

Electrical test and measurement  
solutions for the railway industry

**Megger**<sup>®</sup>

Generating and ensuring a  
faultless power supply

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**EN**  
ENGLISH  
UK & EIRE

**About Megger**

Megger is a global provider of electrical power asset management, grid performance solutions and predictive analytics that inform and validate asset health decision-making. We design and manufacture test and measurement instruments that perform electrical measurements for preventative maintenance, troubleshooting, and commissioning.

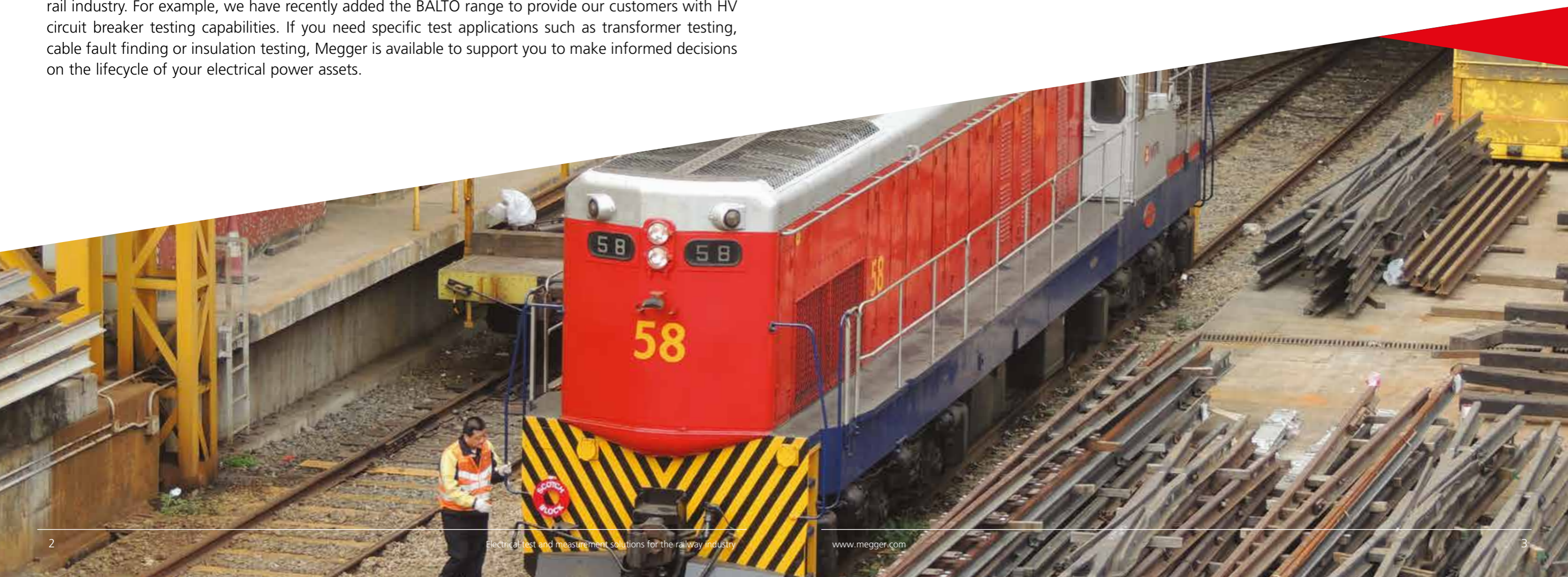
Megger’s test and measurement equipment has supported customers all over the world to improve their facilities’ efficiency, reduce costs, extend the life of apparatus, and through trending and analysis, anticipate equipment failure and future performance. We have local offices in many locations with technical support teams and distributors all over the world. Our manufacturing sites are located in Germany, Sweden, UK, USA and Israel.

**Megger in railway applications**

Megger has partnered directly with rail network providers to develop test and measurement equipment ideally suited for rail applications, and we continue to grow our product portfolio to complement the rail industry. For example, we have recently added the BALTO range to provide our customers with HV circuit breaker testing capabilities. If you need specific test applications such as transformer testing, cable fault finding or insulation testing, Megger is available to support you to make informed decisions on the lifecycle of your electrical power assets.

