

# Tap Changer Analyzer & Winding Ohmmeter RMO100TT

- On-load tap changer dynamic resistance measurement
- Three resistance measurement channels
- Three temperature measurement channels
- Automatic resistance/temperature measurement for the Heat Run test
- Rapid automatic demagnetization
- Tap changer motor current monitoring channel
- Automatic discharge circuit
- Built-in tap changer control unit
- Detailed analysis of test results using DV-Win software



## Description

The Tap Changer Analyzer & Winding Ohmmeter RMO100TT is designed for an on-load tap changer analysis and for the resistance measurement of inductive test objects. The RMO100TT generates a true DC ripple-free current. The injection of current and discharge of energy from the inductance are both automatically regulated.

The RMO100TT injects a current at the voltage level as high as 60 V. This ensures the duration of test is as short as possible, and that the desired test current is reached faster. The three independent channels enable testing of three windings in series – primary, secondary and tertiary windings. There is enough memory within the RMO100TT instrument to store 500 measurements. All measurements are time- and date-stamped.

The instrument is equipped with a thermal and overcurrent protection. The RMO100TT has a very high ability to cancel electrostatic and electromagnetic interferences that exist in HV electric fields. It is achieved by proprietary filtration solution applied to the instruments hardware and software design..

Automatic discharging circuit (independent of power supply) safely discharges the energy stored in the transformer windings at the end of the test in very short time. An audible and visible indication of the discharging state is provided. An automatic connections check is performed at the beginning of each test, and the instrument warns the user if an open connection is detected.

## On-Load Tap Changer Analysis

The RMO100TT can be used to measure the winding resistance of individual taps on a power transformer's tap changer without discharging between the tests.

The unit also checks whether the on-load tap changer (OLTC) performs switching without an interruption. The moment a tap position is changed from one tap to another, the device detects a sudden, very short drop of the test current. These drops called "Ripple" should be consistent, where any drop out-of-line should be investigated. Defective "make before break" tap changer performance results in a 100% Ripple value, which is easy to observe. This is an indication of an interruption during the change, in which case the transition time also increases. This type of defect is one of the most troublesome ones. Other tap changer malfunctions detected analyzing measurements of Ripple, Transition time, and visualizing DRM graphs, can be observed too.

## Demagnetization Feature

After a DC current test, such as a winding resistance measurement, the magnetic core of a power or instrument transformer may be magnetized (remanent magnetism). Also, when disconnecting a transformer from service, some amount of magnetic flux trapped in the core could be present. The remanent magnetism can cause various problems such as erroneous diagnostic electrical measurements on a transformer, or an inrush current at start-up of power transformer, or incorrect operation of protective relays due to magnetized CT cores.

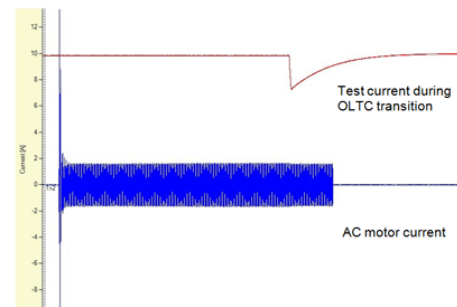
To eliminate this source of potential problems, demagnetization should be performed. When the discharging process has been completed, the RMO100TT can perform fully automatic demagnetization. Demagnetizing the magnetic core of a transformer requires alternating current applied with decreasing magnitude down to zero. The RMO100TT provides this alternating current by internally changing the polarity of a controlled DC current. During the demagnetization process the RMO100TT supplies current at decreasing magnitude for each step, following a proprietary developed program.

## DV-Win Software

The DV-Win software enables control and observation of the test process, as well as saving and analyzing the results on a PC. It provides a test report, arranged in a selectable form as an Excel spreadsheet, PDF, Word, or ASCII format. The software provides an OLTC (tap changer) condition assessment through analysis of the graphs representing dynamic resistance values during the tap changer transitions. Additionally, the DV-Win measures and calculates OLTC transition time, the ripple and the resistance for each tap changing operation. The standard interface is USB. RS232 is optional.

## Tap Changer Motor Current Monitoring Channel

The AC current monitoring channel is enables monitoring and recording the OLTC mechanical-drive motor current during the tap changer operation. The motor-current waveform is also printed on the same DV-Win-generated graph, and can help in detecting OLTC mechanical problems. An AC current clamp is available as an optional accessory.

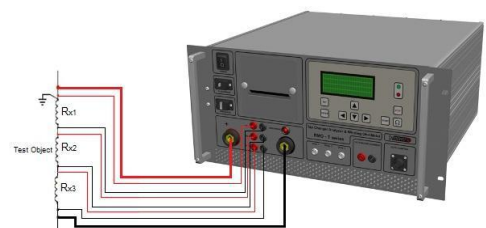


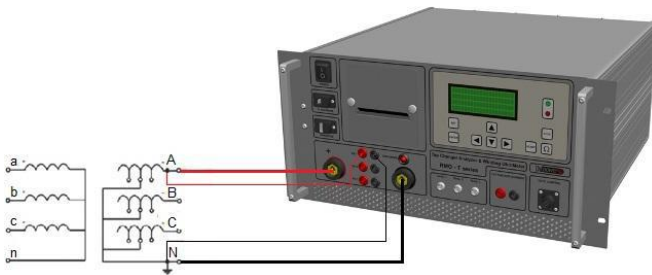
## Heat Run Test Application

The DV-Win software has an additional Heat Run temperature/resistance extrapolation feature. After the transformer heating is switched off, the RMO100TT is immediately connected to all three transformer windings and the timer is started. The winding resistance and temperature are measured at regular time intervals. This information is used to automatically extrapolate these values at the moment when the transformer was switched off.

