



Airpin AQ-1

Technical Factsheet

Wearable Industrial Air Quality Monitor



Product Overview

The Airpin AQ-1 is a wearable air quality monitor designed for industrial environments requiring continuous personal particulate exposure monitoring. Built to close the loop on personal protective equipment and workplace safety protocols, the device provides real-time measurement of particulate matter, volatile organic compounds, and environmental parameters in mining, construction, and field operations.

The base configuration measures 35mm diameter by 12mm thickness, weighing 50 grams with integrated rechargeable lithium-ion battery. Constructed with UV-stable, chemical-resistant polymers rated IP67 waterproof and dustproof, the AQ-1 operates reliably in harsh industrial conditions while maintaining laboratory-grade measurement accuracy.

Physical Design and Durability

Industrial Construction

The AQ-1 housing utilises UV-stable, chemical-resistant polymers engineered to withstand exposure to industrial chemicals, impact damage, and extreme weather conditions. The IP67 rating ensures complete protection against dust ingress and temporary water immersion, enabling operation in wet and dusty environments typical of construction and mining sites.

High-visibility materials integrated into the design ensure compliance with safety visibility requirements while maintaining a low profile that does not obstruct helmets, safety glasses, or high-visibility apparel. The device clips securely to clothing and equipment through multiple attachment options designed for industrial use.



Form Factor Specifications

At 35mm diameter and 12mm thickness, the AQ-1 provides comprehensive air quality monitoring within a compact form factor suitable for all-day wear. The 50-gram weight distributes comfortably across clothing attachment points without creating pressure points or interfering with normal work activities.

The sealed design eliminates external ports or openings that could compromise durability, with all environmental sensing conducted through protected pathways that maintain IP67 rating while ensuring accurate airflow access to internal sensors.

