# WIRELESS M-BUS TECHNOLOGY – OVERVIEW, BENEFITS & COMPARISON

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# SHORT INTRODUCTION


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# AGENDA

- Introduction to Wireless M-Bus
- History and Evolution
- Technical Overview
- Advantages and Disadvantages
- Technology Comparison
- Use Cases and Future Outlook
- Würth Elektronik solutions
- Conclusion

# INTRODUCTION TO WIRELESS M-BUS

# WHAT IS WIRELESS M-BUS?

**Wireless Metering Standard**
Wireless M-Bus is a European standard enabling wireless communication for smart utility meters.

**Frequency Bands and Cost**
Operates in license-free ISM bands making it cost-effective and suitable for diverse environments.

**Communication Flexibility**
Supports both uni-directional and bi-directional communication for flexible deployment.

**Secure Data Transmission**
Utilizes AES-128 encryption to ensure secure and reliable data transmission in metering systems.

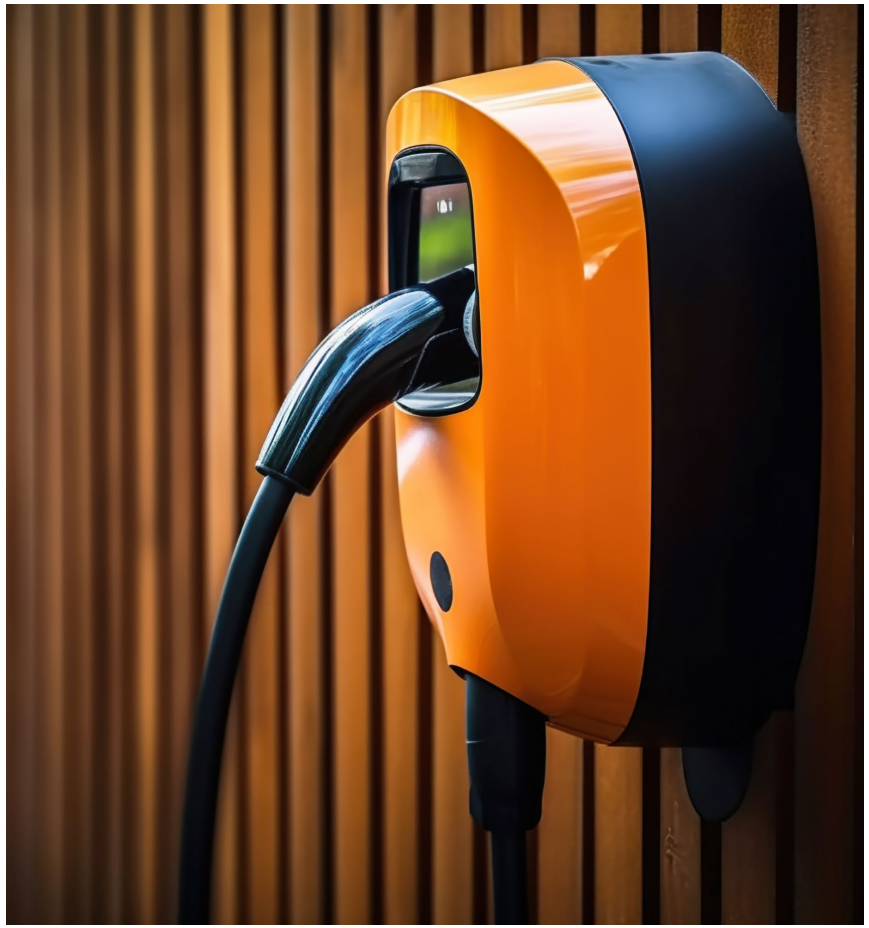
# APPLICATIONS OF WIRELESS M-BUS

**Smart Metering**
Wireless M-Bus enables automated billing and monitoring in utilities, enhancing accuracy and reducing manual labor.

**Industrial Monitoring**
Supports wireless sensor networks for monitoring environmental conditions and equipment performance in industries.

**Smart City Initiatives**
Used in smart city projects like waste management and energy optimization for efficient urban management.

**Robust Communication**
Operates reliably in harsh environments with ability to penetrate concrete and long battery life.



