Online Partial Discharge Monitoring

White Paper 2026 | From periodic outage testing to real-time condition awareness - switchgear, GIS, transformers and cables

HW-PD-SOL-2026 | V1.0 | Aug 2026 | Public

Why online PD monitoring

Partial discharge (PD) is the earliest sign of insulation deterioration. Switchgear, GIS, transformers and cables develop discharge over time under manufacturing defects, installation damage, ageing or contamination - if not detected in time, it can escalate to breakdown, explosion and wide-area outages.

Single-parameter monitoring is easily disturbed and prone to false alarms; multi-parameter fusion diagnosis has become the industry consensus.

HUWOR provides AE (acoustic), TEV (transient earth voltage), UHF (ultra-high frequency) and HFCT (high-frequency current) sensing with multi-channel IED monitoring units, covering switchgear, GIS, transformers and cables in both wireless and wired deployment forms. Key endorsement: sensor battery life measured by Jiangsu Electric Power Research Institute at 18.66 years (HFCT) / 23.15 years (3-in-1); the online PD monitoring system has passed CSG 3.0 and State Grid testing.

System architecture (device - edge - cloud)

HUWOR PD monitoring uses a three-layer architecture with unified access to the intelligent condition monitoring platform:

Platform layer - Intelligent Condition Monitoring System: B/S architecture, PRPS/PRPD patterns, multi-class diagnostic algorithms, Modbus/IEC 61850, mobile app.

Acquisition layer - IoT concentrator / PD IED unit: LoRa + RS485 + Ethernet + 4G aggregation; IED 4-16 channels, sampling >= 100 MHz, refresh <= 1 s, recognises 5+ discharge types.

Sensing layer - PD multi-parameter sensors: AE / TEV / UHF / HFCT and combined forms, wireless LoRa or wired RS485.

Monitored objects - switchgear / RMU, GIS, transformers, cable joints and grounding cables, LV distribution areas.

Wireless (LoRa self-mesh) sensors need no cabling and minimal outage time - ideal for retrofitting existing substations without power interruption; wired (RS485/Modbus) forms suit stations with existing cable ducts or new builds.

Core product family

3-in-1 sensor HMJ1010-WAT: AE + TEV + temperature/humidity, magnetic mounting, no cabling. TEV 1-100 MHz, acoustic 40 kHz, temperature -40~125 C (+/-0.3 C), humidity 0-100% RH (+/-3% RH). For switchgear/RMU. Battery life measured at 23.15 years.

UHF sensor HMJ1010-WG / space UHF HMJ1010-WGK: 300-1500 MHz, sensitivity <= 6.5 V/m, dynamic range >= 40 dB, LoRa wireless. For GIS PD monitoring.

HFCT sensor HMJ1010-HFCT: 0.5-30 MHz, clamp-on grounding wire, minimum detectable PD <= 50 pC, range 100 pC - 10 nC. For cable joints and transformer grounding cables. Battery life measured at 18.66 years.

UHF + pulse-current sensor (RMU/switchgear): 300-1500 MHz, 0-75 dBm (+/-1.5 dB), pulse-current 0-1000 pC (+/-10 pC); RS485 output of amplitude, time-domain waveform and PRPS/PRPD patterns.

Contact AE sensor HMJ1010-WAEB (transformer) / HMJ1010-WAEA (GIS): 100-400 kHz / 30-200 kHz, sensitivity >= 105/120 dB.

4-in-1 sensor HMJ1010-WGN: AE + TEV + UHF + temperature/humidity; ceramic insulator sensor HMJ1010-WTX for pulse-current and lightning counting on distribution transformers; composite sensor HMJ1010-WF (HFCT + sheath circulating current, 3-30 MHz, PD <= 50 pC, circulating current 0-300 A, RS485/Modbus, IP67).

Selection guide

Switchgear / RMU PD: wireless or wired - 3-in-1 / 2-in-1 sensor + space UHF + concentrator.

GIS PD: wireless - UHF / acoustic sensor + SF6 gauge + concentrator.

GIS / transformer PD (high precision): wired - built-in UHF sensor + IED unit.

Transformer PD: wireless - contact AE + HFCT + concentrator.

Cable PD: wireless / wired - HFCT + cable gas sensor.

Selection notes: HFCT clamps onto grounding wires for cables and transformer grounding loops; UHF suits enclosed GIS; AE/TEV suit switchgear surfaces and interiors; multi-parameter fusion significantly reduces false alarms.

Deployment essentials

Live retrofitting: magnetic / clamp / bracket mounting without outage.

Networking: sensors via LoRa to IoT concentrator, uplink via RS485/Ethernet/fibre/4G; wired forms connect directly via communication cables.

Multi-parameter fusion diagnosis: PRPS/PRPD patterns and discharge-type recognition algorithms for classification, localisation and severity assessment.

System integration: IEC 61850 and Modbus protocols, connectable to existing auxiliary control / online monitoring master stations.

Power: built-in lithium batteries (measured 18.66-23.15 years) - meeting and exceeding the >= 10-year design-life requirement of grid standards (Q/GDW 1535-2015 / DL/T 1498 series).

Software platform

Intelligent Condition Monitoring System: B/S architecture, VUE front-end + microservice back-end, MySQL/SQLite + Redis, MQTT/HTTP. PRPS/PRPD patterns, multi-class algorithms, Modbus/IEC 61850 and encrypted protocols, Android 4.2+ / HarmonyOS 2.0+ mobile app.

Device Condition Intelligent Monitoring Platform / Edge Computing APP: unified monitoring of PD, temperature, arresters, SF6 and environment; edge APP runs on Java 1.8 + Docker (Ubuntu 18.04) for on-site data processing.

Trust evidence & track record

Third-party measurement: HFCT sensitivity <= 50 pC, battery life 18.66 years; 3-in-1 battery life 23.15 years - both measured by Jiangsu Electric Power Research Institute.

System-level testing: online PD monitoring system HMJ1030-PD passed CSG 3.0 and State Grid testing (Xuchang KETOP / Xi'an HV Research Institute).

Grid supply & awards: products meet CSG 10 kV automated RMU (AE/TEV 2-in-1) and State Grid (Shandong/Jiangsu/Beijing) PD sensor requirements; consecutive CSG framework bid awards in 2025; 2026 awards from State Grid Sichuan (first grid sporadic materials e-commerce procurement) and State Grid Jiangxi (first 2026 framework agreement - substation online monitoring accessory package, ranked No.1 overall).

Qualification: national high-tech enterprise, established 2010, ISO 9001/14001/45001; 39 granted patents (11 invention), 63 software copyrights; Guangdong famous high-tech products; Hebei Science & Technology Award 2nd prize; CSM (China Instrument & Control Society) S&T; Progress 2nd prize.

Standard participation: co-drafted Q/GDW 12082-2021 and other power-industry standards.

Get the full solution

This white paper is a series overview. HUWOR provides customised selection lists, typical design drawings and pilot schemes matched to your equipment type, voltage level and cabling conditions. Contact us at sales@huwor.com.cn for a one-to-one selection and pilot consultation.

About Huawang Technology (HUWOR)

Zhuhai Huawang Technology Co., Ltd. (HUWOR) is a national high-tech enterprise established in 2010, specialising in condition monitoring and assessment of power equipment. The company supplies smart sensors, testing instruments and online monitoring systems for partial discharge detection, with R&D; centres in Zhuhai and Xi'an, 39 granted patents (11 invention), 63 software copyrights and ISO 9001/14001/45001 certified manufacturing. HUWOR supports OEM and ODM projects for distributors and system integrators worldwide.