**Wireless** Makes **Utility** Facilities Monitoring Easy!

The **WL40F Series** are low-electric-power wireless devices that require **No License**.

No license application or renewal fees. Free to use!

Application examples

**Quick Installation!**

- **Wastewater/Waste fluids**
  - pH meter

- **Central monitoring room**
  - PC / SCADA
  - Web Data Logger DL30
  - Modbus/TCP
  - Web (Internet)
  - Tablet
  - Smartphone
  - Router

- **Power equipment**
  - **900 MHz ISM Band**
  - Multi-hop Wireless System

- **Air conditioning**
  - **900 MHz ISM Band**

- **Exhaust gas**
  - **900 MHz ISM Band**

- **Boiler**
  - **900 MHz ISM Band**

- **Chiller**
  - **900 MHz ISM Band**

- **Fuel**
  - **900 MHz ISM Band**

- **Demineralized water**
  - **900 MHz ISM Band**

- **Gas**
  - **900 MHz ISM Band**

- **Pump flow rate**
  - **900 MHz ISM Band**

The use of wireless communication equipment requires approval on a country-by-country basis. The WL40F Series products are usable only in the US.

M-SYSTEM CO., LTD.
www.m-system.com
Recommendation for Wireless Monitoring of Utility Facilities

Introduction

Factories, hospitals, schools, and many other entities throughout the United States have utility facilities that are in operation at all times. Such utility facilities include power, gas, boiler, and compressor equipment as well as pumping equipment for groundwater and wastewater treatment equipment. They play important roles in most sites. Nevertheless, many of them are maintained in conventional “manual” methods because they have not been considered as a subject for centralized monitoring.

M-System has released the WL40F Series 900 MHz Band Multi-hop Wireless System as a means to easily and inexpensively realize centralized monitoring of utility facilities. The FCC Part 15 compliant low-electric-power wireless devices require no licence for use in the United States.

Furthermore, for the effective use of the WL40F Series, M-System offers the DL8 Web Data Logger and the TR30-G Tablet Recorder, which can be connected direct to the Internet, as well as the DL30 Web Data Logger, which can be installed onsite for use with ease.

M-System has summarized application examples of these radio applications so that everyone in charge of facility maintenance may use them. These are a few examples of installations that M-System has delivered using the above products.

Advantages of using the WL40F Series for the centralized monitoring of utility facilities

1. Short installation work period
   - No opening in schedule for wiring work.
   - A wireless system needs no pit digging or cable laying work, realizing a drastically shortened installation period with a simple work plan.

2. Low installation cost
   - Material and cable embedding work cost
     - We want to add more monitoring points but work costs are surprisingly high.
     - Wireless system cost is much lower simply because there is no signal line wiring.

3. Reasonable unit cost
   - What about the total running cost of a wireless system?
     - The WL40F Series 900 MHz Band Multi-hop Wireless System needs no radio license, no license application fee, and no monthly communications charge.

4. Easy system modification and expansion
   - Well, considering all the work needed to add only one measuring point...
     - Just install one Child unit in the desired place. It’s also easy to change the location afterwards.

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The user can collect monitoring data of a factory's utility facilities from remote locations such as the headquarters and branch offices. The system can send e-mails to report abnormal or failures to the user's smartphone.

Terminology in this Brochure:
“Parent” and “Child” mean “Wireless Master” and “Wireless Slave” stations respectively, whereas “Master” and “Slave” mean “Modbus Master” and “Modbus Slave”.

M-System has released the WL40F Series 900 MHz Band Multi-hop Wireless System as a means to more monitoring points but work costs have not been considered as a subject for conventional “manual” methods.

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Furthermore, for the effective use of the WL40F Series, M-System offers the DL30 Web Data Logger, TR30-G Tablet Recorder, and the DL8 Web Data Logger. These are a few examples of installations that M-System has delivered using the above products.

Internet

Management rooms

Plant

Onsite

Remote locations

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- **Parent** and **Child** mean “Wireless Master” and “Wireless Slave” stations respectively, whereas “Master” and “Slave” mean “Modbus Master” and “Modbus Slave”.

- **FCC Part 15 compliant**

- **900 MHz ISM Band Multi-hop Wireless System**

- **Modbus/TCP**

- **IoT Internet of Things**
What is 900 MHz band wireless communication?

