

Dv/power 

Product Catalog





The company was founded in 2000 by a group of engineers with an extensive experience in the power electronics technology area. The headquarters are located in **Stockholm, Sweden**.

Under the trademark **DV Power™** the company develops, manufactures and markets the new generation of the test and measurement equipment for the electric power industry.

Our products are

- **PORTABLE** - Up to three times lighter than similar devices from our competitors.
- **POWERFUL** - Use lighter and thinner cables.
- **USER-FRIENDLY** - Completely automated test procedure.
- **EFFICIENT** - Modern switch techniques, power electronics, sophisticated design.
- **ACCURATE** - Typical accuracy of our products is $\pm 0,1\%$.
- **ROBUST** - The rigid design makes our products ideal for use in high voltage substation and industrial environments.
- **COMPLIANT** - IEC and other applicable international standards, CE approved.

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SALES

The price list and additional information on delivery terms can be received from the DV Power area/country distributor or directly via the e-mail: sales@dv-power.com.

DV Power has a rising presence on the World Market, with over **50 representatives and distributors worldwide**. DV Power products can be found and are in use in more than **70 countries**.

WARRANTY

DV Power provides a **three year warranty** on all our products. This is a guarantee to our customers they will receive the highest quality instrumentation available.

Our Support

DV Power customer support center provides a wide range of services

- Technical support
- Product maintenance and calibration
- Feature upgrades
- Training
- Webinars
- Seminars

DV Power has a worldwide network of representatives providing local customer support for sales and after-sales enquiries. Please visit us online to find more information about your local contact:

<http://www.dv-power.com/distributors/>

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Equipment service

Before contacting us, please have following information ready

- serial number of your DV Power test device
- information about object being tested, problem description and possibly message(s) reported by our test device
- DV-Win software version installed on your PC
- your PC information: manufacturer, operating system and language, security programs like firewalls and anti-virus software
- contact details: name, company name, phone number, e-mail address

Additionally, it is very helpful to include screenshots of the relevant status and error messages.



BATTERY TEST EQUIPMENT



Batteries are crucial component to the overall reliability of a substation. Inability of a battery string to provide a sufficient voltage / power supply to protection circuits may lead to catastrophic consequences to the substation equipment resulting in a power outage.

Listening to the demands of the test engineers from all around the world, we developed state-of-the-art battery testing and monitoring solutions to meet customer's wide ranging test procedures (standardized as well as customized).

The essential test for a condition assessment of a battery string is the capacity test. Combined with a battery voltage recording a user gets an accurate, user-friendly set of tools with no limitations regarding power, voltage or discharge current of the battery string under test. DV Power offers you exactly such a set.

- Battery Load Units – **BLU/BXL Series**
- Battery Voltage Recorders – **BVR Series**
- Battery Voltage Supervisors – **BVS Series**
- Universal Battery Charger – **BAC25A**

With this set of instruments, a user can collect, analyze and present various battery status information, such as

Instrument \ Parameter	BLU/BXL Series	BVS Series	BVR Series	BAC25A
Capacity (IEEE 450, IEEE 1188, IEEE 1106)	●			
Intercell connection voltage		●		
Internal resistance measurements * (IEC 60896-11, IEC 60896-22)	●	●		
Cell/ambient temperature measurement (IEEE 450, IEEE 1188)		●	●	
Voltage of each cell (IEEE 450, IEEE 1188, IEEE 1106)		●	●	
Recharging procedure				●
Short circuit current estimation (IEC 60896-11, IEC 60896-22)	●	●		

**Provided in combination of BLU and BVS devices*

All devices except BAC25A from this portfolio include DV-B Win set of software application tools providing data acquisition, storing, analysis and reports generation.

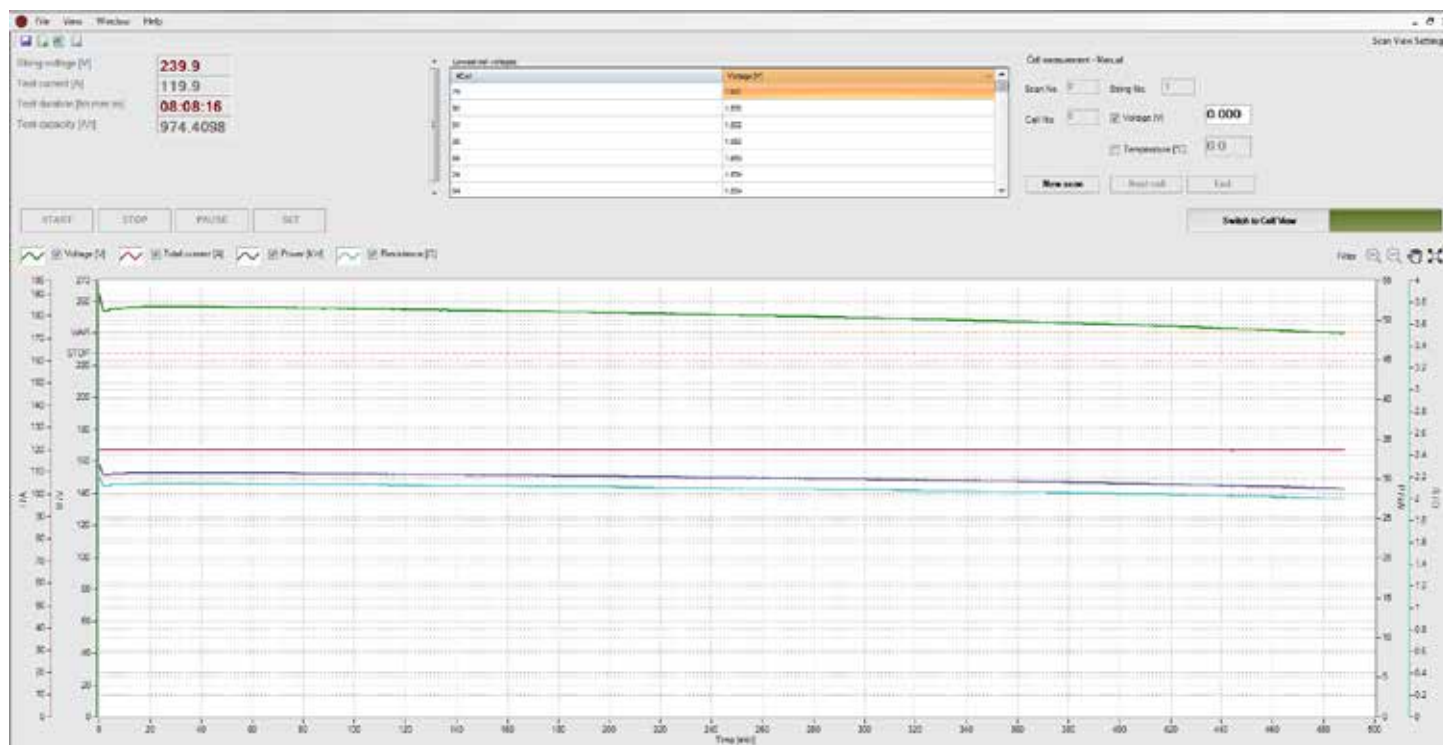
Battery Load Unit – BLU

BLU series of devices are designed for battery capacity measurement using the most advanced power electronics solutions to control different discharge modes. BLU units are portable, easy to use and include a set of DV-BWin software application tools for Windows based PC.

BLU devices are provided with an internal memory for saving test data, as well as a flash drive port and USB cable for an easy data transfer to PC. In addition, they are equipped with a keyboard and graphical color display for user-friendly interaction.

Main Features

- Lightweight starting from 12,8 kg (28.2 lbs) up to 20.6 kg (45.4 lbs)
- Powerful – up to 28,4 kW discharge power
- Operation modes: Constant I/ Constant P/ Constant R
- User selectable load profile operation mode
- No need to disconnect batteries from the load
- Test settings can be altered during a discharge test
- Easily expandable for larger battery strings using BXL
- Parallel unit operation enabled
- Adjustable alarm and shut down parameters
- Overcurrent and thermal protection
- Detailed test analysis available by using DV-B Win
- Battery internal resistance measurement – in combination with Battery Voltage Supervisor (BVS) according to IEC 60896 standard



BLU and BXL Series – Standard Models

Overview of the BLU Series devices maximum currents for various battery voltage ranges with the minimum achievable cell voltage of 1,75 V (for 2 V cells) or 0,9 V (for 1,2 V cells) is presented in the table below. Maximum currents available by using BXL series devices are also presented in the table

Maximum discharge current (A)										
Battery voltage (V)		BLU100A	BLU200A	BLU340A	BXL-A	BLU110T	BLU220T	BXL-T	BLU360V	BXL-V
Nom.	Min/Max									
1,2	0,2	-	-	-	-	110	-	10	-	-
	1,5				-			17		-
2	1,75	-	-	-	-	110	-	20	-	-
	1,5				-			27		-
6	5,25	40	50	50	59	110	100	74	50	11
	7,05				80			100		15
12	10,5	80	100	100	119	110	200	156	100	26
	14,1				160			210		35
24	21,0	160	200	160	186	110	340	312	160	55
	28,2				250			420		75
48	42,0	160	200	160	186	110	340	312	160	115
	56,4				250			420		155
60	52,5	120	120	160	81	-	275	260	160	141
	70,5				110			350		190
110	96,3	110	120	160	119	-	-	-	160	96
	129,3				160			-		130
120	105,0	100	120	150	134	-	-	-	150	107
	141,0				180			-		145
220	192,5	55	75	110	67	-	-	-	110	85
	258,5				90			-		115
240	210,0	50	70	100	67	-	-	-	100	93
	282,0				90			-		125
480	300	-	-	-	-	-	-	-	50	34
	480				-			-		55
Weight (kg / lbs.)		12,3 / 27	14,5 / 32	20,6 / 45.4	12,5 / 28	12,8 / 28.2	15,1 / 33	12,5 / 28	20,6 / 45.4	16 / 35
Max Power (kW)		14,2	19,7	28,4	25,4	6,2	19,4	24,7	28,4	33,8

Battery Extra Load Unit – BXL Series

In case a required discharge current or power exceeds the capacity of a single BLU device, the External Load Unit BXL can be used as an additional load. BXL can be used only in a combination with a BLU device.