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## General testers



**High voltage discharge rod EST**  
For damped discharge and direct, visible earthing

- Features**
- Available for multiple voltage ranges
  - For safe discharging and earthing of cables and test units



**HV test set series**  
Portable HV test sets for DC voltage testing of cables and cable installations

- Features**
- Available in three versions: 50/80/110 kV
  - Monitoring functions maximise safety and ease of operation
  - Quick and easy to set up
  - Meets individual needs through a modular design



**MIT400/2 series**  
Cat IV insulation testers for electrical and industrial maintenance engineers

- Features**
- Insulation testing up to 1000 V and 200 GΩ range
  - Stabilised insulation test voltage
  - Single range, faster continuity testing from 0.01 Ω to 1 MΩ
  - 600 V TRMS AC and DC voltage measurement
  - Live circuit detection and protection



**DLRO2 and DLRO2X**  
Ducter™ low resistance ohmmeters

- Features**
- Noise rejection mode with Confidence Meter™ (DLRO2X)
  - Manual and auto save results for export to USB (DLRO2X)
  - Difference Meter for quick data comparisons
  - Use long leads at 1 A without compromising test speed
  - Safely test the resistance of inductive loads at 1 A
  - < 600 V active protection against inadvertent live connections without blowing a fuse



**DLRO10**  
10 a low resistance ohmmeters

- Features**
- Accurate results in under three seconds
  - Auto current reversal cancels standing EMFs
  - Fuse protected to 600 V
  - NiMH battery reduces weight
  - 250 mW power limit (with optional override) to avoid heating the test sample



**MGFL100**  
Battery ground fault locator

- Features**
- Alarms when the real fault is identified
  - Adjustable current and voltage limits
  - Powered off AC or internal battery
  - Locates faults up to 400 kΩ
  - Locates faults on AC or DC systems
  - Operates on systems up to 600 V
  - Locates faults on low frequency, 16.67 Hz systems



**DET2/3**  
High resolution earth tester

- Features**
- High resolution of 1 mΩ, ideal for large earth (ground) systems
  - Versatile tests modes
  - High accuracy for earth (ground) electrode grid and soil resistivity tests
  - Rechargeable battery power that can last all day with a fast re-charge (up to 10 hours)
  - Robust instrument with IP65 protection
  - Automatic test frequency selection, with filters and high current features



**MIT515, MIT525, MIT1025**  
5 kV, 10 kV, 15 kV DC insulation resistance testers

- Features**
- Measures up to 30 TΩ
  - Safety rated up to CAT IV 1000 V to 3000 m
  - Unique dual-case design
  - Additional user protection
  - Operates from battery or AC mains supply
  - Rapid charge Li-ion battery
  - Advanced memory with time/date stamp



**DET14C/24C**  
Earth resistance clamp testers

- Features**
- Elliptical clamp shape improves access to earth cables and straps up to 50 mm
  - Low maintenance flat jaw interface
  - Measures ground resistance from 0.05 Ω to 1500 Ω



**TC3231**  
Thermal camera

- Features**
- 2.2 inch (55.88 mm) 320\*240 TFT LCD display
  - 32 x 31 pixel resolution IR temperature measurement
  - Measurement range -20 ° to 300 °C / -4 °F to 572 °F
  - Adjustable emissivity
  - Micro SD memory for storing up to 6000 images
  - High and low alarm (enable and disable)
  - Selectable colour palette



**MPQ2000**  
Portable power quality analyser

- Features**
- Power-off phase A or auxiliary, allowing it to be used anywhere
  - Weather proof to NEMA 4 standard for use in any environment
  - Auto CT identifies the current that the instrument is connected to and the range that it is in
  - Verifies connection is correct and performs auto data analysis



**DPM1000**  
Power clamp meter

- Features**
- AC/DC voltage to 1000 V
  - AC/DC current to 1000 A
  - True RMS
  - Resistance 100 kΩ
  - Bluetooth® link to the Megger Link app
  - Phase rotation indication



Learn more about general testers

<https://megger.link/General-testers>

## Rolling stock application



**TDR1000/3**  
Advanced handheld single channel TDR

- Features**
- Simple operation
  - Auto set up for instant use
  - Ultra fast pulse for near end fault identification
  - Trace HOLD feature to allow comparison between cables
  - IP54 rating offers real life working
  - Designed for use on all metallic cable pairs