Sensing Capabilities

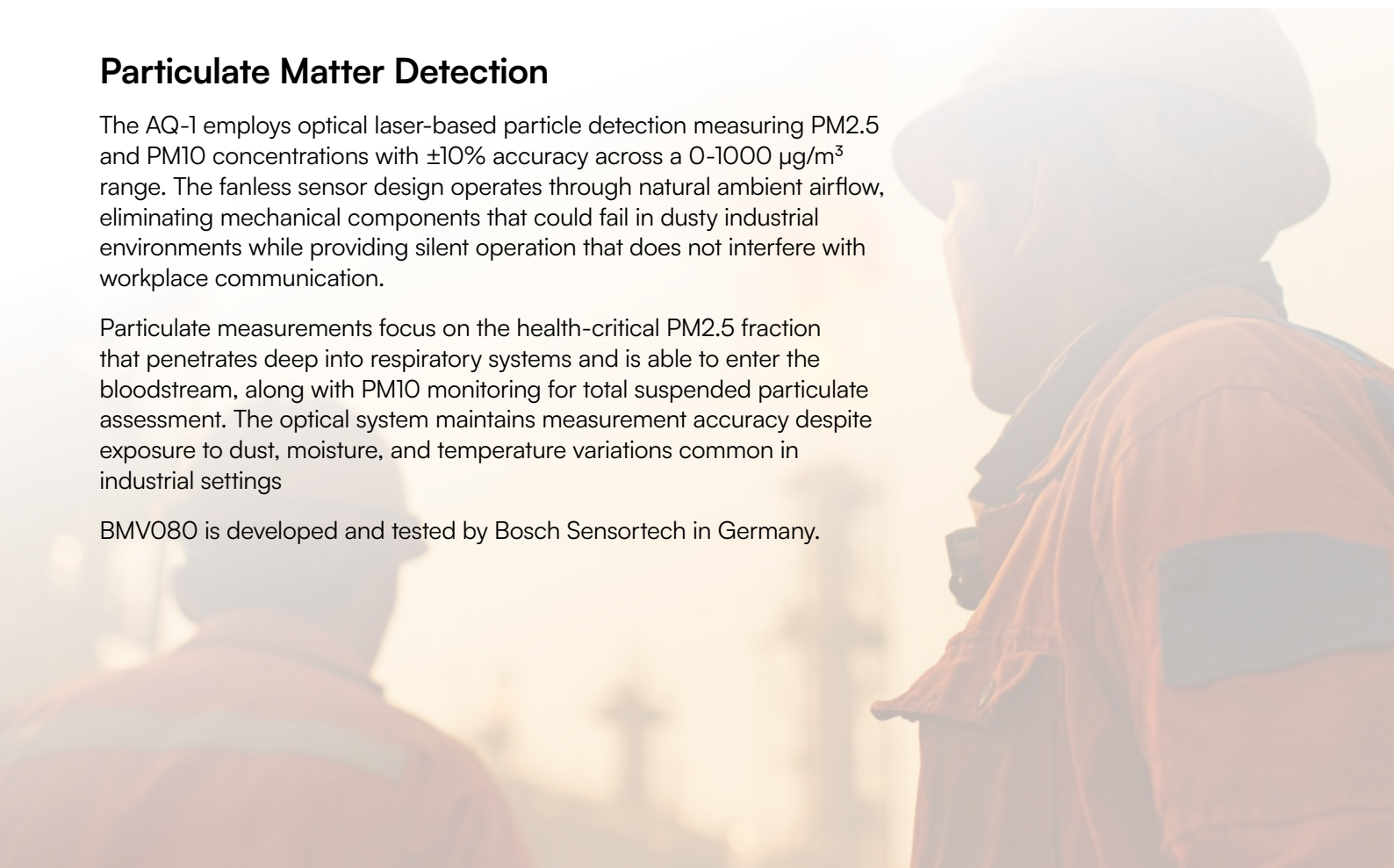
Parameter	BME688 Environmental Sensor	BMV080 Particulate Sensor
Primary Measurements	VOCs, CO ₂ equivalents, Temperature, Humidity, Pressure	PM2.5, PM10 particle mass concentration
Detection Range	VOCs: 100ppb sensitivity CO2 eq: IAQ index 0-500 Temperature: -40°C to +85°C Humidity: 0-100% RH Pressure: 300-1100 hPa	PM2.5/PM10: 0-1000 µg/m ³
Accuracy	Temperature: ±0.5°C Humidity: ±3% RH Pressure: ±0.6hPa Gas classification: 94% F1 Score	±10 µg/m ³ @ 0-100 µg/m ³ ±10 101-1000 µg/m ³
Resolution	Temperature: 0.01°C Humidity: 0.0008% RH Pressure: 0.18 Pa	1 µg/m ³
Response Time	Gas sensor: 0.75-92 seconds Humidity: ~8 seconds Temperature/Pressure: Near-instantaneous	1.03 seconds per measurement
Operating Conditions	-40°C to +85°C 0-100% RH	+15°C to +65°C 0-95% RH (non-condensing)
Technology	AI-enhanced gas detection with heater element Digital environmental sensing	Fanless optical laser particle detection

Particulate Matter Detection

The AQ-1 employs optical laser-based particle detection measuring PM2.5 and PM10 concentrations with ±10% accuracy across a 0-1000 µg/m³ range. The fanless sensor design operates through natural ambient airflow, eliminating mechanical components that could fail in dusty industrial environments while providing silent operation that does not interfere with workplace communication.

Particulate measurements focus on the health-critical PM2.5 fraction that penetrates deep into respiratory systems and is able to enter the bloodstream, along with PM10 monitoring for total suspended particulate assessment. The optical system maintains measurement accuracy despite exposure to dust, moisture, and temperature variations common in industrial settings

BMV080 is developed and tested by Bosch Sensortech in Germany.





Gas Detection Systems

Gas Detection Systems

The integrated BME688 environmental sensor detects volatile organic compounds, CO₂ equivalents, and provides general alerts for elevated gas concentrations. With sensitivity reaching parts per billion levels, the sensor monitors chemical vapours from industrial processes, fuel combustion, and solvent use across diverse workplace environments.

