

Partial Discharge Measuring Systems Series 9120



When quality is an issue,
the choice is Haefely Trench Tettex



I N S T R U M E N T S

General

In order to meet present and future test requirements for partial discharge measurements, Tettex Instruments has developed modular PD detectors and measuring impedances for PD measurements on high-voltage insulation by the straight detection or bridge method. The modular design of these detectors makes them suitable for combination with various displays and amplifiers according to individual measurement requirements.

The measuring system meets IEC, VDE, AEIC, IPCEA, ASTM and ANSI standard specifications.

Features

- Solution-oriented systems and instruments provide practically unlimited applications.
- Flexible modular system with application oriented amplifiers: e.g. a conventional broadband amplifier or a narrow-band amplifier (for on site measurements).
- Bridge detectors with an additional measuring impedance can also be used as fully effective straight PD detectors.
- Moving-coil and digital instrument displays provide output information for an XY-recorder on the following PD measurement values (see VDE 434 and IEC 270):
Apparent charge q
Average discharge current I
Quadratic rate D
Repetition rate n
- Highly-effective interference suppression for onsite measurements can be ensured by combination of the bridge-detector system with a narrow-band amplifier.
- Remote controllable PD measurements via RS 232C interface.

Technical Specifications

PD detectors

Inputs

- PD signal from measuring impedance or bridge, input impedance: selectable 50 Ω or 8 k Ω .
- Synchronizing signal from measuring impedance, bridge or external potential transformer.

Outputs

- Synchronous-detected PD signal for external CRO
- Calibration signal
- XY-recorder connection: (applicable to types 9124 and 9126)
linear 0...4 V DC
logarithmic 0...10 V DC
for all information displayed

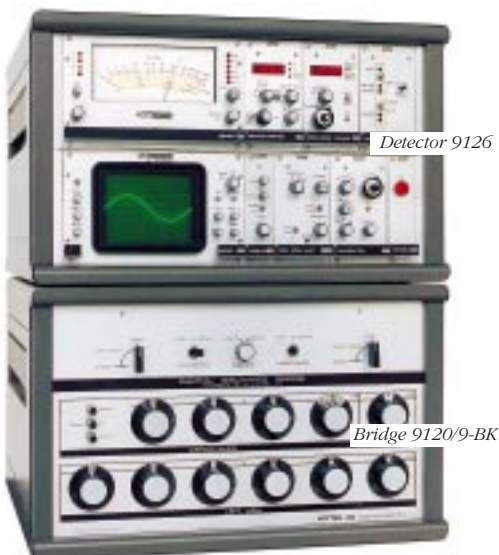
Temperature range

+ 15°C to 35°C

Power line

230/115 V
50/60 Hz, 60 VA

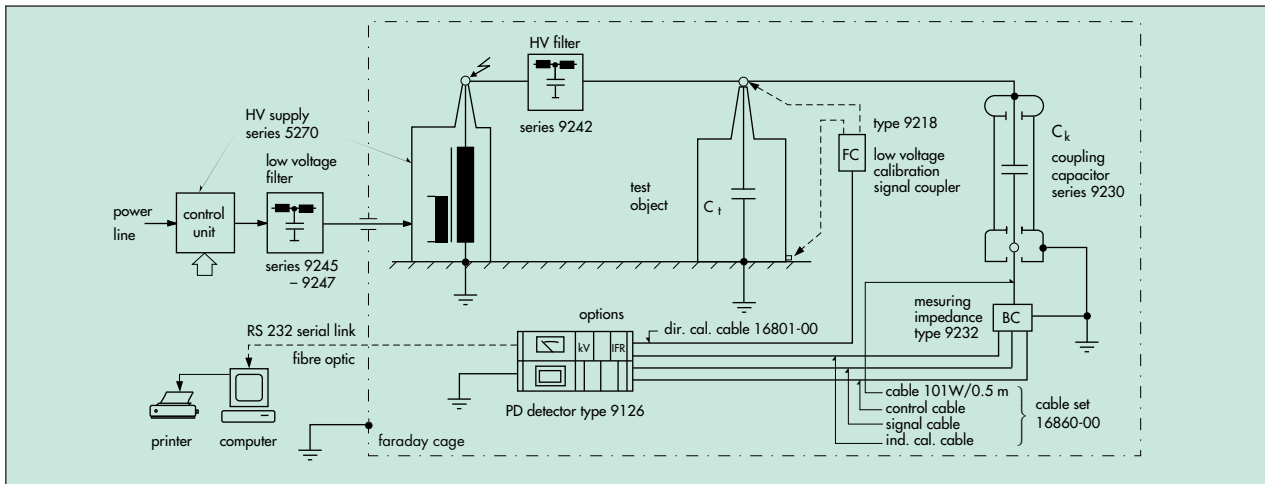
These detectors meet the protection requirements specified in VDE 0411/ Part 1a and IEC 348 (Class I protection).



