M I O | USER GUIDE

LoRa GATEWAY SYSTEM | LPG00

M2I

M2I Corporation

Industrial I/O Wireless Controller
MIO-LPG00

Hardware Manual

Thank you for using Industrial I/O Wireless Controller of M2I corporation.

Please read this manual carefully to know installing, wiring, operating, servicing and inspecting this equipment.

Index

Chapter 1 Safety Precautions

■ **Before using the product**

To use the product safely and effectively, please read the contents of this manual thoroughly before use. Please keep to the safety precaution, for it is to prevent accidents and potential danger from occurring. Safety precaution is classified into 'Warning' and 'Caution' and their meanings are as follows. Also the indicated illustrations on the product and in the manual have the following meanings.

⚠ Warning	Violating the instruction may result in serious personal injury or death.
⚠ Caution	Violating the instruction may result in slight personal injury or product damage.
🚫	Be cautious, for danger may be present.
❗	Be cautious, for there is a possibility of an electric shock.

■ **General Precautions**

🚫 Do not press the screen with a hard or sharp object (awl, screwdriver, pen) with too strong a force. It may cause malfunction of touch due to damage of the front sheet.

🚫 Do not use or store in an environment with high vibration.

❗ Do not allow foreign objects such as water, liquids, or metal powders to enter the product. This may cause breakage or electric shock.

🚫 Use the radio or mobile phone at least 30cm away from the main unit.

🚫 Two or fewer bright spots may appear on the LCD screen, and certain areas may appear brighter, but this is not a defect in LCD characteristics.

🚫 Do not store or operate in direct sunlight. Direct sunlight can change the properties of the LCD.

❗ Do not touch an adaptor or power code with wet hands. It can cause electric shock.

🚫 Do not use this product in explosive environments with flammable liquid, gas, or dust.

🚫 If the product needs long-term storage without using, avoid direct sunlight and keep dry condition.

■ **Design Precautions**   ⚠Warning

For protecting whole control system from outer power input or malfunction of product, protection circuit must be installed outside of product.

❗ Physical protection devices as emergency switch, limit switch, or motion interlock circuit and others to prevent a critical damage of whole system's safety and human accident from the product's malfunction.

❗ When computers or other outer devices control (operation mode change) the product, set interlock in sequence program to protect from any communication errors.

❗ Input/output signals or communication cables must have at least 100mm(3.94inch) distance from power cable or high-tension wire. Especially communication cables must be set apart from power cables.

■ **Wiring Precautions**   ⚠Warning

❗ Be sure the wiring is done correctly by checking the product's rated voltage and the terminal layout. Incorrect wiring could result in fire, damage or malfunctions.

❗ Tighten the terminal screw with the specified torque. If the screws of terminal are loose, it could result in short circuit, fire, malfunctions. FG Terminal must be used a dedicated ground. Not doing so could result in malfunctions.

❗ a. Grounding should be the Class 3 grounding. The cable for grounding should be more than 1.5㎟.

❗ b. grounding point be closed to the products and make short the distance to the ground cable if possible.
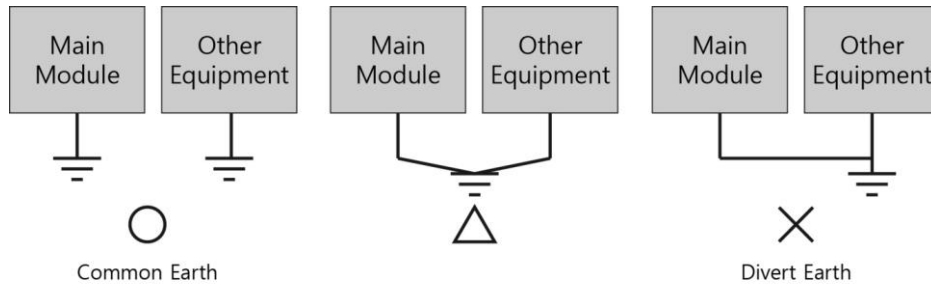
Fig. Grounding Example Diagram

■ **Installation Precautions**　⚠ Caution

Do not install the location which exceeds allowed temperature. Product can be damaged or shorten the life. Especially Install environment as below should be avoided.

🚫 Do not Install product to the place which the ambient temperature is out of limits, from -10℃ to 50℃ or on the surface of control board which high pressure equipment is installed.