Depending on a required discharge capacity, one or several BXL-T (up to 48 V DC), BXL-A (up to 300 V DC) or BXL-V (up to 480 V DC) units can be connected in parallel with a BLU device. BXL-T, BXL-A and BXL-V units can be used with BLU-T, BLU-A and BLU-V devices respectively.

Discharging process is controlled by a BLU device, by measuring the BXL current with the current clamp. Prior to starting the discharging, the BXL enables its load capacity to be set by selecting one of the available resistance values. Automatically offered load resistance values depend on a voltage of a battery BXL is connected to.

Main Features

- Lightweight from 12,5 kg / 28 lbs up to 16 kg / 35 lbs
- Powerful up to 35 kW
- Operating voltage: from 0,9 up to 480 V DC
- Operation mode: Constant R
- User selectable resistance values on different voltage ranges
- Discharging process controlled by BLU series
- Parallel unit operation enabled



Battery Voltage Supervisor – BVS

Battery Voltage Supervisor Capacity Model (BVS-CM) is a battery voltage monitoring system for real time data gathering and presentation. It contains of up to 128 individual BVS Modules (CVM), and the Control Unit (BVS CU). Power supply for each module (CVM) is provided from the Control Unit (BVS CU). BVS identifies potential battery malfunction by continuously monitoring String voltage, cell voltage, intercell voltage, string current and ambient temperature during the discharge test.

The device is used during a battery charging / discharging process. When used in a combination with the BLU device it serves as an efficient supplement to battery capacity testing. Additional BVS feature available in a combination with the BLU Series is a battery internal resistance measurement.

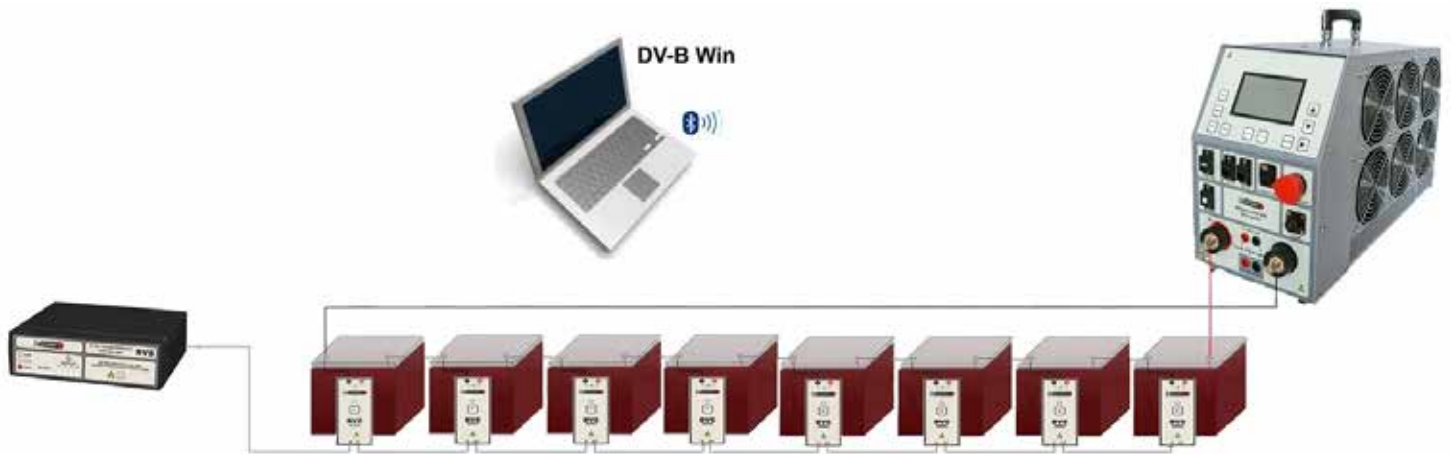


Data acquisition and extensive analysis tools are available in the DV-B Win software application set.

Battery Voltage Supervisor – BVS

Main Features

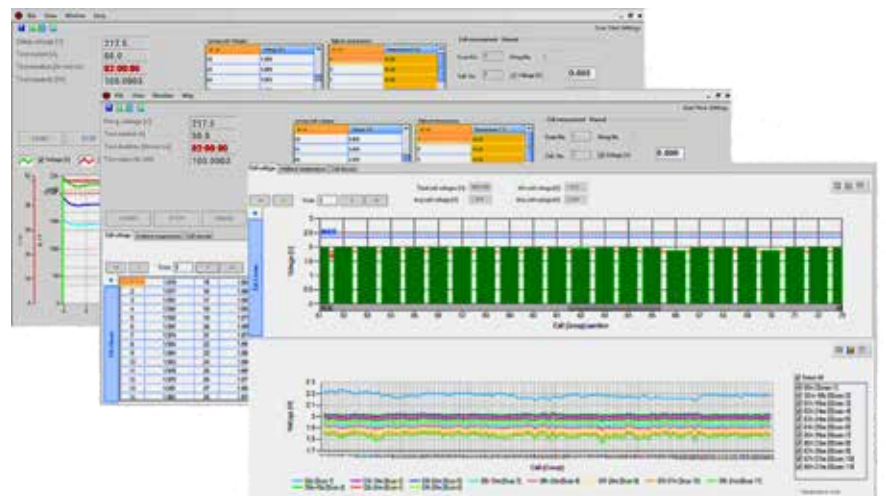
- Lightweight and very easy to install and operate.
- Measures cell voltages of up to ± 30 V
- Measures string voltages up to 600V
- String current measurement
- Bluetooth communication between Control Unit unit and a PC software
- Sampling rate interval is user selectable.
- In combination with the BLU series of devices, according to IEC 60896 standard provides internal resistance measurement



BVS, as well as all DV Power battery test instruments include DV-B Win software application tools based on the Windows operating system, providing user friendly interface as well as data management features (data acquisition, test control, test result analysis, report generation), as shown in the figures below.

DV-B Win Software - Features

- User friendly interface
- Test monitoring and control
- Test data acquisition
- Previous test cases data import
- Data management
- Data analysis
- Data export
- Report generation
- Battery monitoring



Battery Voltage Recorder – BVR

Battery Voltage Recorders are rechargeable handheld devices for measuring an individual battery voltage and temperature while the battery is either in online or offline mode. When used in combination with the BLU device it serves as an efficient supplement to the battery capacity testing.

Both BVR devices measure and record cell voltages instantaneously, in less than one second. DV-B Win software application tool set is provided with both BVR unit types to save and analyze data, easily identify bad cells and create test reports.

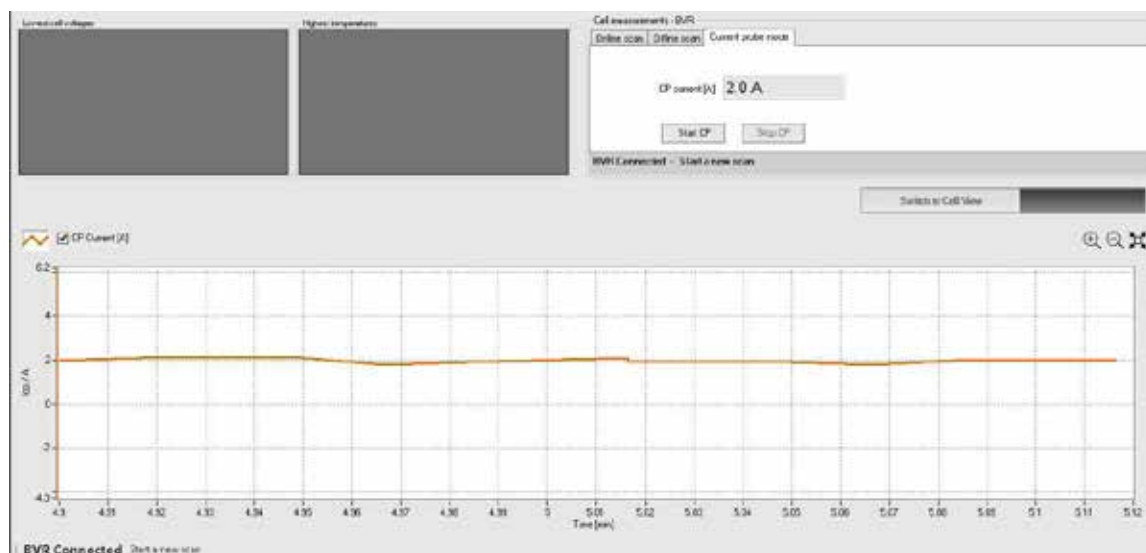


Technical Specifications

Battery Voltage Recorder BVR11

Battery Voltage Recorder BVR20

Parameters Measured	Battery Voltage Recorder BVR11	Battery Voltage Recorder BVR20
Measurement range	Voltage, ambient temperature String Voltage: $\pm 500\text{V DC}$ Cell Voltage: $\pm 30\text{V DC}$	Voltage, cell/ambient temperature Voltage: $\pm 30\text{V DC}$
Resolution	String Voltage: 100 mV Cell Voltage: 10 mV	Voltage: 1 mV
Typical accuracy	$\pm (0,05\% \text{ rdg} + 0,05\% \text{ FS})$	$\pm (0,05\% \text{ rdg} + 0,05\% \text{ FS})$
Warranty	3 years	3 years
Data Transfer	Bluetooth USB Cable to PC	USB Cable to PC
Internal Storage	1000 results	1000 results
Weight	0,5 kg / 1.1 lbs	0,6 kg / 1.3 lbs
Additional features	String voltage measurement Current measurement	RFID cell recognition Communicating with external density meter



BVR11 has current measurement as additional feature.

