DUNAKONTROLL
MOISTURE INTELLIGENCE

Industrial Moisture Gate for Wood (IMG-W)
System overview

How IMG-W works

The basic principle of IMG-W

Industrial Moisture Gate for Wood (IMG-W), previously referred to as the HPNA system, is designed to measure the moisture content of wood logs delivered by truck.

The system provides:

- High-capacity measurement – the entire truckload is assessed in a single operation.
- Rapid results – the process is completed in less than two minutes (typically within one minute, depending on the sensor configuration).
- Automation and objectivity – measurements are fully automated and cannot be influenced by operating staff.
- Seamless integration – collected measurement data is automatically transferred to the ERP system via standard IT communication channels.

During operation, the system acquires data on key material properties and processes this information to calculate the average moisture content for the complete load.

To achieve accurate results, two distinct subsystems are employed for data collection, each contributing to the reliable determination of moisture content.

a) The **Microwave system** generates more multiply polarised low-power electromagnetic fields. The changes in the electromagnetic fields are caused by water, which provides information about the water in the load.
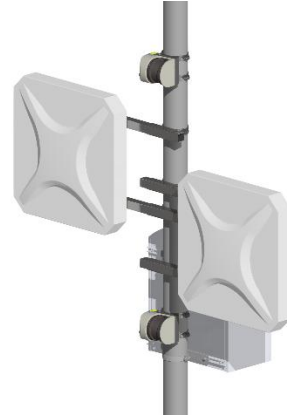
b) The **3D optical system** collects physical data on the load, such as the width, length, height, speed of the truck, its structure - missing bales, gaps between bales, etc. -, the start and end of the load, the size of the platform, and uses this data to control the microwave system and calculates the volume of the load.
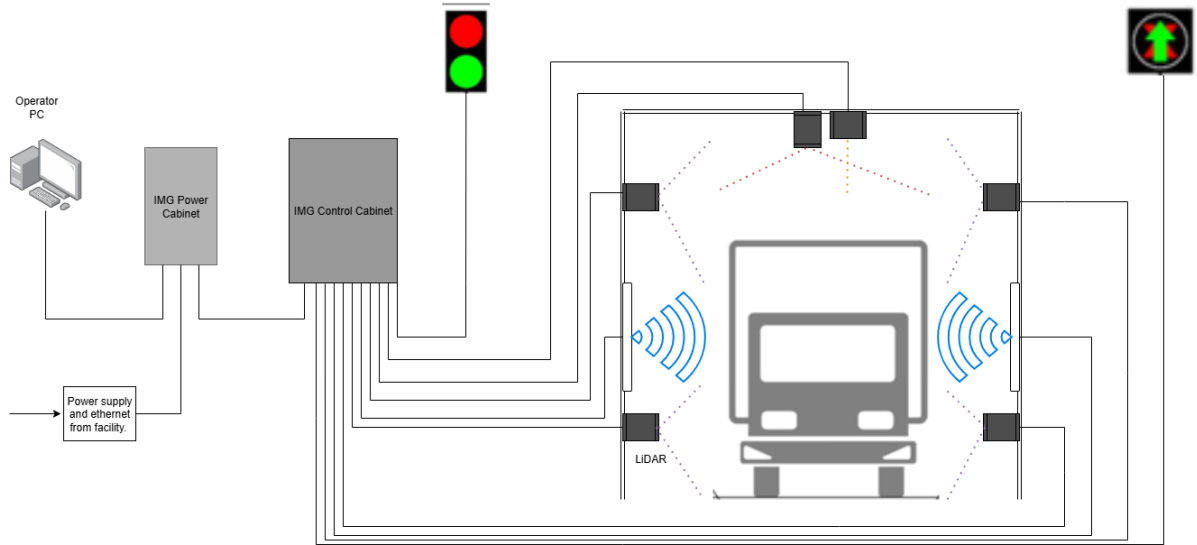
Layout of IMG-W

