ENWISE-LADM1

Laser Suspended Particulate Matter (SPM) Analyzer Datasheet

Release Version	V2.1
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Firmware Version	V3.6
Released By	Dr Sivam

Introduction

- **Continuous Emissions Monitoring:** The **Enwise-LADM1** is a highly advanced device designed for continuous and accurate monitoring of suspended particulate matter (SPM) emissions from industrial stacks or process ducts. It utilizes an optical transmissometer arrangement, measuring in opposing directions through the same gas stream section, to continuously gauge the transmissivity of visible light across the stack or duct.

- **Reliable Dual-Pass Optics:** This innovative dual-pass measurement approach provides an accurate average of dust concentration and allows the analyzer to dynamically detect and compensate for any misalignment errors due to stack movement. This ensures that measurements remain reliable and accurate over time in real operating conditions.

- **Advanced Features:** While measuring SPM via optical transmission is a simple concept, the Enwise-LADM1 takes this technology to the next level by incorporating advanced features such as automatic zero and span calibration, real-time data logging & trending, and remote data access through an RS-485 interface. These features make the Enwise-LADM1 a highly reliable and effective tool for monitoring and controlling particulate emissions, offering peace of mind to plant operators and environmental regulators alike.

Applications

- **Industrial Emissions Monitoring:** Continuous monitoring and control of SPM emissions from industrial stacks or ducts to ensure emission levels remain within permitted regulatory limits.

- **Process Optimization:** Utilized in industries that generate high particulate matter (e.g., power generation, cement manufacturing, steel production) to optimize processes and reduce particulate emissions by providing real-time feedback.

- **Regulatory Compliance:** Assists facilities in complying with environmental regulations by tracking SPM levels and providing logged data for official reporting and audits, demonstrating that emissions remain below prescribed limits.

- **Environmental Research:** Serves as a valuable instrument for research on the impact of particulate matter on human health and the environment by providing continuous and accurate emission data.

- **Data Trending & Analysis:** Offers long-term data logging to monitor emission trends and patterns over

time. This helps in proactive maintenance and in making informed decisions to improve environmental performance.

- **Operational Response:** Empowers plant operators with timely information to respond quickly and adjust operations if particulate levels rise, thereby optimizing production processes and minimizing environmental impact in real time.
- **Easy Integration:** A cost-effective solution for tracking SPM emissions that is simple to install and integrate into existing plant control or SCADA systems, minimizing implementation effort.
- **Sustainability Goals:** By helping to minimize particulate pollution and improve local air quality, the Enwise-LADM1 supports organizations in achieving sustainability and corporate environmental responsibility goals.
- **Reporting & Documentation:** Provides reliable measurement data that can be used for environmental reporting and compliance documentation, helping businesses avoid penalties by maintaining proper records and demonstrating control of emissions.

Key Features

- **Real-Time SPM Measurement:** Continuously measures suspended particulate matter concentration in stack or duct emissions in real time for up-to-the-minute monitoring.
- **High Sensitivity:** Offers high sensitivity and accuracy, capable of detecting even fine particulate concentration changes.
- **Robust Industrial Design:** Engineered with a durable design to function reliably over long periods in harsh industrial environments (heat, dust, vibration, etc.).
- **Automatic Calibration:** Equipped with automatic zero and span calibration systems that periodically self-check and adjust the instrument to ensure consistent, precise readings without manual intervention.
- **Data Logging & Storage:** Built-in data logging capability for recording emission data over time, enabling long-term monitoring, trend analysis, and easy retrieval of historical data.
- **Compliance Reporting Features:** Outputs and stores data in formats that facilitate environmental compliance reporting, showing clear evidence of adherence to emission standards.
- **Dual-Pass Optical Path:** Utilizes a dual-

