



## Modular Wireless I/O System

### User Guide

Version 80-7046-001\_M

### Model Numbers

RADIO KITS: BM-0868-RM1 | BM-0900-RM1 | BM-0915-RM1 | BM-2400-RM1

I/O MODULES: BM-D100-144 / BM-A420-122 / BM-A010-122

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## 1. PREFACE/SAFETY

Thank you for choosing the WIO® Modular Wireless I/O System by OleumTech®.

This system is a point-to-point, bi-directional wireless I/O mirroring solution that is ideal for replacing hardwire and conduit or for implementing it into new or existing infrastructures. The WIO System requires no software or programming and is extremely easy to install and use. It's the easiest way from point A to point B, and back.

This document is designed to guide you through setting up the system by familiarizing you with the hardware, installation, wiring, and overall system management. This guide also provides how to use the WIO System's Advanced User Interface.

You can also utilize the online video training program available on at <http://wio.oleumtech.com> as a supplemental learning tool.

If you have any questions about this product, you may call or email:

ProSoft Technology Support Services  
1.661.716.5100  
[support@prosoft-technology.com](mailto:support@prosoft-technology.com)



**WARNING:** Ensure installation of the system meets applicable state and national electrical code requirements.



**WARNING:** The installation of the system should only be performed by a qualified installer.



**WARNING:** To prevent ignition of flammable or combustible atmospheres, disconnect power before servicing.



**WARNING:** Power must be disconnected or turn off prior to attaching or removing any I/O Modules from the system – failure to comply may cause damage to the I/O Module(s).



**WARNING:** When connecting the device to an external power supply, do not exceed the defined voltage: 9-30 Vdc max.



**WARNING:** Contains no user serviceable parts. Unauthorized modification to device or supplied accessories may damage devices and void warranty.



**WARNING:** The WIO System must be installed within an enclosure that requires a tool to access. This is to prevent inadvertent disconnection of any of the power wiring, signal wiring or communication cables.



**WARNING:** This device is not intended for use on processes that have the potential to generate high vibration levels that would adversely impact product performance or life.



**WARNING:** EXPLOSION HAZARD. Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.



**AVERTISSEMENT:** Assurez-vous que l'installation du système répond aux exigences du code électrique national et national en vigueur.



**AVERTISSEMENT:** L'installation du système ne doit être effectuée que par un installateur qualifié.



**AVERTISSEMENT:** Pour éviter l'inflammation des atmosphères inflammables ou combustibles, débranchez l'alimentation avant de procéder à l'entretien.



**AVERTISSEMENT:** L'alimentation doit être déconnectée ou éteinte avant de connecter ou de retirer des modules d'E / S du système. Le non-respect peut endommager le module d'E / S.



**AVERTISSEMENT:** Lors de la connexion de l'appareil à une alimentation externe, ne pas dépasser la tension définie: 9-30 Vdc max



**AVERTISSEMENT:** Ne contient aucune pièce réparable par l'utilisateur. Toute modification non autorisée de l'appareil ou des accessoires fournis peut endommager les appareils et annuler la garantie.



**AVERTISSEMENT:** Le système WIO doit être installé dans un boîtier nécessitant un outil. Ceci a pour but d'empêcher la déconnexion par inadvertance du câblage d'alimentation, du câblage de signal ou des câbles de communication.



**AVERTISSEMENT:** Cet appareil n'est pas conçu pour être utilisé sur des processus susceptibles de générer des niveaux de vibration élevés susceptibles d'affecter les performances ou la durée de vie du produit.



**AVERTISSEMENT:** RISQUE D'EXPLOSION. Ne déconnectez pas l'équipement à moins que l'alimentation ait été coupée ou que la zone ne soit pas dangereuse.

## 2. COMPLIANCES

### *Important Information to the User*

- This device **MUST** be professionally installed only by a factory representative or a trained authorized technician.
- Changes or modifications not expressly approved by the manufacturer may void the user's authority to operate the equipment.
- This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: 1) this device may not cause harmful interference, and 2) this device must accept any interference received, including interference that may cause undesired operation.
- To reduce potential radio interference to other users, install and use only the antenna supplied by the manufacturer to ensure successful communications.

### *FCC RF Exposure*

To comply with FCC RF exposure compliance requirements, a separation distance of at least 20 cm must be maintained between the antenna of this device and all persons.

### *FCC Interfere*

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and if not installed and used in accordance with the instructions, may cause harmful communications to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures:

- Reorient or relocate the antenna.
- Increase the separation between the equipment and receiver.
- Consult the manufacturer for technical help.

This equipment has been certified to comply with the limits for a class B computing device, pursuant to FCC Rules. In order to maintain compliance with FCC regulations, shielded cables must be used with this equipment. Operation with non-approved equipment or use of unshielded cables is likely to result in interference to radio and television reception. The user is cautioned that changes or modifications made to the equipment without the approval of the manufacturer could void the user's authority to operate this equipment.

