

Spectrum Analyzer, Partial Discharge Detector, and RIV Meter Model PD3U



Testing Applications

- Condition evaluation of insulation systems
- Quality assurance testing in manufacturing plants
- Routine testing in a variety of applications

Partial Discharge Measuring

The model PD3U comprises a Spectrum Analyzer, a PD detector, and a RIV meter in one instrument. This combination enables PD measurements even with a large background noise, such as in non-shielded test areas. Observing the frequency spectrum of a significantly noisy PD signal allows the user to select frequency bands with less disturbance resulting in a clearer pattern acquisition.

In RIV mode, the instrument has bandwidth of 9 kHz and 270 kHz. When utilizing either the CAL3B or CAL3D calibrator, the range is 400 kHz – 1900 kHz in steps of 100 kHz. Technically, the 4 Channel unit in RIV mode, is a selective μ V-meter according to the CISPR weighing curve whereas the repetition rate has a strong impact on the reading.

Measurements are according to IEC 60270-2000, IEEE C57.12.90, and RIV measurements are according to NEMA/CISPR regulations and other relevant standards.

- **Compact** design
- **Easy to use**
- **Precise** results
- **Stand-alone** or **computer** operated
- **Frequency spectrum analysis**
- **4-channel** measurement capability
- **Center frequency** is adjustable from **10 kHz – 10 MHz in 10 kHz steps**



Spec Mode

Shows the frequency spectrum of the input signal with a selectable span of up to 10 MHz. Three spectrum traces of the current input channel can be stored, compared, and analyzed. A variable cursor serves to set the center frequency for acquisition of the PD pattern.

Scope Mode

Displays the PD pattern versus phase. The SYNC frequency ranges from 10 to 500 Hz. The PD activity can be shown as vertical bars or as dots.

Meter Mode

Displays PD activity similar to analog metering. Three modes are available for the charge value in pC (FAST, NORM, IEC270) and one for the voltage value in μV (RIV).

HVM Mode

Used to observe the measured voltage waveform. The High Voltage Meter (HVM) shows the voltage supplied at the SYNC input. The input voltage is sampled in high resolution and one cycle is displayed as an oscilloscope trace. Any distortion of the high voltage is identified. The screen is automatically synchronized with the measured voltage and the amplitude deflection is controlled by an auto-range function.

Desktop Acquisition and Display Unit

- Spectrum, Scope and Meter display
- Selectable bandwidth 9 kHz and 270 kHz
- Center frequency is adjustable from 10 kHz – 10 MHz in 10 kHz steps
- MUX4 Multiplexer 4-channel measurement
- Internal (line 50/60 Hz) and external synchronization (10-500 Hz)
- Auto-range function
- Backlit LCD 240 x 128 dots
- RIV and PD calibration
- RIV reference input
- Automatic storage of current settings
- Universal serial interface (USB, up to 921 kB)
- AMP IN and REF IN connector
- REC OUT
- **Built-in Voltage Measurement**
Measures the voltages at the external sync input terminal
Display of peak; peak/ $\sqrt{2}$, and RMS value
Input range 100 Vrms
Input impedance: 1 M Ω
- **Built-in TTL Gating**
Triggered Noise Cancellation
Software controlled gating from a signal connected to an auxiliary input
Gating threshold may be set manually or automatically
Includes the built-in logarithmic preamplifier RPA6