🚫 Do not install to the place where strong shock or vibration continuously have impacted on product.

❗ If the product is left unused for a long time, charge it and store it at room temperature.

🚫 Backside of the device and console box should have at least 100mm of space for maintenance and ventilation, and please be sure to install a cooling fan when you install the device in sealed space.

🚫 Use the product indoors only.

🚫 Use the product under 2000M altitute.

■ **Disposal Precautions**　⚠ Caution

When you dispose of product and battery, please treat it as industrial waste. It can create poisonous substances or explosion.

■ All field-wiring connections to this unit shall be from Limited Voltage / Limited Current, below 24Vdc isolated secondary source with an output fuse, or Class 2.

Chapter 2 Overview
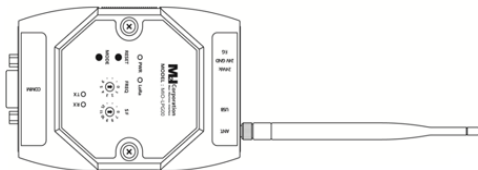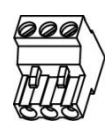
2.1 Introduction

This industrial I/O wireless controller is an industrial control device required in the industrial field. This product is made for communication with other devices (HMI and etc) and Industrial I/O wireless device(MIO-LPE00) by wired/wireless method.

2.2 Package Contents

The components of the product are as follows.
Before using the product, please check that all of the following components are included.

Item	Figure	Quantity
Main Body (MIO-LPG00)		1
User Manual		1
Antenna		1
Power Connector		1

2.3 Explanation of Model name

Industrial I/O controlled wireless controller and device product configurations are as follows.

2.3.1 Industrial I/O Control Wireless Controllers and Devices

Base Unit	Protocol	Network	Unit Purpose	Type
MIO-	L: LoRa	P: Peer to Peer	G: Gateway	00: Basic
			E: End node	

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Chapter 3 General Specification

3.1 System Power Specifications

Input Voltage	24Vdc
Input Voltage Range	20Vdc ~ 28Vdc
Consumption Power	3W or less
Voltage endurance	24Vdc, within 10ms
Insulation Resistance	500VDC, 10MΩ

3.2 Serial Communication Specifications

Communication Method	RS-232C/422/485
COMM. Speed.	2400 ~ 115.2K bps
Frequency Select	Rotary Switch (1 ~ 6)
Status LED	System Power, COMM. Receive, COMM. Transmit, Wireless Communication Status

3.3 LoRa Communication Specifications

Frequency Range	TX: 922.1 ~ 923.1 MHz, RX: 923.3 MHz
Antenna Model and Type	1T1R Dipole Antenna, KE-L09DM
Security Setting	AES-128 Support

3.4 Environment Specifications

Operation Temperature (℃)	-10 ~ +50
Storage Temperature (℃)	-20 ~ +60
Operation Humidity (%RH)	0 ~ 90 (No dew)
Atmosphere	No corrosive gas
Vibration Endurance	Amplitude: 10≤F < 25 Hz(2G) X,Y,Z each direction(for 30 minutes)
Noise Immunity	1000Vp-p(Pulse width 1 μs)
Static Electricity Discharge	Connective discharge from EN61000-4-2: ±4 kV
Shock Endurance	10G X,Y,Z each direction(for 3 times)
Surge Voltage	500V(Line-Line)
Ground Connection	Class 3(Under 100Ω)
Protection Classification	IP20

3.5 Structure Specifications

Cooling System	Natural air circulation
Case Material	ABS(Flame Retardant)