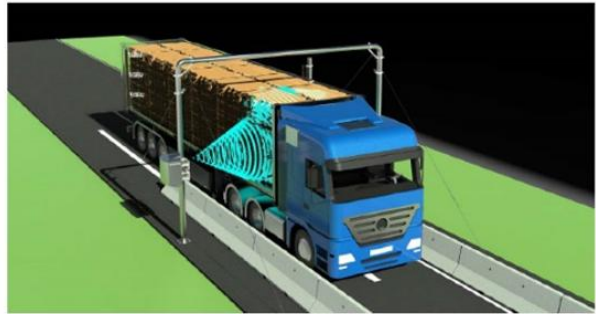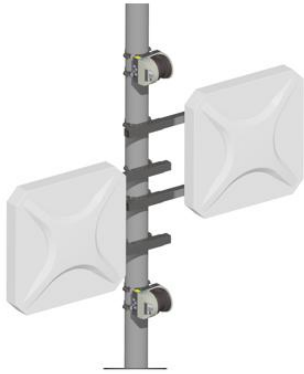The system is designed to measure logs - loaded parallel to the direction of travel.
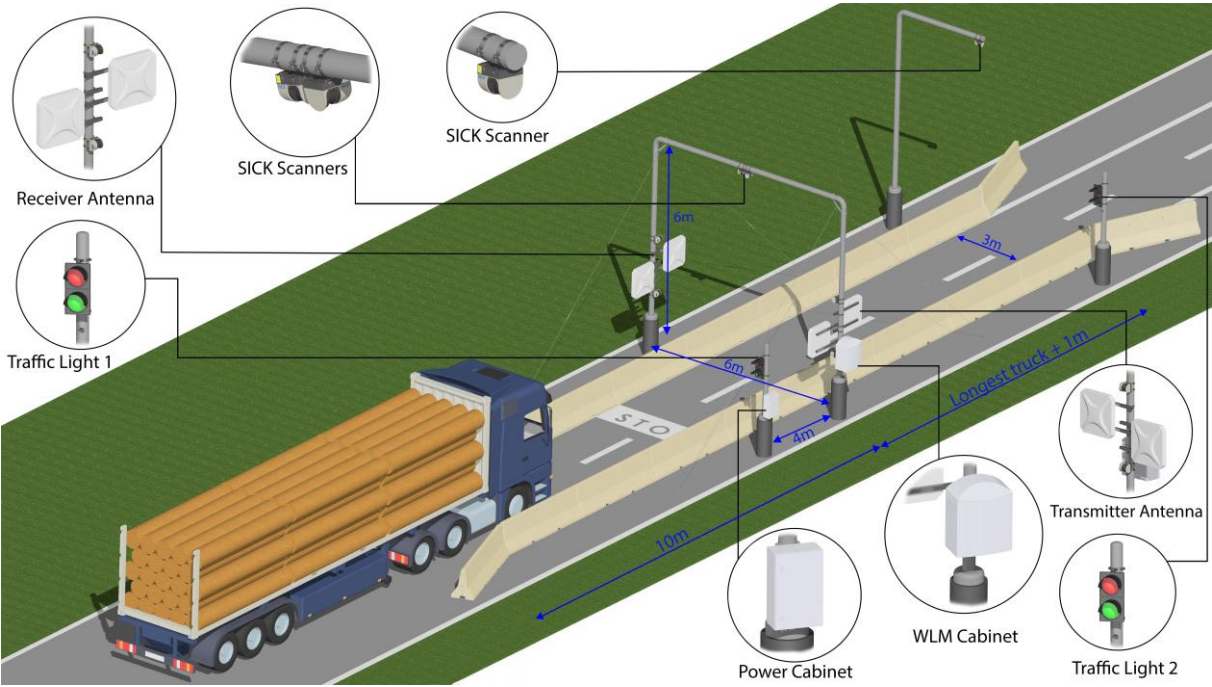
Configuration overview:

Note: All 6 scanners are installed at the 1st gate, and Scanner #7 is installed at the 2nd gate.
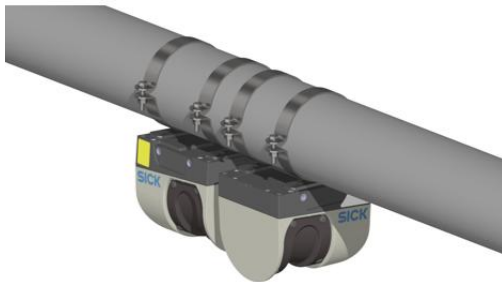
Function of each element

a) Antennas:

The antennas are responsible for emitting the multi-polarized electromagnetic waves generated by the microwave unit within the IMG-W Cabinet. These waves pass through the load, where they are received by antennas positioned on the opposite side, enabling accurate measurement of material properties.

b) 3D LIDAR

⚠ LiDAR (Light Detection and Ranging) is a laser-based sensing technology that combines laser and radar principles for mapping, monitoring, and surveying surfaces and objects. Within the IMG-P system, 3D LiDAR ensures:

- High-precision spatial mapping of the truck load.
- Accurate, repeatable measurement results.
- Reliable inspection of both moving objects and material geometry.

c) IMG-W Cabinet

IMG-W Cabinet serves as the central processing unit of the system and includes:

A high-performance industrial PC, dedicated to processing LiDAR signals, handling control data, and executing the calculation models.

A microwave unit, typically comprising three software-defined radios to generate radio signals at the required frequencies.

Integrated power supply units, ensuring stable and efficient power delivery to all components.
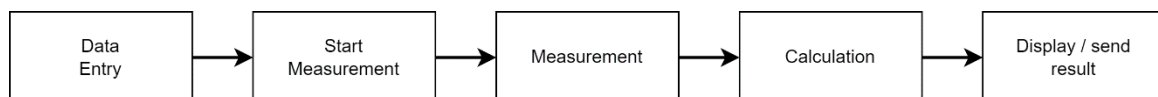
Requirements for the measurement

To ensure accurate and reliable operation of the IMG-W system, the following conditions must be met:

1) Log orientation: Wood logs must be stacked parallel to the truck's direction of travel.