Universal Battery Charger – BAC25A

Main Features

- Lightweight – only 10 kg / 22 lbs
- Instrument max power – up to 2,7 kW
- Voltage range – Adjustable for different battery voltage ranges 12V – 300V DC
- Current range up to 25 A DC
- Typical voltage accuracy $\pm (0,25 \% \text{ rdg} + 0,25 \% \text{ FS})$
- Adjustable alarm and shutdown parameters for preventing excessive charge
- Automatic switch from boost charging mode to float charging mode upon reaching the preset boost time
- Overvoltage protection
- Parallel unit operation deployed for higher charging currents

Battery charger BAC25A is a portable battery charger used for charging primarily Lead Acid batteries.

It is intended to

- Support the main charger in order to charge a battery much faster
- Serve as a replacement unit to the main battery charger

This device is equipped with thermal and overcurrent protection.



Technical Specifications

Voltage (V DC)	Current (A DC)	Boost voltage (V DC)		Float voltage (V DC)	
		Lead-Acid		Lead-Acid	
12	Up to 25	14		13	
24	Up to 25	29		27	
48	Up to 25	57		54	
60	Up to 20	72		68	
110/120	Up to 20	133/145		125/135	
220/240	Up to 10	263/290		248/270	



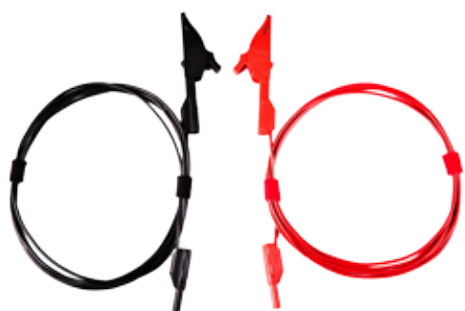
Current cables with alligator clamps (A4) isolated



Extension cables



Voltage sense cables with banana plugs



Voltage sense cables with banana plugs + dolphin clips



Current cables with alligator clamps (A2) isolated



PT100 temperature indicator



Temperature sensor for ambient temperature measurement



Communication cable for CVM-C connection



Dolphin clips



Alligator clips

CIRCUIT BREAKER TEST EQUIPMENT



Circuit breaker test devices are robust and field-portable instruments with local or PC controlled functionality. This set of instruments provides powerful measurement tools during manufacturing, commissioning, and maintenance phases of a circuit breaker and disconnecter life span.

The essential part of a circuit breaker condition assessment is the ability to compare the latest test results with previous. Measured values are stored and compared with the limits specified by the manufacturer. A fingerprint obtained in this way can be used at a later stage as a reference during subsequent measurements. In order to obtain accurate comparison, the tests need to be performed using identical test parameters. Any deviation and change in the test results may indicate the circuit breaker condition deterioration. This ability is supported by the DV-Win test plans and graph overlay features.

	RMO	POB	SAT	CAT03	CAT31 CAT61	CAT34 CAT64 CAT64A CAT124A	CAT35 CAT65 CAT66 CAT125 CAT126	CAT-P
Contact Resistance (IEC 60694)	•						•	
DRM							•	
Coil Resistance (IEC 62271-100)			•					
Coil Current (IEC 62271-100)		•	•		•	•	•	•
Motor mechanism charging time (IEC 62271-100)		•	•			•	•	
Minimum trip voltage (IEC 60694)		•	•					
Timing of circuit breaker main and resistor contacts (IEC 62271-100)				•	•	•	•	•
Timing of circuit breaker auxiliary contacts (IEC 62271-100)					•	•	•	•
Synchronization between the contacts (IEC 62271-100)				•	•	•	•	•
Motion and velocity (IEC 62271-100)						•	•	
“First trip” test						•	•	•

Micro Ohmmeters – RMO Series

The RMO series of instruments are designed for contact resistance measurement of non-inductive test objects. Based on the most advanced switch mode technique available today, the RMO series of instruments generate a true DC ripple-free current with automatically regulated test ramps.

RMO-A SERIES	RMO-G SERIES	RMO-D SERIES	OTHERS
RMO100A	RMO100G	RMO200D	RMO200H (Handheld)
RMO200A	RMO200G	RMO500D	
RMO300A	RMO300G	RMO600D	RMO60E
RMO400A	RMO400G		
RMO500A	RMO500G		
RMO600A	RMO600G		
	RMO800G		

Micro Ohmmeters – RMO-A Series

The RMO-A series models are the "entry level" of the RMO devices, but not much less potent than the remaining series of the RMO devices. It includes six different models placed in the metal housing. The main difference between these models is the maximum test current that can be generated.

RMO600A

- Lightweight - only 8 kg / 18 lbs
- Test currents 5 A - 600 A DC
- High output voltage 5,9 V @ 600 A DC
- Measuring range 0,1 $\mu\Omega$ - 999,9 m Ω
- Typical accuracy \pm (0,1 % rdg + 0,1% FS)
- Best resolution 0,1 $\mu\Omega$
- Standalone / PC controlled (DV-Win Software)



Micro Ohmmeters with Both Sides Grounded Feature – RMO-G Series

The RMO-G series includes seven models mounted in plastic housings. Comparing to RMO-A series, there are additional "High Precision Module", "Both Sides Grounded" and "Remote Control" features available as options.

RMO200G

- Lightweight – only 8 kg / 17,6 lbs.
- Test currents 5 A – 200 A DC
- Typical accuracy \pm (0,1 % rdg + 0,1% FS)
- Best resolution 0,1 $\mu\Omega$
- BSG (Both Sides Grounded) test mode
- High Precision built-in module (optional)
- Remote control feature (optional)
- Standalone / PC controlled (DV-Win Software)



Micro Ohmmeter With Demagnetization Feature – RMO-D Series

The RMO-D series instruments are the most advanced version of the RMO family of instruments with the built-in High Precision module which provides an increased precision and offers a highly accurate contact resistance measurement in the range from $1 \mu\Omega$ to $30 \mu\Omega$, with $0,01 \mu\Omega$ resolution. The additionally offered feature is the ability to perform fully automatic demagnetization of a current transformer core after the measurement.

The demagnetization feature implemented in the RMO-D series does not require any modifications or additional connections; it is automatic and very quick. In a combination with DTRtest, it provides the simplest and the most efficient testing of dead tank circuit breakers compared to with any micro ohmmeter on the market.

RMO600D

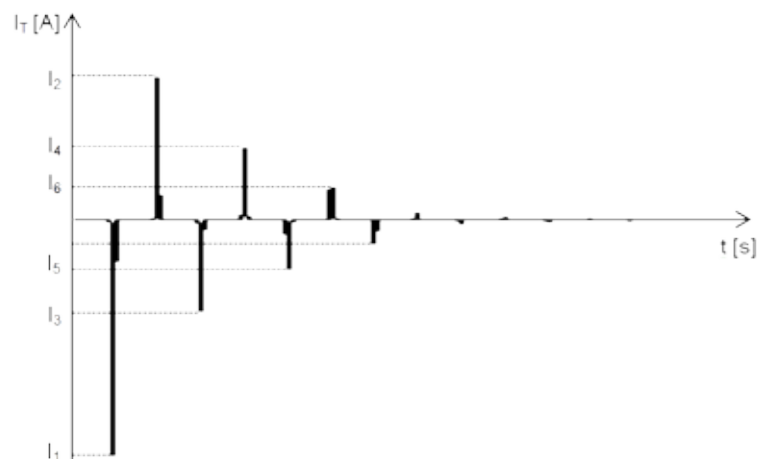
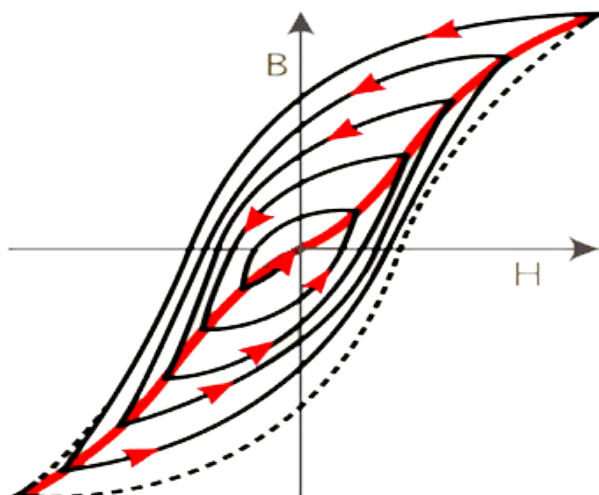
- Lightweight - only 11 kg / 24 lbs
- Powerful 5 A - 600 A DC
- Typical accuracy $\pm (0,1 \% \text{ rdg} + 0,1\% \text{ FS})$
- Best resolution $0,01 \mu\Omega$
- BSG (Both Sides Grounded) test mode
- High Precision built-in module
- Remote control feature (optional)
- Demagnetization feature
- Standalone / PC controlled (DV-Win Software)



Demagnetization feature

After the contact resistance measurement of dead tank circuit breakers, it is necessary to demagnetize the CT cores. This is because a DC current used for this measurement flows directly through the current transformers (CTs) mounted on the bushings. Causing that some amount of magnetic flux is probably trapped in the current transformer core. The remnant magnetism can cause various problems such as erroneous diagnostic electrical measurements on a CT or an incorrect operation of protective relays.