### 3. SYSTEM OVERVIEW

#### SYSTEM HIGHLIGHTS

- Point-to-point wireless I/O mirroring system
- Replicate raw signals in either direction (bi-directional)
- Fully customizable modular I/O solution
- Supports 0-10 V, 4-20 mA, and discrete I/O
- No software configuration required
- Mounts onto a 35 mm DIN rails
- Class I, Division 2 (Zone 2) certified
- 40 °C to 80 °C
- Isolated I/O: each Module provides field isolated inputs and outputs
- Fast response time: 1 second default / turbo-mode up to 100 ms depending on number of connection I/O Modules
- RF and I/O fail detection: NPN outputs on Radio Modules
- Secure: factory paired, secure AES encryption keeps network protected from intrusions
- Less wire clutter: single power termination per station
- FailSafe: user can defines how outputs are failed over when RF or I/O communication is ever lost
- FailSafe output modes:
  - Digital: On, off, last known value (default)
  - Analog: Any value on scale (Advanced UI required), last known value (default)
- Provides manual local FailSafe override function via dry contact input on Radio Module
- WIO System can support multiple I/O Modules
  - System can support up to sixteen (16) Digital Modules max
  - System can support up to eight (8) 0-10 V Modules max
  - System can support up to five (5) 4-20 mA Modules max



When adding more than five (5) I/O Modules and creating different I/O Module combination, please determine maximum allowable I/O Module combination per system by utilizing the power budget calculator. [CLICK HERE](#)



Lorsque vous ajoutez plus de cinq (5) modules d'E / S et que vous créez une combinaison de modules d'E / S différente, déterminez la combinaison de modules d'E / S maximum par système en utilisant le calculateur de budget de puissance. [Cliquez ici](#)

### **Custom-Tailor I/O Mix, Bi-Directional**

The OleumTech® WIO® Modular Wireless I/O System provides instant I/O connectivity and is one of the easiest and most cost-effective solutions for solving a vast number of point-to-point I/O and stranded asset monitoring and control challenges. Each Radio Kit can be fully customized using available 0-10 Vdc, 4-20 mA, and Digital I/O Modules. The bi-directional connectivity gives you the flexibility to connect third-party equipment such as a PLC or RTU to either side of the radio link.

### **No Programming Required**

Not having to learn or program any software is what makes the WIO System so easy to use. And although this system does not require any programming, an Advanced User Interface (UI) for PCs is available to take full advantage of the entire feature set. Through the Advanced UI, you can view and optimize RF strength; view input and output status; set analog fail-safe output values; locally force outputs for diagnostic testing; and more.

### **Just Add I/O Modules**

Constructing a Modular Wireless I/O System begins with a WIO Radio Kit. The Kit includes a factory-paired Radio set and all the mounting hardware necessary for installation onto 35 mm DIN rails. Then, simply add matching pairs of I/O Modules to get just the right mix of I/O. There are three available I/O Modules to choose from: Analog 4-20 mA, Analog 0-10 Vdc, and Digital. Each paired Radio System provides a secure I/O link using AES encryption. You can safely and reliably run multiple radio pairs in close proximity.

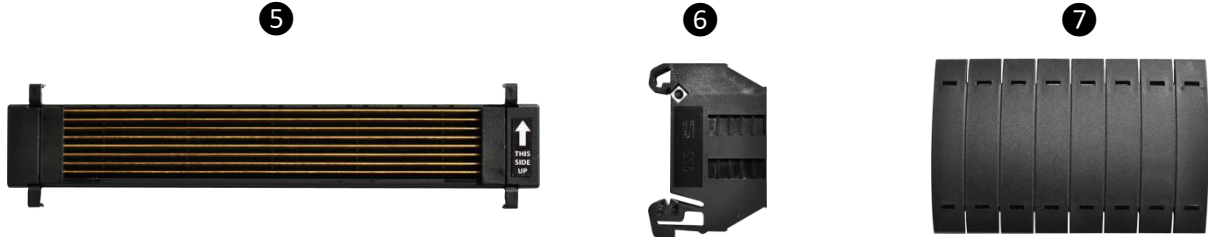
### **Fail-Safe Output Protection**

You can set the predetermined value for each output in case of an RF or I/O failure. DIP switches are used for the Digital I/O Module to control the fail-safe output settings. The Analog I/O Modules default to 0 V or 4 mA. Advanced UI can be utilized for setting any other desired value. The system's RF and I/O health can be remotely monitored by tying the NPN outputs on the Radio Modules to a third-party monitoring system.

## 4. HARDWARE AT A GLANCE



1. Radio Module: BM-0868-RM1 (EU), BM-0900-RM1 (NA/ME), BM-0915-RM1 (Aus/NZ), BM-2400-RM1 (NA/ME)
  - a. Radio Module Kit (BM-xxxx-RM1K)
2. Digital Module: BM-D100-144
  - a. 2-Pack (BM-D100-144D); 1-Pack (BM-D100-144S)
3. 4-20 mA Analog Module: BM-A420-122
  - a. 2-Pack (BM-A420-122); 1-Pack (BM-A420-122)
4. 0-10 V Analog Module: BM-A010-122
  - a. 2-Pack (BM-A010-122D); 1-Pack (BM-A010-122S)



5. DataRail attaches onto 35 mm x 7.5 mm DIN rail
  - a. Part# 61-7000-001 included with Radio Kit 6" fits Radio Module + 5 I/O Modules
  - b. Optional Part# 61-7000-002: (8" fits Radio Module + 8 I/O Modules)
  - c. Optional Part# 61-7000-003: (10" fits Radio Module + 11 I/O Modules)
  - d. Optional Part# 61-7000-005: (14" fits Radio Module + 17 I/O Modules)
6. End Terminal Bracket for securing DataRail and Modules to DIN Rail
7. DataRail Cover for protecting empty DataRail slots – excess pieces can be snapped-off by hand

