

**Partial discharge and
loss factor
measurement system
for rotating machines
and MV/HV cables**



ICMflex

Different measurement tasks – one instrument

The ICMflex greatly simplifies distribution class cable testing, as well as rotating machine testing and other field tasks involving partial discharge (PD) detection, tan delta (TD, loss factor) measurements, and PD fault location.

The ICMflex has been designed to simplify testing and allows you to perform a range of different measurement tasks with one instrument. Its principle of operation minimizes testing and operation time, and increases operator's safety. General applications are testing of rotating machines (as well as stator bars and single bars) and medium/high voltage cables. The system is mostly used for on-site testing, but can also be used in laboratories and workshops.

Main users of the ICMflex

- Service groups that testing motors, generators, and accessories
- Service groups testing high voltage cables, terminations, and joints
- Factories and manufacturers of cables and generators
- Maintenance and repair shops
- High voltage laboratories
- Research and development departments in industry, e.g., special designs for university projects



Features and benefits

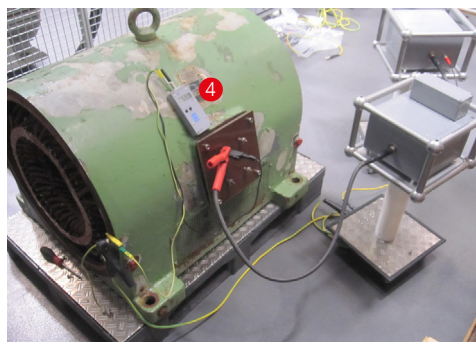
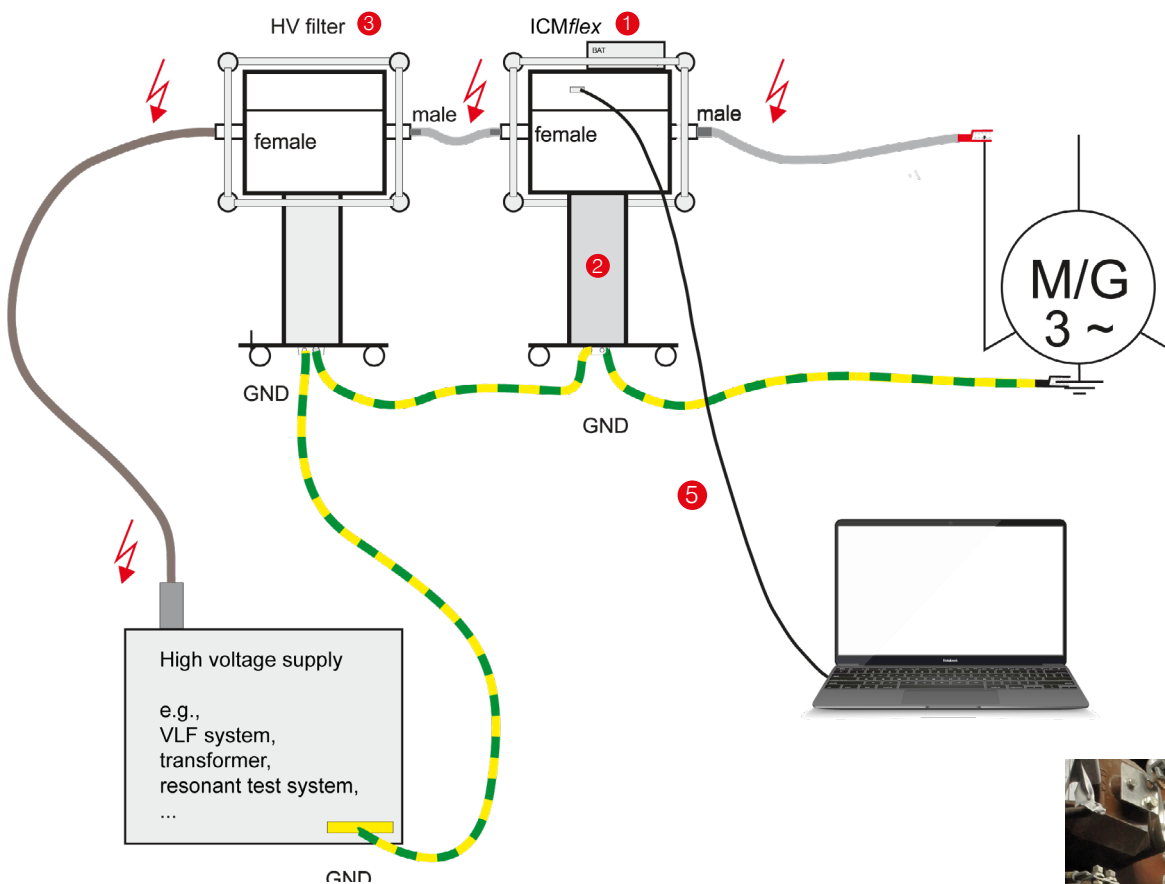
- Entire acquisition hardware on high voltage potential, hence, no signal cables needed
- Gating input (analogue and fibre optic) for noise reduction
- Fully computer controlled via Bluetooth or fibre optic cable
- Available for a many different voltage levels
- Simplification of challenging measurement tasks
- Can perform three different kind of measurements simultaneously with just one instrument: PD detection, loss factor measurement, and PD fault location
- Minimisation of testing and operation time
- High level of operator's safety
- Highest sensitivity and precision