Demagnetizing magnetic core of a transformer requires alternating current applied with decreasing magnitude down to zero. By reducing the magnitude of the applied current to the zero value, the total magnetic flux, or remnant magnetism, is also annulled. The RMO-D provides this alternating current by internally changing the polarity of a controlled DC current source. During the demagnetization process the instrument supplies current at decreasing magnitude at each step, following a proprietary developed solution algorithm.



Protective Earth Resistance Meter – RMO60E

The RMO60E is ideal for testing the protective bonding (grounding) of equipment using the test current of up to 60 A DC, following the standard 61010-1 IEC 2001 requirements. The set is equipped with the thermal and overcurrent protection. The RMO60E has a very high ability to cancel electrostatic and electromagnetic interference in HV electric fields. It is achieved by a very efficient filtration. The filtration is achieved applying proprietary hardware and software solutions.



Special features for RMO Series

DTRtest – A new test mode for dead tank circuit breakers testing

Presence of current transformers (CT) on the dead tank circuit breakers may introduce errors during the contact resistance measurement due to CT magnetizing process. For this reason, it is necessary to saturate a CT prior to starting a measurement.

DTRtest menu is specially designed for resistance measurement of the dead tank circuit breakers and it is implemented in all three series of our micro ohmmeters – RMO-A, RMO-G and RMO-D series. All calculations for detecting the saturated condition of CTs are done by internal algorithm. Accordingly, the process of setting the measurement parameters and conducting a test in this mode, is very simple and does not differ much from a live tank circuit breaker testing.

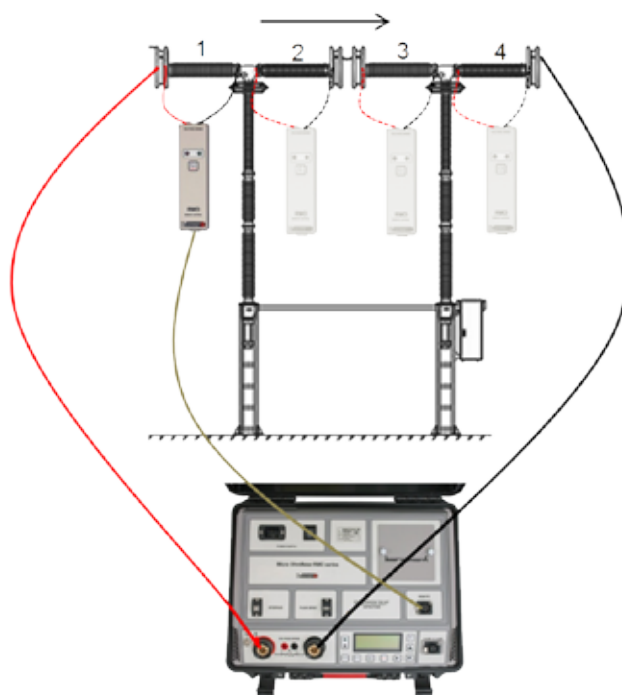
High Precision Module (built-in)

The high-precision module is newly developed built-in addition to our RMO-D micro ohmmeters (for RMO-G series it is available as an option). It provides an increased precision and offers a highly accurate contact resistance measurement in the range from 1 $\mu\Omega$ to 30 $\mu\Omega$, with 0,01 $\mu\Omega$ resolution.

Our RMO-G and RMO-D devices with this built-in High Precision Module may be used for applications on very small resistance measurements of non-inductive test objects. This requirement is usually met at resistance inspections of generator circuit breakers, welding joints, GIS testing, etc.

Remote Control Unit and Test Probes

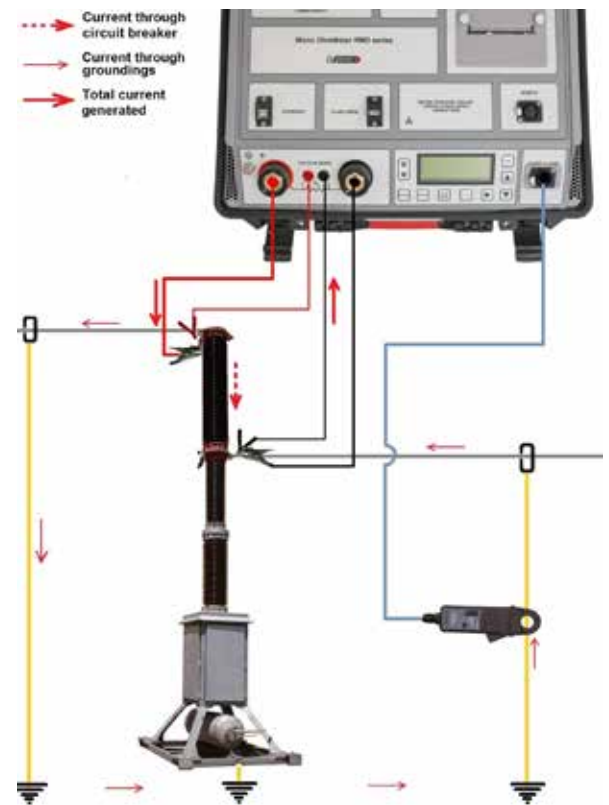
In order to remotely perform the measurements, the RMO-G and RMO-D devices are provided with the RMO Remote Control Unit or with the RMO Remote Control test probes (with trigger button). It is additional safety feature, but it also enables multiple measurements to be performed with the same test current. This significantly speeds up the entire test procedure.



Both Sides Grounded feature

In order to provide a complete protection from the induced voltages during the HV circuit breaker contact resistance measurement, it is necessary to ground the circuit breaker at both sides.

The RMO200H devices as well as the RMO-G and RMO-D series instruments have the possibility to perform measurements with both sides of a test object grounded. This will ensure the operator's safety and protect the instrument as well.



Handheld Micro Ohmmeter – RMO200H



RMO200H is a handheld Micro Ohmmeter based on a state of the art technology, using the most advanced switch mode technique available today. RMO200H is battery operated device.

The ultra-capacitor enables generating a true DC ripple-free current up to 220 A. A special software provided with the device enables downloading and analysis of the results, creating and exporting test reports in different formats, but also full control of the device in test, if necessary.

- Lightweight – only 0,9 kg / 2 lbs.
- Powerful – up to 220 A DC
- Battery operated
- Measuring range 0 – 999,9 m Ω
- Typical accuracy \pm (0,2 % rdg + 0,2 % FS)
- Both Sides Grounded Measurement
- Rmax function
- Standalone / PC controlled (DV-Win Software)

As a standard, the RMO200H handheld Micro Ohmmeter is provided with mini USB cable, DV-Win software, transport case and carrying belts. Besides these accessories, there are several variations of test leads available for different test applications and connection diagrams.

Circuit Breaker Analyzers and Timers – CAT series

CAT devices are either standalone or PC controlled digital instruments for circuit breakers' condition assessment. The robust design incorporates cutting edge technology with latest enhancements for safe and fast testing of medium or high-voltage circuit breakers with live or dead tank design.






The user can select any desired operational mode: Close (C), Open (O), Close-Open (C-O), Open-Close (O-C), Open-Close-Open (O-C-O). Test results can be stored in the instrument's internal memory, a USB memory stick or printed on a thermal printer (optional accessory) in both, tabular and graphical form.

The first series of CAT instruments are designed to meet requirements of an easy to use circuit breaker analyzer & timer with an attractive price. Their primary intention is timing and motion measurement of HV and MV circuit breakers.

Circuit Breaker Analyzer & Timer CAT64

- Safe and fast testing
- Simple & easy to operate
- Timing and motion measurement
- 6 timing channels (3x2) for main and resistive contacts
- 3 timing channels for auxiliary inputs
- Resistance measurement of pre-insertion resistors
- 2 Coil current measurement channels
- 2 Additional analog inputs + 1 Transducer input
- Supports both digital and analog transducers
- Detailed analysis of test results using DV-Win software



CAT I series	CAT03	CAT31	CAT34	CAT61	CAT64
					
Main contacts and preinsertion resistors contacts timing channels	3	3	3	6	6
Auxiliary contacts timing channels	NO	3	3	3	3
Coil control	NO	YES	YES	YES	YES
Coil current measurement channels	NO	2	2	2	2
External trigger channels	2	2	2	2	2
Analog input channels	NO	NO	2	NO	2
Transducer input channels	NO	NO	1	NO	1
Thermal printer (built-in)	Optional	Optional	Optional	Optional	Optional
"First trip" test	NO	NO	YES	NO	YES