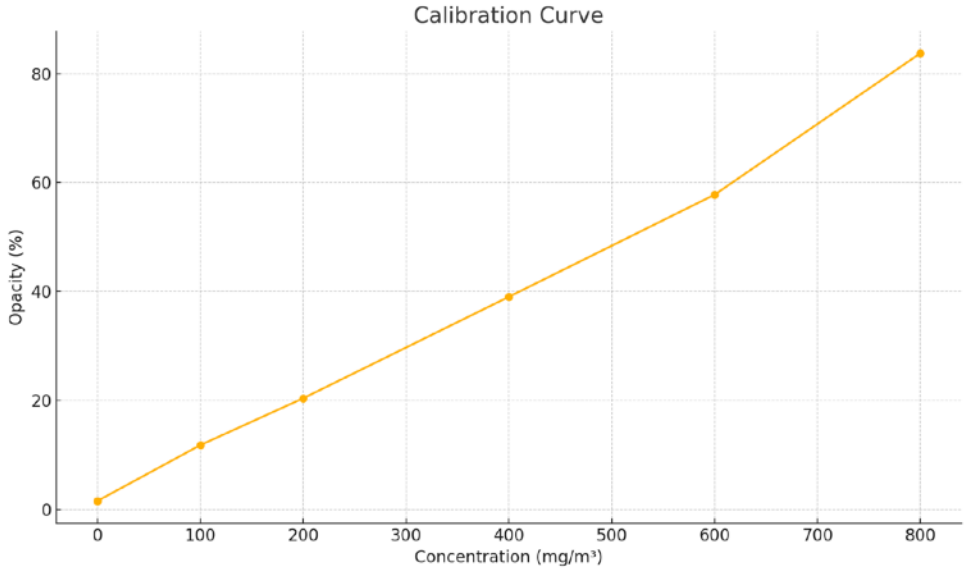
pass, open-path transmissometer technique (sending light across the stack twice) to obtain reliable and accurate opacity readings correlated to dust concentration.

- **Air Purge System:** Integral high-efficiency air curtains (air purge system) keep the optical lenses clean by preventing dust buildup, which reduces maintenance frequency and increases instrument uptime.
- **Auto Zero/Span Check:** Integral automatic zero and span check features to continuously verify and maintain the calibration, ensuring accuracy is maintained over time.
- **Misalignment Compensation:** Dynamic misalignment checking that alerts or auto-corrects if the transmitter/receiver alignment is disturbed (for example, by stack movement or vibrations), thus maintaining measurement accuracy.

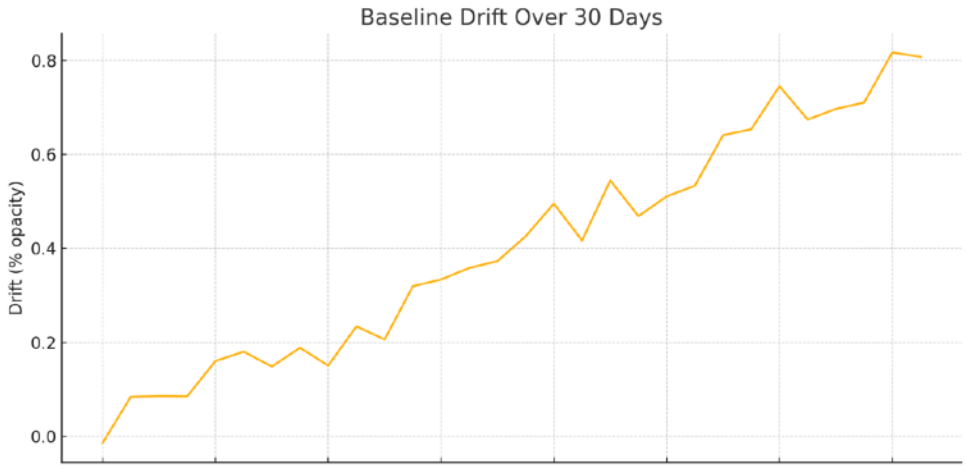
Technical Specifications

- **Operating Principle:** Light absorption (opacity) measurement via dual-pass optical transmissometer
- **Measuring Units:** mg/m^3 (milligrams per cubic meter) of particulate concentration
- **Light Source:** Modulated high-intensity LED @ 638 nm wavelength
- **Light Detection:** Continuous measurement of transmitted and received light intensity (T & R)
- **Optical Path Length:** 0.5 to 12 meters (path length configurable as per site requirements)
- **Accuracy:** ±0.2% opacity (high measurement accuracy for opacity/particulate levels)
- **Measuring Range:** 0 – 800 mg/m^3 SPM concentration
- **Resolution:** 0.1 mg/m^3 (able to detect very small changes in concentration)
- **Drift:** < 1% opacity per month (long-term stability of measurement baseline)
- **Calibration:** Automatic zero and span calibration (with manual trigger option for calibration checks)
- **Operating Temperature:** 0 to 250 °C (suitable for high-temperature stack environments)