2) Load height:

   - Minimum measurable height: 1.6 m (excluding metal gates or other elements that may interfere with microwave transmission).

   - Maximum height: subject to prior agreement.

3) Load width: The minimum required width of the load is 1.7 m.

4) Visibility for LiDAR: The laser scanners must have an unobstructed line of sight to the full load.

5) Truck speed: When passing the antennas, the truck's speed must not exceed 5 km/h.

6) Containers: Loads delivered in metal containers cannot be measured.

7) On truck equipment: Metal objects located on the truck platform (e.g., self loading cranes) must be reduced to a minimum and always kept in a fully retracted and locked position during measurement.

8) Material uniformity: Each load must contain only one type of wood (hardwood or softwood). Mixed loads require a dedicated, separate measurement process.

Measurement process

The system can operate as a standalone solution. However, it delivers the greatest efficiency when integrated with the facility's ERP system (e.g., SAP). Once connected, it supports fully autonomous operation, eliminating the need for human interaction. As a contingency, the system can also revert to manual operation, for example, if the ERP system becomes unavailable.

IMG-W follows a defined workflow. While the process can be tailored to local requirements, the core steps are as follows:

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┌──────────┐      ┌──────────┐      ┌──────────┐      ┌──────────┐      ┌──────────┐
│   Data   │ ──►  │  Start   │ ──►  │          │ ──►  │          │ ──►  │ Display/ │
│  Entry   │      │Measurement│      │Measurement│      │Calculation│      │send result│
└──────────┘      └──────────┘      └──────────┘      └──────────┘      └──────────┘
```

1) <u>Data entry</u>
    - Data can be entered manually via the Dashboard
    - Alternatively, it can be transferred automatically from the ERP system.

2) <u>Start measurement</u>
    - In manual mode, the operator initiates the process by clicking the **START** button on the Dashboard
    - In automatic mode, the measurement can be triggered by:
     - ERP system
     - Card reader kiosk
     - ANPR camera (licence plate or registration number)
     - Other configured sources

3) <u>Measurement</u>
    Once triggered, the system autonomously carries out the measurement process. Vehicle movement within the measurement zone is managed by traffic lights and continuously monitored during the procedure.

4) <u>Calculation</u>
    After the vehicle exits the measurement zone, the system processes the collected data and calculates the average moisture content of the load.

5) <u>Results</u>
    The final result is displayed on the Dashboard and, if connected, automatically transmitted to the ERP system.

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Displaying measurement results
(measurement data sent to the IT system)

Wood Moisture Measurement Report

Report generated on: 01.08.2024 10:05

Measurement		
Date/Time:	7/31/2024 16:48	
Ticket Number:	202407311648	
Plate No.:	NTD716	
Paper Grade	Lágy	
Supplier:	Supplier 1	
Load Weight:	18 000 kg	
Solid Volume:	36 m^3	
Dry matter content:	13 835 kg	76.9%
Moisture Average:	**30.1%**	
Basic Density:	**384.3 kg/m^3**	

Profile:

Example - 3D system generated 3D model
(**not** sent to the IT system)
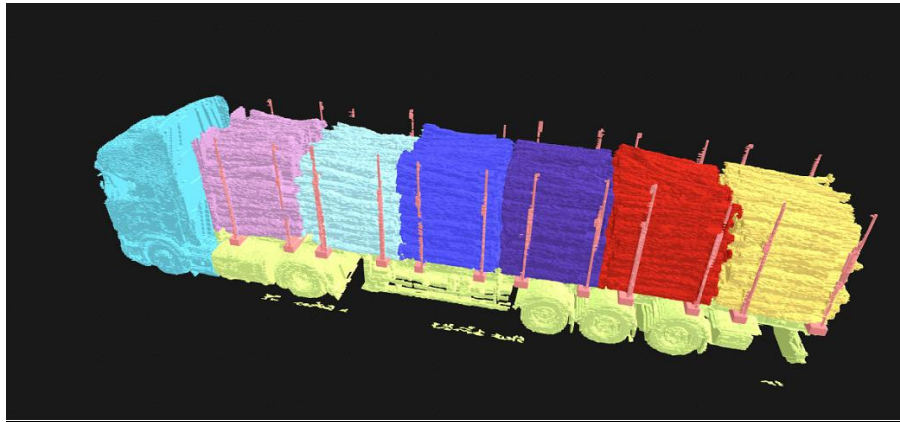
Parameters of the measuring system

The IMG-W system operates with the following technical parameters:

a) Measurement characteristics

- Moisture measurement range: 6% to 50% gross moisture content of wood logs

- Microwave signal frequency: up to 930 MHz (ISM band)

- Transmitted signal power: 10 mW

- Sender–receiver distance: approx. 6 m

- Microwave dynamic range: approx. 70 dB

b) Measurement outputs
During each measurement, the system determines and stores the following parameters of the load:

- Average moisture content of the complete load

- Load parameters (structural and geometric)

- Total load volume

- Truck speed during measurement

- Net load volume

- Log diameters (individual and average)

- Basic density data of the incoming load

- Measurement date and time