Specifications

Acquisition Unit

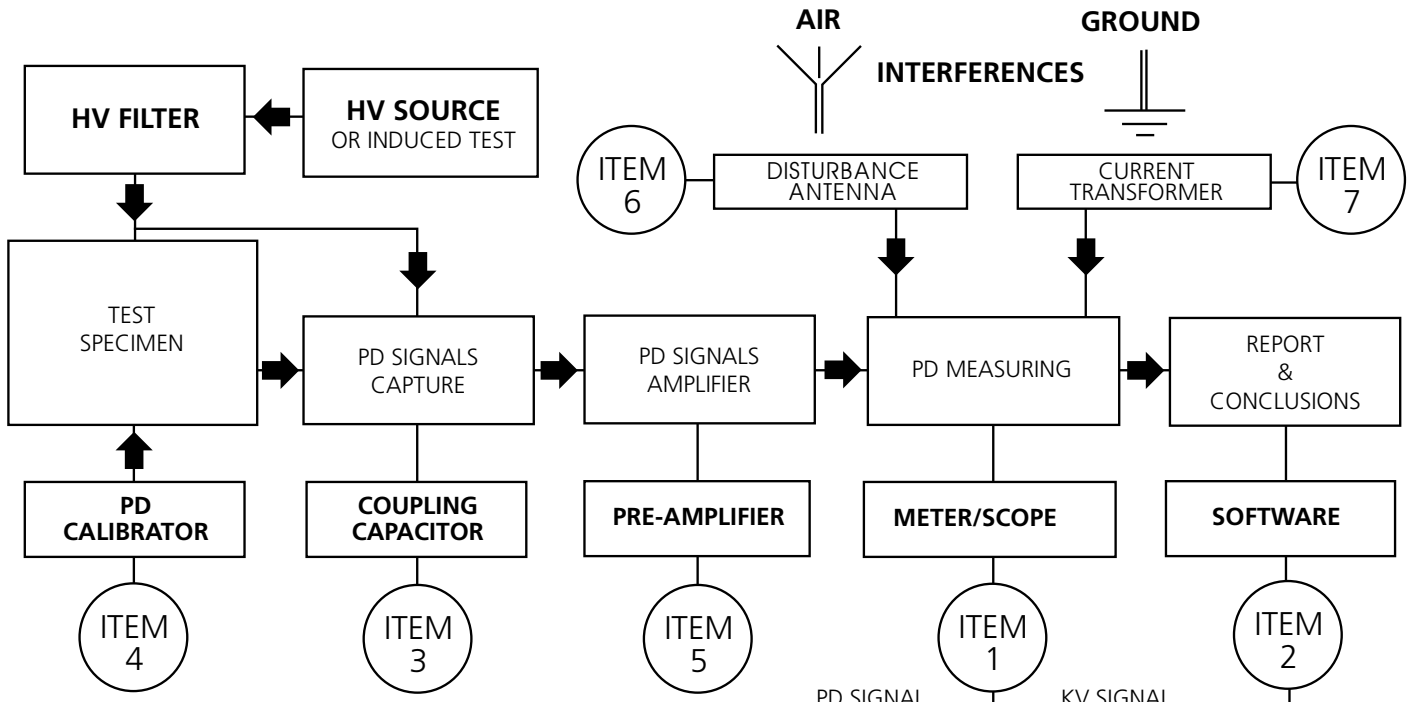
Input	100-240 VAC, 50/60 Hz
Power	25 VA
Temperature Range	10°C – 40°C
Dimensions	9 3/8" (236 mm) W
	11 1/2" (295 mm) D
	5 1/4" (133 mm) H
Weight	7 lbs. (3 kgs)

Reference Voltage Input

Input Impedance	100 M Ω / 200 pF
Input Voltage	Max. 120 V (rms)
Frequency	10-500 Hz