TYPE	RATED VOLTAGE U, (RMS)	RATED CURRENT I, (RMS)	FREQUENCY RANGE f	REFERENCE CAPACITOR C _n	SHUNT CAPACITOR C _{sn}	SHUNT CAPACITOR C _{sx}
ICMflex	20 kV	1 A	2–265 Hz	1000 pF	2 μF	5 μF/30 μF
	30 kV	5 A	2–265 Hz	1000 pF	3 μF	10 μF/100 μF
	30 kV	100 mA	0.02–0.1 Hz (2–265 Hz)	1000 pF	3 μF	40 μF/400 μF
	50 kV	1 A	2–265 Hz	1000 pF	2.5 μF	10 μF/100 μF
	50 kV	100 mA	0.02–0.1 Hz (2–265 Hz)	1000 pF	4 μF	40 μF/100 μF
	100 kV	1 A	2–265 Hz	1000 pF	10 μF	10 μF/100 μF
	100 kV	100 mA	0.02–0.1 Hz (2–265 Hz)	1000 pF	10 μF	40 μF/400 μF
	150 kV	1 A	2–265 Hz	1000 pF	15 μF	10 μF/100 μF
	150 kV	100 mA	0.02–0.1 Hz (2–265 Hz)	1000 pF	15 μF	40 μF/400 μF
	20 kV to 1000 kV (*)	to be specified	2–265 Hz	to be specified	to be specified	to be specified

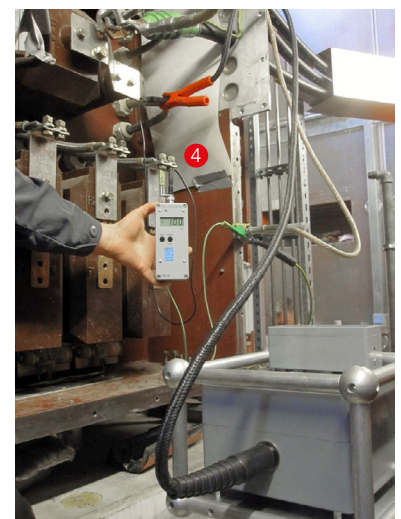
(*) Available on request

Rotating machines and single stator testing

- 1 ICMflex acquisition unit with options PD and TD
- 2 Reference capacitor
- 3 HV filter
- 4 PD calibrator
- 5 Fibre optic (FO) cable to laptop