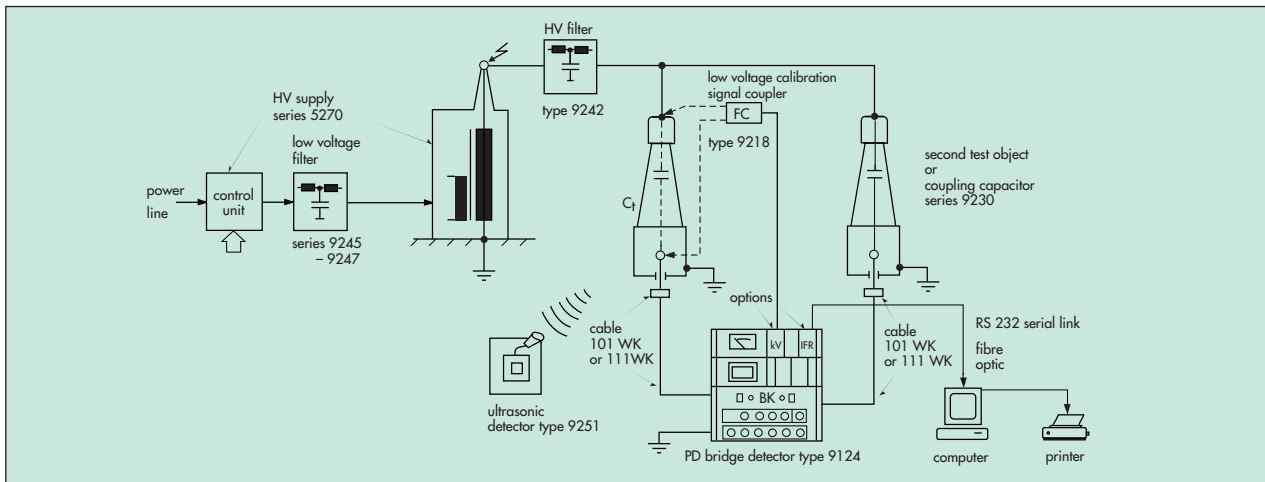
PD detectors/Basic equipment		Straight method	Bridge method
		9126	9124
9120/4-MR	Moving-coil instrument display	x	x
9120/5-SC	CRO display	x	x
9120/..*	Amplifiers	x	x
9120/6-CL	Calibrator	x	x
9120/16-TW	Time window	x	x
9120/9-BK	Brücke/Pont/Bridge		x

* application specific amplifiers

Measurement by straight method / Test set-up for grounded test objects



Measurement by bridge method / Test set-up for ungrounded test objects



PD test systems

TETTEX Instruments supply different measuring systems «tailor-made», e.g. for the following applications:

- Power and distribution transformers: see Tettex Application 514
 - Current and voltage instrument transformers
 - High-voltage cables (PD measurements and PD fault location)
 - Power capacitors: see Tettex Application 512
 - Generators: Monitoring and diagnostic
 - Low-voltage components: see Tettex Solution 114
 - Automatic PD detection and interpretation by computer
- PD test systems for special applications on request

Options

Scope for extending the system with the following plug-in units:

Kilovoltmeter

type 9120/11-KM

RS-232C interface

type 9120/33-IFR

Discharge power

type 9120/14-PW

Plug-in modules for PD detectors see separate leaflet 9120/Modules

Software applications

PD ASR optimization

9120/SWASROPT

Optimizing program for interference rejection by 9120/10-ASR narrow-band amplifier

