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 µV-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.
**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.

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### 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/√2, and RMS value
- Input range 100 Vrms
- Input impedance: 1 MΩ

### 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

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### SPECIFICATIONS

#### Acquisition Unit

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input</td>
<td>100-240 VAC, 50/60 Hz</td>
</tr>
<tr>
<td>Power</td>
<td>25 VA</td>
</tr>
<tr>
<td>Temperature Range</td>
<td>10°C – 40°C</td>
</tr>
<tr>
<td>Dimensions</td>
<td>9¾” (236 mm) W</td>
</tr>
<tr>
<td></td>
<td>11½” (295 mm) D</td>
</tr>
<tr>
<td></td>
<td>5¼” (133 mm) H</td>
</tr>
<tr>
<td>Weight</td>
<td>7 lbs. (3 kgs)</td>
</tr>
</tbody>
</table>

#### Reference Voltage Input

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Impedance</td>
<td>100 MΩ / 200 pF</td>
</tr>
<tr>
<td>Input Voltage</td>
<td>Max. 120 V (rms)</td>
</tr>
<tr>
<td>Frequency</td>
<td>10-500 Hz</td>
</tr>
</tbody>
</table>

#### Partial Discharge Signals

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coupling</td>
<td>AC</td>
</tr>
<tr>
<td>Input Impedance</td>
<td>50 Ω (without RPA)</td>
</tr>
</tbody>
</table>
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
### 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.

<table>
<thead>
<tr>
<th>Model</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIL4M/V1µ0</td>
<td>Designed for up to 100 kV, 1 nF Capacitor Range, 400 mA max</td>
</tr>
<tr>
<td>CIL4M/V2µ0</td>
<td>Designed for up to 200 kV, 1 nF Capacitor Range, 400 mA max</td>
</tr>
<tr>
<td>CIL4M/V3µ5</td>
<td>Designed for up to 350 kV, 1 nF Capacitor Range, 400 mA max</td>
</tr>
<tr>
<td>CIL4M/V4µ0</td>
<td>Designed for up to 400 kV, 1 nF Capacitor Range, 400 mA max</td>
</tr>
</tbody>
</table>

*Other quadrupoles are available

### RPA1 Preamplifiers (one required for each channel)

Remote power supplied and controlled preamp
With 50 Ω line driver \( Z_{in}=1 \, kΩ \ || 50 \, pF \)
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.
A calibrator (calibration charge injector) is suitable for use in calibrating partial discharge measurements. The appropriate choice of a calibration instrument depends on the range of typical charge values of the test instruments PDs being measured.

### Model Range Use

<table>
<thead>
<tr>
<th>Model</th>
<th>Range</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAL1A</td>
<td>1,2,5,10,20,50,100 pC</td>
<td>Standard lab use</td>
</tr>
<tr>
<td>CAL1B</td>
<td>100,200,500 pC, 1,2,5,10 nC</td>
<td>High output, mainly suitable for rotating machine testing and recommended for transformer testing</td>
</tr>
<tr>
<td>CAL1C</td>
<td>1,2,5,10,20,50,100 pC at 100 pF with external high voltage capacitor</td>
<td>Can be used with HV injection Capacitor</td>
</tr>
<tr>
<td>CAL1D</td>
<td>10,20,50,100,200,500,1000 pC</td>
<td>Transformer Testing</td>
</tr>
</tbody>
</table>

Additional Specs: 50 Hz or 60 Hz light synchronization, IEC60270 compliant, 2 pulses/cycle option, BNC connection.

Calibrators include a DKD calibration certificate to ensure the traceability to international standards.

### 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).

- Quadrupole Connection Set
- Calibrator Connections
- Power Lead

ACCESSORIES for Additional RIV Measurements

- **RIV Quadrupole 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
  Imax ≤800 mA
  Cd = 2 uf (Umax 100 Vrms)
  Switchable (150 Ω / 300 Ω)

- **RIV Calibrator**

<table>
<thead>
<tr>
<th>Model</th>
<th>Range</th>
<th>Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAL3B</td>
<td>400 kHz to 1.9 MHz, 10 μV to 10 mV V (50 Ω)</td>
<td>NEMA 107 compliant</td>
</tr>
<tr>
<td>CAL3D</td>
<td>400 kHz to 1.9 MHz, 10 μV to 10 mV (into 300 Ω) V (&gt;20 kΩ)</td>
<td>CISPR 18-2 compliant</td>
</tr>
</tbody>
</table>

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

Our 80,000 square-foot headquarters is a modern manufacturing facility. All aspects of electrical, mechanical, and software design and production are performed in this facility and controlled by an ISO9001 certified quality program. 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.