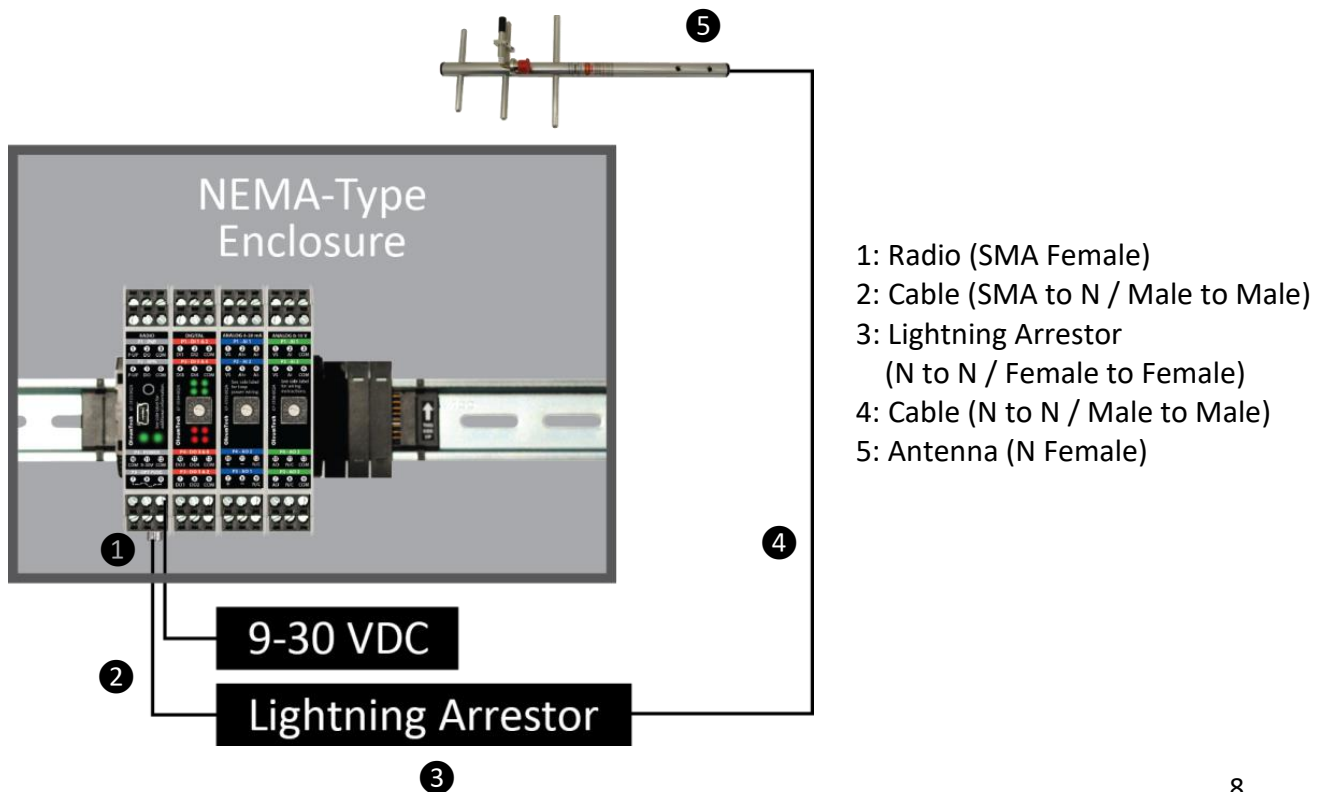








## 5. INSTALLATION

### A. Outdoor Enclosure Installation

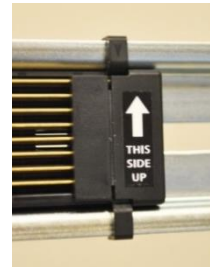
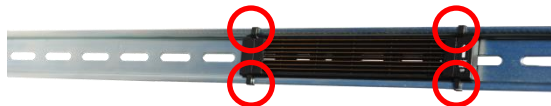
1. Install or use existing outdoor NEMA-type enclosure.
2. Be sure the WIO® System meets applicable grounding requirements in the enclosure.
3. Install a 35 mm x 7.5 mm DIN rail (at least 166 mm (6.5-inch) wide) inside the enclosure.
4. Provide external power supply: 9-30 VDC.
5. Provide antenna and antenna cable with SMA male end to connect to WIO Radio Module.
  - a. There are various types of antennas including bulkhead, omni, and yagi. Please use the appropriate type for your application.
6. Connecting a lightning arrestor is highly recommended.
7. Install antenna (performing a RF site survey prior to installation is highly recommended).
8. Make a hole on the bottom of the enclosure to run wires.
9. Run conduit for power and antenna cable.
10. Connect antenna cable to antenna and then feed cable into enclosure.
11. Feed power wiring into enclosure.
12. Repeat above steps for other site location.





**B. WIO® System Assembly (attach from left to right)**

-  **WARNING:** Power must be disconnected or turned off prior to attaching or removing any I/O Modules from the system – failure to comply may cause damage hardware.
-  **WARNING:** Entire system with Radio and I/O Module(s) must be fully assembled before supplying power to the Radio Module for the system to boot and operate properly. Failure to do so may cause RF link and I/O link to fail.
-  **AVERTISSEMENT:** L'alimentation doit être déconnectée ou éteinte avant d'installer ou de retirer des modules d'E / S du système. Le non-respect peut entraîner des dommages matériels.
-  **AVERTISSEMENT:** L'ensemble du système avec module (s) de radio et d'E / S doit être entièrement assemblé avant d'alimenter le module radio pour que le système démarre et fonctionne correctement. Si vous ne le faites pas, la liaison RF et la liaison E / S peuvent échouer.