Chapter 4 Part Names and General Specifications

4.1 Product Size
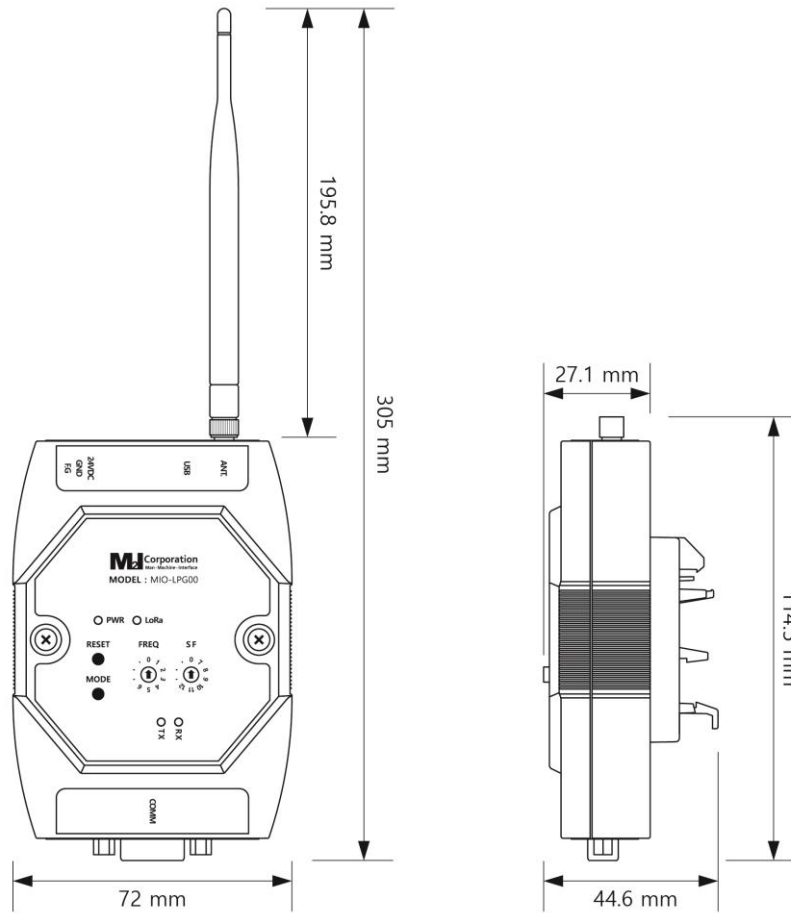
Model	W (mm)	D (mm)	H (mm)
MIO-LPG00	72	305	44.6

4.2 Part Names and General Specifications

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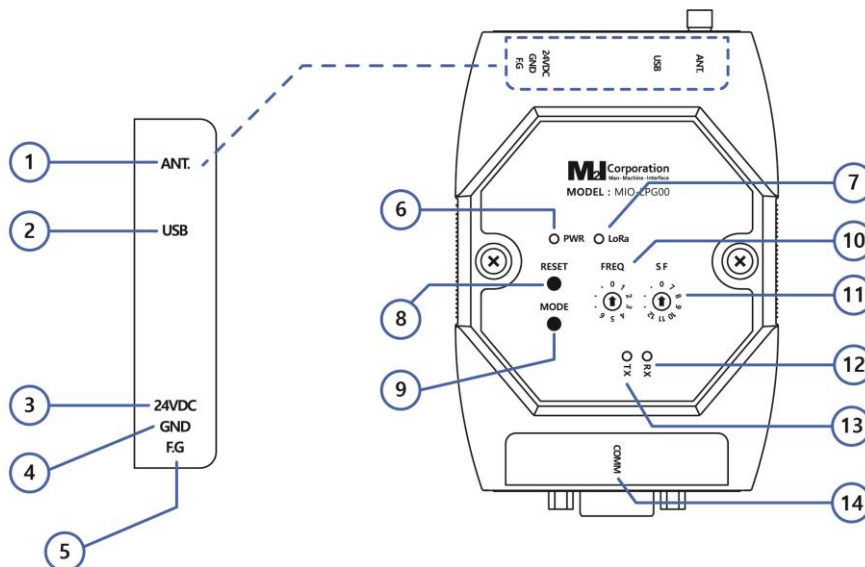
No	Name	Description
①	ANT.	LORA Antenna Hole
②	USB	USB Setup Connector
③	24Vdc	System Power Input (DC 24V)
④	24V GND	System Power GND
⑤	F.G	F.G
⑥	PWR LED	Power Status Display
⑦	LoRa LED	LORA Communication Status Display
⑧	RESET 버튼	System RESET
⑨	MODE 버튼	MODE Operation Button
⑩	FREQ 변경 스위치	Frequency Ch [0...6] Switch
⑪	SF 변경 스위치	SF Setting [0], [7...12] Switch
⑫	RX LED	COMM Receive Status
⑬	TX LED	COMM Transmit Status
⑭	COMM	Serial Communication Connector

Chapter 5 Operation and Settings

5.1 System Configuration

In order to communicate with the I/O wireless device, you must refer to the following information to connect.

5.2 Status LED

The operation status of the status indicator LED is shown below.