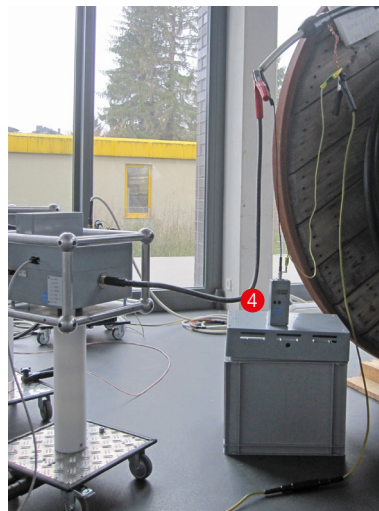
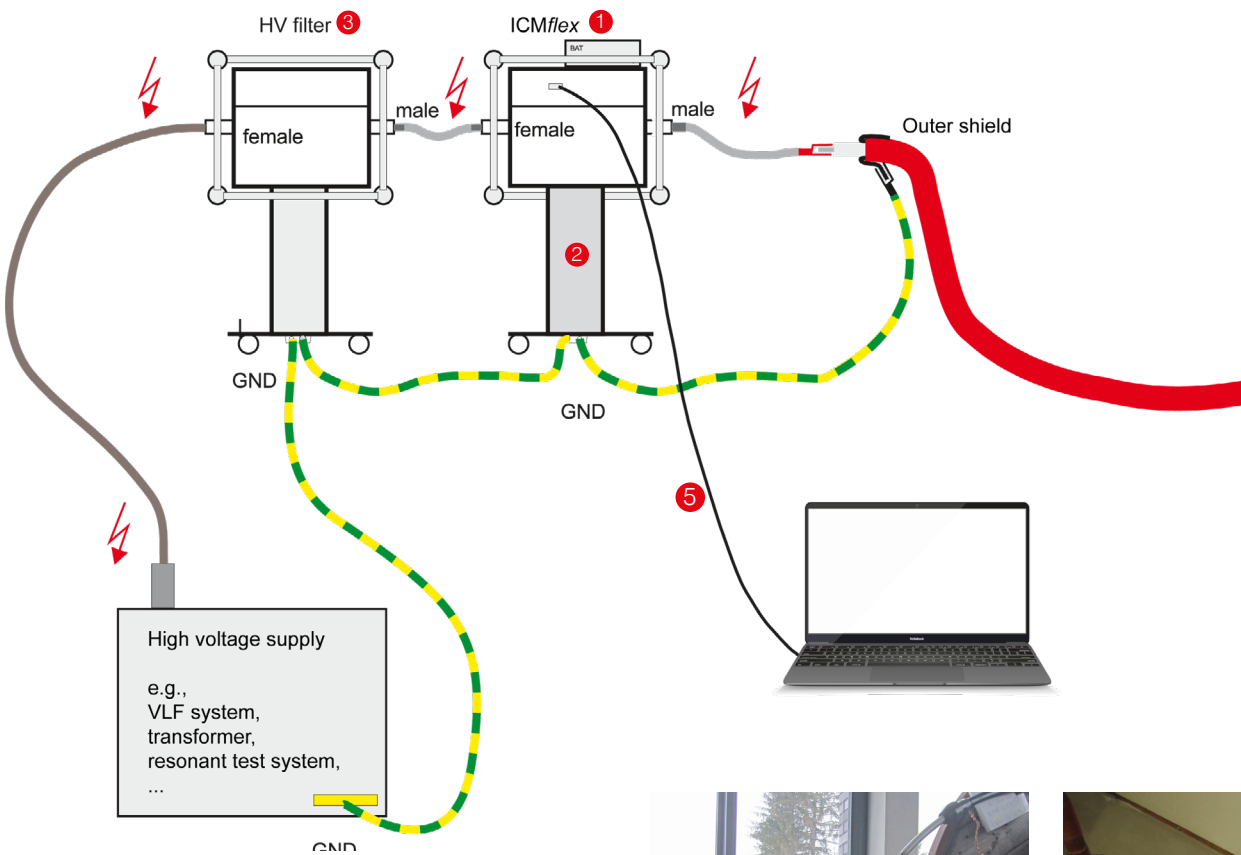
Calibration on a small asynchronous motor



Calibration on a synchronous generator

MV/HV cable testing

- 1 ICMflex acquisition unit with options PD, TD, and LOC
- 2 Reference capacitor
- 3 HV filter
- 4 PD calibrator
- 5 Fibre optic cable to laptop



Calibration on an MV cable



Calibration on a stress cone

All-in-one panel

- Three main display modes:

PD

The PD display mode is the preferred display for partial discharge measurements showing the recorded phase-resolved partial discharge pattern (PRPD) together with a comprehensive overview of all measured signals.