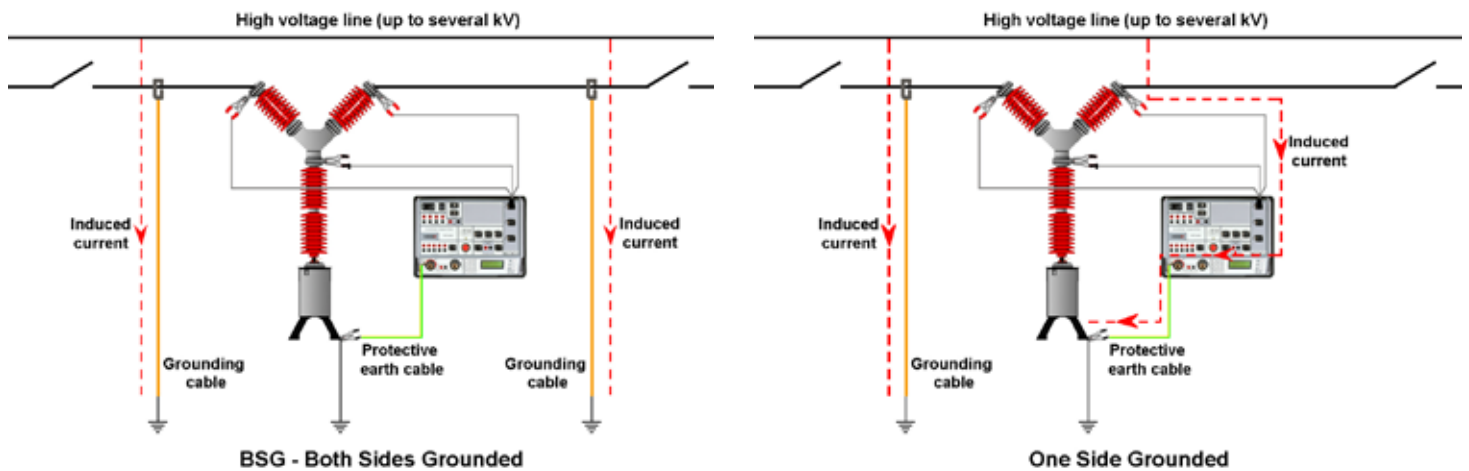
The second series utilize the latest enhancements for safe and fast testing, with unique technical capabilities for additional diagnostics of circuit breakers. Sophisticated design ensures efficient and reliable operations in high-voltage substations and industrial environments.

Circuit Breaker Analyzer & Timer CAT126

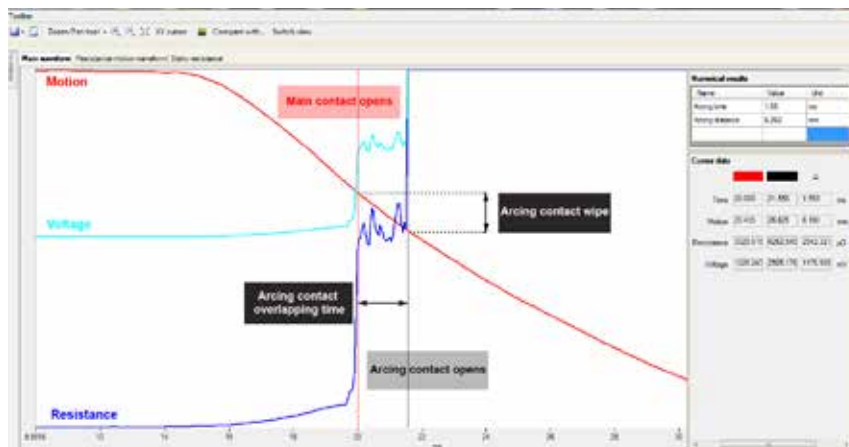
- Safe and fast testing
- Timing and motion measurement
- 12 timing channels (3x4) for main and resistive contacts
- 6 timing channels for auxiliary inputs
- 3 transducer input channels
- 4 Coil current measurement channels
- 4 additional analog input channels
- Built-in Micro Ohmmeter 500 A
- Dynamic resistance measurement
- Detailed analysis of test results using DV-Win software



BSG (Both Sides Grounded) feature enables safe and fast testing in high voltage substations, without removing the safety ground connections on both sides of the circuit breaker. No additional modules or remote boxes are required. Each main contacts timing channel is able to detect main contacts state in case when both terminals are grounded.



DRM (Dynamic Resistance Measurement)



This built-in micro ohmmeter can also be used for the DRM. The DRM test is performed by injecting a current through the breaker contact and simultaneously monitoring the voltage drop across the breaker contact as well as the current flow during the operation of the breaker.

Resistance curve, as a function of contact travel, can be used to reveal failures in relation to the arcing contact condition. CAT series instruments provide a high resolution measurement required for the DRM test.

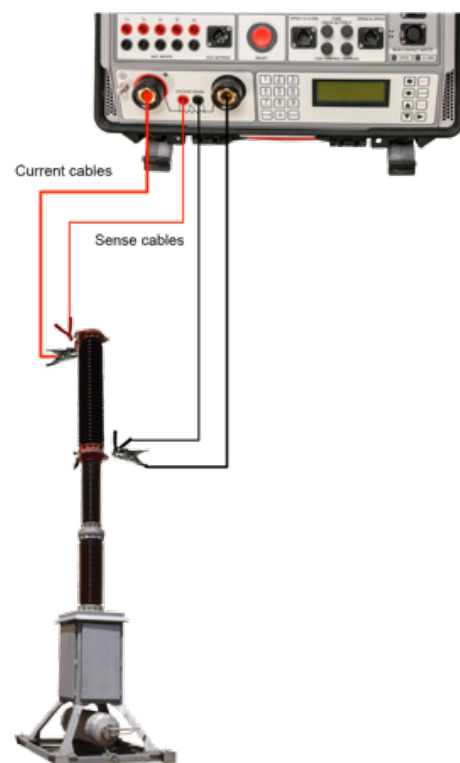
Static/Contact Resistance Measurement

The built-in micro ohmmeter generates a true DC ripple-free current with automatically regulated test ramps. The resistance measurement is using well-known Kelvin's four points method. The DC current is generated through closed circuit breaker contacts. The voltage drop is measured between the terminals of the circuit breakers. The resistance is calculated using Ohm's law $R=U/I$.

Very high output power (output voltage multiplied with output current) of our micro ohmmeters enables two main advantages:

- Wide resistance measurement range even when very high currents are used
- Use of thinner/longer test cables, depending of the customer requirement.

The output current is filtered and has a ripple of less than 1 %.



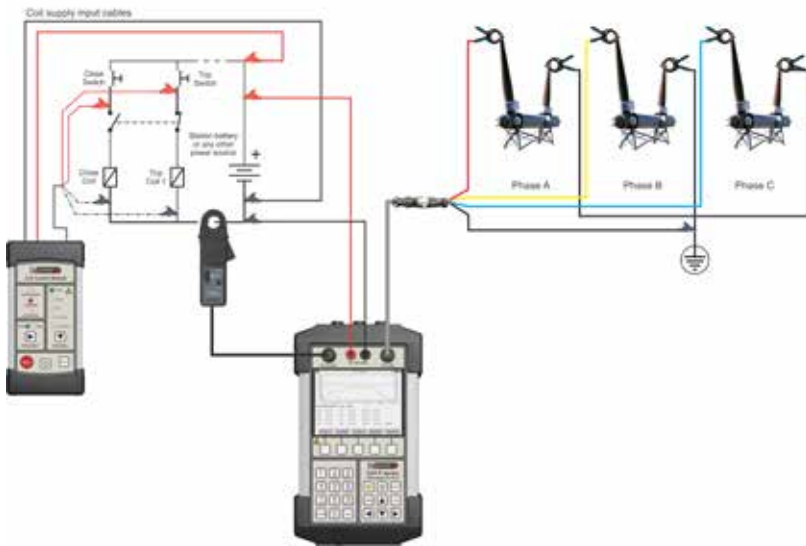
CAT II series	CAT35	CAT64A	CAT65	CAT66	CAT124A	CAT125	CAT126
Main contacts and preinsertion resistors contacts timing channels	3	6	6	6	12	12	12
Auxiliary contacts timing channels	6	6	6	6	6	6	6
Coil control	YES	YES	YES	YES	YES	YES	YES
Coil current measurement channels	4	4	4	4	4	4	4
Analog input channels	4	4	4	4	4	4	4
Transducer input channels	3	3	3	3	3	3	3
Thermal printer (built-in)	Optional	Optional	Optional	Optional	Optional	Optional	Optional
"First trip" test	YES	YES	YES	YES	YES	YES	YES
Micro ohmmeter	200 A	NO	200 A	500 A	NO	200 A	500 A
Dynamic resistance measurement	YES	NO	YES	YES	NO	YES	YES

Handheld Circuit Breaker Analyzer and Timer – CAT-P

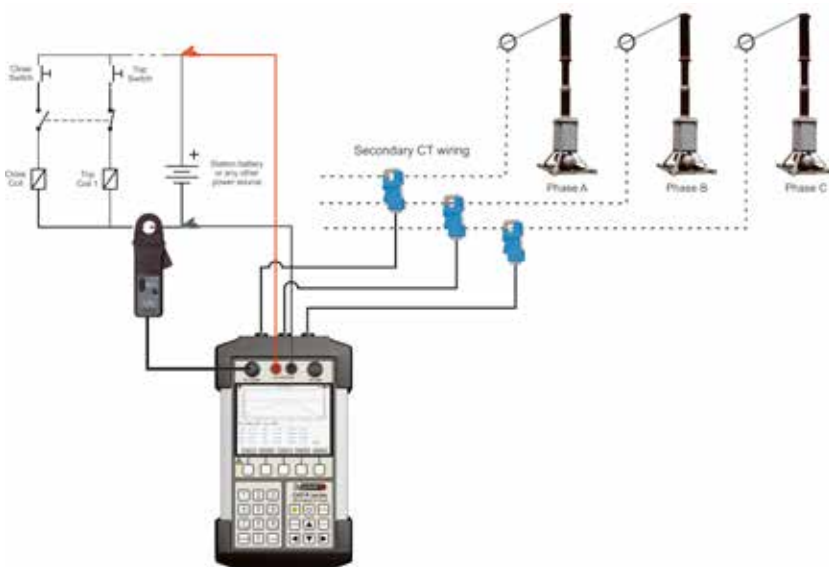
- Portable (1,4 kg / 3.1 lbs)
- Internal battery power supply
- Online measurement (First trip test)
- Offline measurement
- DC voltage and DC current measurement
- AC current measurement during the First Trip test
- Touch screen color display 145 mm (5.7 in)
- On-site analysis of test results (overlay up to 4 records in graphical form)
- Test results analysis and comparison with results obtained from other CAT instruments using DV-Win software



Handheld Circuit Breaker Analyzer & Timer CAT-P is a digital instrument for circuit breakers condition assessment. CAT-P records timing graphs of main arcing contacts, DC substation battery voltage, Trip and Close coil currents. Main contacts operating time in on-line mode is calculated based on AC secondary CT's currents. The timing channels record closing and opening of the main contacts.