	LED	Status	Description
PWR	Green	ON / OFF	ON when Main Power is Input
LoRa	Green	Transmit Data	LoRa Transmit Data Status

	Red	Receive Data	LoRa Receive Data Status
	Orange	Blink	When Setting mode is on by MODE button
RX	Green	ON / OFF	ON as receiving COMM data
TX	Green	ON / OFF	ON as transmit COMM data

5.3 Frequency Select and Communication Settings

Frequency and Communication Settings can be set by rotary switch or private program.

5.3.1 Frequency Select Switch

You can select LoRa Frequency. If you set this switch as 0, it will select the frequency as set in a private program (S/W).
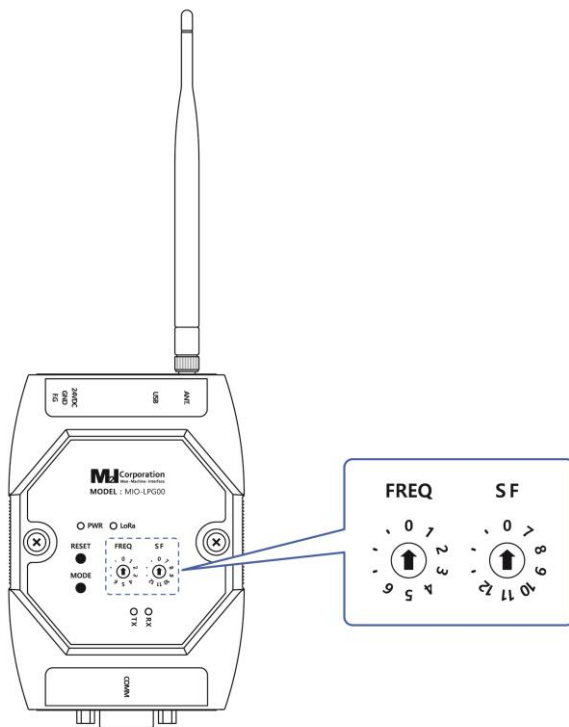
Switch No.	Select Freq(MHz)
0	No Use
1	922.1
2	922.3
3	922.5
4	922.7
5	922.9
6	923.1

5.3.2 SF SF Setting Switch

You can set SF bitrate (7 ~ 12). The higher number of this, the longer communication range is possible. But the transmit speed will be slow down.

Below image is showing the relationship between data speed and communication range.
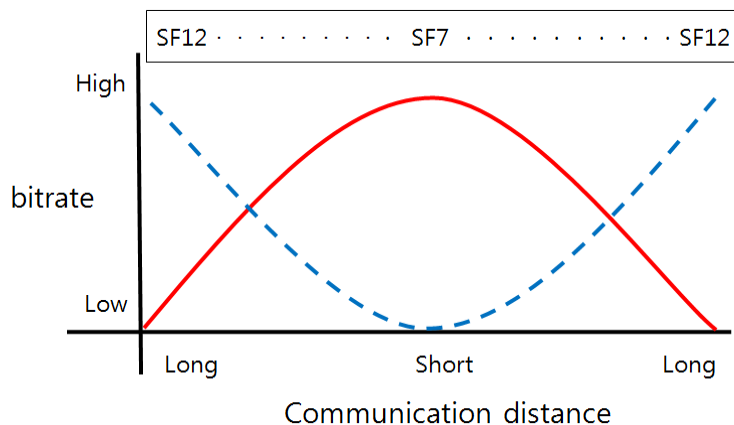
5.3.3 Private Program Setup

