Mütek™ PCD-04
Particle Charge Detector
Standard / Travel

**BENEFITS**
- Easy to handle
- Transportable
- Reliable also at high conductivity
- Travel: Titration module
- Travel: Disposable cartridges with Mütek standard poly-electrolyte solutions

**FEATURES**
- Detects anionic trash sources
- Monitors cationic demand
- Checks charge demand of additives
- Identifies charge level
- Determines iso-electric point (IEP)
- mV- and μeq/l-display, optional pH-display

**GENERAL**
The Mütek™ PCD-04 Particle Charge Detector measures the colloidally dissolved substances in an aqueous sample. In the paper industry, the PCD is a standard tool for detecting anionic trash levels but also for characterizing chemical additives. It is the most widespread streaming current detector worldwide which is also due to its capability of charge measurements at high conductivity.

Identification of charge levels is not only very important for the paper industry but also for numerous alternative applications like waste water treatment, beverage and food industry, ceramics, colors and pharmaceuticals.

The Mütek™ PCD-04 Travel is a true stand-alone lab unit and perfectly suited for the frequent traveler and the newcomer to charge measurement as it offers a built-in titration module. Cartridges with Mütek™ standard poly-electrolyte solutions and a special titration algorithm make lab life easy and guarantee reproducible results.

Optionally, the Mütek™ PCD-04 and PCD-04 Travel can be equipped with a pH-electrode.

**SYSTEM REQUIREMENTS**
The instrument is intended for indoor use at temperatures in the range of 15 °C to 40 °C (59 °F – 104 °F). It is rated for voltages of 100 - 240 VAC at 50 Hz / 60 Hz. It should be placed on a stable and plane table and be protected against water. For R&D purposes the PCD-04 can be combined with an automatic titrator, e.g. the Mütek™ PCD-T3 Titrator Three (Please, see product sheet 117 for more information).

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BACKGROUND

In aqueous systems, solid particles as well as colloidally dissolved substances carry electrical surface charges. These charges influence the interaction of suspended and dissolved material with chemical additives.

MEASURING PRINCIPLE

The surface charges of colloids and solids in water lead to a concentration of oppositely charged ions, the so-called counterions, at the particle surface. If these counterions are separated from or sheared off this particle, a streaming current can be measured in mV. A streaming current of zero mV denotes the zero point of charge where all existing charges in a sample are neutralized.

Streaming current measurements with the Mütek™ PCD-04 are based on the following principle:

Colloidal particles will adsorb at the cell wall as well as at the piston. The counterions remain comparatively free. A defined narrow gap is provided between cell wall and piston. Driven by a motor, the piston oscillates in the measuring cell and creates an intensive liquid flow. This entrains the free counterions and separates them from the adsorbed sample material. At the built-in electrodes, the counterions induce a current which is rectified and amplified electronically. A streaming potential with the appropriate sign is shown on the display.

MEASUREMENT

**MÜTEK™ PCD-04**

An accurate volume of an aqueous sample is placed in the measuring cell. Once the Mütek™ PCD-04 is turned on by pressing “On” on the menu screen, the piston of the cell starts moving up and down. The display shows a positive or negative mV-signal. However, the height of the mV-signal will not allow an interpretation of the sample’s charge quantity (cationic / anionic demand).

In order to quantify the charges, a polyelectrolyte of opposite charge is added until reaching the zero point of charge (0 mV). A titration can be performed manually by using a hand-pipette, however only the combination with an automatic titrator will give bias-free, accurate and reproducible results.

**MÜTEK™ PCD-04 TRAVEL**

Once the cartridges for Poly-Dadmac and PES-Na or alternatively PVSK have been screwed in the cartridge holder, placed correctly and rinsed, the actual sample measurement can start by pressing “On” on the menu screen.

Shortly after the streaming potential is stable, the titration can begin. The titration module will automatically select the titrant which is charged oppositely to the sample (anionic sample – cationic titrant) and add it to the sample until 0 mV is reached. As a result the consumption of titrant in ml is indicated on the display as well as the charge demand in µeq/l.

**BENEFITS**

- Lab standard in the paper industry
- Fast and easy-to-understand results
- High reproducibility
- Whole range of applications available

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SAMPLE SPECIFICATION

Basically, every aqueous sample can be measured with the Mütek™ PCD-04. Once the sample is in the cell and the detected mV-signal is comparatively stable, the sample can be measured. The motor will run smoothly, if the sample viscosity resembles the viscosity of water. Significantly higher viscosities cannot be measured.

In order to detect a streaming potential, the particle sizes in the sample should be between 1 nm and 500 µm. Conductivity of a sample should not exceed 50 mS/cm.

PAPER MILL SAMPLE
Stock samples containing fibers and solids should be screened. For detecting the surface charges of fibers the Mütek™ SZP-06 System Zeta Potential is recommended.