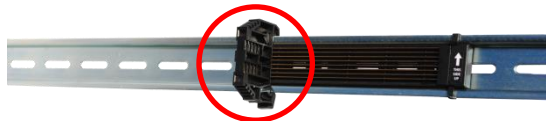
1. Securely attach DataRail onto a 35 mm x 7.5 mm DIN rail by gently pressing on all four (4) corner clips.



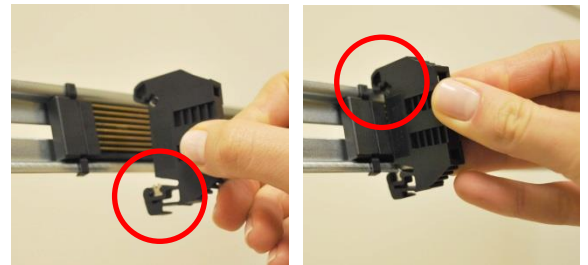
-  Must attach DataRail with arrow pointing up.
-  Doit joindre DataRail avec la flèche pointant vers le haut.

2. Secure DataRail to DIN rail by attaching an End Terminal Bracket.

- a. First, hook the metal end of the Bracket to DIN rail and then snap the other end onto DIN rail into place. (be sure to position the Bracket far left of the DataRail where metal blades meet the plastic)



Attach components from left to right without gap.

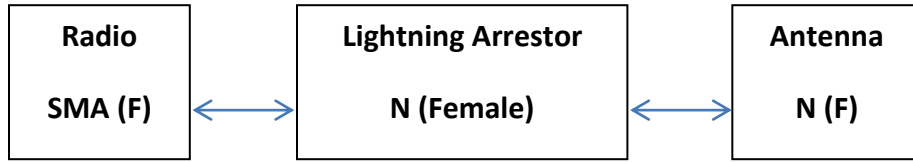


3. Attach Radio Module to DataRail (place it next to the Bracket without any gap).

- a. First, latch the top hook onto the rail, then snap-in the spring-loaded clip into place.



- b. Connect Antenna. Radio Module is equipped with SMA (female) connector. For outdoor installation, place a lightning arrestor between Antenna and Radio Module connection.



- 4. Attach I/O Module(s) to the system.
  - a. Place Modules in any combination (do not leave gaps between Modules).
  - b. When using more than five (5) I/O Modules, determine maximum I/O Module combination by using power budget calculator. [CLICK HERE http://goo.gl/t67r3k](http://goo.gl/t67r3k)




**WARNING:** Power must be disconnected or turn off prior to attaching or removing any I/O Modules from the system – failure to comply may cause damage to the I/O Module(s)



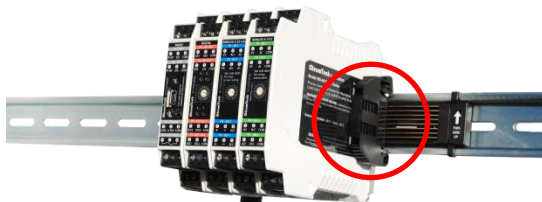
**AVERTISSEMENT:** L'alimentation doit être déconnectée ou éteinte avant d'installer ou de retirer des modules d'E / S du système. Le non-respect peut entraîner des dommages matériels.



- c. Then, use the 16-position Switch located on the front of each I/O Module to set device ID(s).
  -  Each pair of Modules must be set to its own ID for the system to function properly.
  - Chaque paire de modules doit être définie sur son propre ID pour que le système fonctionne correctement.



- 5. Attach the other End Terminal Bracket to secure the Modules (place it next to the last module without leaving a gap).



6. Protect any unused DataRail slots with Cover. Snap-off extra pieces and store for future use.



7. Terminate I/O and supply power as required. Use solid or stranded wire (AWG) 28-12.

### C. How to Detach Components from DataRail

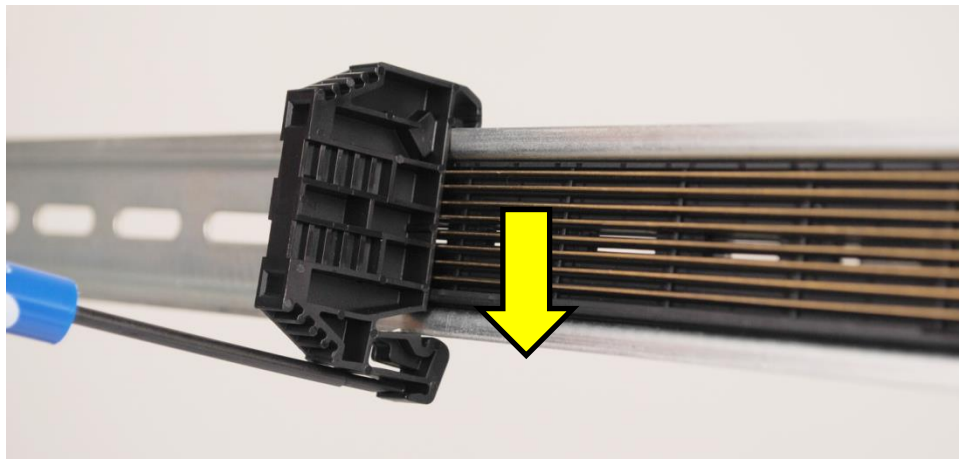


**WARNING:** All live wiring connections and power must be safely disconnected before taking any components off the DataRail or WIO® System!



**AVERTISSEMENT:** Tous les branchements et l'alimentation doivent être déconnectés en toute sécurité avant de retirer tout composant du système DataRail ou WIO®!