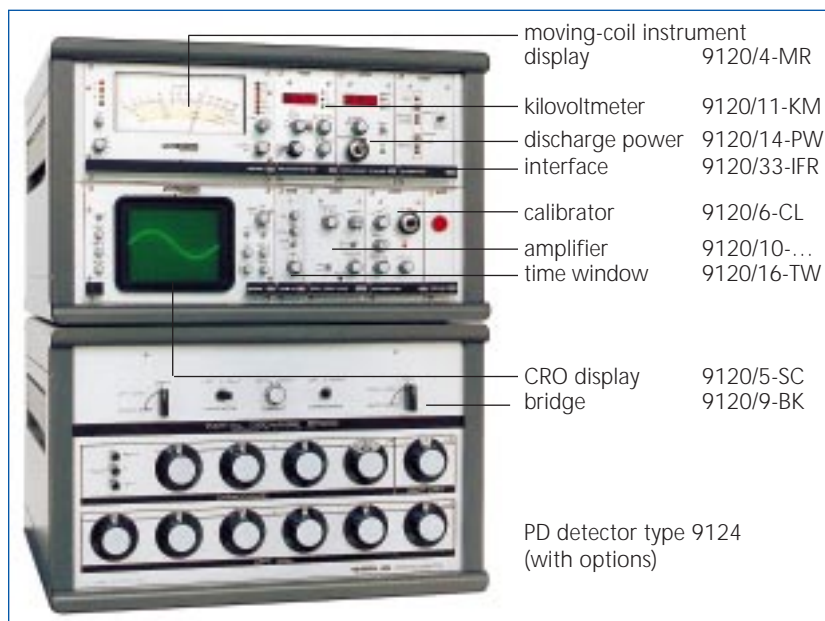
PD Laboratory tool

9120/SWPDLAB

Program for automatic measurement of PD as a function of the supply voltage

More information on request

Modules for partial discharge detector Series 9120



Conventional amplifier, remote controllable type 9120/10-AKR

For universal use. Very high sensitivity combined with the type 9232 or 9238 broadband measuring impedance (50 Ω matching).

- For manual or remote controllable sensitivity setting
- Flexible and automatic PD measurements by two channel amplifier

Deliverable in two versions

Type 9120/10-AKR standard
 Type 9120/10-AKRU acc. to ANSI/IEEE C 57.113

Input impedance

50 Ω in the frequency range 20 kHz...2 MHz or

Input impedance

8 kΩ / 30 pF (on filter position 200 kHz only)

Bandpass frequency ranges

Channel 1
 20/70 kHz...2 MHz
 Channel 2
 20...200/400/1000 kHz (type 9120/10-AKR)
 70...120/300/1000 kHz (type 9120/10-AKRU)

Remote control

via interface (IFR) type 9120/33-IFR

Bridge type 9120/9-BK

(according to Kreuger)

Conductance settings "Right"-hand bridge-arm: 0.3–1–3–10–30–100–300 mS*
 "Left"-hand bridge-arm: 6 decades from 0.001 to 300 mS*
 * (mS = milli Siemens = mmho)

Max. current 5 A

Balancing capacitance 3 decades 0...99.9 nF and one ±100 pF variable differential capacitor

Output impedance to detector 8 kΩ, automatic matching

Output Insulated current converter for system synchronization and test voltage measurement by type 9120/11-KM kilovoltmeter

Input Connection for indirect calibration. Passive and electronic overvoltage and overcurrent protection

Dimensions W 500 x H 322 x D 470 mm (19.7 x 12.6 x 18.5 in)

Weight ≈ 24 kg (≈ 53 lb)

Broadband measuring impedance type 9232

Matching between PC detector and coupling capacitor:

Input impedance 200 Ω

Max input current 3 A

Output impedance 50 Ω

Frequency range

45 Hz...450 Hz
 30 kHz...2 MHz/6dB

Dimension (WxHxD)

190x195x170 mm
 (7.7x7.7x6.7 in)

Weight

3 kg (6.6 lb)



9232



9120/10-AKR



9120/5-SC

Narrow band amplifier, remote controllable type 9120/10-ASR

For on-site PD measurement or in high interference environments (e.g. transformers, generators).

Very high sensitivity combined with the type 9232 or 9238 broadband measuring impedance (50 Ω - matching).