# HISTORY AND EVOLUTION

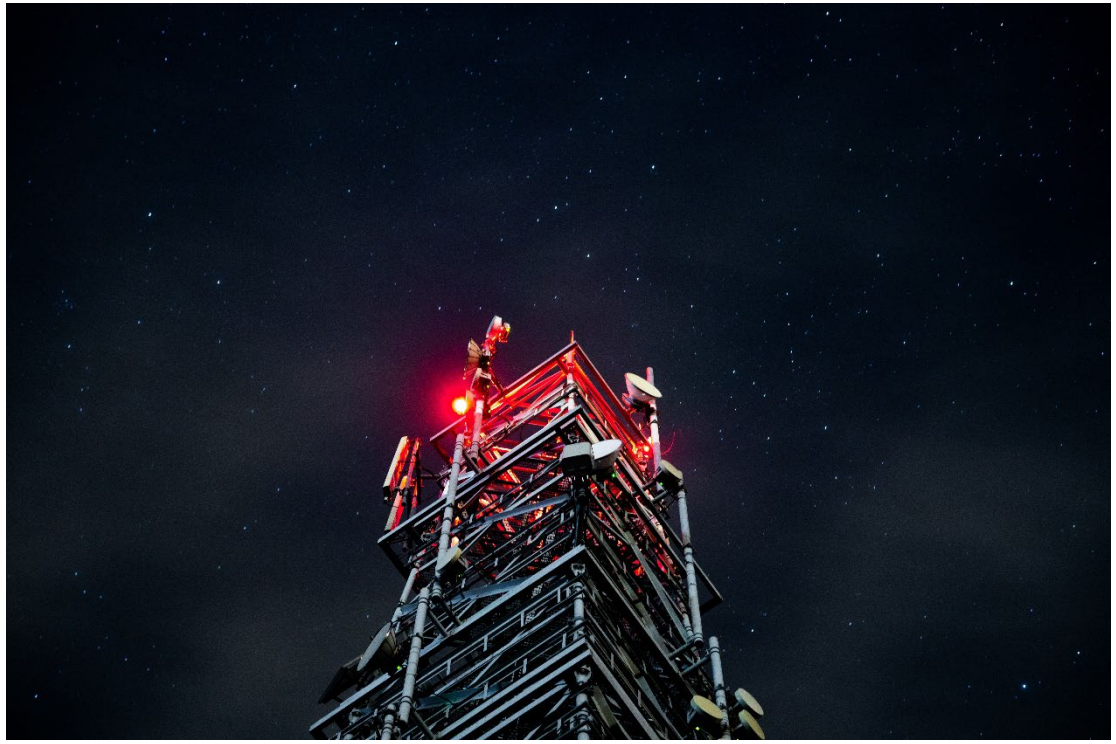
# ORIGINS AND STANDARDIZATION

**Development of M-Bus Protocol**
M-Bus was developed in the 1990s as a wired communication standard for utility meters in Europe.

**Introduction of Wireless M-Bus**
Wireless M-Bus standard was introduced in 2003 to support low data rates and long battery life for AMR systems.

**Evolution and Adoption**
The standard evolved to support multiple communication modes and frequencies, enhancing utility applications.

**Benefits Driving Adoption**
Wireless M-Bus adoption is driven by reliability, cost-effectiveness, and infrastructure compatibility across Europe.



# INTEGRATION WITH IOT

**Smart Metering Enablement**
Wireless M-Bus enables smart metering with low power use and reliable communication for long-term operation.

**Integration in AMI Systems**
The technology integrates into advanced metering infrastructure for real-time data collection and analysis.

**Interoperability and Ecosystem**
Wireless M-Bus supports device interoperability ensuring seamless integration across diverse IoT ecosystems.

**Scalable and Secure Communication**
The technology evolves to meet demands for scalable, secure, and efficient wireless communication in utilities.

# TECHNICAL OVERVIEW

# NETWORK ARCHITECTURE AND COMMUNICATION MODES

**Star Network Topology**
Wireless M-Bus uses a star network where meters connect to gateways for centralized data collection.

**Diverse Communication Modes**
Multiple modes like Mode S, T, R2, and F optimize data rate, frequency, and power consumption for varied needs.

**Protocol Stack Layers**
The protocol stack includes RF, physical, data link, and application layers for structured communication.

**Secure Communication**
AES-128 encryption ensures secure data transmission with support for uni-directional and bi-directional communication.

# PERFORMANCE AND SECURITY FEATURES

**Communication Performance**
Wireless M-Bus provides up to 2 km range and data rates from 2.4 to 100 kbps based on mode and frequency.

**Power Efficiency**
Low power design allows battery life of 15 to 20 years in practical applications, minimizing maintenance needs.

**Operational Cost Reduction**
Operating in license-free ISM bands reduces costs for utility companies and enables easier deployments.

**Security Features**
AES-128 encryption and authentication prevent unauthorized access, ensuring data confidentiality and integrity.

# ADVANTAGES AND DISADVANTAGES

# ADVANTAGES OF WIRELESS M-BUS

**Long Battery Life**
Wireless M-Bus devices offer long battery life of 15–20 years, minimizing maintenance and operational costs.