The WL40F Series Wireless I/O System employs a licence-free 900 MHz ISM band module. Compared with 2.4 GHz band and 5 GHz band wireless LANs and wireless networks for instrumentation that use higher frequency bands, the 900 MHz band ensures stable communication quality and a long communications distance. It does not require license registration, and unlike mobile communications, users do not need to pay telecommunications charges to telecommunications service provider. Therefore, the 900 MHz band is ideal in terms of operating cost as well.

What is multi-hop technology?

Multi-hop wireless communication is a wireless network conveying data through a number of wireless communication devices in a "bucket-brigade" manner. Relaying paths are automatically switched to an alternative one when one section of the connection is weak. In the WL40F Series, up to 100 child stations connect to a single parent station. The communications distance between stations can be up to 0.62 miles (1 km), thus making it possible to construct a wireless network in a wide range.

Transmission Distance

An initial power level of 20 mW will be attenuated more as a result of path loss over a large area.

As shown in Table 1, the rated reception sensitivity limit of the WL40F Series is -90 dBm.

With a margin of three times taken into account, the practical reception sensitivity limit is considered to -85 dBm.

Reference: A level of -90 dBm is equivalent to 1 pW based on a level of 0 dBm as 1 mW.

According to the graph of Distance vs. Reception Level on the right-hand side, the communications distance should be several thousand meters at a level of -85 dBm. However, this is a theoretical value.

With consideration of the propagation environment, the rated maximum inter-station transmission distance is set to 0.62 miles (1 km).

Radio wave test

Required before introducing the system.

Power Level Changes in Radio Channel

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Introduction of 900 MHz band wireless products

FCC Part 15 compliant 900 MHz band products — for use in the US

**Parent** Wireless Gateway
- Model: WL40EW2F
  - Modbus-RTU transparent

**Child** Wireless Gateway
- Model: WL40MW1F
  - Modbus-RTU transparent

**Wireless I/O**
- Model: WL40W1F
  - 2 × Di, 2 × Do
  - 2 × 4-20 mA input with excitation supply

The pictures show the rooftop antenna types. Sleeve antenna types are also available.

920 MHz band products — for use in Japan — available in different styles

**Parent** Wireless Gateway
- Model: WL40EW2F
  - Modbus-RTU transparent

**Child** Wireless Gateway
- Model: WL40MW1F
  - Modbus-RTU transparent

**Wireless I/O**
- Model: WL40W1F
  - 2 × Di, 2 × Do
  - 2 × 4-20 mA input with excitation supply
  - 1 × universal input, 1 × pulse input, 1 × Do
  - Multi-power transducer

**Multiport Gateway / Wireless Gateway**
- Multiport type for 920 MHz + WiFi access point
  - IP65

**Tower Light**
- IP65

**Tower Light**
- Modbus interface
  - IP65

**Multiport Gateway / Wireless Gateway**
- Multiport type incorporating versatile functions, including a remote monitoring function, data logging function, and event reporting function, available through a website screen.

**Plug-in Wireless I/O**
- Modbus interface
  - 4 × clamp-on current sensor input
  - 2 × universal input

**Wireless Gateway**
- Modbus interface
  - IP67

**R3 Series Multi-channel Remote I/O**
- 920 MHz + Modbus interface module
- 920 MHz interface module

The pictures except for tower lights and multiport/wireless gateways show the rooftop antenna types. Sleeve antenna types are also available.

The use of wireless communication equipment requires approval on a country-by-country basis.

Modbus/TCP master units to be combined with WL40F Series

**Web Data Logger**
- Model: DL8
  - The Web Data Logger is an Internet-of-things (IoT) terminal incorporating versatile functions, including a remote monitoring function, data logging function, and event reporting function, available through a website screen.
  - Basic functions
    - Simple web server (e.g., for a trend screen)
    - Data logging
    - Email function
    - FTP function
    - Modbus/TCP communications function

**Tablet Recorder**
- Model: TR30-G
  - The Tablet Recorder is a data recorder that displays collected and accumulated trend data on a website screen using a tablet or PC via an IP network, such as a Wi-Fi network.
  - Basic functions
    - Trend data/Event data recording
    - Simple web server (e.g., for a trend screen)
    - Email function
    - FTP function
    - Modbus/TCP communications function
    - Various calculation inputs

**Web Data Logger**
- Model: DL30 - JAPANESE VERSION ONLY
  - The Web Data Logger is a data logger of onsite-installation type incorporating versatile functions, including a remote monitoring function, data logging function, and event reporting function, available through a website screen as well as a report creation function.
  - Basic functions
    - Simple web server (e.g., for a trend screen)
    - Data logging
    - Email function
    - FTP function
    - Modbus/TCP communications function
    - PLC communications function
    - Report (daily, monthly, and annual report) creation function
    - Various calculation inputs
    - Scheduling

For details, see the website of M-System.
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Wiring work passing through hazardous area

Industry: Petroleum – Application: Fuel

Before
- Measuring signals of wastewater treatment facilities

After
- Tank yard Monitoring room
- Explosion-proof area

In order to add monitoring points, wiring must cross an explosion-proof area.