Manual or remote controllable frequency setting

Adjustable center frequency range of the bandpass filter

20 kHz...2 MHz
(with 50 Ω input impedance)

Selectable bandwidths

4/9/30 kHz

Input impedance

50 Ω or 8 k Ω switch-selected

Remote control

via interface (IFR)
type 9120/33-IFR

CRO display type 9120/5-SC

Information displayed:

PD pulse and/or zero-axis crossing marker
Adjustable brightness of PD pulses

PD display

On ellipse:

adjustable opening, phase setting independent of frequency, 0...270° adjustment in 45...450 Hz frequency range.

On sine curve:

one period, adjustable amplitude
Separate pulse amplitude adjustment

CRT

Flat screen, green face with internal graticule;
display 10 cm (W) x 8 cm (H)

Moving-coil instrument display type 9120/4-MR

Information displayed

Apparent charge q (pC)
Average discharge current I (μ A)
Quadratic rate D (nC²/s)
Repetition rate n (Hz)

PD display

By moving-coil instrument, 120 mm scale, logarithmic scale divisions from 1...1000

Error limits

\pm 10% between 20 and 700 scale divisions

Discharge time

adjustable from 1...10 s

PD ranges

0.01–0.1–1–10–100 x
scale reading (pC)

Current

ranges 0.1–1–10–100–1000
x scale reading (μ A)

Quadratic rate ranges

1–10²–10⁴–10⁶ (nC²/s)

Repetition rate range

100 Hz... 100 kHz

Time window type 9120/16-TW

Selected windowing of interference pulses by two symmetrical time windows

The phase position referred to the test voltage is adjustable
Synchronization of CRO display and calibration signal

Frequency range

45...450 Hz

Width of window

adjustable 0...165°

Window position

adjustable 0...305°

Mode of display

Direct impulse display (NORM)
Impulse stretching (STR)

Calibrator type 9120/6-CL

Functions

Direct calibration via low-voltage calibration signal coupler (type 9218) acc. to IEC 270, VDE 0434/05.83, DIN 57434 and IEEE 454 specifications.

Indirect calibration via measuring impedance (type 9232, 9236 etc.) or bridge (type 9120/9-BK) as per ASTM D 1868-81 specification.

PD calibration

Ranges 10–100–1000 pC
Range adjustment
10%...100% of range

PD current calibration

5 μ A correspond to 1000 pC,
Repetition frequency 5 kHz

Calibration pulses

Alternating positive and negative.
Automatic synchronization of calibration pulse with measuring voltage between 45 Hz and 450 Hz frequency.

Calibration pulse phase angle

adjustable between 0°...315°

Rise time < 100 ns

Pulse width > 20 μ s

Fall time \approx 500 μ s

Additional plug-in modules (optional)

E.g. Discharge power unit
9120/14-PW see separate data sheets.



9120/10-ASR



9120/4-MR



9120/16-TW



9120/6-CL

RS 232C interface type 9120/33-IFR

Option for types 9126 and 9124 PD detectors.

The IFR converts the measured values (pC), (kV) and (W) in a digital form and transmits serial data to a computer or printer. Used also for remote control of the amplifiers AKR, AKRU, ARS and AR.

Operating mode:

Printer connection

Remote control by connection to a computer

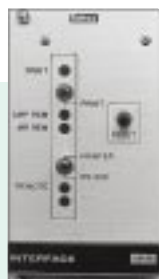
In digital form transmitted measuring quantity

Apparent charge q	in (pC)
Average discharge current I	in (µA)
Quadratic range D	in (nC ² /s)
Repetition rate n	in (Hz)
Voltage U (U _{peak} /√2) or (RMS)	in (kV)
Discharge power P	in (W)
Calibration values settings q	in (pC),
I	in (µA)

Specifications

Full duplex
Format 8 bit, 1 stopbit
Baud rate

Computer output
selectable 300...9600 Bd
Printer output 2400 Bd



9120/33-IFR



9120/11-KM

Kilovoltmeter type 9120/11-KM

Option for types 9126 and 9124 PD detectors.

