detailed analysis

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.



PTM supports you in the best possible way during execution of diagnostic tests via wiring diagrams and asset-specific test plans according to international standards.

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 or 15 Hz … 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	$I_{max, continuous}$
3-phase AC (RMS)	0 … 230 V (LN)	100 mA_{RMS}
	0 … 80 V (LN)	16 A
	0 … 40 V (LN)	33 A
1-phase AC (RMS)	0 … 240 V	16 A
	0 … 120 V	33 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 … 50 A	80 V
	0 … 33 A	120 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 % range
Current clamp input	3 V_{RMS}
Tap up/down switch	Current[1]: 300 $mA_{continuous}$ 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 % range
	0 … 3 V	0.01 % rd + 0.003 % range
	0 … 30 V	0.01 % rd + 0.003 % range
	0 … 300 V	0.012 % rd + 0.003 % range
DC	0 … 42.4 mV	0.022 % rd + 0.032 % range
	0 … 424 mV	0.01 % rd + 0.017 % range
	0 … 4.24 V	0.007 % rd + 0.012 % range
	0 … 42.4 V	0.01 % rd + 0.017 % range
	0 … 424 V	0.007 % rd + 0.012 % range

HV & LV inputs – current[4]

Input	Range	Accuracy[3]
AC (RMS)	0 … 4 A_{RMS}	0.036 % rd + 0.0033 % range
	0 … 40 A_{RMS}	0.023 % rd + 0.013 % range
DC	0 … 0.56 A_{DC}	0.1 % rd + 0.023 % range
	0 … 5.6 A_{DC}	0.037 % rd + 0.026 % range
	0 … 56 A_{DC}	0.008 % rd + 0.01 % range

Combined values

DC resistance measurement

Current	Range	Accuracy[3]
3 A_{DC}	10 … 100 Ω	0.1 % rd + 0.18 % range
	1 … 10 Ω	0.1 % rd + 0.267 % range
	0.1 … 1 Ω	0.1 % rd + 0.18 % range
30 A_{DC}	1 … 10 Ω	0.037 % rd + 0.017 % range
	0.1 … 1 Ω	0.04 % rd + 0.027 % range
	0.01 … 0.1 Ω	0.033 % rd + 0.017 % range
	0.001 … 0.01 Ω	0.037 % rd + 0.027 % range
	0.0001 … 0.001 Ω	0.05 % rd + 0.043 % range
100 A_{DC}	3 … 30 mΩ	0.033 % rd + 0.017 % range
	300 … 3000 µΩ	0.037 % rd + 0.027 % range
	30 … 300 µΩ	0.05 % rd + 0.043 % range
	3 … 30 µΩ	0.07 % rd + 0.44 % range

Ratio measurement

Range	Accuracy[3]
1:1 … 10	0.03 % rd + 0.043 % range
1:10 … 100	0.027 % rd + 0.043 % range
1:100 … 1000	0.027 % rd + 0.043 % range
1:1000 … 10 000	0.027 % rd + 0.043 % range

1 Only AC permitted

2 Typical phase accuracy at 50 / 60 Hz, V > 30 % of range: 0.017°

3 Means “typical accuracy”; at typical temperatures of 23 °C ± 5 K; 98 % of all units have an accuracy which is better than specified

4 Typical phase accuracy at 50 / 60 Hz, I > 30 % of used range: 0.025°

5 From 2000 m to 5000 m altitude CAT III compliance only with half voltage

6 From 2000 m to 5000 m altitude only CAT II compliance or CAT III compliance with half voltage

7 Signals below 45 Hz with reduced values possible.

8 Reduced accuracy at mains frequency or its harmonics.

9 Recommended system requirements marked in bold

10 Graphics adapter supporting Microsoft® DirectX 9.0 or later is recommended.

11 Installed software required for the optional Microsoft Office® interface functions.

Power specifications

Voltage	Nominal: 100 V ... 240 V AC Permitted: 85 V ... 264 V AC
Frequency	Nominal: 50 Hz / 60 Hz Permitted: 45 Hz ... 65 Hz
Power fuse	Automatic circuit breaker with magnetic overcurrent tripping at I > 16 A
Power consumption	Continuous: < 3.5 kW 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, up to 5000 m / 16400 ft (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 (W = 464 mm / 18.3 inch without handles)
Weight	Device with display: 20.6 kg / 45.5 lbs 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

Primary Test Manager™

System requirements[9]

Operating system	**Windows 10™, 64-bit**
CPU	**Multicore system with 2 GHz or faster** Single core system with 2GHz or faster
RAM	minimum 4 GB (**8 GB**)
Hard disk	minimum 5 GB of available space
Storage device	DVD-ROM drive
Graphics adapter	Super VGA (1280×768) or higher-resolution video adapter and monitor[10]
Interface	Ethernet NIC
Installed software[11]	**Microsoft Office® 365,** Office® 2019, Office® 2016 or Office® 2013

CP TD12

High-voltage output

U	THD	I_{max}	S_{max}	t_{max}
0 ... 12 kV AC	< 2%	300 mA	3600 VA	> 2 min
		100 mA	1200 VA	> 60 min

Capacitance Cp (equivalent parallel circuit)

Range	Typical accuracy [3]	Conditions
1 pF ... 3 µF	Error < 0.05 % of reading + 0.1 pF	I_x < 8 mA, U_{test} = 2 kV ... 10 kV
1 pF ... 3 µF	Error < 0.2 % of reading	I_x > 8 mA, U_{test} = 2 kV ... 10 kV