**MTR105**  
Rotating machine tester

- Features**
- Full colour graphic display
  - Three-phase insulation resistance
  - Temperature correction for insulation resistance
  - Guard terminal
  - DLRO for wire Kelvin
  - Continuity and diode test
  - Capacitance and inductance test

**ADX**  
Baker ADX static motor analyser

- Features**
- Daylight viewable large 10.4 inch touch screen
  - Included waterproof, industrial keyboard with integral mousepad
  - IEC61010 safety compliant detachable test leads
  - Testing capabilities include: winding resistance, insulation resistance, inductance, capacitance, PD on surge, dielectric analysis (DA), polarisation index (PI), dielectric analysis (DA), DC step voltage, DC continuous ramped, DC HiPot, EAR+™

**Baker AWA-IV**  
Static motor analyser

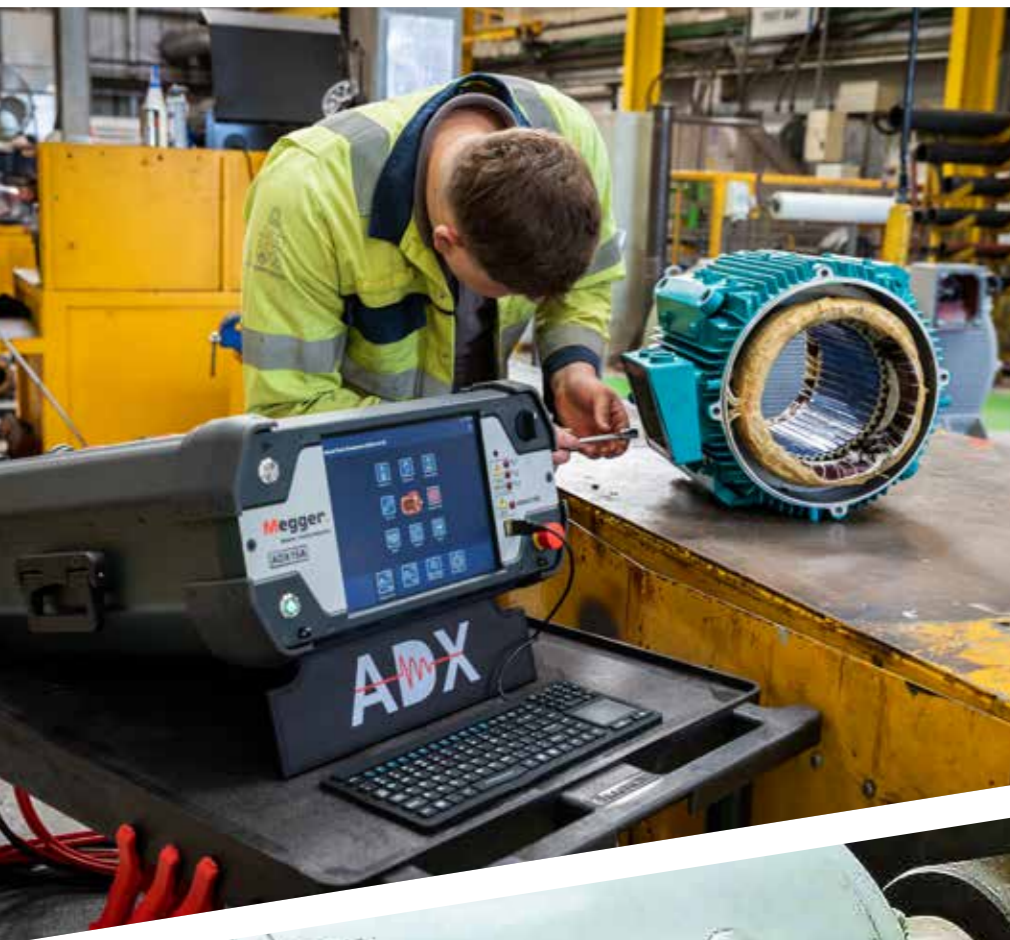
- Features**
- Range includes 2 kV, 4 kV, 6 kV, and 12 kV models
  - Testing capabilities include: surge, winding resistance, Megohm, PI, DA, continuous ramp DC step voltage, and DC hipot tests
  - 12 kV HO (high-output) version for performing surge tests on large motors and generators