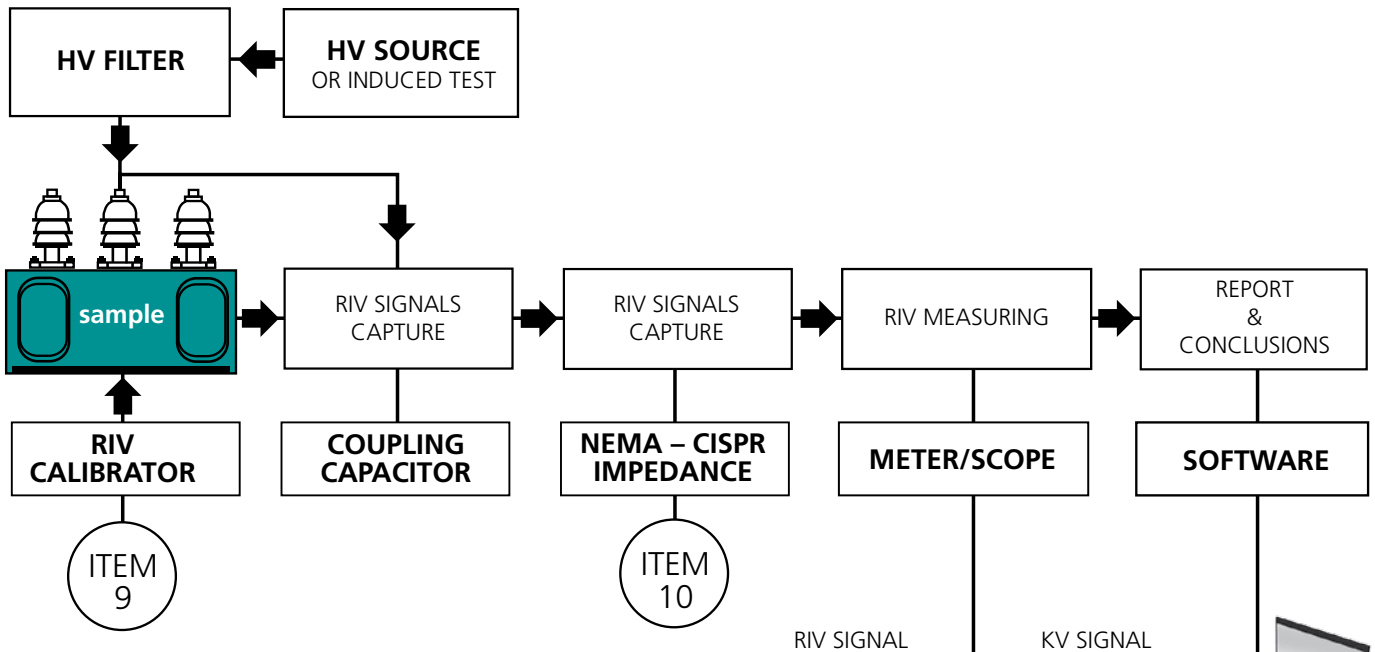
Partial Discharge Signals

Coupling	AC
Input Impedance	50 Ω (without RPA)



ITEMS REQUIRED for PD APPLICATIONS

- (1) Measuring Unit
- (2) Software --> Control and Report (optional)
- (3) Coupling Capacitor/Quadrupole/Voltage Divider (one required for each channel)
- (4) Calibrator Unit --> for PD Measurement
- (5) Preamplifier (one required for each channel)
- (6) Disturbance Antenna
- (7) High Frequency Current Transformer
- (8) RG58 Cables --> for the connection between the instrument and the impedance



ADDITIONAL ACCESSORIES REQUIRED for RIV MEASUREMENTS

- (9) Calibrator Unit --> for RIV Measurement
- (10) RIV Quadrupole --> Measuring Impedance for RIV NEMA-CISPR





Frequency Range: 40-800 kHz
Input Impedance: 10 kΩ/50 pF
Input Sensitivity: <200 μV
Roll-Off: 40 dB/dec
Bipolar

Description

RPA1 Preamplifiers (one required for each channel)

Remote power supplied and controlled preamp
 With 50 Ω line driver $Z_1=1\text{ k}\Omega\parallel 50\text{ pF}$
 Broadband version 40 kHz - 20 MHz

The RPA1 is the standard preamplifier for measurements in the low frequency range according to standards such as IEC60270. Preamplifiers serve to condition, filter, and amplify the partial discharge signal to be measured. Because the frequency range in which PD signals are measured is strongly dependent on the preamplifier used, proper selection of a preamplifier is an important part of noise mitigation and can have a strong effect on the appearance of the partial discharge pattern itself.