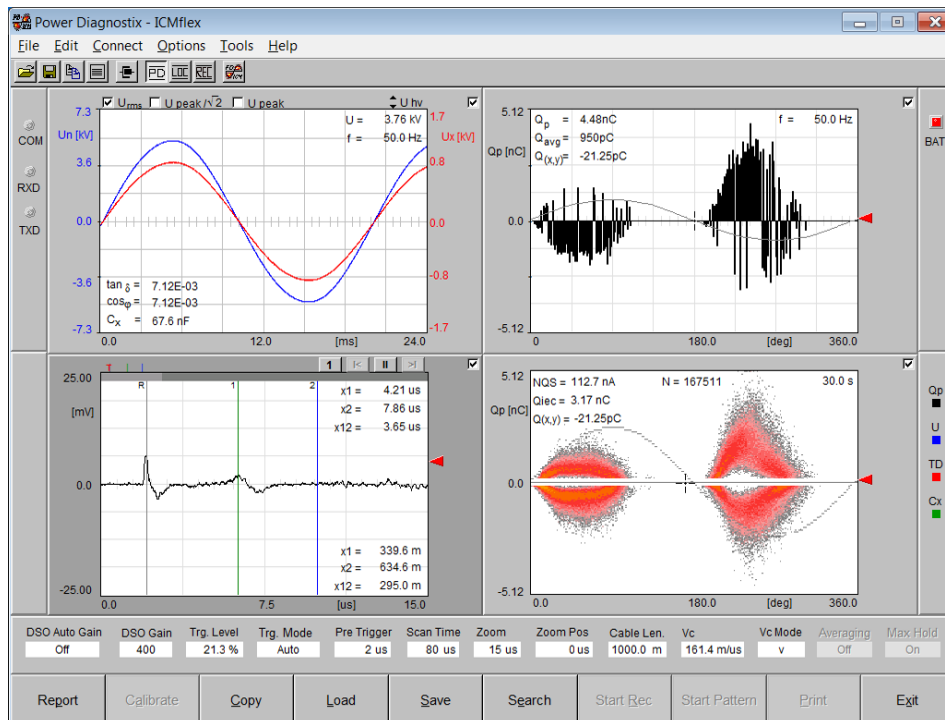
LOC

The LOC display mode is used to perform PD fault location on cables giving the currently measured time-domain signal, together with the localisation result in the top left corner.

REC

The REC display mode is typically for standardised factory acceptance and on-site test procedures, giving a comprehensive overview about the complete measured value set of the required voltage steps.

- Voltage measurement:
 - Power factor
 - Tan delta
 - Capacitance
 - Voltage
 - Frequency
- PD scope
- Time domain reflectometry (TDR) for cable fault location
- Phase resolved partial discharge pattern