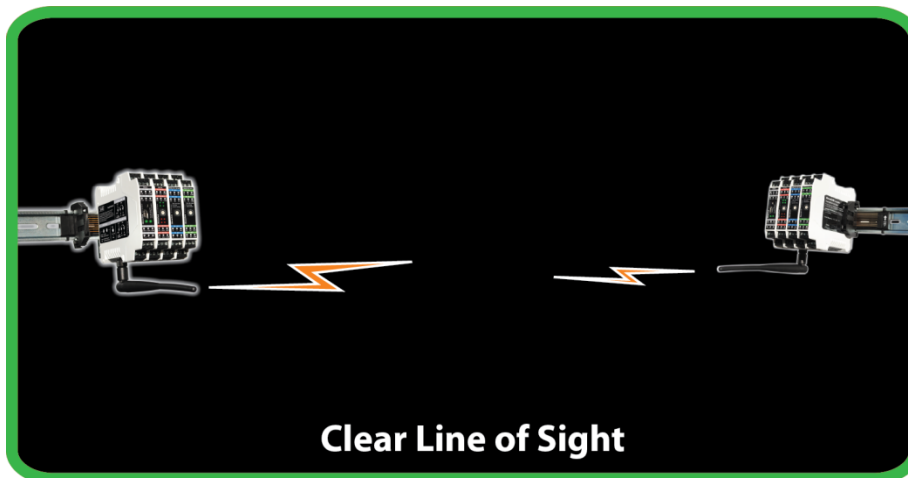
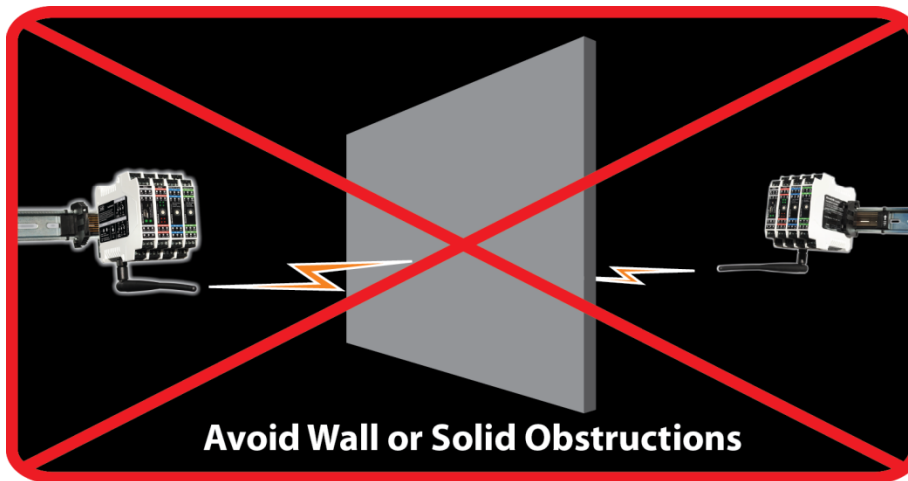
1. End Terminal Bracket can be removed from din rail by inserting the tip of a flathead screwdriver into the removal slot. Control the direction with the screwdriver handle to pull the latch away from the din rail for safe removal.



2. WIO® Modules can be removed from the din rail by inserting the tip of a flathead screwdriver into removal slot located on the metal clip. Lift-up on the screwdriver handle to pull the spring-loaded clip away from the din rail for safe removal.