Quadrupoles (one required for each channel)

A quadrupole (sometimes called a measuring impedance) can be placed in series with either the coupling capacitor or in series with the test object. Some quadrupoles also output a low-voltage copy of the applied high-voltage wave for synchronizing with the PD detector.

The **CIL/V quadrupoles** contain a capacitor acting as a voltage divider together with the high voltage coupling capacitor. This provides a low-voltage copy of the applied high voltage wave that can be used through a HST to synchronize the PD detector and monitor the quality of the applied high-voltage wave.

The **CIT quadrupoles** are transformer type units, where a preamplifier's input resistance serves as the required damping resistor. CIT units offer a higher sensitivity than the CIL coupling units. Furthermore, CIT units are available for bridged configurations to connect to two similar test objects.



Model	Range
CIL4M/V1μ0	Designed for up to 100 kV, 1 nF Capacitor Range, 400 mA max
CIL4M/V2μ0	Designed for up to 200 kV, 1 nF Capacitor Range, 400 mA max
CIL4M/V3μ5	Designed for up to 350 kV, 1 nF Capacitor Range, 400 mA max
CIL4M/V4μ0	Designed for up to 400 kV, 1 nF Capacitor Range, 400 mA max

*Other quadrupoles are available

CAL-4U Universal Partial Discharge Calibrator

A calibrator (calibration charge injector) is suitable for use in calibrating partial discharge measurements.



Applicable Standards	IEC 60270:2000, ICEA T-24-380-2000	
PD Output Values	1, 2, 5, 10, 20, 50, 100, 200, 500, 1000, 2000, 5000 or 10000 pC (selectable through rotary knob)	
Polarity	either positive or negative (selectable through pushbutton)	
PD Output Charge Tolerance	< ±3%	
Pulse Step Time	< 60 ns	
Injection Capacitance Values	±1 – 100 pC:	$C_i \approx 0.7 \text{ pF}$
	±200 – 1000 pC:	$C_i \approx 7.5 \text{ pF}$
	±2000 – 10000 pC:	$C_i \approx 76 \text{ pF}$
Operation Modes	single or double pulse (only single pulse output with external charge injection capacitor mode)	
Double Pulse Time Interval	1 – 120 μs (selectable in CAL-4U menu)	
Double Pulse Polarity	either positive or negative (selectable through pushbutton)	
Synchronization	Internal or light synchronization (15 – 300 Hz)	
Internal Synchronization Frequencies	50 Hz or 60 Hz (selectable in CAL-4U menu)	
PD Range for External C_i Mode	±1 pC – 10 nC (depends on value of external charge injection capacitor C_i). Examples: for $C_i = 1 \text{ pF}$: 1 – 100 pC for $C_i = 10 \text{ pF}$: 10 – 1000 pC for $C_i = 100 \text{ pF}$: 100 – 10000 pC	
Power	USB or two LR6 (size AA) 1.5V non-rechargeable batteries	
USB Connector Type	'Mini B'	
CAL-4U Output Connector	BNC	
Remote Control Feature	CAL-4U can be fully controlled through USB using the (optional) Phenix PD-CAL software	
Dimensions (W x L x H)	4.65" x 6.3" x 1.46" (118 mm x 160 mm x 37 mm)	
Weight	1.2 lbs (0.545 kgs)	



CT1 Current Transformer

1:10 @ 50 Ω , d=15 mm, 500 kHz - 80 MHz

When a current transformer is used instead of a quadrupole, the current transformer can be placed around a coupling capacitor terminal or around a part of the test object itself. A current transformer has the advantage of providing galvanic isolation between the PD detector and the high voltage circuit. Current transformers are offered as separate modules or integrated with a coupling capacitor into a single unit.