- **Operating Humidity:** 0 – 100% RH (designed to operate across the full range of humidity conditions)
- **Power Supply:** 220 V AC, single phase, 50 Hz (standard mains power)
- **Purging Air Requirement:** Max 4.5 bar instrument air for optical lens purging system
- **Data Interface:** RS-485 communication output (supports MODBUS/ RTU or other protocols for remote data access)
- **Sensor Material:** Stainless Steel 316 (SS316) construction for sensor components (corrosion-resistant, high durability)



Demonstrates the analyzer's linear response (opacity vs. concentration) and its high-accuracy span calibration.



Illustrates the device's long-term stability (drift <1% opacity/month) and the need for occasional calibration checks.

Installation Instructions

- **Site Selection:** Choose an appropriate installation site on the stack or duct. The location should be representative of the gas stream, easily accessible for maintenance, and free from flow disturbances or obstructions.

- **Mount Transmitter Unit:** Attach the Enwise-LADM1 light transmitter on one side of the stack/duct at the chosen location. Secure it firmly using the provided mounting flange and hardware. Ensure the mounting is level and stable.

- **Mount Receiver Unit:** Directly opposite the transmitter on the other side of the stack, mount the light receiver unit. Use alignment tools to ensure the transmitter and receiver directly face each other on the same horizontal plane. Secure the receiver with appropriate hardware.

- **Alignment:** Carefully align the transmitter and receiver so that the light beam can traverse the stack and hit the receiver center. Proper alignment is critical for accurate measurements. Many systems include an alignment scope or optical sight to assist with this step.

- **Electrical Connections:** Connect the power supply to each unit (or to the central control unit, if applicable) according to the wiring diagram. The system requires a stable 220 VAC single-phase supply with ground. Also connect any signal cables between the sensor units and the control/display unit (or PLC/DAQ system) as instructed.

- **Initial Power-On:** Once mounted and wired, power on the Enwise-LADM1 system. The device will perform a self-check. Observe the startup sequence on the display to ensure all components initialize correctly.

- **Baseline Calibration:** Before regular operation, perform an initial **Zero Calibration** (with no dust in the path or using the shutter/obscuration method) and **Span Calibration** (using the built-in optical filter or by aligning transmitter/receiver fully) to set the measurement baseline. Follow the calibration instructions provided (and see Calibration section below).

- **Configure Operational Settings:** Using the menu, configure necessary settings such as measurement averaging time, data logging interval, alarm thresholds, and communication settings (e.g., RS-485 address/protocol) according to your operational requirements.

- **Air Purge Setup:** Connect the purge air supply to the Enwise-LADM1's air curtain nozzles. Use clean, dry compressed air

(up to 4.5 bar) to continuously or periodically purge the optical lens surfaces. This will prevent dust accumulation on the lenses and reduce maintenance.

- **Verification:** After installation and configuration, verify the system's performance. Generate a known obscuration (if possible) to test the response, or compare the readings with a reference if available. Ensure that the readings are stable at zero when the path is clear.

- **Routine Maintenance:** Establish a maintenance schedule. This should include regular inspection of optical heads, cleaning the lenses (using the air purge or manual cleaning if needed), checking alignment, and verifying calibration. The system's built-in self-checks (auto zero/span and misalignment alerts) will assist in maintaining optimal operation.

Operation

The Enwise-LADM1 is designed for user-friendly operation, featuring a simple interface with a display and keypad for navigating settings and functions.

Keypad Functions:

- **Menu Key:** Opens the instrument's main menu. Pressing the Menu key allows access to various configuration and calibration functions (such as viewing info, performing calibrations, setting time, etc.). Once in the menu, use the navigation keys to toggle through available options.