**Baker DX**  
Static motor analyser

- Features**
- Comprehensive range of tests in one instrument
  - Configurable to meet needs and price point
  - 4 kV to 12 kV for wide spectrum of motors and coils
  - Compatible with the Baker PPX Power Packs for testing up to 40 kV
  - High and low voltage tests to characterise circuits and insulation

**MET1000**  
All-in-one true RMS electrical tester

- Features**
- LED and LCD display with self-test
  - Detachable test probes
  - AC/DC Voltage to 1000 V
  - 200 A AC measurement
  - True RMS on ACV/ACA
  - Inrush current
  - Phase rotation



Learn more about ADX

<https://megger.link/Baker-ADX>



**TPT420**  
Voltage tester

- Features**
- CAT IV 1000 V
  - IP64 Rated
  - 12 - 1000 V AC
  - 12 - 1500 V DC
  - Continuity test function with visual and acoustic indication
  - Voltage indication with no batteries



**DCM1500**  
1500 A TRMS clamp multimeter

- Features**
- DC and AC current measurement up to 1500 A
  - True RMS measurement for greater accuracy
  - Large jaw size improves safety when working with uninsulated conductors
  - 750 V AC and 1000 V DC
  - Resistance, continuity and frequency measurement



**DCM340**  
600 A AC/DC 600 V AC/DC clamp multimeter

- Features**
- Up to 2000 A output
  - DC current range
  - Frequency counter
  - Analogue bar graph
  - Back light



## Substation testing

### Battery testing



**BITE2P**  
Battery impedance tester < 7000 ah

**Features**

- Determines condition of lead-acid and NiCd cells up to 7000 Ah
- On-board pass/warning/fail indications
- Also tests inter-cell connections and system ripple current
- Built-in printer



**BITE5**  
Battery tester

**Features**

- Measures impedance on cells up to 200 V
- Supports battery discharge testing
- Measures DC voltages up to 1000 V
- Measures AC voltages up to 600 V
- Touch screen set-up and trending
- Measures AC and DC current



**TORHEL900**  
Battery discharge test system

**Features**

- Discharge testing for full insight into battery capacity
- Enhanced safety features including spark free connection and emergency safety fuse
- Ability to test the battery without disconnecting it from the system
- High discharge capacity shortens the test time
- A complete stand-alone discharge test system



Learn more about battery testers

<https://megger.link/Battery-testing>

### Switchgear testing



**PD SCAN**  
Handheld scanner for PD surveying in MV and HV plants

**Features**

- For fast verification of partial discharge activity in MV and HV plants
- Universal application range, thanks to wide variety of sensors
- Integrated camera and QR code scanner
- Easy to use via keypad and touch screen
- Reporting via MeggerBook RE software Power factor test set



**UHF PD Detector**  
Online PD substation surveying system

**Features**

- Non-invasive tool for online PD measurements in MV and HV substations
- Large colour touch screen for easy operation
- Dual channel system for direct comparison between two sensors



**T22/1**  
AC HV test system

**Features**

- Continuous testing with AC voltages up to 75 kV RMS at 1 kV A
- Expandable with a second transformer for testing up to 150 kV RMS
- Built-in overload protection
- DC testing up to 80 kV with optional rectifier and more



**High-voltage test system HPG 50 ... 110-H**  
Compact and powerful AC test systems

**Features**

- Compact, maintenance free, cast resin high voltage transformers
- Separate control and HV unit
- Voltage continuously adjustable
- Powerful system: 1.2 kVA continuous operation, up to 3 kVA 60 min short-time operation
- DC testing via rectifier



## Substation testing

### Transformer testing



#### Power transformer test vehicle

Comprehensive portable transformer testing

**Features**

- Routine and advanced diagnostic tests
- Centralised control and reporting
- Automated test circuit arrangement and switching process
- Safe operation and user guidance through the tests
- Easy extraction of mounted instruments
- Two sets of cables (HV and LV) are shared among different instruments

#### TRAX

Transformer and substation test system

**Features**

- State of the art measurement methods for advanced diagnostic testing
- Winding and contact resistance measurement up to 100 A true DC for best accuracy
- Adaptive algorithm for faster and optimal transformer demagnetization
- True dynamic resistance measurement of on-load tap changer
- ITC corrected tan delta/power factor and capacitance testing at 12 kV / 500 mA
- Built-in circuit breaker analyser
- Manual mode for advanced trouble shooting or for designing your own test