DA1 Disturbance Antenna

The disturbance antenna can be used to pick-up noise signals caused by local corona discharge, or AM radio waves for instance. Its magnetic holder allows a flexible placement on a transformer tank or to other metallic parts close to the object under test. The output signal can be used to trigger the gate input circuit of all PD acquisition or monitoring devices.



Connecting Cables

A full set of high quality RG58 cables with BNC connectors is supplied (20 m) (custom length is available upon request).

- Quadropole Connection Set
- Calibrator Connections
- Power Lead

Options

- **Rack Mounting Kit**
19", 3RU for mounting into a control console
- **PD3U Software**
Standard Data Acquisition & Control Package
Virtual Instrument to remote control the PD3U and to record data vs. time and vs. voltage
3-D Phase Resolved PD Pattern Acquisition, including ActiveX driver
Supports fast USB communication
12 month free software updates via Web Site
- **Active-X Driver** (Access to the Com port for use with PHENIX software or 3rd party software)

Accessories for Additional RIV Measurements

- **RIV Quadropole Model CIT4M/v2u0/RIV**
(1 required per channel)

Measuring Impedance for PD, RIV NEMA and CISPR use

Built-in voltage divider
Coupling isolation transformer
Ck: 600 pF to 2.5 nF
I_{max} ≤ 800 mA
C_d = 2 uF (U_{max} 100 V_{rms})
Switchable (150 Ω / 300 Ω)

- **RIV Calibrator**

Model	CAL3B	CAL3D
Frequency	400 kHz to 1.9 MHz	400 kHz to 1.9 MHz
Range	10 μV to 10 mV	10 μV to 10 mV (into 300 Ω)
Injection Capacitance	V (50 Ω)	V (>20 KΩ)
Use	NEMA 107 compliant	CISPR 18-2 compliant

Additional Specs: 50 Hz or 60 Hz light synchronization, BNC connection

Partial Discharge Free Coupling Capacitors

- Model CC25-1, 25 kV, 1 nF, 50-400 Hz with base
- Model CC50-1, 50 kV, 1 nF, 50-400 Hz with base
- Model CC100-1, 100 kV, 1 nF, 50-400 Hz with base
- Model CC200-1, 200 kV, 1 nF, 50-60 Hz with base and casters
- Model CC300-1, 300 kV, 1 nF, 50-60 Hz with base and casters
- Model CC400-1, 400 kV, 1 nF, 50-60 Hz with base and casters
- Model CC500-1, 500 kV, 1 nF, 50-60 Hz with base and casters
- Model CC600-1, 600 kV, 1 nF, 50-60 Hz with base and casters

Partial Discharge Free Injection Capacitors

- Model IC100-0.1, 100 kV, 100 pF, 50-400 Hz with base
- Model IC200-0.1, 200 kV, 100 pF, 50-60 Hz with base and casters
- Model IC300-0.1, 300 kV, 100 pF, 50-60 Hz with base and casters
- Model IC400-0.1, 400 kV, 100 pF, 50-60 Hz with base and casters
- Model IC500-0.1, 500 kV, 100 pF, 50-60 Hz with base and casters

NOTE:

- Injection capacitors require CAL1C PD Calibrator
- Multiple channel PD systems require multiple capacitors
- 400 Hz operation available only up to 200 kV on both Coupling and Injection Capacitors



Model CC100-1



Model IC100-0.1



PHENIX Technologies is committed to providing leadership, innovation, technology, quality, and service in all areas of our business.

Our 85,000 square-foot headquarters is a modern manufacturing facility. All aspects of electrical, mechanical, and software design and production are performed in this facility. Our engineers offer a unique blend of theoretical knowledge and practical experience. Our Service and Calibration Department assists customers during and after installation to ensure years of trouble free service.

We carry our commitment into the future as we proudly continue to provide the best in **high voltage, high current, high power test systems and components.**



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