It is a private program supplied by M2I Corporation. It can change the internal settings.
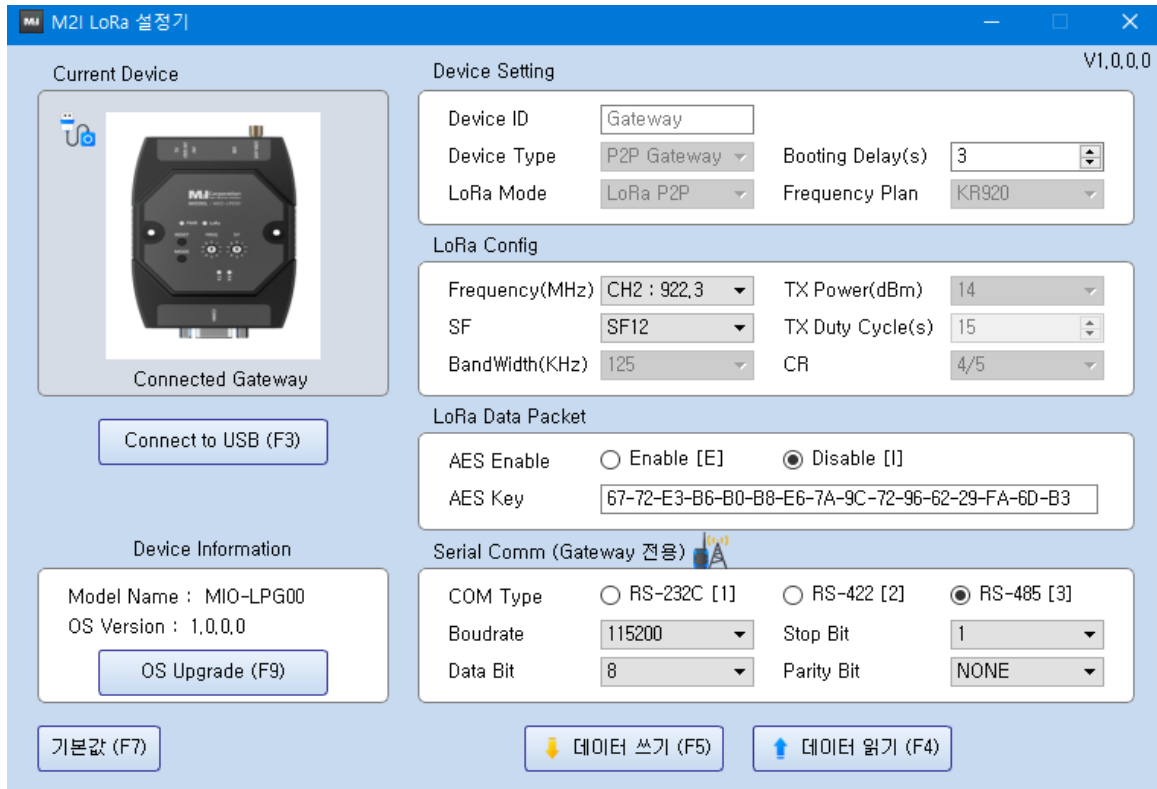
(1) Device Setting: Display the key information of connective device.

(2) LoRa Config: Setting Frequency, TX Power, SF

  - Frequency: Setting the frequency of device. Device's rotary switch should be set as 0.

  - SF: set between 7~12. Higher number makes data speed down, but longer communication range.

    SF select switch of device should be set as 0.

(3) LoRa Data Packet: LoRa communication's AES(Advanced Encryption Standard) setting.

(4) Serial Comm(*Gateway only): Set the mode and specification of serial communication.

(5) OS Upgrade: OS upgrade by connecting USB.

  - The device should be Boot mode. (How to: Push the 'RESET' button while the 'MODE' button is pushed.).

5.4 RESET Button and MODE Button

5.4.1 RESET Button

Reset the whole system.

5.4.2 MODE Button

Use when you set the settings automatically.

(1) Push 'MODE' button for 3 seconds of MIO-LPG00, MIO-LPE00 (LoRa LED will blink).

(2) Push 'MODE' button of MIO-LPG00 for 1 second, settings of MIO-LPG00 will send to MIO-LPE00 device, and settings of MIO-LPE00will be changed same as MIO-LPG00 (and then device will reset).

- Multiple MIO-LPE00 devices' setting can be changed.

Chapter 6 Interface

This product is using independent LoRa protocol, so it is not compatible with other devices. Please check below contents to connect between devices.

6.1 Wireless Communication Specifications

Items	Contents
Frequency Range	922.1MHz ~ 923.3MHz
Signal Strength	Max. 25mW (+14dBm, with Antenna)
Communication Range	2Km or less
Antenna	1T1R Dipole Antenna, +3.2dBm
Data Security	AES-128

6.2 Serial Communication Specifications
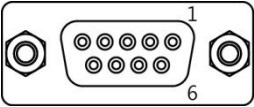
6.2.1 RS-232C

Items		Contents
Protocol		Full Duplex
Synch		Asynchronous
Communication Distance		About 15m
Type of Connection		1:1
Control Code		ASCII Code or HEXA Code
Transmission Speed		2400,4800,9600,19200,38400,57600,76800,115200 bps
Data Type	Data Bit	7, 8 bit
	Parity Bit	NONE, ODD, EVEN Parity
	Stop Bit	1, 2 bit
Modular Jack		DSUB 9pin

