



D53S SILICA MONITOR

Real-time silica differentiation with multi- sensor AI.

PM fractions, UV absorption, gas sensing, heated sample conditioning, and embedded AI/ML for silica-regulated environments.

More than a dust reading: the D53s provides a silica indication, confidence context, and supporting sensor data for investigation and control-room workflows.



PURPOSE

Silica classification needs more than laser scatter.

The D53s combines physical sensor signals to distinguish silica-bearing dust from diesel, smoke, organics, coal, cement, and mixed contaminants.

Multi-Sensor Fusion

Combines PM, UV absorption, gas profile, humidity, temperature, and AI model features for more robust silica differentiation.

Edge AI/ML

Classification and regression run directly on the device without requiring cloud or external processing.

Humidity Control

A heated/dried sample chamber keeps sample RH below approximately 40% to reduce moisture-related false readings.

Silica Confidence

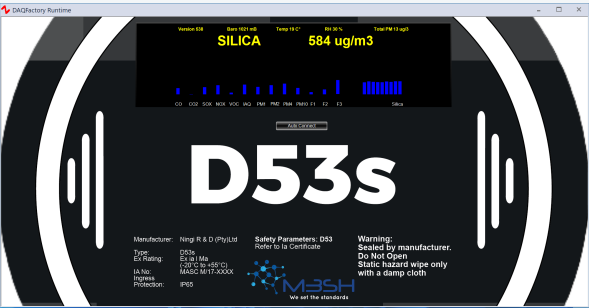
Operators can view silica score and confidence together to understand whether dust characteristics match silica patterns.

Per-Sensor Readings

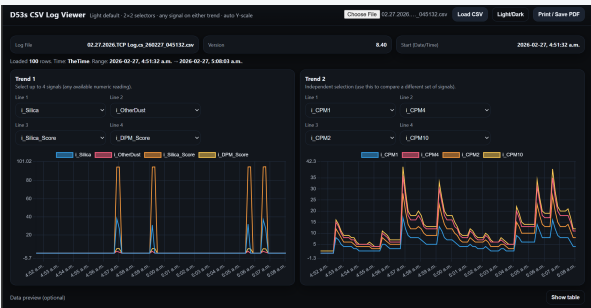
Individual sensor outputs support root-cause investigation instead of hiding the result behind a single black-box value.

System Integration

RS485, Modbus RTU/TCP, Modbus TCP/IP, EtherNet/IP, M3SH P5G, and gateway options support site integration.



Display and local indication for operational visibility.



Sensor and output data support review, trending, and investigation.

Smart silica and dust monitoring for harsh sites.

Real-time PM and silica intelligence for mining, processing plants, and bulk material handling.

Why Measure Silica And Dust

Silica dust is one of the most dangerous airborne particulates in mining and construction environments. Accurate detection is critical for worker safety and regulatory compliance.

The M3SH D53s is designed for real-time measurement of PM1, PM2.5, PM4, and PM10 mass concentrations in harsh environments. The silica version applies UV spectral indices and laser-induced incandescence within a process of elimination to exclude non-silica particulate matter.

Sensor Fusion Intelligence

The monitor combines up to 23 measured parameters in an AI/ML sensor fusion model. PM fractions, UV optical signatures, gas profiles, and environmental conditions are used to identify silica-containing dust and estimate silica concentration.

For maximum accuracy, the system is designed around the full 23-parameter dataset. Where application requirements allow, selected non-critical sensors can be omitted for cost-sensitive deployments while retaining the core silica dust signature.

Applications

- Underground mining
- Surface mining
- Manufacturing
- Heavy industry
- Construction
- Tunneling
- Stockpile domes
- Conveyors

What You Get

Capability	Benefit
Silica, organics, and dust differentiation	AI-driven classification of interfering sources such as smoke and organics.
PM, UV, LII, and gas sensing	Combines optical and gas data for real-time decision-making.
Chamber humidity control	Dual-heater chamber keeps the sample stream below 40% RH.
PLC/SCADA/data historian integration	Supports alarms, trend tracking, and faster response to dust events.

Design Benefits

Forced airflow brings samples into contact with sensors, filters out particles above 10 µm, and supports automatic chamber flushing at preset intervals. Patented airflow and self-cleaning design reduce particle buildup, while inlet and exhaust flow sensors provide blockage alarm capability.

Process of elimination across physical signals.

Silica is non-organic and does not produce combustion signatures. The D53s uses that context to rule out other sources.

Area	D53s Multi-Sensor Fusion	Laser Scatter Alone
Detection method	PM fractions, UV absorption, gas profile, humidity, and AI/ML	Light backscatter intensity and pattern
Chemical context	Uses absence or presence of organics and combustion markers to isolate likely silica	Cannot directly identify chemical composition
Differentiation	Helps rule out diesel, fire, organics, fog, coal, and mixed airborne sources	Limited to size and shape inference
False-positive control	Reduced through multiple independent sensor inputs	Higher risk where dust types overlap physically
Transparency	Explainable logic using several physical phenomena	Often depends on proprietary scatter-pattern claims

Important Configuration Note

M3SH does not offer sensor removal for the D53s silica model. The AI classification depends on the full installed sensor set to distinguish silica from other particulate matter.