**Robust and Reliable**
The technology operates reliably in harsh environments like basements and remote locations.

**Secure Communication**
Wireless M-Bus supports secure AES-128 encryption ensuring data protection and privacy.

**Scalable and Interoperable**
Easy deployment and standardized protocol enable scalable networks and interoperability across manufacturers.

# DISADVANTAGES AND LIMITATIONS

**Limited Scalability**
Wireless M-Bus is less scalable than cellular technologies, restricting its use in large-scale deployments.

**Regional Frequency Constraints**
Operating in regional frequency bands limits Wireless M-Bus applicability in some geographic areas.

**Low Data Rates**
Wireless M-Bus supports relatively low data rates, unsuitable for high-speed communication needs.

**Performance Issues with Mobility and Interference**
Best for static installations; mobility and interference from other devices can degrade performance.

# TECHNOLOGY COMPARISON

# COMPARISON WITH LORA, LTE-M, AND NB-IOT

| FEATURE | WIRELESS M-BUS | LORAWAN | LTE-M | NB-IOT |
|---|---|---|---|---|
| **Range** | Up to 2 km | Up to 15 km | Cellular coverage | Cellular coverage |
| **Power** | Ultra-low | Ultra-low | Moderate | Low |
| **Data Rate** | Up to 100 kbps | 0.3–50 kbps | Up to 1 Mbps | Up to 250 kbps |
| **Cost** | Low | Low | Medium | Low |
| **Mobility** | Low | Low | High | Low |
| **Infrastructure** | Private | Private/Public | Public | Public |

# USE CASES AND FUTURE OUTLOOK

# CURRENT APPLICATIONS

**Smart Metering**
Wireless M-Bus enables automated billing, real-time monitoring, and efficient resource management in water, gas, and electricity metering.

**Industrial Monitoring**
Supports wireless sensor networks that monitor environmental conditions and equipment performance in industrial settings.

**Smart City Initiatives**
Applied in waste management and energy optimization for urban smart city projects to improve efficiency and sustainability.

**Challenging Environment Operation**
Functions reliably in basements, sheds, and remote locations due to long battery life and robust wireless connectivity.

# FUTURE TRENDS

**Integration with Hybrid Networks**
Wireless M-Bus will integrate with hybrid networks, coexisting with LPWAN technologies like LoRa and NB-IoT for broader connectivity.

**Enhanced Features and Interoperability**
Future Wireless M-Bus versions will offer improved features and better interoperability to support diverse IoT applications.

**Expanded Application Areas**
Wireless M-Bus will expand its role in smart cities, industrial automation, and environmental monitoring, increasing its impact.

**Technological Advancements**
Advancements in battery technology and data analytics will enhance Wireless M-Bus utility and performance significantly.

# WÜRTH ELEKTRONIK WM-BUS SOLUTIONS

# MORE THAN YOU EXPECT

## SUPPORT THROUGHOUT THE WHOLE PRODUCT LIFE CYCLE

### CONCEPT

- Local support through our technical sales team and field application engineers in 50 countries
- Design-in support
- Reference designs with leading IC manufacturers
- Seminars, webinars, in-house seminars and videos-on-demand

### DESIGN & DEVELOPMENT

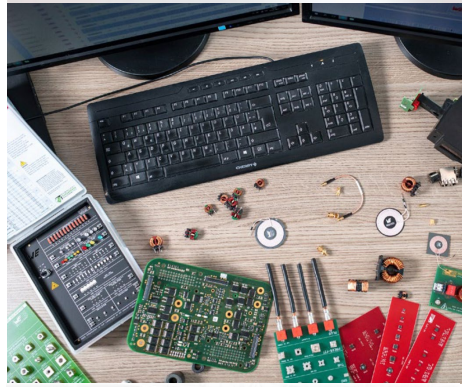
- Technical consulting through our technical sales team and field application engineers
- Free samples within 24 – 48 h
- Online platform REDEXPERT
- Application notes
- Design kits with free refill
- Component libraries for CAD and CAE tools
- Application handbooks in hardcopy & e-book

### PROTOTYPING & TESTING

- No MOQ
- EMC test lab racks
- Re-Reeling
- EMC lab search engine

### PRODUCTION & AFTER SALES SERVICE

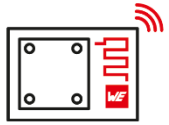
- All catalog products available ex stock
- Logistic concepts
- Longtime availability of components
- Smart PCN
- Customer API
- Customer platform MyWE