CO₂ equivalent measurement provides ventilation adequacy assessment in enclosed workspaces, confined spaces, and areas with limited air exchange. Temperature and humidity monitoring delivers environmental context essential for interpreting pollution measurements and ensuring worker comfort in extreme conditions.

BME688 is developed and tested by Bosch Sensortech in Germany.



Environmental Parameter Monitoring and Operating conditions

The device continuously tracks temperature, humidity, and atmospheric pressure to provide comprehensive environmental assessment beyond air quality pollutants. These measurements enable environmental compensation algorithms that maintain sensor accuracy across the wide temperature and humidity ranges encountered in industrial operations.

Operating temperature range extends from -40°C to +85°C for gas sensors, accommodating outdoor winter operations and heated industrial processes. Humidity tolerance up to 100% RH ensures reliable operation in high-moisture environments including underground operations and coastal industrial sites.



Power Management

Battery System

The base configuration incorporates a rechargeable lithium-ion battery providing 14 days of continuous operation under standard industrial monitoring protocols. The high-density battery system balances extended operation with the compact form factor required for comfortable all-day wear.

Charging occurs through pogo pin dock connections that maintain the device's sealed construction while enabling fast charging. The charging system accommodates shift-based operations where devices can be recharged during shift changes or maintenance periods.

Power Optimization

Intelligent power management adapts measurement frequency based on environmental conditions and detected pollution levels. During periods of stable air quality, the system extends battery life through reduced measurement intervals, while automatically increasing monitoring frequency when pollution events are detected.

Ultra-low power sleep modes preserve battery during inactive periods, with rapid wake capabilities ensuring immediate response to changing air quality conditions. The power architecture supports continuous 24-hour operation across multi-day deployments typical of remote industrial sites.

**14 days of
continuous
operation**

Industrial Safety Integration

Workplace Compatibility

The AQ-1 integrates seamlessly with existing personal protective equipment without compromising safety protocols or equipment effectiveness. Secure clip attachment systems accommodate safety vests, hard hats, tool belts, and uniform configurations while maintaining device stability during physical work activities.

Safety Monitoring

Continuous monitoring of PM2.5, VOCs, and CO₂ levels enables proactive identification of hazardous air quality conditions before they impact worker health. The device provides site supervisors with real-time exposure data across distributed work teams through connected platforms.

Automated alert systems notify both workers and supervisors when pollutant levels exceed established safety thresholds, enabling immediate response to protect personnel and comply with occupational exposure regulations. Beyond immediate hazard detection, the AQ-1's continuous monitoring provides aggregate exposure data over time, which is crucial for understanding true health outcomes as cumulative exposure patterns determine long-term health risks and regulatory compliance.