- **Up (▲) Key:** Scrolls **up** through menu options. Use this to navigate upward or increase values when setting parameters.

- **Down (▼) Key:** Scrolls **down** through menu options. Use this to navigate downward or decrease values in configuration settings.

- **Exit Key:** Exits the current menu or function and returns the display to the home screen (measurement mode). Press Exit to cancel an operation or back out of a menu without making changes.

Menu Options: (accessible via the Menu key – use Up/Down to navigate and Menu/Enter to select)

- **Info:** Displays general information about the instrument, such as device ID, firmware version, current date/time, and other system info. This is useful for record-keeping and verifying the instrument's identity and status.

- **Zero Calibration:** Allows the user to

perform a zero calibration to reset the baseline measurement. Selecting this option will zero the particulate measurement (should be done with a clear optical path or with the provided zero-calibration obstruction in place). The system will prompt and guide the user through the process and confirm when zero calibration is successful.

- **Span Calibration:** Allows the user to perform a span (full-scale) calibration. This sets the instrument's sensitivity scale. The user should follow on-screen instructions, which typically involve using a known optical filter or aligning transmitter and receiver fully. The analyzer may prompt to cover the receiver from external light during this procedure. Upon completion, a confirmation of span calibration success is displayed.

- **Set Time:** Enables setting the date and time on the instrument's internal clock. Use this to adjust the system clock so that logged data is correctly time-stamped. The interface will let you edit the date/time values; use the Up/ Down keys to change values and Menu/Enter to confirm.

- **Test Sensor:** Initiates a self-test of the sensor system. The Enwise-LADM1 will run an internal diagnostic to verify that the transmitter, receiver, and electronics are functioning properly. The test results or any error codes will be displayed, indicating if any component requires attention.

Note: Additional advanced menu items like **Max SPM** (which displays the maximum recorded SPM value over a period) and **K-Factor** (a calibration factor used to correlate optical readings with actual dust concentration) are available for technicians. These are generally preset during installation/calibration and typically do not require frequent adjustment by the operator.

Calibration

Regular calibration ensures that the Enwise-LADM1 provides accurate and reliable readings. There are two primary calibration procedures for this analyzer:

- **Zero Calibration:** This calibration sets the analyzer's baseline (zero point). To perform a zero calibration, first ensure that **no particulate matter is present in the optical path** (for example, perform this when the process is shut down, or use a mechanical shutter to block the transmitter light completely). With a clear path (i.e., the receiver should ideally read zero dust/100% transmission), navigate to the **Zero Calibration** option in the menu and select it. The instrument will adjust its zero point to the current reading. Wait for the on-screen confirmation that the zero calibration is completed successfully. After a zero

calibration, the output should read zero (or very minimal) dust.

- **Span Calibration:** This sets the full-scale reference point for the analyzer. To span calibrate, you need to provide a known reference point at or near the upper end of the measurement range. This can be done by using a **calibration filter** (an optical filter that simulates a certain dust opacity) or by aligning the transmitter and receiver in a way that simulates maximum expected dust (sometimes done in a controlled calibration setup). Select **Span Calibration** from the menu. Follow the prompts – for example, the instrument might ask you to insert the calibration filter or ensure the receiver is fully illuminated by the transmitter. It's important to prevent external light or factors from affecting the reading during this process (cover or shield the receiver if instructed). The Enwise-LADM1 will then adjust its gain/ scale according to the reference and confirm when the span calibration is successfully done.

Calibration Schedule: It is recommended to perform a zero and span calibration during the initial installation and periodically thereafter (e.g., monthly or quarterly) depending on regulatory requirements and operating conditions. Additionally, calibration should be checked after any major maintenance or if you notice any drift in the readings. The Enwise-LADM1's automatic calibration checks and low drift specification (<1% opacity per month) reduce the frequency of manual calibrations needed, but adhering to a regular calibration schedule ensures maximum accuracy and compliance confidence.

Contact Information

For inquiries, technical support, or purchasing information regarding the **Enwise-LADM1** analyzer, please contact us:

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