Offline testing: CAT-P and Coil Control Module connection to dead tank circuit breaker with one breaking element per phase.



Online testing: CAT-P connection to dead tank circuit breaker with one breaking element per phase.

AC / DC Power Supply for Circuit Breaker Testing – POB series

The Coil Tester & Power Supply POB series instruments are powerful, lightweight, variable voltage power supply units ideal for testing circuit breakers where substation battery is not connected or available. They are intended for operating breaker coils and spring-charging motors in commissioning and maintenance testing. These devices are compatible with breaker analyzers from different vendors and eliminate use of station batteries during testing.

Highlights

- Lightweight – up to 10,6 kg / 23.4 lbs
- Minimum trip voltage test of the circuit breaker's coils
- Power supply for spring-charging motors
- Providing a power supply during a test with breaker analyzers from different vendors

Main Features

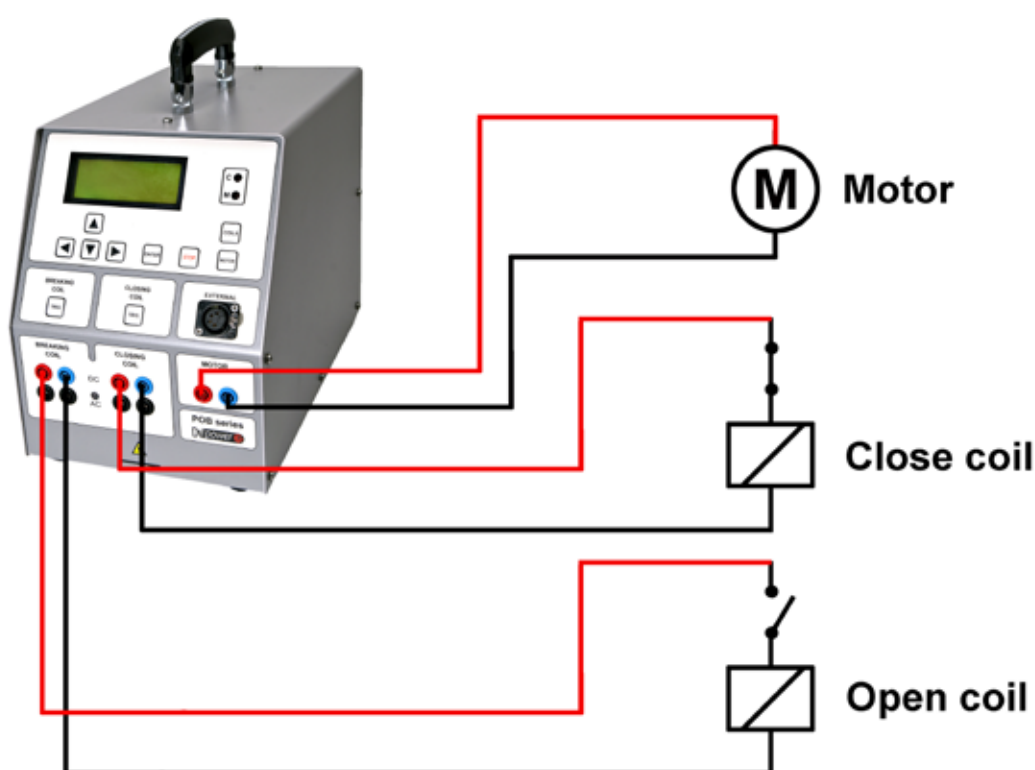
- Output current up to 40 A
- True DC ripple-free voltage
- DC Voltage from 10 V to 300 V
- AC Voltage from 10 V to 250 V



	Max DC Current	Max AC current	Output DC Voltage	Output AC Voltage
POB30AD	30 A	12 A	10 V – 300 V	10 V – 250 V
POB40AD	40 A	15 A	10 V – 300 V	10 V – 250 V
POB40ADL	40 A	15 A	1 V – 50 V	1 V – 40 V

	Max DC Current	Output DC Voltage
POB30D	30 A	10 V – 300 V
POB40D	40 A	10 V – 300 V
POB40DL	40 A	1 V – 50 V

Connecting the POB series to a test object



Circuit Breaker Coil Analyzer – SAT Series

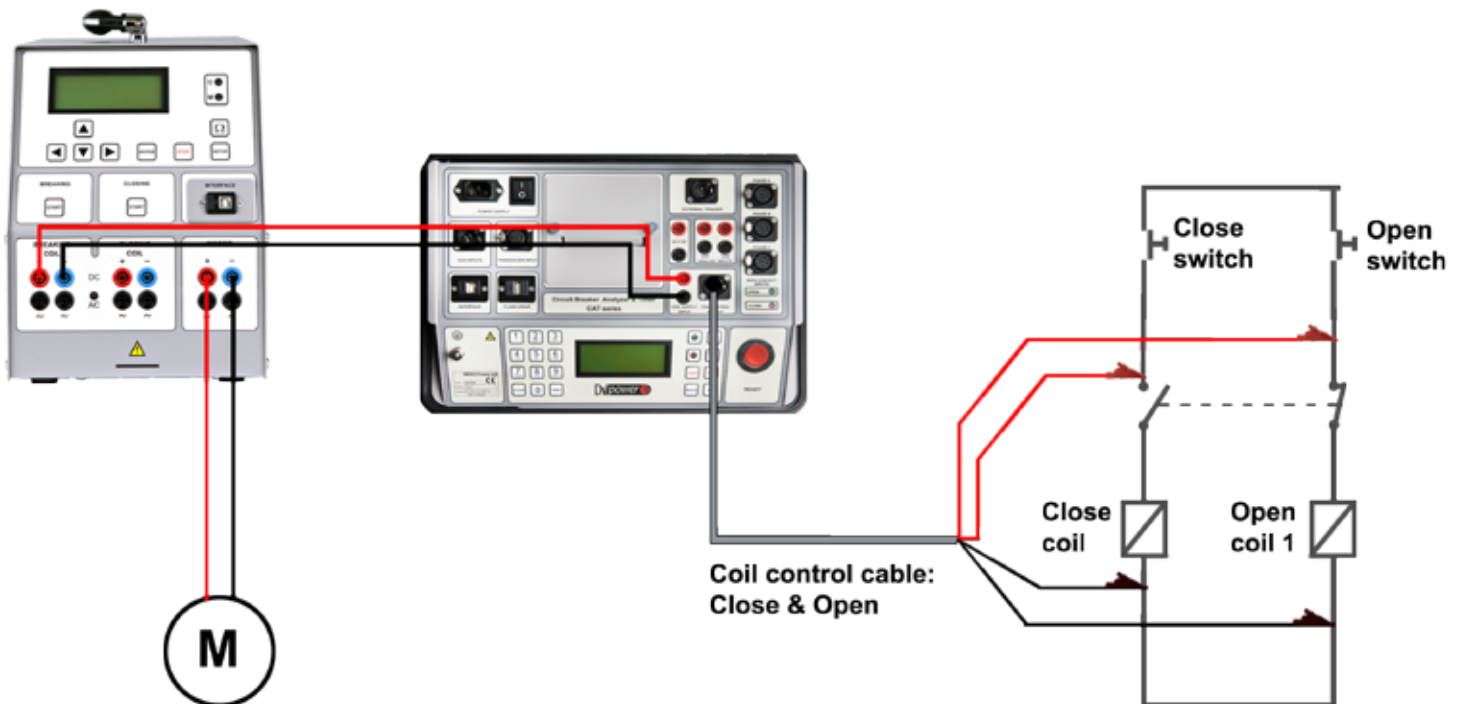
Circuit Breaker Coil Analyzers, SAT series are designed for circuit breaker testing when a battery is disconnected or unavailable. The instruments can be operated in a stand-alone mode or connected to a PC. A powerful Windows based DV-Win application software tool set, allows the operator to completely program a test plan in advance. Once the test is completed the test results can be displayed, archived, compared, analyzed in trend charts, and compiled into test reports. With their unique features, and in combination with the CAT series of device, SAT devices provide a complete diagnostics of a circuit breaker, while greatly reducing the test duration. They are compatible with breaker analyzers from other vendors as well. A robust design makes these instruments well suited for use in a variety of harsh environments.

The SAT series provide also a Coil Resistance Measurement, and is equipped with an AC motor supply output.