## Connecting the RMO100TT to a Test Object

The RMO100TT has three separate resistance measurement channels, which enable simultaneous measurement of the primary, secondary and tertiary winding on the same phase. This significantly speeds up the measurement and reduces the total transformer testing time. The three resistances are connected in series using the provided current connection cables. The current and sense cables are connected as shown in the figure to the right. At the start of the test a cable continuity check is performed. In case of disconnection, an alarm is activated, and the error message is shown on the display.





The winding resistance of individual taps of a power transformers tap changer can be measured by using the Tap Changer (TapC) mode of the RMO100TT. There is no need to charge and discharge the transformer between tap position changes. The inputs of the instrument are protected during the switching process in order to avoid damage to the instrument in case of a faulty tap changer. Only the first channel (CH 1) is active during the TapC mode measurement.

## Accessories

### Included

- DV-Win PC software
- Mains power cable
- Ground (PE) cable
- USB cable
- Built-in tap changer control unit + cable set 5 m

### Recommended

- Current cables 2 x 10 m 16 mm<sup>2</sup> and Sense cables 2 x 10 m with TTA clamps
- Current connection cable 2 x 5 m 16 mm<sup>2</sup> with TTA clamps
- Sense cables 2 x 2 x 10 m with TTA clamps
- Current clamp 30 / 300 A + cable set 5 m
- Cable bag
- Temperature probes 3 x 50 mm + 5 m cable set

### Optional

- Built-in thermal printer 80 mm
- Test shunt 150 A / 150 mV
- Current cables 2 x 10 m 16 mm<sup>2</sup> with TTA clamps
- Sense cables 3 x 2 x 10 m with TTA clamps
- Cable plastic case



Current cables with TTA clamps



Voltage sense cables with TTA clamps



Current connection cable



Test shunt



Cable plastic case



Temperature probes 3 x 50 mm + 5 m cable set



Current clamp 30 / 300 A + cable set 5 m



Cable bag

\*The above cables are also available in several lengths. Please contact DV Power for more information.

## Technical Data

### Static Resistance Measurement

- Test currents: 5 mA – 100 A DC
- Output voltage: up to 60 V DC
- Measurement range: 0,1  $\mu\Omega$  - 2 k $\Omega$
- Typical accuracy:  $\pm$  (0,1 % rdg + 0,1 % F.S.)

### Data Storage

- 500 internal memory positions
- USB flash drive feature enables storage of a huge number of measurements

### AC Current Measurement Channel

- Resolution: 0,1 ms
- Amplitude resolution: 16 bit

### Current Clamp Meter Specifications

- Current range: 30 / 300 A (RMS)
- Output sensitivity: 10 / 1 mV/A
- Resolution:  $\pm$  50 /  $\pm$  100 mA
- Accuracy:  $\pm$  1% of the reading

### Printer (optional)

- Thermal printer
- Graphic and numeric printout
- Paper width 80 mm

### Mains Power Supply

- Connection according to IEC/EN60320-1; UL498, CSA 22.2
- Mains supply: 90 V - 264 V AC
- Frequency: 50/60 Hz
- Mains supply voltage fluctuations up to  $\pm$ 10 % of the nominal voltage
- Input power: 2250 VA
- Fuse 15 A / 250 V, type F, not user replaceable

### Environmental Conditions

- Operating temperature: -10  $^{\circ}$ C - + 55  $^{\circ}$ C / 14 F - +131 F
- Storage & transportation: -40  $^{\circ}$ C - + 70 $^{\circ}$ C / -40 F - +158 F
- Humidity 5 % - 95 % relative humidity, non condensing

### Resolution

- 0,1  $\mu\Omega$  – 999,9  $\mu\Omega$ : 0,1  $\mu\Omega$
- 1000 m $\Omega$  – 9,999 m $\Omega$ : 1  $\mu\Omega$
- 10,00 m $\Omega$  – 99,99 m $\Omega$ : 10  $\mu\Omega$
- 100,0 m $\Omega$  – 999,9 m $\Omega$ : 0,1 m $\Omega$
- 1,000  $\Omega$  – 99,99  $\Omega$ : 10 m $\Omega$
- 100,0  $\Omega$  – 999,9  $\Omega$ : 0,1  $\Omega$
- 1000  $\Omega$  – 2 k $\Omega$ : 1  $\Omega$

### OLTC Dynamic Resistance Measurement

- Sampling rate: 0,1 ms
- Automatic open circuit detection and warning
- Transition current ripple measurement
- Transition time measurement using DV-Win software
- Timing measurement of different transition changes using DV-Win graph analysis tools

### Computer Interface

- USB
- Optional: RS232

### Warranty

- Three years

### Dimensions and Weight

- Dimensions: 502 mm x 190 mm x 395 mm  
19,75 in x 7,48 in x 15,53 in
- Weight: 15,5 kg / 34,2 lbs

### Applicable Standards

- Installation/overvoltage: category II
- Pollution: degree 2
- Safety: LVD 2006/95/EC (CE Conform)  
EN 61010-1
- EMC: Directive 2004/108/EC (CE Conform)  
Standard EN 61326-1:2006
- CAN/CSA-C22.2 No. 61010-1, 2nd edition, including Amendment 1

### Temperature Measurement

- Three temperature measurement channels

*All specifications herein are valid at ambient temperature of + 25  $^{\circ}$ C and recommended accessories. Specifications are subject to change without notice.*