Power monitoring of plant substation

Industry: Chemical – Application: Power

Before
- Remote I/O R9 Series
  - Power measurement

After
- Factory substation Monitoring room
  - Power monitoring

Power monitoring is essential for energy savings, but has considerable cost and time...

Predictive maintenance of moving machines

Industry: Ceramic industry – Application: Transport

Before
- Coal loading crane Monitoring room
  - Current
  - Vibration

After
- Quotation

We cannot conduct necessary work in a high place.

Remote monitoring of cooling towers

Industry: Rubber – Application: Air conditioning

Before
- High-elevation onsite work is a risk.

After
- Wireless remote monitoring can assure safety. I can check the operating status anywhere with my tablet.

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Flow rate monitoring of drainage and groundwater pumps

Industry: Agriculture, forestry, and fisheries – Application: Drainage

Before
- So much trouble to go around and collect data manually.
- We need automatic data logging and daily/monthly reporting.

After
- Using the pre-formatted reporting function is easy.
- Automatic logging is available.

Water quality management of abandoned mine site

Industry: Mining – Application: Drainage

Before
- The site is too far away from the building for hardware connection.

After
- The use of wireless communication equipment requires approval on a country-by-country basis. The WL40F Series products are usable only in the US.
- Wireless system needs no signal wiring work.
- Remote monitoring of intake well and treatment plant is possible.

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Remote monitoring of intake well and demineralizer

**Industry:** Agriculture, forestry, and fisheries

**Application:** Demineralized water

*Before*

- Demineralizer measurement data, water level, and flow rate

*After*

- Drainage
- Water intake

We tried on the 2.4 GHz band but most points are too far away.

**WL40F Series**

900 MHz Band

A pre-introduction test proved WL40F Series easily reaches all the sites.

Patrol check on the pressure data of each room

**Industry:** Nonferrous metals/Metal products

**Application:** Compressor

*Before*

- Atmospheric pressure

*After*

- Air conditioning

Tiresome work of going in and out of each room every hour for just checking pressure data.

The Web Data Logger automatically stores data. I can check them in my office.

Centralized monitoring of vibration data on motors and conveyers

**Industry:** Iron steel

**Application:** Transport

*Before*

- Motors
- Rollers

Planning for wiring of over 300 measurement points gives me a headache.

Expansion is simple by adding slave stations step by step.

Monitoring of air piping end pressures

**Industry:** Food

**Application:** Air conditioning

*Before*

- Filling room
- Packing room

Monitoring of output end pressures

COMP: Compressor; PIA = Pressure indicating alarm

Monitoring end pressure is important but wiring work for a remote monitoring system is too expensive.

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**Water level monitoring of power plant’s demineralized water tank**

*Industry: Power – Application: Demineralized water*

- **Before**
  - Existing tank
  - Water level monitoring
  - We have to modify the existing cable layout if we want to install a new tank.
  - No additional cable is needed, and the tank position can be freely selected.

- **After**
  - New tank
  - Water level monitoring

**Utility management of printing/bindings companies**

*Industry: Printing/Binding companies – Application: Air conditioning*

- **Before**
  - Discontinued
  - Monitoring room
  - No additional wires needed, and the wireless system is so convenient!

- **After**
  - Monitoring room
  - Temperature AND pH monitoring using a wireless connection.

**Water leakage monitoring of data center**

*Industry: Communication – Application: Gas industry*

- **Before**
  - We want to monitor water leakage but it’s impossible to add new wiring at this stage.

- **After**
  - Water leakage monitoring
  - Thanks to the wireless system, we can install water leakage sensors anywhere with ease.

**Gas flow rate monitoring of semiconductor factory**

*Industry: Electrical equipment – Application: Gas*

- **Before**
  - Gas flow meter
  - Automatic logging
  - Before

- **After**
  - Gas flow meter
  - Web-based data logger plus wireless network is so convenient!
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Remote monitoring of car washing machines

**Industry: Railroad/Bus – Application: Facilities**

**Before**

- Remaining detergent
- Vibration etc.