6.2.2 RS-422/485

Items		Contents
Protocol		Full Duplex/Half Duplex
Synch		Asynchronous
Communication Distance		About 500m
Type of Connection		1:N(N ≤ 31)
Control Code		ASCII Code or HEXA Code
Transmission Speed		2400,4800,9600,19200,38400,57600,76800,115200 bps
Data Type	Data Bit	7, 8 bit
	Parity Bit	NONE, ODD, EVEN Parity
	Stop Bit	1, 2 bit
Modular Jack		DSUB 9pin

6.2.3 COMM. Connector pin number and Signal name

Type	Pin No.	Signal	Direction	Meaning
9Pin Female	1	RX+(TRX+)	Input	RS-422/485 Receive Data (+)
	2	RD	Input	RS-232C Receive Data
	3	SD	Output	RS-232C Send Data
	4	RX+(TRX-)	Input	RS-422/485 Receive Data (-)
	5	SG	-	Signal Ground
	6	TX+(TRX+)	Output	RS-422/485 Send Data (+)
	7	N.C	-	Not Available
	8	N.C	-	Not Available
	9	TX-(TRX-)	Output	RS-422/485 Send Data (-)

(1) Be sure to connect the RD and SD to the RS-232C communication line by crossing each other with a Twisted Pair Cable. Please connect SG directly.

(2) RS-422/485 communication line must use RDA and RDB as Twisted Pair Cable, SDA and SDB as Twisted Pair Cable.

(3) Please connect Signal Ground and Outer Device's Signal Ground together. It will make better noise endurance.

(4) Do not use shield wire of communication line as signal ground. It may cause communication failure.

Chapter 7 Installation and Wiring ⚠Warning

7.1 Specifying Install Location

(1) For the performance, ventilation and safe use of the equipment, keep the distance between the back of the main unit and each wall of the container at least 100mm. In order to minimize external mechanical hazards, please control the mechanical hazards of the surrounding environment

(2) It should be installed within -10 ~ 50°C and 10~80% relative-humidity.

(3) Install the cooling fan when installed in an enclosed space.

(4) Do not make power cable and communication cable be neighboring. It can cause malfunction from noise.

(5) An install location should be separated from power line and I/O cables which has a lot of noise. Also make the wiring length short as possible.

7.2 DIN RAIL
This product has DIN Rail (width 35mm) Hook for mounting.

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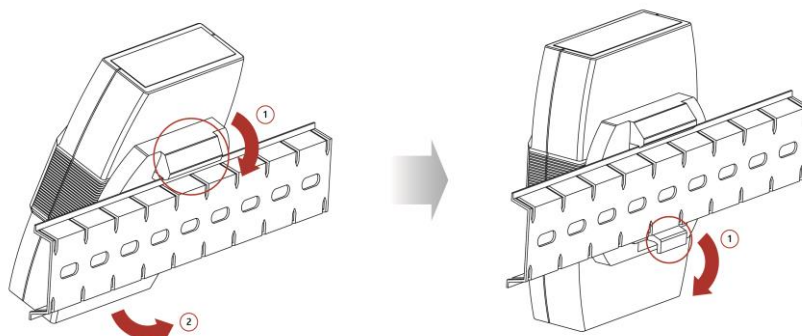
7.3 Power, Ground, and Communication Cable Specification

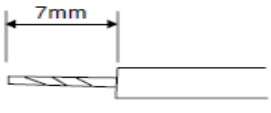|	
Power Cable	0.75~1.5mm^2(18~16AWG)
Ground Cable	1.5mm^2(16AWG) or more
Conductor Type	Simple or Standard Wire
Bolt tightening force	≥ 0.4N.m ⚠Warning
Conductor Length	
Temperature rating of the field installed conductors	65℃ or under

- Power and ground terminal specifications are as follows. When installing the power and grounding terminals, use the pin terminals to improve electrical transmission and to prevent the power line wearing.
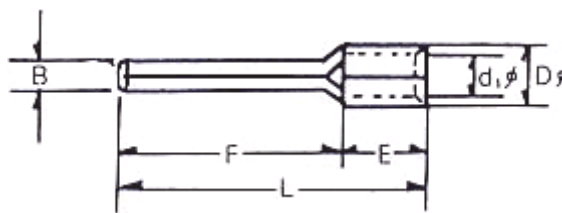
B	L	F	E	D	d
1.8~2.0	22~18	12~14	5	3.3~3.8	2~2.5