		SAT30A	SAT40A
Load voltage	Max load interval	Max Current	Max Current
110 V	20 sec	24 A	30 A
110 V	60 sec	20 A	24 A
220 V	20 sec	12 A	15 A
220 V	60 sec	10 A	12 A



CAT and SAT connection principle





Main contact cables with A2 clamps



Current and sense cables with TTA clamps for RMO200H



Sense cables with alligator clamps A2



Current clamp



Linear analog transducer



Universal transducer mounting kit and digital transducer with accessories



Coil Control module



Cable bag



Transport case with cables

TRANSFORMER TEST EQUIPMENT



With the DV Power instruments various useful diagnostic tests can be performed on power and instrument transformers. They include DC current tests “winding resistance measurement and tap changer analysis”, as well as AC voltage tests, such as transformer turns ratio, excitation current measurement, phase angle measurement and vector group detection.

DV Power transformer test instruments also use the DVtest method for on-load tap changer testing – a unique specialized non-intrusive method for the tap changer analysis. In addition, the automatic transformer demagnetization function is deployed removing effects of a magnetized transformer core and minimizing the transformer inrush current. DV Power tap changer analyzers also include a dedicated AC/DC current measurement channel used for monitoring the tap changer motor current during the tap changer operation.

Applications supported by DV Power transformer test equipment include:

	TWA40D	TWA25A	RMO-TT	RMO-TD	RMO-TW	DEM	TRT
Winding resistance measurement (IEC 60076-1)	•	•	•	•	•		
DVtest on-load tap changer analysis	•		•	•			
Make before break on-load tap changer verification	•	•	•	•	•		
Heat run test (IEC 60076-2)	•	•	•	•	•		
Automatic transformer demagnetization	•	•	•	•	•	•	
Turns ratio measurement of power and instrument transformers (IEC 60076-1)							•
Excitation current measurement and demagnetization status verification							•
Phase angle measurement							•
Transformer vector group detection							•
Magnetic balance test							•

Tap Changer Analyzers & Winding Ohmmeters – RMO-TW, TD and TT Series

The Winding Ohmmeters RMO-TT, -TD, and -TW series are designed for winding resistance measurement of transformers, generators, motors, and for the on-load tap changer analysis of power transformers. Typical application areas of RMO-TT, -TD, and -TW are high-voltage substations and industrial equipment.

Series	RMO-TT			RMO-TD			RMO-TW			
Model	RMO 100TT	RMO 60TT	RMO 40TT	RMO 60TD	RMO 40TD	RMO 25TD	RMO 50TW	RMO 30TW	RMO 20TW	RMO 10TW
Maximum test current	100 A	60 A	40 A	60 A	40 A	25 A	50 A	30 A	20 A	10 A
Temperature measurement channels	6	3		1			1			
Resistance measurement channels	3			3			3			
DVtest sampling resolution	0,1 ms			0,1 ms			4 ms			
Tap changer motor current measurement	YES			YES			NO			
Demagnetization	YES			YES			YES			
Automatic discharge function	YES			YES			YES			
Built-in tap changer control unit	YES			YES	Optional		NO			
USB Flash drive	YES			YES	Optional		NO			
Thermal printer (built-in)	Optional			Optional			Optional			
Accuracy	±(0,1% rdg + 0,1% FS)			±(0,1% rdg + 0,1% FS)			±(0,1% rdg + 0,1% FS)			

Tap Changer Analyzer & Winding Ohmmeter – RMO100TT

- The most powerful portable winding ohmmeter on the market, providing test currents of up to 100 A DC
- 3 resistance and 6 temperature measurement channels
- On-load tap changer dynamic resistance measurement
- Rapid automatic demagnetization
- AC current monitoring channel for tap changer motor current measurement
- Measuring range 0,1 $\mu\Omega$ – 10 k Ω
- Automatic discharge process



Tap Changer Analyzer & Winding Ohmmeter – RMO60TD

- 3 resistance and 1 temperature measurement channels
- Test current 5 mA – 60 A DC
- On-load tap changer dynamic resistance measurement
- Rapid automatic demagnetization
- AC current monitoring channel for tap changer motor current measurement
- Measuring range 0,1 $\mu\Omega$ – 10 k Ω
- Built-in tap changer control unit



Winding Ohmmeter – RMO50TW

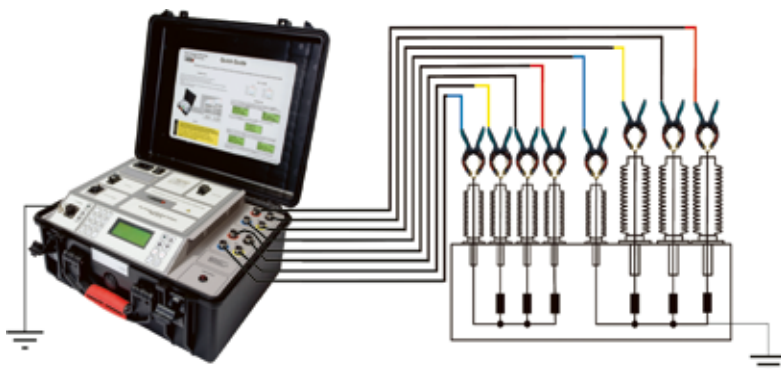
- 3 resistance and 1 temperature measurement channel
- Test current 5 mA – 50 A DC
- On-load tap changer verification
- Rapid automatic demagnetization
- Measuring range 0,1 $\mu\Omega$ - 10 k Ω
- Automatic discharge process
- Lightweight – only 8,5 kg/18.7 lbs



Tap Changer and Winding Analyzer – TWA40D

Tap Changer & Winding Analyzer TWA40D is one-of-a-kind diagnostic solution for power transformer testing. Using this device, the transformer testing is safer, significantly faster, and more convenient. The TWA40D instrument is designed for simultaneous three-phase tap changer analysis and six-winding resistance measurement of both, the primary and the secondary transformer windings. Each vector group has a special measurement algorithm that is optimized for the fast stabilization of test results.

Measurements are obtained very quickly by saturating the magnetic core through the HV and LV windings at the same time. Once all 6-8 bushings are connected and the transformer configuration selected, the instrument adjusts the test procedure automatically. The TWA40D generates a true DC ripple-free current. The Current injection and discharge of energy from the magnetic circuit are both automatically regulated.



Using the two sets of four cables, all bushings on HV and LV sides are connected at once. The connection to the transformer is made with two-contact clamps providing for four-wire Kelvin test method.

- Simultaneous three-phase OLTC dynamic resistance measurement and analysis (for YN configuration)
- Rapid core saturation for fast LV winding test
- Total test current 5 mA - 40 A DC
- Resistance measurement range 0,1 $\mu\Omega$ - 10 k Ω
- All 6 windings measured in one test
- Extremely quick measurement, the cable setup is performed only once
- Typical measurement accuracy of 0,1%
- Automatic discharge process
- Rapid automatic demagnetization
- AC / DC current monitoring channel for tap changer motor current measurement
- Built-in tap changer control unit

Three-Phase Tap Changer Analysis

Dynamic resistance graphs are recorded for all three phases simultaneously, so the synchronization is verified using the cursors provided in the DV-Win software. All three phase traces are plotted on the same graph. In addition, the tap changer motor current is recorded and displayed on the same graph. The measurement is completed quickly even on the largest power transformers.

Automatic Three-Phase Demagnetization

The TWA40D instrument can perform three-phase demagnetization after the DC test is finished. The process is completely safe, fully automated and a very fast. This enables the user to avoid problems such as high inrush currents at the start-up of power transformers, incorrect operation of protective relays, erroneous diagnostics or inaccurate electrical measurement on a transformer.

Interchangeable Cables with TRT Turns Ratio Testers

The test cables used for the measurement are completely compatible with the DV Power TRT series of Three-Phase Transformer Turns Ratio Testers. This enables the user to measure, using a one-time test leads setup:

- Transformer turns ratio
- Excitation current
- Phase angle
- Magnetic balance test
- Winding resistance at every tap position
- Dynamic resistance during each on-load tap changer transition
- On-load tap changer motor current
- On-load tap changer transition time for every transition
- On-load tap changer transition ripples for every transition
- Transformer vector group

The **TWA25A** is a simplified version of the TWA40D model, specifically focused on the three-phase winding resistance measurement. The differences between the TWA25A and TWA40D models are listed in the table below.

	TWA40D	TWA25A
Six-winding resistance measurement	YES	YES
DC test current	5 mA – 25 A (up to 25 A for winding resistance measurement and up to 40 A for the 3-phase synchronization test)	5 mA – 25 A
Measurement accuracy	$\pm (0,1 \% \text{ rdg} + 0,1 \% \text{ FS})$	$\pm (0,1 \% \text{ rdg} + 0,1 \% \text{ FS})$
Simultaneous 3-phase winding resistance measurement	YES (Quick YN test)	NO
DVtest sampling resolution	0,1 ms	4 ms
Simultaneous 3-phase DVtest	YES	NO
Tap changer motor current measurement	YES	NO

On-Load Tap Changer Analysis using DV Power Instruments – DVtest



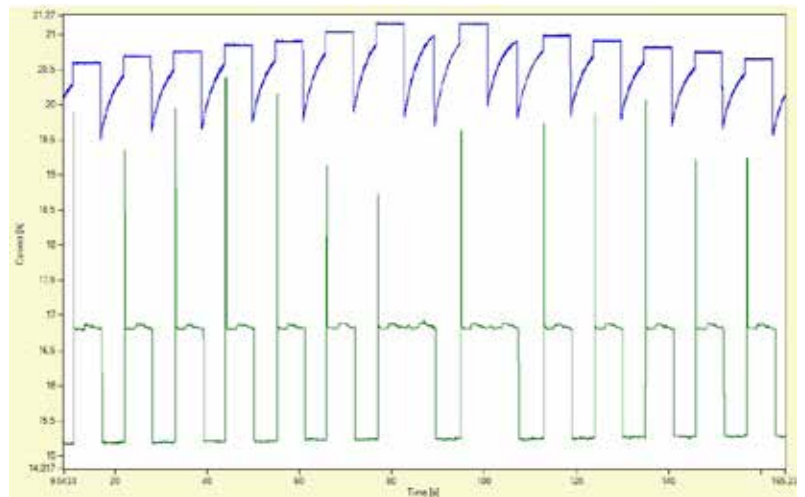
The TWA40D instruments enable simultaneous OLTC testing of all three phases in a single pass through the tap positions. In this manner, the total OLTC testing time is greatly reduced, by two thirds in comparison with the classic methods. This test procedure also enables observing the synchronization problems between the different phases.