Dissipation factor DF (tan δ)

Range	Typical accuracy [3]	Conditions
0 ... 10 % (capacitive)	Error < 0.1 % of reading + 0.005 % [8]	f = 45 ... 70 Hz, I < 8 mA, U_{test} = 2 kV ... 10 kV
0 ... 100 (0 ... 10000%)	Error < 0.5 % of reading + 0.02 %	U_{test} = 2 kV... 10 kV

Power factor PF (cos φ)

Range	Typical accuracy [3]	Conditions
0 ... 10 % (capacitive)	Error < 0.1 % of reading + 0.005 % [8]	f = 45 ... 70 Hz, I < 8 mA, U_{test} = 2 kV ... 10 kV
0 ... 100 %	Error < 0.5 % of reading + 0.02 %	U_{test} = 2 kV ... 10 kV

VAM1

Sensor Interface

Sensor type	IEPE acceleration sensor
Number of Sensor Channels	3

Output

Voltage	max. 30 V_{DC}
Current @ sensor voltage in the range of 0V to 24V	4 mA ± 10 %

Input

Voltage Range	max. 10 V_{pp} AC
Bandwidth	3.6 Hz to 100 kHz
Sample Rate	250 kHz
Signal to Noise Ratio (SNR)	> 102 dB

Mechanical data

Dimensions (W × H × D)	109 × 72 × 63 mm / 4.3 × 10.7 × 2.5 inch
Weight	0.65 kg / 1.43 lbs

We create customer value through ...

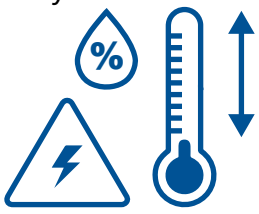
Quality

We always want you to be able to rely on our testing solutions. This is why our products have been developed with experience, passion and care and are continually setting ground-breaking standards in our industry sector.

You can rely on the highest safety and security standards

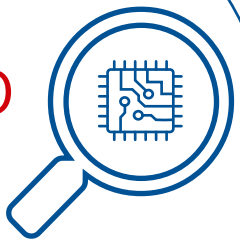
Superior reliability with up to

72



hours burn-in tests before delivery

100%



routine testing for all test set components

ISO 9001
TÜV & EMAS
ISO 14001
OHSAS 18001

Compliance with international standards

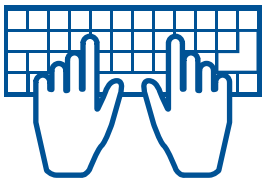
Innovation

Thinking and acting innovatively is something that's deeply rooted in our genes. Our comprehensive product care concept also guarantees that your investment will pay off in the long run – e.g. with free software updates.

... a product portfolio tailored to my needs

More than

200



developers keep our solutions up-to-date

More than

15%

of our annual sales is reinvested in research and development

Save up to

70%

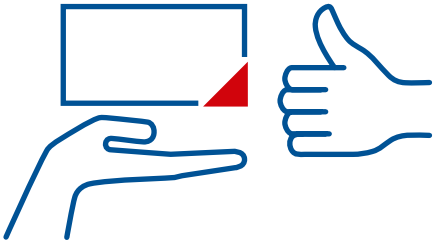
testing time through templates, and automation

We create customer value through ...

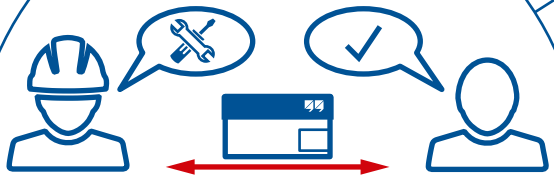
Support

When rapid assistance is required, we're always right at your side. Our highly-qualified technicians are always reachable. Furthermore, we help you minimize downtimes by lending you testing equipment from one of our service centers.

Professional technical support at any time



Loaner devices help to reduce downtime



Cost-effective and straight-forward repair and calibration

offices worldwide for local contact and support

Knowledge

We maintain a continuous dialogue with users and experts. Customers can benefit from our expertise with free access to application notes and professional articles. Additionally, the OMICRON Academy offers a wide spectrum of training courses and webinars.

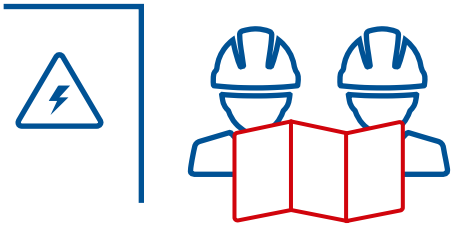
More than

300

Academy and numerous hands-on trainings per year

Frequently OMICRON hosted user meetings, seminars and conferences

to thousands of technical papers and application notes



Extensive expertise in consulting, testing and diagnostics

OMICRON is an international company that works passionately on ideas for making electric power systems safe and reliable. Our pioneering solutions are designed to meet our industry's current and future challenges. We always go the extra mile to empower our customers: we react to their needs, provide extraordinary local support, and share our expertise.

Within the OMICRON group, we research and develop innovative technologies for all fields in electric power systems. When it comes to electrical testing for medium- and high-voltage equipment, protection testing, digital substation testing solutions, and cybersecurity solutions, customers all over the world trust in the accuracy, speed, and quality of our user-friendly solutions.

Founded in 1984, OMICRON draws on their decades of profound expertise in the field of electric power engineering. A dedicated team of more than 900 employees provides solutions with 24/7 support at 25 locations worldwide and serves customers in more than 160 countries.

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

www.omicronenergy.com

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