- Attach the power cord to the power terminal of the body as follows. ⚠Warning
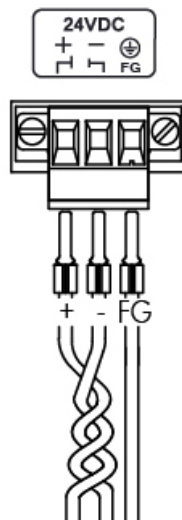
7.4 Cradle Ground Wiring ⚠Warning

(1) Although the instrument has sufficient noise countermeasures, in order to ensure the safety of the instrument and the safety in use, the user must connect the ground of the instrument.

(2) Grounding should be done with a dedicated ground. It is recommended that the ground is a 3-class ground. (Ground resistance is 100Ω or less)

(3) When the dedicated grounding is not possible, please make the common ground as shown below.
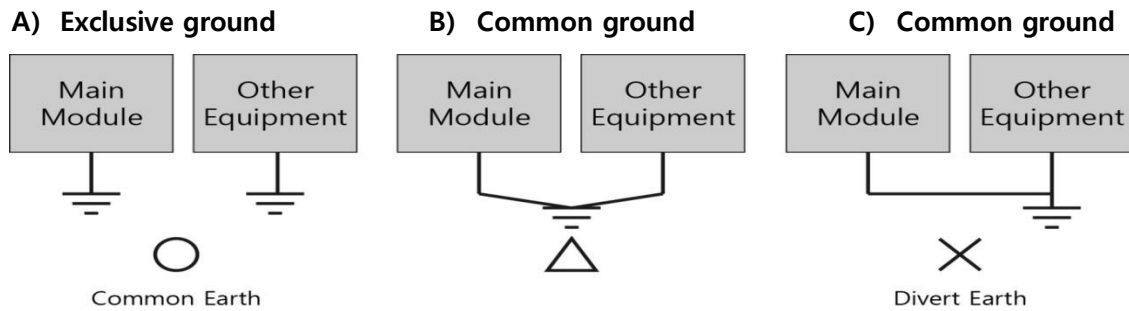
A) Exclusive ground **B) Common ground** **C) Common ground**

Fig. Grounding Example Diagram

(4) Keep ground near the instrument and keep the ground wire as short as possible.

Chapter 8 Maintenance ⚠Warning

8.1 Case Cleaning
Use soft cloth wet by detergent to wipe dirty surface of case out.

8.2 Periodic Check Points
Check the followings periodically for best condition of the device.
(1) Environment
   1) Is the operating temperature within the allowable range (-10°C~50°C)?
   2) Is the operating humidity within the allowable range (10%~80% RH)?
   3) Is the Surrounding pollution no corrosive gas?
(2) Power
   1) Is the input power in right range?
(3) Related Items
   1) Check the touch pad there is no damage, scratch or pollution.
2) Check the status of device by Status LED.

8.3 Problems with the Device ⚠Warning
(1) If there is a problem during operation, stop using it and contact the A/S department of M2I Corporation, which is indicated on the product label.
(2) Only the authorized worker from M2I Corporation can check and repair problems related to malfunction of the machine.
(3) If the problem cannot be solved at the installation site, the equipment can be collected and moved to M2I Corporation.
(4) The manufacturer, M2I Corporation, is not responsible for damage or malfunction of the equipment caused by the use conditions of the user beyond the installation and use standards described in the manual.

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Chapter 9 Products Label

M₂Corporation
Man · Machine · Interface

KC

Manufacture (AS): M2I Corporation

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　　　　　　Tel: 82-31-465-3366

Product Category: Industrial I/O Wireless Controller

Model Name: MIO-LPG00

Operating Temp: -10℃ ≤ Ta ≤ +50℃

Power Specifications: 24Vdc, 3Wor less

KC Certificates:

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- **Please read related contents in this manual when you use M2I product, and operate the product staying safe with appropriate handling.**
- **This manual should be stored in secured and appointed place so that it can be read in any needs.**

This wireless product has Relevant Assessments for business environment and certified by RADIO WAVES ACT 58.2.

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