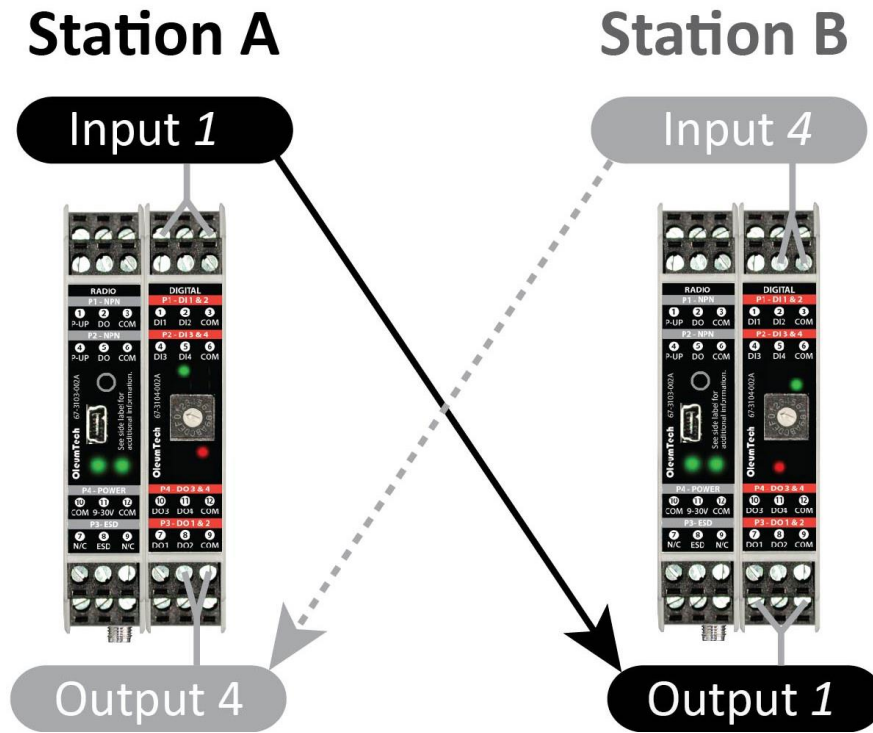


## 6. RF SETUP – BEST PRACTICE



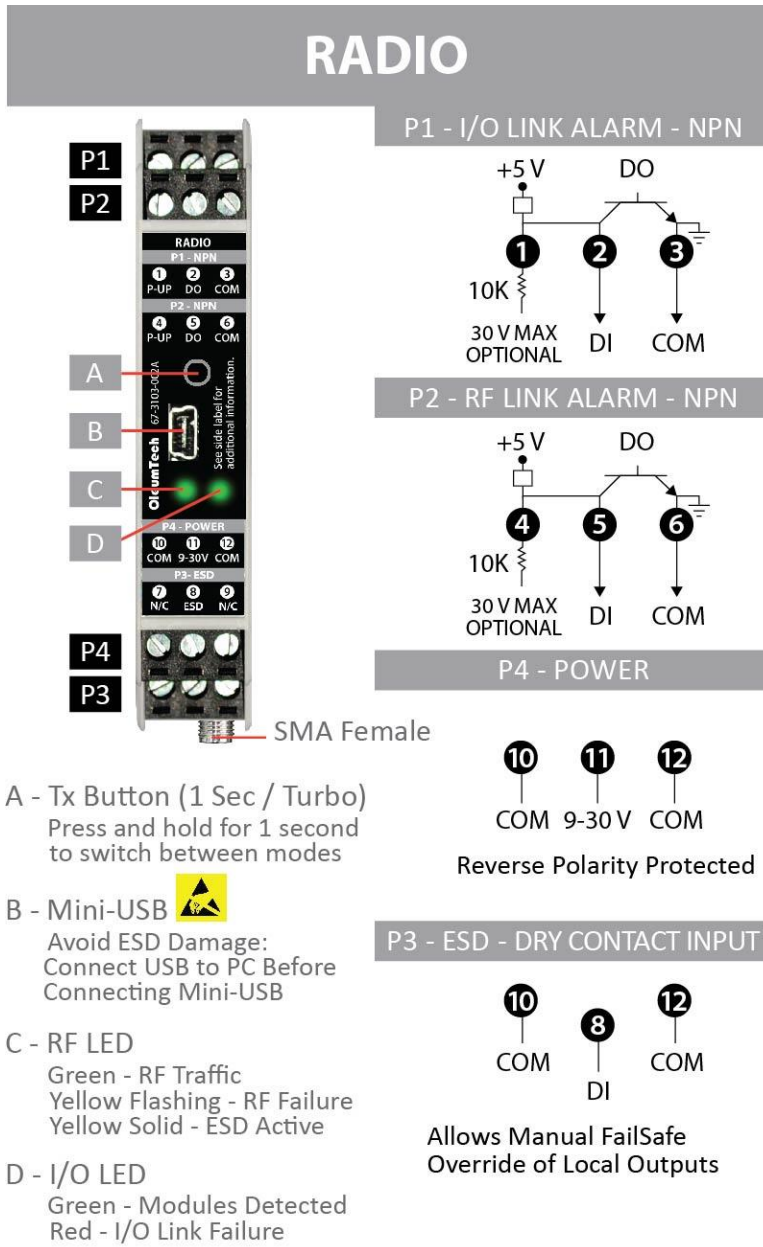
1. When setting up and installing antennas, avoid walls, tall buildings, trees, and other solid obstructions for improving RF signal quality.
2. Having a clear line of sight between antennas is ideal for best RF signal quality.
3. Use appropriate antenna and use high quality antenna cables with the WIO System for best performance.
4. After entire system is installed, verify RF LED on Radio Module is green, which serves as indication for good RF traffic.
5. Advanced: Run RSSI test. Connect PC to Radio Module's mini USB port using a USB to mini USB cable and utilize the WIO® System Advanced Software to evaluate Received Signal Strength. In general, achieving above -85 dBm is recommended for signal quality. In an environment with low interference, 90-100% packet throughput can be achieved at lower levels, even as low as -100 dBm.

### 7. SIGNAL CHAIN DIAGRAM



## 8. RADIO MODULE WIRING DIAGRAMS

### A. Radio Module Overview (BM-0900-RM1 Shown)



Connect I/O Link Alarm output to report when there is an I/O link failure. Once the failure is corrected, must reset power.

Connect RF Link Alarm output to report when there is an RF link failure.

This Input allows connection of a dry contact switch for manually overriding system into FailSafe state for all outputs.

Use Solid / Stranded (AWG) 28-12 Wire Gauge



Radio Module does not share a common ground with I/O Modules. All inputs and outputs on I/O Modules provide field isolation.



Le module radio ne partage pas un terrain d'entente avec les modules d'E / S. Toutes les entrées et sorties des modules d'E / S fournissent une isolation sur le terrain.