The KM processes the H.V. signal coming from an external circuit (capacitive divider or current/voltage converter)

Measurement of RMS or peak/√2 voltage

Measuring ranges

1–10–100–1000 kV

Display

red LED, 3½ digit, 7 mm high

Error limits

± 2% of range

Frequency range 45...450 Hz

Low-voltage calibration signal coupler (FC) type 9218

For galvanically separated coupling of the calibration signal to the test sample in direct calibration.

Input impedance

50 Ω

Calibration pulse

max. 1000 pC
(corresponding to U = 7.07 V coupled via C=141 pF)

Dimensions

W 145 x L 65 x H 35 mm
(15.7 x 2.6 x 1.4 in)

Weight

0.2 kg (0.44 lb)



9218



9219

Self-test adapter type 9219

Intended for all Tettex PD detector types, to check the functionality of the modules, i.e. calibrator, amplifier, meter display, scope, time window.

The self-test adapter is connected on the back of the detector between the direct calibrator output and the signal input.

Dimensions

W 37 x H 30 x L 500 mm
(1.5 x 1.2 x 19.7 in)

Weight

0.3 kg (0.66 lb)

External calibrator (CE) type 9216

Battery-powered calibrator. For direct coupling of the calibration signal to the test object acc. to IEC 270, VDE 0434/05.83, DIN 57434 und IEEE 454.

Battery IEC 6F 22

Battery voltage 9 V

Calibration

pulse ranges 10–102–103–104 pC

Light synchronization

Dimensions

W 67 x L 110 x H 42 mm
(2.6 x 4.3 x 1.7 in)

Weight

0,2 kg (0.44 lb)



9216

Compact Partial Discharge Detector Type 9132

General

The portable compact partial discharge detector type 9132 is a economical version of the 9120 PD detector family which has proved successful over a number of years.



The main applications of this PD detector are routine measurements to determine the value of the PD signal at a particular voltage or to measure the initiation voltage of this PD.

The PD detector is supplied as a complete system with measuring impedance, external calibrator and cable set.

This simplified version is especially suitable for flexible use both in the laboratory and in-situ. On the other hand the detector can be used as a reserve measuring device with an already available measuring impedance.

This measuring system complies with standards and recommendations IEC 270, VDE 0432, IEEE 454, IPCEA S-68-516 / NEMA WC8-1976.

Features

- A compact, low cost PD measuring system
- Extremely well suited for routine measurements
- Very simple to operate
- Direct read-out of PD measurement values apparent charge q (pc) and repetition rate n (Hz)
- Remote controllable amplifier
- Inputs with overvoltage protection

Options

- Narrow-band amplifier with adjustable centre frequency and band-width, remote controllable
- Interface RS-232C (V24)

Technical data

PD detector type 9132
(with amplifier type 9120/10-AKR)

Inputs

PD signal from measuring impedance

Input impedance 50 Ω /8 kW, switchable

Outputs

Amplifier output impedance 50 Ω (standard value)

Broadband output impedance 50 Ω

DC voltage proportional to the measuring value:

linear 0...4 V

logarithmic 0...10 V

RS 232C interface, connector 25 pole, female

Power line

230/115 V,

50/60 Hz, 23 VA

Temperature range

+ 5...40°C

Dimensions

(W x H x D):

type 9132

420 x 190 x 440 mm

(16.5 x 7.5 x 17.3 in)

type 9132 R

482 x 134 x 435 mm

(19 x 5.3 x 17.2 in)

Weight

type 9132

10.5 kg (23.1 lb)

type 9132R

7.5 kg (16.5 lb)

Reference conditions and rated range of use acc. to IEC 359 requirements (class I)

This instrument meets the protection requirements specified in VDE 0411/part 1a and IEC 348 (class I protection)

Specifications of the detector modules

Types 9120/4-MR, 9120/10-AKR (or AKRU), 9120/10-ASR, 9120/33-IFR and external calibrator 9216 see technical leaflet 9120/modules.

Broadband measuring impedance type 9231

Matching unit between PD detector and coupling capacitor:

Input impedance 200 Ω

Max. input current 1 A

Output impedance 50 Ω

Frequency range

20 kHz...2 MHz/6 dB

Dimension (W x H x D)

175 x 125 x 145 mm

(6.9 x 4.9 x 5.7 in)

Weight

1.3 kg (2.9 lb)