Green

0-24 ug/m3 silica



Green LED status

Amber

25-49 ug/m3 silica



Amber LED status

Red

>=50 ug/m3 silica



Red LED status

Thresholds can be configured by the customer through the DQ file.

Key measurement channels.

The public sensor list should be confirmed before release because the master sheet and earlier notes differ on some channels.

Channel	Role In Classification
PM1 / PM2.5 / PM4 / PM10	Particle mass and size trends; PM4 and PM10 support respirable and inhalable dust context.
UV-A / UV-B / UV-C	Detects UV absorption associated with aromatic hydrocarbons and fine particulate signatures.
PAH	Master sheet lists PAH 0-100% index points for D53s.
VOC	Helps eliminate organic fumes, fuels, solvents, and smoke-related sources.
CO	Combustion indicator; CO is absent with silica but present with diesel or smoke events.
CO2	Ventilation and air-exchange context; confirm final range before publishing.
NOx / SO2	Diesel, combustion, and industrial gas markers that help rule out non-silica events.
O2	Optional oxygen channel; not part of the standard D53s sensor package unless specified.
Humidity / Dew Point / Absolute Humidity	Compensation and chamber control to keep sample conditions stable.
AQI / Barometric Pressure	Operating context and broader air-quality interpretation.

Silica Score And Confidence

Score	Confidence	Interpretation
High	High	Strong indication of silica exposure.
High	Low	Dust present, but the model is less certain it is silica.
Low	High	Small amount of dust, but characteristics resemble silica.
Low	Low	Little evidence of significant silica exposure.

Confidence Guide

Confidence	Meaning
90-100%	Strong match to known silica-containing dust.
50-80%	Several silica characteristics present; mixed dust may exist.
10-40%	Insufficient or weak match to trained silica patterns.

Core specifications.

Communications

Area	Capability
Standard wired	RS485 and PoE
Optional	Private 5G wireless
Protocols	Modbus RTU/TCP, Modbus TCP/IP, EtherNet/IP
SCADA	DAQFactory and register map for customer DCS/PLC/SCADA integration CSV files every 24 h from 4 s logging; user download anytime; 8 GB industrial SD stores approx. 2 years before automatic rollover.

Accuracy And Service

Measure	Value
Accuracy	+/- (5 ug/m3 + 5% of measured value) at 0-100 ug/m3; +/-10% at 100-1,000 ug/m3
Repeatability	+/-2 ug/m3 + 2% of measured value
Consumables	Dust inlet filters; gas modules service items

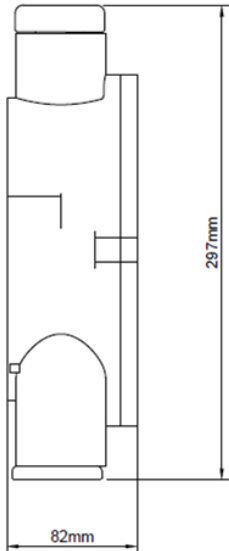
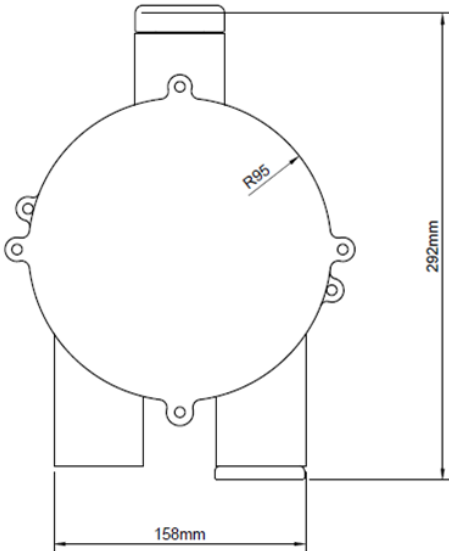
Dimensions And Weight

Item	D53s
Dimensions	L 298 mm x W 196 mm x H 82 mm
Weight	~3.24 kg

Construction	Mounting
Reinforced thermoset GRP; IP65	Side mounting holes or hanging bracket / roof bolt

Core Specifications

Item	D53s Silica Monitor
Operating temperature	-20 to +50 C
Storage temperature	-40 to +85 C
Power supply	9 to 48 VDC standard; 115 to 230 VAC optional; 12 to 24 VDC to be confirmed
Power consumption	<18 W typical
Response time	<60 s typical
Sample rate	2 l/min
Start-up time	60 sec
Display	3.9 inch TFT; status LEDs + LED ring
Warranty	1-year limited warranty





D53s Silica Monitor

Real-time silica indication and PM monitoring via sensor fusion, heated sample conditioning, and embedded AI/ML.

Intrinsic Safety Certification - South Africa

Ex ia I Ma | IA Certificate MASC M/26-8195X

This national certification applies only within South Africa. Global certification is pending, with approval expected in Q4 2026.

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