Data Management and Connectivity

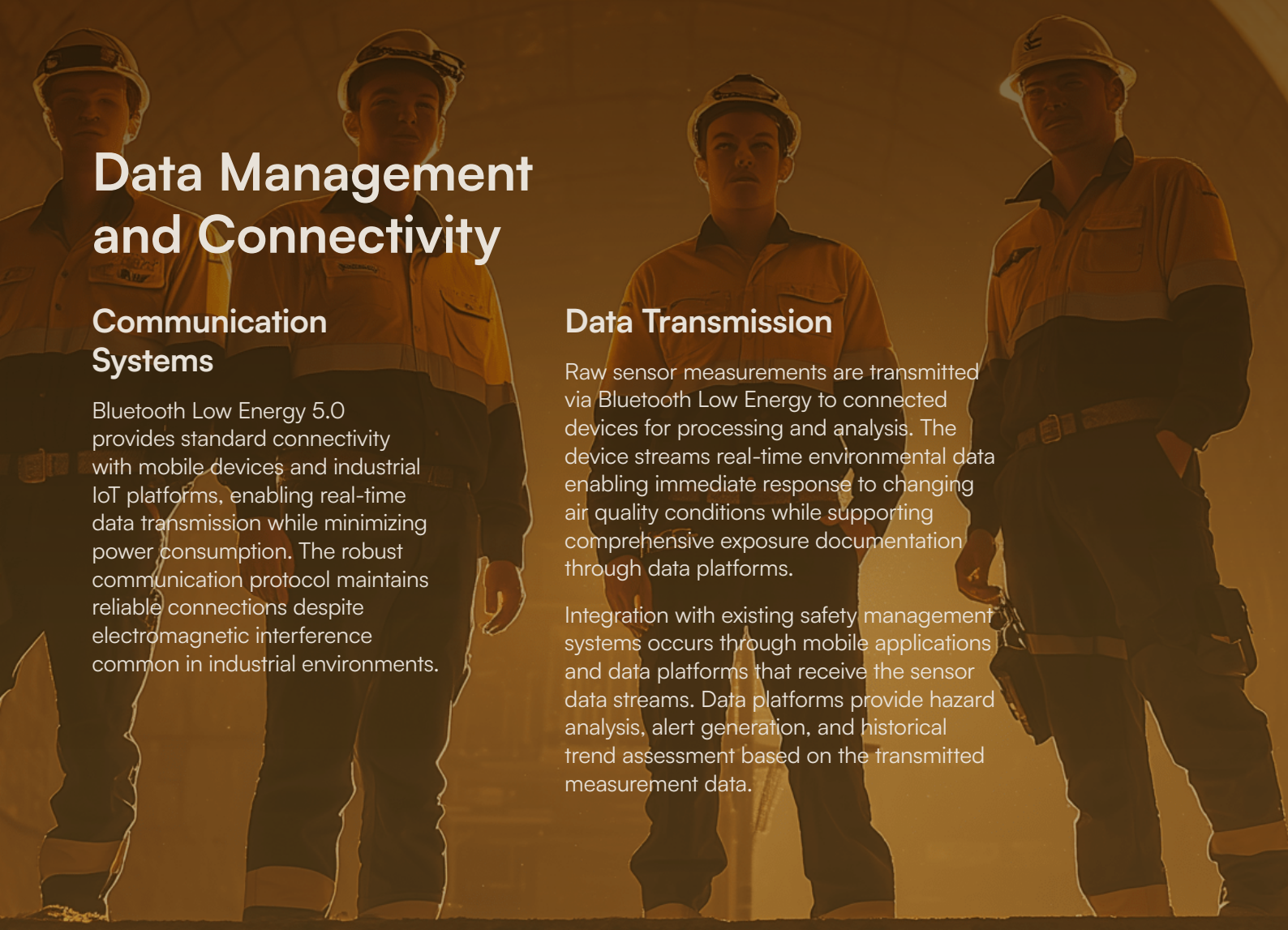
Communication Systems

Bluetooth Low Energy 5.0 provides standard connectivity with mobile devices and industrial IoT platforms, enabling real-time data transmission while minimizing power consumption. The robust communication protocol maintains reliable connections despite electromagnetic interference common in industrial environments.

Data Transmission

Raw sensor measurements are transmitted via Bluetooth Low Energy to connected devices for processing and analysis. The device streams real-time environmental data enabling immediate response to changing air quality conditions while supporting comprehensive exposure documentation through data platforms.

Integration with existing safety management systems occurs through mobile applications and data platforms that receive the sensor data streams. Data platforms provide hazard analysis, alert generation, and historical trend assessment based on the transmitted measurement data.



Deployment and Management

Large-Scale Implementation

The AQ-1 supports fleet management across industrial sites with centralized device configuration, data collection, and maintenance scheduling. Standardized deployment protocols ensure consistent monitoring across different work areas, shifts, and personnel assignments.

Device management includes remote configuration updates, calibration verification, and battery status monitoring through centralized platforms. This systematic approach enables large-scale deployment across multiple sites while maintaining data quality and device reliability.

Regulatory Compliance

Measurement capabilities align with occupational exposure monitoring requirements for particulate matter and chemical vapors in industrial settings. The device supports documentation requirements for regulatory compliance including data logging, exposure assessment, and worker protection verification.

Calibration protocols and measurement accuracy specifications meet industrial hygiene standards for personal exposure monitoring. Data integrity features include measurement validation, device health monitoring, and audit trail capabilities supporting regulatory inspection and compliance documentation.