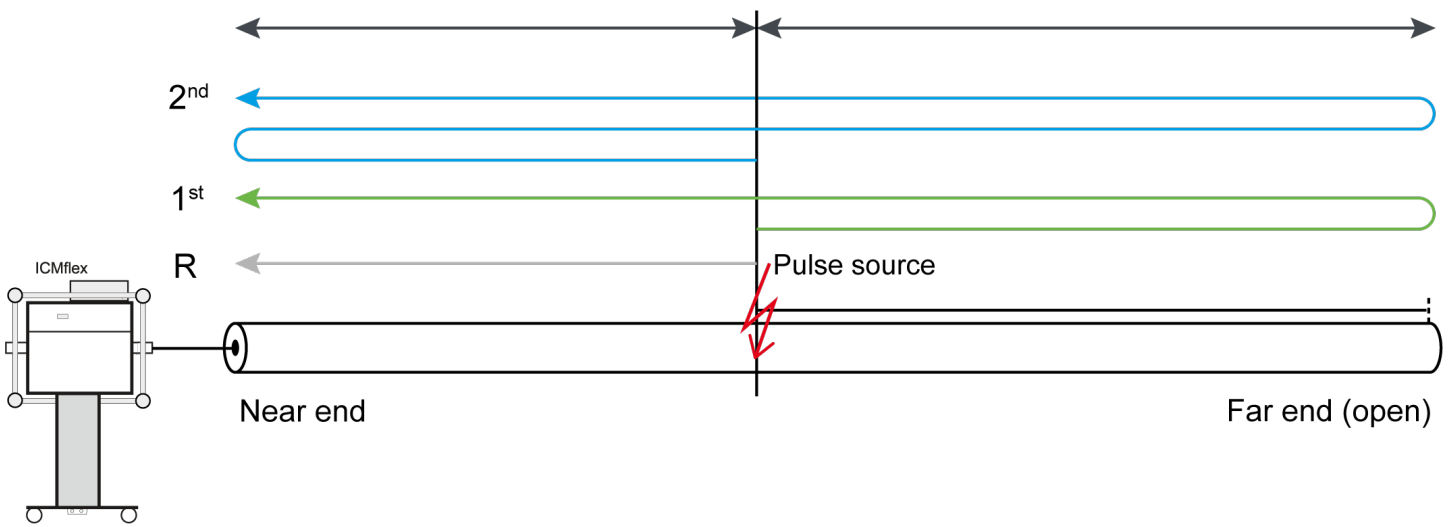


ICMflex software

Cable fault location

The ICMflex with the option for cable fault location (LOC) comes with a digital storage oscilloscope (DSO) to process PD signals on a time-based curve. Single PD pulses can be triggered with a time resolution of 10 ns (100 Msamples/s). An analogue bandwidth of 20 MHz enables precise localisation and mapping of the discharge activity along the cable.

A PD pulse that is caused by an imperfection within the insulation travels to both ends of the cable. If there is an open end, each PD pulse occurring in the cable will be reflected to the opposite end, when reaching one of the cable end terminations. The distance of the PD source to the near and/or far end of the cable can be calculated using the time difference between the arrival times of pulses at the coupling capacitor.



External gating

With the gating options of the ICMflex, it is possible to gate disturbance and VLF switching pulses. The disturbance signals which are scattered over the HV line are detected by the high frequency current transformer (HFCT) embedded in the high voltage filter. Analogue gating can then be activated in the software while in PD mode. Furthermore, an ICMflex with a gating function comes with an additional input for an FO cable, which can receive a signal on HV potential provided by a gating signal transmitter (GST1), whereas the current transformer is placed on low voltage potential.