#### TAU3

True three-phase transformer winding analyser

**Features**

- Turns ratio, winding resistance, adaptive demagnetization, short-circuit impedance, magnetic balance
- Accuracy guaranteed from -20 °C to +50 °C
- Save time and protect operators with efficient one-time lead connection for all tests

#### DELTA4000

12 kV dissipation factor / tan delta system

**Features**

- Capacitance and dissipation factor (power factor/tan delta) test set
- Automatic and manual operation
- Accurate and repeatable measurement results with high noise suppression
- Lightweight, rugged two-piece design
- New built-in Individual Temperature Correction (ITC patent pending)
- 1 Hz assessment

#### TTRU3

True three-phase turns ratiometer

**Features**

- Guaranteed accuracy  $\pm 0.10\%$  from -20 °C to +50 °C
- Step-up ratio testing
- Step-down ratio testing
- Magnetic balance test capabilities
- Confirmation of expected nameplate vector configuration
- Ability to measure actual vs expected phase shift
- One touch automatic OLTC testing..

#### OTS and OTD

Breakdown voltage (OTS) and oil insulation dissipation factor (OTD) test sets

**Features**

- Laboratory instrument for measuring insulating oil breakdown voltage (OTS)
- Integrated test cell heating and cooling systems (OTD)
- Efficient oil fill and integrated automated oil drain facility (OTD-OTS)
- Fully automated standard and user-defined tests. Supports all international standards (OTD-OTS) and more

#### MVCT

VT and CT test set

**Features**

- Ability to test both VTs and CTs
- CT knee points up to 30 kV
- CT grouped testing includes demagnetisation, knee points, ratios, saturation curves, winding resistances, polarities and phase deviation (on all taps of multi-ratio CTs)
- VT testing including demagnetisation, ratio, winding resistance, polarity and phase deviation
- Performs secondary burden tests
- Integrated 1 kV DC insulation test system



Learn more about power transformer testers

<https://megger.link/Transformer-testing>



## Substation testing

### Protection relay testing - Single-phase testing



**SMRT1D**  
Single-phase relay tester

**Features**

- Small, rugged, lightweight, and powerful
- Operate with or without a computer
- Intuitive manual operation with Smart Touch View Interface (STVI)
- Built-in display (SMRT1D)
- High current, high power (75 Amps/400 VARMS)
- Network interface provides IEC 61850 test capabilities
- Fully automated testing using RTMS software and more

**SVERKER780**  
Single-phase relay test sets

**Features**

- The engineer's toolbox for all single-phase relay testing
- Standalone functionality
- Rugged and reliable for field use
- Its powerful measurement section can display (in addition to time, voltage, and current) Z, R, X, S, P, Q, phase angle, and  $\cos \phi$



Learn more about  
single-phase relay  
testers

<https://megger.link/single-phase-relay>

### Protection relay testing - Multi-phase testing



**SMRT46D**  
Multi-phase relay tester

**Features**

- Integrated Smart Touch View Interface™ STVI provides stand-alone operation using intuitive high resolution graphic touchscreen, no PC required to operate
- 4 voltage channels, 3 current channels, with convertible voltage channels provides 1 voltage and 6 currents
- High current output - 60 Amps at 300 VA per phase
- Convertible voltage channels – 15 Amps at 120 VA

**SVERKER900**  
Relay and substation test system

**Features**

- The testbox for substation three-phase testing
- 3 currents and 4 voltages
- Standalone functionality
- Rugged and reliable for field use
- Generation of 900 V and 105 A in single-phase mode
- Secondary and primary testing



Learn more about  
multi-phase relay  
testers

<https://megger.link/multi-phase-relay>



# Substation testing

## Circuit breaker testing



**BALTO Compact**  
Compact DC high current circuit breaker tester

- Features**
- Specially designed for testing DC High speed circuit breakers
  - Ergonomic and compact design
  - Power source from batteries and ultra-caps max. 4000 A
  - Current rising slope according to IEC 61992-2 (traction power substations) and IEC 60077-2 (rolling stock)
  - Measures trip current (Ids); opening time, contact resistance and secondary injection testing for relays
  - Generates PDF reports on board and more