The Quick YN test is a unique DV Power proprietary measurement method which enables performing the measurements of three winding resistances on a tap changer in YN configuration at the same time, and measuring the resistances in all tap positions in all three phases with a single pass through the tap positions. TWA40D is the only instrument in the market with this capability, which can significantly reduce the time required for a full winding resistance test.

The static resistance measurement provides winding resistance values at every tap position for each of the three phases. There is no need to discharge the transformer between the measurements in different tap positions. The DV-Win software creates the static resistance graph from the results of the resistance measurement in different positions, as well as the automatic recalculation of the measured values to a reference temperature value. The shape of the static resistance graph depends on the winding regulation mode.

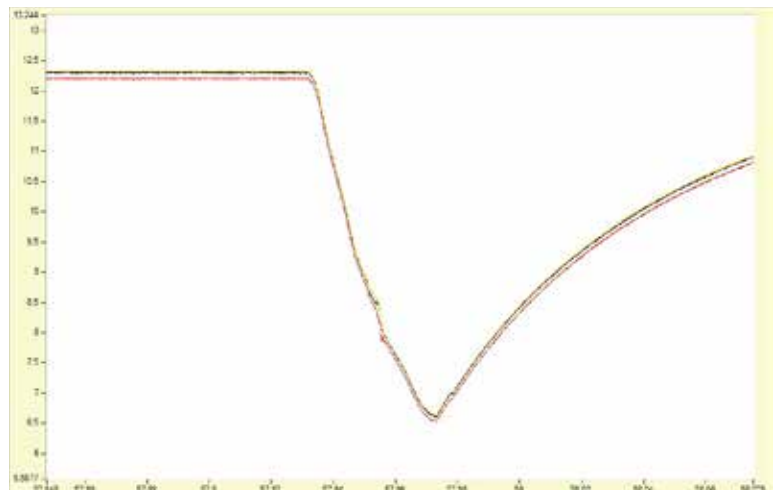
The dynamic resistance measurement (DVtest) feature enables measuring and recording the test current at high sampling rate during the tap changer transition. The variation of the current represents the change of the resistance in the circuit during the change of tap positions. Tap changer verification can be performed with the DV-Win software or by stand-alone TWA40D or RMO-T instruments. The stand-alone instruments detect any open circuit during the tap changer operation.

The dynamic resistance measurement graph is unique, powerful tool providing condition assessment of an OLTC regarding the mechanism itself and its contact wear. It is recorded by the DV-Win software.



The graph analysis tools enable detection of:

- High resistance contacts in the tap selector
- Loose contacts in the tap selector
- Burned, loose contacts in the diverter switch
- Broken resistors in the diverter switch
- Abnormal arcing
- Misaligned contacts
- Contact bounce
- Mechanical and motor problems
- Phase synchronization problems



The AC current monitoring channel 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.

Three-Phase Transformer Turns Ratio Testers – TRT Series

The TRT is a true three-phase, fully automatic test set, specially designed for a turns ratio, a phase shift, and an excitation current measurement of power, distribution, and instrument transformers. The TRT determines the transformer turns ratio by accurately measuring voltages across the unloaded transformer windings. As a test result it displays the ratio of these voltages. This ratio of voltages can also be automatically rescaled to match the physical ratio of a number of turns on a transformer high and low voltage side.

All the TRT devices are equipped with a tap changer control unit that allows changing tap positions remotely, and even automatically. USB Flash Drive feature enables saving all the test results to a USB memory stick. DV Power provides 112 mm built-in thermal printer as an option.

Main Features

- Best turns ratio accuracy $\pm 0,03\%$
- Highest ratio range 0,8 – 50 000
- Test voltages 1 V to 250 V AC
- Measurement of turns ratio, phase shift, and excitation current
- Automatic vector group detection
- Automatic turns ratio measurement at every tap position
- Internal memory enables storing 10 000 results
- Test plans available with included DV-Win software
- Magnetic balance test



Setting up the TRT is as simple as connecting it to de-energized transformer and selecting one of the following two approaches, or both of them, to test the three-phase transformer:

SINGLE-PHASE – Three single-phase voltages are applied to the three transformer primary windings, and all three phases are measured consecutively (phase by phase). All connections and short circuit procedures at the primary and secondary voltage terminals are done automatically and internally before each measurement, depending on the selected vector group. Over 130 different transformer and autotransformer configurations can be tested this way. The friendly user interface makes a test procedure setup simple and easy. A user provides only a transformer’s configuration data and the predefined measurement procedure is automatically applied by the instrument itself. If the (auto) transformer configuration is not available, the TRT can automatically detect it using its built in proprietary algorithm.

TRUE THREE-PHASE – A true three-phase excitation voltage is applied to the three transformer primary windings. Three induced phase voltages are measured at the same time. In such a way it is possible to detect the phase angle and measure the turns ratio of any transformer type, including phase shifting transformers, where other “three-phase” turns ratio testers cannot.

TRT devices are divided into 4 series, based on the maximum test voltage and test voltage source. The TRT63 series has the highest test voltage of 250 V, making it the most accurate on the market.

Series	Maximum test voltage	Test voltage source
TRT63	250 V AC	Both single-phase & true three-phase
TRT4x	125 V AC*	Both single-phase & true three-phase
TRT3x	100 V AC	Both single-phase & true three-phase
TRT03	100 V AC	Single-phase

* Combined with Extension Transformer CVT40 it can output 5 kV AC single-phase, specially for testing capacitive voltage transformers, see the next page

Extension transformer – CVT40

CVT40 is an extension single-phase transformer which, in combination with DV Power TRT4x series devices, can increase the TRT4x output voltage 40 times, up to 5 kV AC. This combination is specifically developed for testing turns ratios of capacitive voltage transformers.

Main Features

- Maximum output voltage 5 kV AC
- Maximum input voltage 125 V AC
- Turns ratio accuracy $\pm 0,5\%$
- Suitable for exciting CVTs of up to $0,02 \mu\text{F}$



Three-Phase Transformer Demagnetizer – DEM60C

The Three-Phase Transformer Demagnetizer DEM60C is a portable instrument designed for single and three-phase transformer core demagnetization. Demagnetization process eliminates the remanent magnetism from the transformer core. In this way users avoid problems such as high inrush currents at the start-up of power transformers, incorrect operation of protective relays, erroneous diagnostics, or inaccurate measurement on a transformer.

This powerful instrument generates a true DC ripple-free current of up to 60 A. The demagnetization process with DEM60C instrument is completely safe, fully automated, and very fast. The instrument generates an alternating current applied with decreasing magnitude down to zero. This option is implemented by internally changing the polarity of a controlled DC current.

Main Features

- Fully automatic demagnetization
- Demagnetization currents 5 mA - 60 A DC
- Lightweight – only 13,1 kg / 29 lbs
- Automatic discharging circuit
- Displaying and monitoring demagnetization current in real time, using DV-Win software



Motor & Generator Winding Ohmmeters – RMO-M Series

Main Features

- Test currents 5mA - 100 A
- Lightweight 8,0 kg/ 17.6 lbs
- Measurement range $0,1 \mu\Omega$ - 1 k Ω
- Accuracy 0,1%
- Resolution up to $0,1 \mu\Omega$
- Two resistance measurement channels
- Automatic discharge circuit



The Motor & Generator Winding Ohmmeter instruments are designed to measure the winding resistance of electrical motors and generators. Based on the state of the art technology, using the most advanced switch mode technology available today, RMO-M series instruments are: accurate (0,1%), powerful (up to 100 A), and lightweight (8,0 kg / 17.6 lbs). Instruments generate a true DC ripple free current with automatically regulated measurement and discharging circuit.



Current clamp



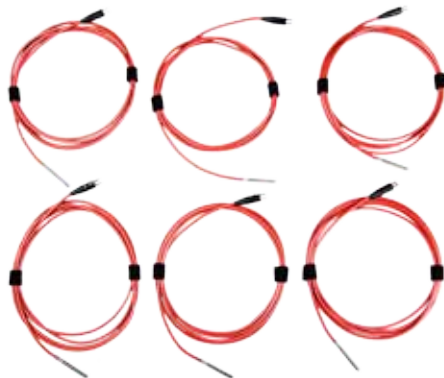
Current cables with battery clamps



Current connection cable with TTA clamps



TRTC Verification Calibrator



Temperature probe set for RMO100TT



TWA & TRT H/X winding test cable set with TTA clamps



Plastic transport case



Cable bag



Transport case

Smart test devices for reliable electric power systems

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