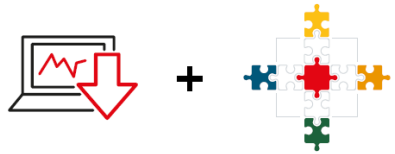
# MORE THAN YOU EXPECT

**Full Service Products**
**Hardware + Firmware**


**Proven High Frequency**
**PCB-Design & Proven Antenna Characteristics**



**Software Toolkit: APIs and Software Development Kits (SDKs)**

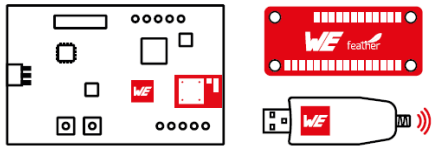


**Certification and Conformity –**
**CE, UKCA, FCC, IC, Telec , SRRC, NCC & ETA-WPC**

**Configurable User Settings with our Firmware WE-ProWare**

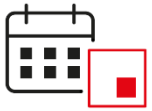

**Free of Charge PC-Software and Mobile Apps**

**Evaluation Tools**



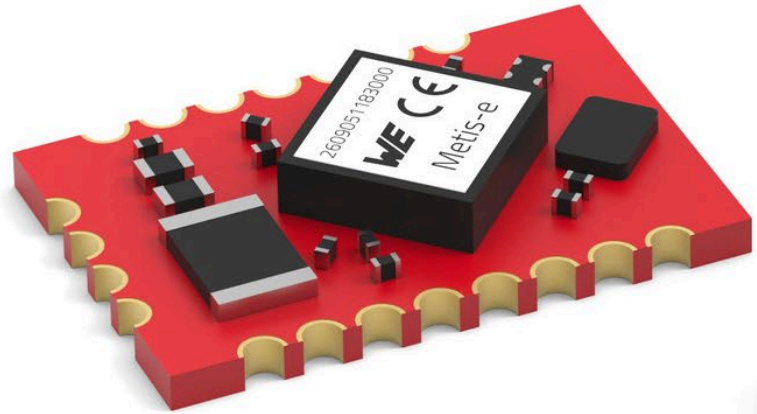
**Technical Support –**
**Talk from Engineer to Engineer**

**Long Term Availability**



# METIS-E

wM-Bus Module



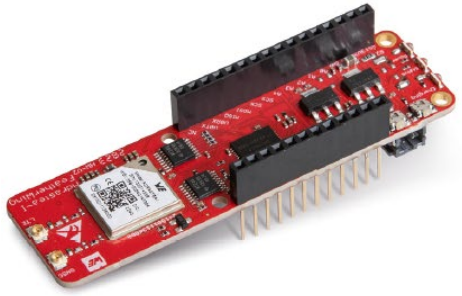

- Compact and cost-optimized module with enhanced performance
- Operating modes: Idle-Mode,Receiving-Mode,Transmitting-Mode and Standby/Shutdown mode
- Wireless M-BUS EN13757-4: 2013 standard
- OMS (Open Metering System) supported
- Range up to 1500 m line of sight
- Small size: 12 x 8 x 2 mm (L x W x H)
- RF output power 14 dBm
- Easy switching between operating modes S, T, C
- Adjustable RF data rates

# EVALUATION TOOLS

## WIRELESS CONNECTIVITY


**Evaluation Kit**

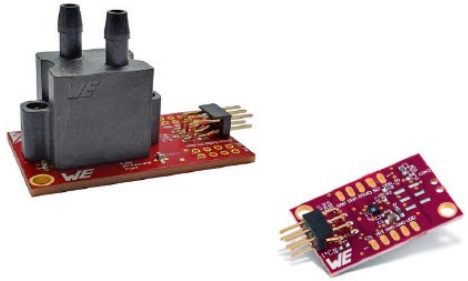
**Mini/Family– Evaluation Board**



**FeatherWings**


**USB Radio Stick**

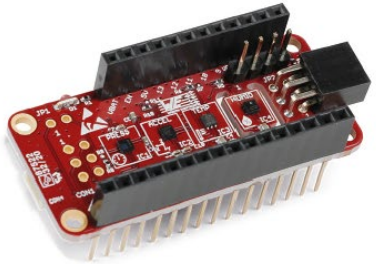
## SENSORS



**Evaluation Board**

**Sensor Node**

**Sensor Shield for Arduino**



**FeatherWing**

# CONCLUSION

# SUMMARY AND RECOMMENDATIONS

**Wireless M-Bus Advantages**
Wireless M-Bus offers low power consumption, robust communication, and secure data transmission ideal for smart metering and industrial use.

**Limitations and Suitability**
Wireless M-Bus is best for static, low-data scenarios but has scalability and mobility limitations compared to other technologies.

**Alternative Technologies**
For mobility and high data rates, LTE-M or NB-IoT are suitable, while LoRa is preferred for long-range private networks.

**Application Recommendations**
Choose communication technology based on application needs; Wireless M-Bus is valuable for utilities and industry requiring efficiency and security.