**Vehicle washing machine**

**Error → Stop**

**After**

- Detergent low level?
- We can predict and prevent errors by remote monitoring and shortened the maintenance time.

- Administration building

Radio paging of forklifts

**Industry: Automobile – Application: Transfer**

**Before**

- No parts!
- No forklifts!

**Forklift**

**Error → Stop**

**After**

- We want to send a call signal for replenishing parts to the forklift standing by.
- The forklift operator can see at a glance which parts are needed.

- Round trip to the warehouse

- Each button (light) identifies a specific part.

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Predictive and preventive conveyor maintenance

**Industry:** Transportation equipment  
**Application:** Transport

Before

- Vibration
- Travel distance

After

- Automatic collection

Visiting each stacker crane regularly to check its operating status to gather maintenance data takes a lot of my time.

Thanks to the CSV format data of the DL8, I can easily check the trend to schedule maintenance sessions.

Opening and closing of large hanger doors

**Industry:** Air transport  
**Application:** Warehouse

Before

- Opening/Closing control signal
- Limit switch

After

- The multiplex transmission system for the PLC is too old to be simply replaced.

The DL8 with wireless network provides an easy replacement and can be installed in a short period.

Remaining level monitoring of gas bottles

**Industry:** Shipbuilding  
**Application:** Gas

Before

- Remaining gas volume

After

- I can monitor each bottle level here and I can receive low level alarm e-mails before they are empty.

Gas bottles are stored in welding areas dotted throughout a shipyard making it difficult to know how much gas is remaining in each area.

Anemometer data management in the office

**Industry:** Shipping  
**Application:** Transport

Before

- The operator may not pay attention to the anemometer when he is intensely working, but it’s a serious safety issue.

The wind data is now monitored at the manager’s office where the operator can be alerted when high winds occur.

After

- The wind data is now monitored at the manager’s office where the operator can be alerted when high winds occur.

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After pH

Remaining level monitoring of special gas bottles in hospital

Industry: Hospital – Application: Gas

Before

- It’s difficult to conduct additional wiring works in the hospital for monitoring the newly added gas bottles.

- Cases for medical purposes

After

- No need of wiring works in connecting the level sensors wirelessly.

Hospitals, Schools, Construction, Gas/Water Supply, Service Businesses, and Retailers

Management of wastewater pH value on campus

Industry: School – Application: Drainage

Before

- 60 monitoring points

After

- The WL40F Series does not need to utilize old telecommunication lines or network structure.

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The WL40F Series are low-electric-power wireless devices that require no license. Wireless makes monitoring of utility facilities easy! Central monitoring room, PC/SCADA, Web Data Logger, DL30 Web (Internet), Smartphone, Tablet, Modbus/TCP, Router.

Centralized monitoring of utility facilities

Application examples
- Compressor
- Pump flow rate
- Gas
- Demineralized water
- Fuel
- Chiller
- Boiler
- Wastewater/Waste fluids
- pH meter
- Air conditioning
- Exhaust gas
- Power equipment
- Child
- Child
- Child
- Child
- Child
- Child

Additional isolated signal channel to the existing installation

Signal Splitters

Compact, plug-in socket mounted
W2 Series (Mini-MW)

27 models

The W2 Series (Mini-MW) Dual Output Signal Conditioners feature a wide range of input and output signals. The socket mounted signal conditioner modules can be removed, tested and replaced without disconnecting wiring. Once plugged in, they are securely fastened with the front screw to the socket.

Low-profile, terminal block style
W5 Series

8 models

The W5 Series Dual Output Signal Conditioners are designed with the minimum required number of carefully selected components to ensure outstanding economy. Only 41 mm (1.61 in) deep, terminal block style modules can be installed anywhere, even behind the panel cover.

Expandable, Compact Remote I/O R7M Series

Supporting the industrial standard Modbus-RTU open network

All-in-one style compact modules can handle 4 analog input, 2 analog output or 16 discrete signals.

8 or 16 discrete input/output module can be attached to the base module

Wide variety of I/O signals available

1500 V AC isolation

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An isolated output signal can be added safely for IoT-applied remote control and centralized monitoring purposes.

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Specifications are subject to change without notice. When ordering, use the latest data sheets available at M-System web site: www.m-system.com