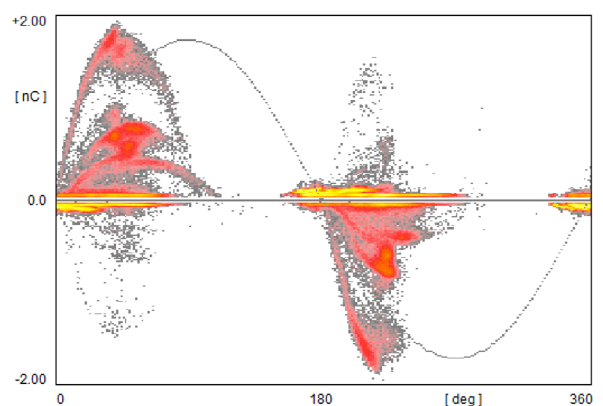
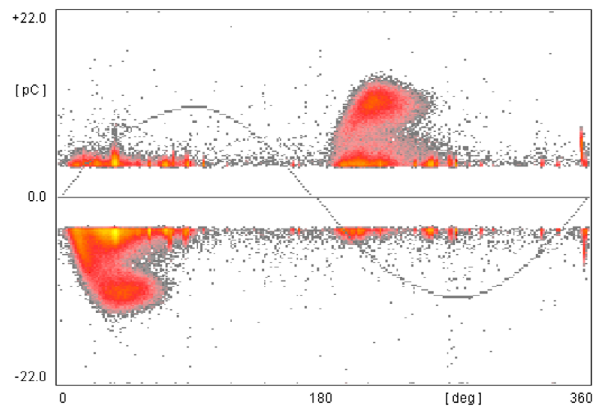
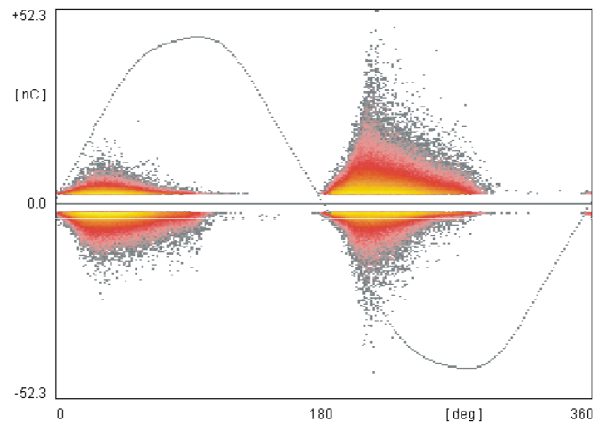


The high-resolution phase-resolved partial discharge pattern

The high frequency PD signal is used for PD pattern acquisition as well as for PD fault location on cables. The PD scope comes with an 8-bit resolution vs. phase and amplitude. The pulse counting goes up to 65536 (16 bits) per phase-amplitude position, providing 8x8x16 bits of resolution for the phase-resolved PD display, which is the best resolution compromise concerning the pattern interpretation.

Step-by-step guide

In order to simplify measurements, a step-by-step guide is implemented with the standard ICMflex software, which enables you to go through the required steps that must be fulfilled prior or during the measurement. Following this step-by-step guide, the software automatically generates a standard cable measurement report. The set of information is saved as an ICMflex file (*.flx) and is available after loading files from hard disc. It appears with exported data in .html or .xls(x) file formats.



Key features



- Mains supply: Battery operated up to 6 hours
- Operation: Remote controlled via ICMflex software
- Display modes: PD scope, PRPD (8x8x16 bits), PD fault location display, time-domain display, record display
- Voltage measurement: 16 bits, 100 kSamples
- Voltage values displayed: U_{RMS} , $\hat{U}/\sqrt{2}$, crest factor
- Frequency of the applied voltage
- Capacitance and loss factor measurement of the device under test
- PD location (TDR): 8 bits, 100 MSamples
- PD input sensitivity: $< 150 \mu V$, corresponds to 0.02 pC (with built-in preamplifier)
- TDR precision: 1 m + 0.1 % of the cable length
- Synchronisation frequency from VLF to 510 Hz
- Step-by-step test procedure
- DAkkS calibrated voltage measurement and PD calibrator
- Communication interfaces: Bluetooth (921 kBit/s) and fibre optic serial link (921 kBit/s)

Thanks to its unique design concept, the entire acquisition hardware of the ICMflex is operated on high voltage potential right at the position where the signals occur. The instrument is fully self-contained and battery operated.

Power Diagnostix Systems GmbH provides quality instruments and engineering services for high voltage diagnostic applications since early 1993.

Our digital partial discharge monitoring systems are used for evaluation of electrical insulation by electric utilities, manufacturers, and research institutes worldwide. We help utility and industrial customers to improve transmission, distribution, and substation systems reliability by implementing partial discharge monitoring that leads to optimised maintenance and investment planning based on asset condition.

Power Diagnostix manufactures its innovative measurement and monitoring devices as well as corresponding accessories (sensors, coupling units, software for data collection, analysis, and diagnostics) in Aachen, Germany. With our equipment customers benefit from over 25 years of experience in partial discharge measurements.

In June 2019, Power Diagnostix became a part of the Megger group.

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