FUNCTIONAL ADDITIVES
Use concentrations of 0.1% (0.1 g additive plus 99.9 g deionized water). Higher or lower concentrated solutions are possible, depending on titrant consumption.

PIGMENTS
Use concentrations of 0.1% (0.1 g solids plus 99.9 g deionized water). Higher or lower concentrated solutions are possible, depending on titrant consumption. Pigment slurries can best be measured with the Mütek™ SZP-06.

BACK TITRATION
Particles with a size of > 500 µm cannot be titrated directly in the PCD-04 measuring cell. However, a quantitative charge detection is possible by a so called back titration. Here, an excess of the oppositely charged titrant is added to the sample which is titrated back after a certain reaction time.

ACCESSORIES

MEASURING CELLS
The Mütek™ PCD-04 and PCD-04 Travel are both equipped with a precision measuring cell (10 ml – 60 ml). The core made from Teflon is reinforced by a robust outer shell made of POM for lifetime fit.

SCREEN FOR FILTRATING FIBER SUSPENSIONS
For sample preparation of paper mill samples our beaker with screen for the PCD-04 / PCD-04 Travel and the SZP-06 can be used.

ALUMINIUM TRANSPORTATION BOX
All Mütek™ Lab units can be ordered with a tailor-made carrying case.

ACCESSORIES

TITRANT SOLUTIONS
Generally, we recommend the use of Poly-Dadmac and PES-Na / PVSK as cationic respectively anionic titration solution as they are practically pH-independent. Poly-Dadmac, PES-Na or alternatively PVSK are available in quantities of one liter (0.001 N). For the Mütek™ PCD-04 Travel all titrants are available as 0.001 N and 0.0001 N solutions in disposable cartridges. Each cartridge is automatically recognized by the system, and its condition – titrant, normality, factor and other characteristics – is shown on the display.

For those who want to prepare their own titrants, empty cartridges can be supplied.

AUTOMATIC TITRATOR
The Mütek™ PCD-04 and PCD-04 Travel can be used as stand-alone units. For R&D applications combination with an automatic titrator is highly recommended.

The Mütek™ PCD-T3 Titrator Three is specially developed for charge titrations and iso-electric point (IEP) detections and is the perfect working companion for Mütek™ PCD-04 (Please see also product sheet 117 for more information.).
PRODUCT SHEET MÜTEK™ PCD-04 PARTICLE CHARGE DETECTOR

TECHNICAL DATA

PCD-04

Dimensions
- Width: 160 mm (6.3 in)
- Depth: 215 mm (8.5 in)
- Height: 340 mm (13.4 in)

Weight
- 6.5 kg (14.3 lb)

Power supply
- External power supply
  Input: 100 – 240 VAC / 1.5 A / 50– 60 Hz

Conditions of service
- Ambient temperature: 15 – 40 °C (59 – 104 °F)
- Storage temperature: 5 – 40 °C (41 – 104 °F)

Measuring values
- Streaming current [mV]
- pH

Results
- Anionic / cationic demand [ml]
- Charge quantity [µeq/l]
- pH

Sample volume
- Precision cell: 10 – 60 ml

Output
- Streaming current on display ± 2500 mV
- pH on display (option)

Operating modes
- Manual
- Automatic

Reproducibility
- Titration Pes-Na vs. Poly-Dadmac:
  Relative Standard Deviation SD(x) < 0.1 % (with PCD-T3)

Detection limit
- Up to 1 ppm depending on sample specification

Standards
- DIN EN 61326
- DIN EN 61010

Safety
- Protection class I

PCD-04 TRAVEL

Dimensions
- Width: 160 mm (6.3 in)
- Depth: 225 mm (8.9 in)
- Height: 370 mm (14.6 in)

Weight
- 8.7 kg (19.2 lb)

Power supply
- External power supply
  Input: 100 – 240 VAC / 1.5 A / 50– 60 Hz

Conditions of service
- Ambient temperature: 15 – 40 °C (59 – 104 °F)
- Storage temperature: 5 – 40 °C (41 – 104 °F)

Measuring values
- Streaming current [mV]
- pH

Results
- Anionic / cationic demand [ml]
- Charge quantity [µeq/l]
- pH

Sample volume
- Precision cell: 10 – 60 ml

Output
- Streaming current on display ± 2500 mV
- Consumption on display
- pH on display (option)
- USB interface
- SD card

Operating modes
- Automatic
- Integrated titration module
- Automatic
- External Mütek™ PCD-T3 Titrator Three

Reproducibility
- Titration Pes-Na vs. Poly-Dadmac:
  Relative Standard Deviation SD(x) < 0.3 %

Detection limit
- Up to 1 ppm depending on sample specification

Standards
- DIN EN 301489-1
- DIN EN 301489-3
- DIN EN 60950
- DIN 300330

Safety
- Protection class I

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