B. Isolation vs Non-Isolation

*Isolation vs Non-Isolation*



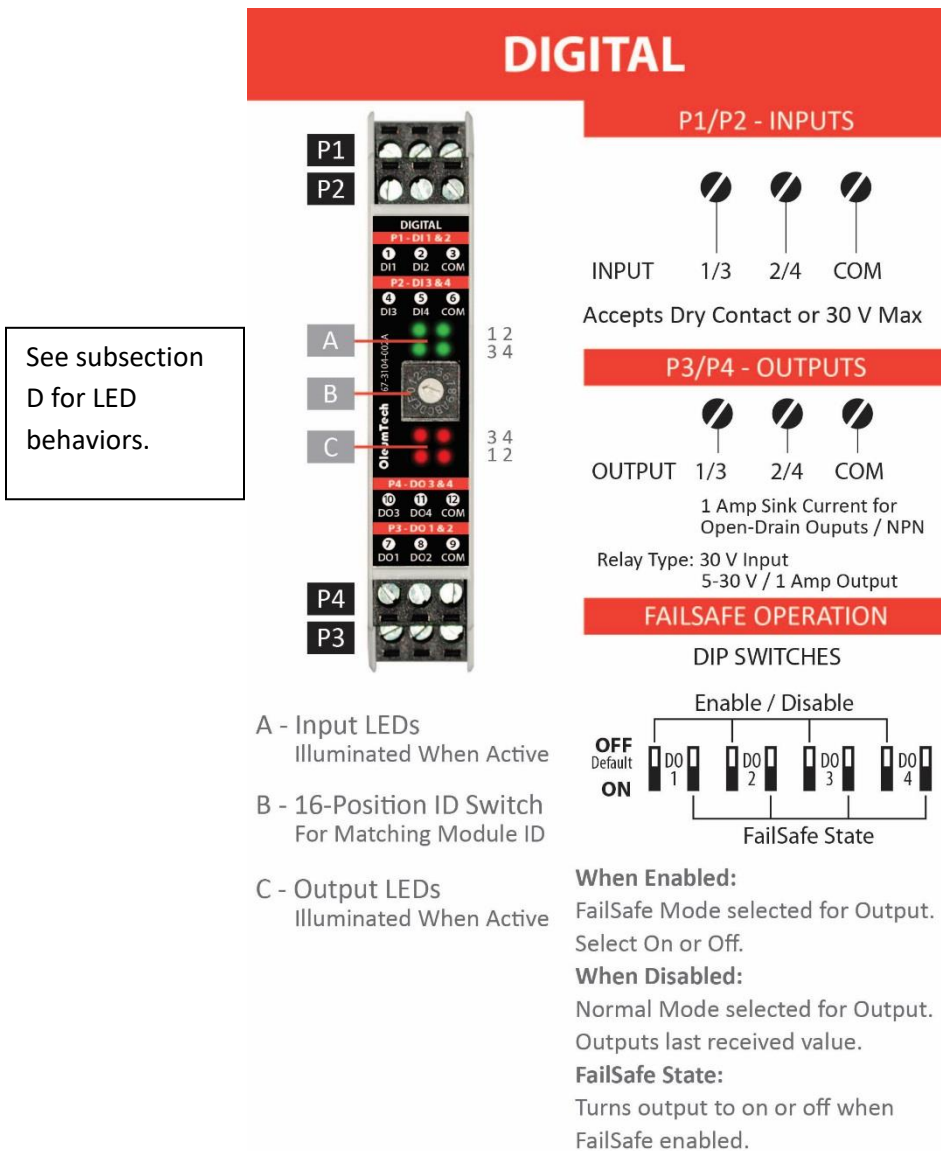
If isolation is required, then separate power sources are required for Radio Module and I/O Module(s).

If isolation is not required, a jumper is required to make common with Radio Module's power supply to to one of I/O Module's COM pin.

Jumper required if using a single power source.

## 9. DIGITAL I/O MODULE WIRING DIAGRAMS

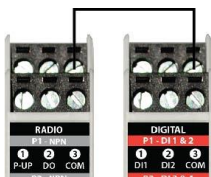
### A. Digital Module Overview (BM-D100-144 Shown)



Use Solid / Stranded (AWG) 28-12 Wire Gauge



Digital I/O Module does not share a common ground with Radio Module. All inputs and outputs on I/O Modules provide field isolation.



If input sensor is powered from the same source as Radio Module, be sure to establish a common ground, otherwise sensor will not work properly.

Le module d'E / S numérique ne partage pas une masse commune avec le module radio. Toutes les entrées et sorties des modules d'E / S fournissent une isolation sur le terrain.

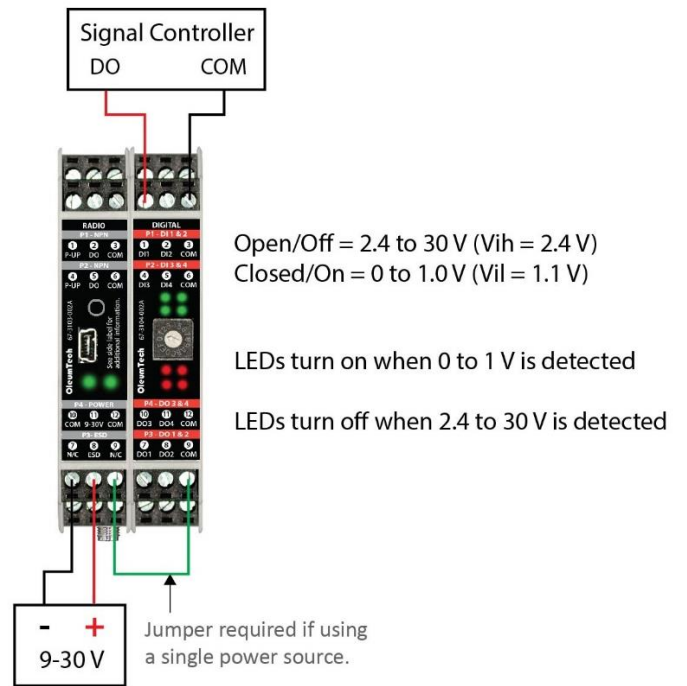
Si le capteur d'entrée est alimenté par la même source que le module radio, veuillez à établir une masse commune, sinon le capteur ne fonctionnera pas correctement.