<https://megger.link/Balto>

**BALTO Modular**  
DC High current circuit breaker tester

- Features**
- Modular version designed for testing DC High Speed circuit breakers. It can be extended up to 40000 A
  - Power source from batteries and ultra-caps
  - According to IEC 61992-2 (traction power substations) and IEC 60077-2 (rolling stock)
  - Measures trip current (Ids); opening time, contact resistance and secondary injection testing for relays
  - BALTO Win – Communication software for PC and more

**EGIL200**  
Circuit breaker analyser

- Features**
- Circuit breaker analyser for standard measurements
  - Easy-to-use and intuitive operation with a minimum of user interaction
  - Measurement performance inherited from market leader Megger TM series circuit breaker analysers
  - Instrument and accessories designed for the most demanding field conditions
  - DualGround™ testing using DCM module - increased safety with both sides of breaker grounded

**DLRO100**  
100 A Highly portable micro-ohmmeter with DualGround™ safety

- Features**
- IP54 rating offers real life working
  - Auto set up mode for instant, easy use
  - AutoFind and FindEnd functions helps find the fault fast
  - Trace tagging facility that allows a name to be saved with the trace
  - Distance dependent gain to counteract signal attenuation

**MOM2**  
Hand-held 200 A micro-ohmmeter

- Features**
- Up to 220 A
  - Battery powered
  - Light, weighs only 1 kg
  - Safe test – DualGround™
  - Auto range: 1 μΩ to 1000 mΩ
  - Bluetooth® PC communication
  - Complies with IEEE and IEC standards

**ODEN AT**  
Primary current injection test system

- Features**
- Most advanced primary current injection test system to simplify all types of switchgear and CT commissioning, ground grid, circuit breaker testing and more
  - Modular design to permit optimal user configuration of output current vs. unit size
  - Compact transport cart facilitates portability into switchgear rooms with limited space



**PMM2**  
Multifunction measurement instrument

- Features**
- Performs fast, accurate checking and testing of protective relay and meter installations during their commissioning and in routine maintenance
  - Integrated onboard touch screen LCD
  - Multi-coloured graphics with intuitive navigation
  - Built-in report generator, timer, and event logging
  - High speed sampling and data recording
  - Measure and display up to four voltages and four currents simultaneously

**VIDAR**  
Vacuum interrupter tester

- Features**
- Tests the integrity of vacuum interrupters quickly, safely, and easily
  - User defined voltage selection
  - Extensive voltage range
  - Easy to operate. Follows ANSI/IEEE standardised DC test methods
  - Lightweight and portable

**DDA300**  
Circuit breaker test set

- Features**
- Circuit breaker test sets designed to test low voltage power and moulded-case circuit breakers equipped with thermal, magnetic, or solid-state trip devices
  - High current output: 60 000 A for model DDA-6000; 35 000 A for model DDA-3000
  - Digital signal processing (DSP) technology
  - Variable pulse time and firing angle output current control
  - Compliant with NEMA AB-4 test guidelines



**EGIL**  
Circuit breaker analyser for one break per phase

- Features**
- Suitable for testing timing and travel on all circuit breakers with single interrupter per phase
  - Extremely easy to use and reliable
  - Two separate timing channels for measurement of auxiliary contacts
  - Analogue measurement channels for travel transducers or general voltage/current measurements



Learn more about circuit breaker testers  
<https://megger.link/Circuit-breaker-testing>



# Cable fault location and diagnostics

## Cable fault location



**TDR 2000 series**  
Advanced dual-channel TDR

- Features**
- CAT IV 600 V and IP54 rating
  - Auto set up mode for instant, easy use
  - AutoFind and FindEnd functions helps find the fault fast
  - Trace tagging facility that allows a name to be saved with the trace
  - Distance dependent gain to counteract signal attenuation
  - Step function to improve detection of near end faults



**Teleflex® SX-1**  
Portable radar/time domain reflectometer

- Features**
- Standalone operation or operation in conjunction with surge wave generators (thumpers)
  - Single jog dial operation with pie chart interface and no-user-intervention Auto mode ARM®
  - Multi-shot technology with 15 fault traces per arc reflection shot



**EZ-THUMP 3 kV and EZ-THUMP 4 kV, model V2**  
Highly portable fault location systems for LV networks

- Features**
- Dual stage 500 J surge energy at 1.5 kV and 3.0 kV EZ-Thump 3 kV only
  - Single stage 500 J surge energy at 4.0 kV EZ-Thump 4 kV only
  - F-OHM HV interlock to ensure safe earthing
  - Battery and AC line operation
  - Automatic end-of-cable and fault locating



**MFM10**  
Sheath fault location system

- Features**
- Test voltage up to ±10 kV DC
  - Up to 750 mA continuous current, also suitable for burning
  - Adjustable current limiter
  - Bipolar measurement for highest accuracy
  - Only one removable HV connection cable



**HVB10**  
High voltage bridge for fault location in long cables

- Features**
- Top class measurement and accuracy
  - Automatic test sequence
  - Bipolar pre-location for the elimination of external influences
  - Detection and indication of wrong connections
  - Only one HV connection cable
  - Completely independent of the parameters of auxiliary lines
  - easyGo operating system



**digiPHONE+2 NTRX Set**  
digiPHONE+2, plus ESG earth rods and Ferrolux receiver

- Features**
- Acoustic-magnetic cable fault location
  - Automatic filtering of Interference signal
  - Cable compass
  - Display of cable depth/current/direction
  - Bluetooth® headphone
  - Lightweight sensor (900 g)



**CARLOC**  
Utility locating system

- Features**
- Display with high contrast for good readability by day and night
  - Current direction indication for clear cable identification
  - Transmitter with two output signals to distinguish between cables lying side by side



**STX40**  
Portable fault location system

- Features**
- True portable outdoor-ready unit, IP43
  - Very easy to use "turn and click" single rotary knob interface
  - Surge/thump energy 2000 Joule
  - DC testing up to 40 kV, surging/thumping up to 32 kV, burning up to 40 kV



**Ferrolux® FLG12**  
Audio frequency generator

- Features**
- Precise location, even above a bunch of cables, with SignalSelect
  - Multi-frequency operation prevents manual switching
  - Durable operation



**CI/LCI**  
Cable identifier

- Features**
- Identifies a de-energized primary cable safely
  - Identifies live secondary cables up to 240 V AC
  - Avoids false positives..

# Cable fault and diagnostics

## Cable testing and diagnostics



**VLF Sine 34 kV**  
Test system for medium voltage cables

**Features**

- High test capacity of 5  $\mu$ F
- Suitable for outdoor use (IP 54)
- Single-button operation
- Integrated safety system
- Reporting
- Continuous duty cycle



**VLF Sine 45 kV**  
Test system for medium voltage cables

**Features**

- Performs cable withstand testing, cable diagnostics and sheath fault pinpointing
- Automatically adjusts the test frequency to the cable length
- Eliminates hazards to the user and prevents extensive damage to the cable
- Easy field operation with no need for external computer



**VLF Sine 62 kV**  
Test and diagnostic system for medium voltage cables

**Features**

- Performs cable withstand testing, cable diagnosis and sheath fault pinpointing
- Smallest and lightest unit on the market in its class
- Automatic result interpretation as per latest IEEE 400.2 standard
- Easy field operation with no need for external computer



**MV DAC-30**  
Damped AC voltage test set with a peak voltage of 30 kV

**Features**

- Safest operation thanks to fully isolated design
- Uses well proven DAC excitation voltage for PD measurements (acc. IEC 60270)
- Real-time data evaluation and display of results
- Two part design for easy transportation



**TDM 45**  
High power test and diagnosis combination for MV cables

**Features**

- Cable testing, cable diagnosis and sheath testing in one device
- Enables standard compliant high power VLF testing at 0.1 Hz (5  $\mu$ F at 40 kV RMS)
- Internal tan delta measurement with automatic result interpretation
- Partial discharge diagnosis using VLF Sine wave, sampled AC or 50/60 Hz slope technology voltages



**TDS NT series**  
Portable high power test system for testing and diagnostics of MV cables up to 40 kV and 60 kV

**Features**

- Two proven voltage wave shapes in one device
- Standard-compliant VLF cable testing with accompanying PD diagnostics
- Non-destructive PD diagnostics by means of proven DAC voltage
- 50 Hz slope technology for a direct comparison with the power frequency



Learn more about cable testing and diagnostics testers

<https://megger.link/Cable-testing-and-diagnostics>



# Generating and ensuring faultless power supply



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