**B. Digital Input Wiring**

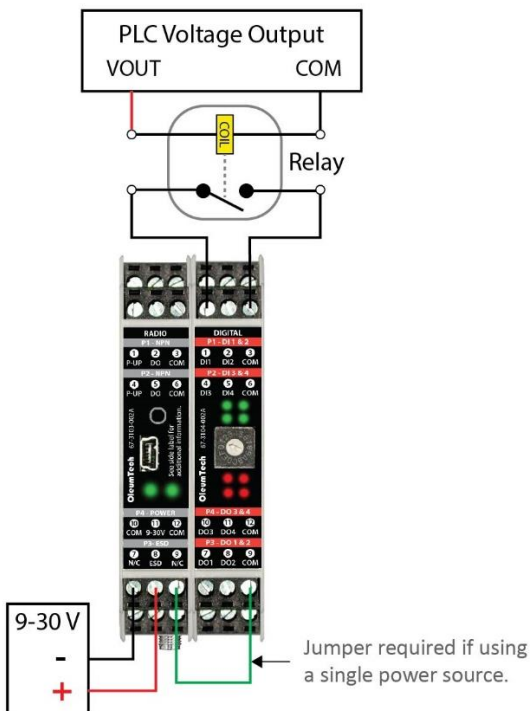
*Dry Contact Input*



*Digital Level Input - Active Low*

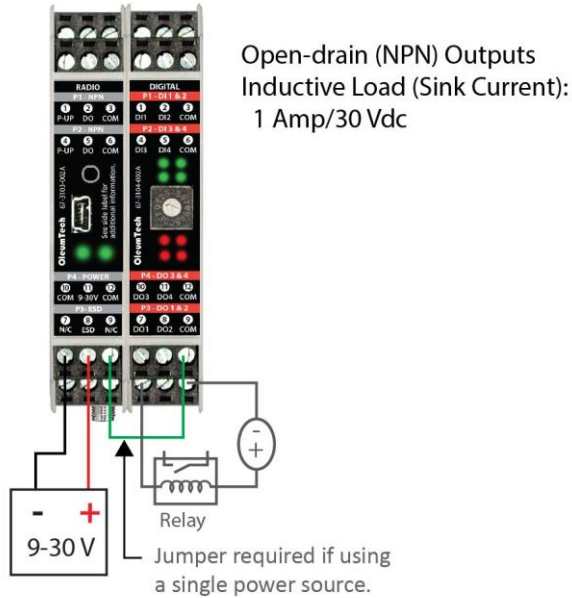


*Digital Level Input - Active High*

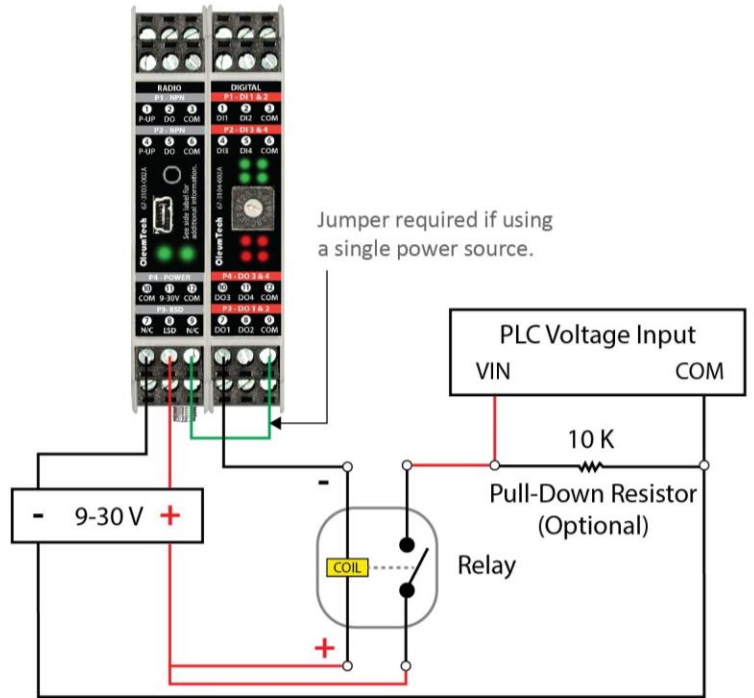


C. Digital Output Wiring

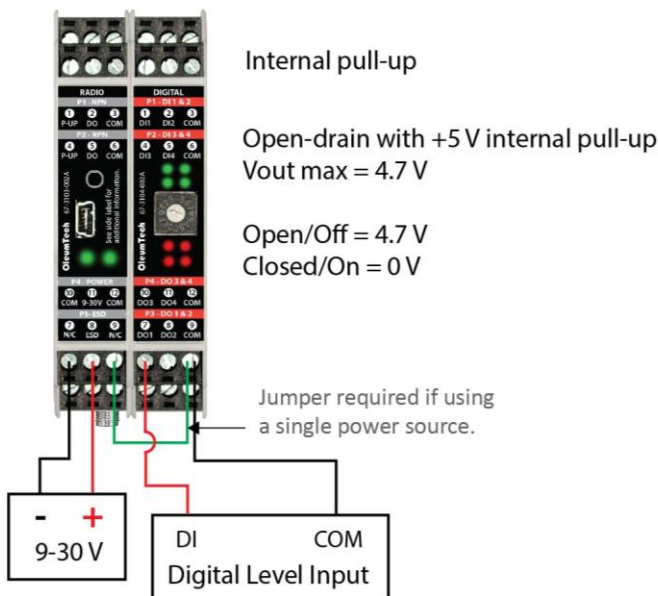
NPN Output



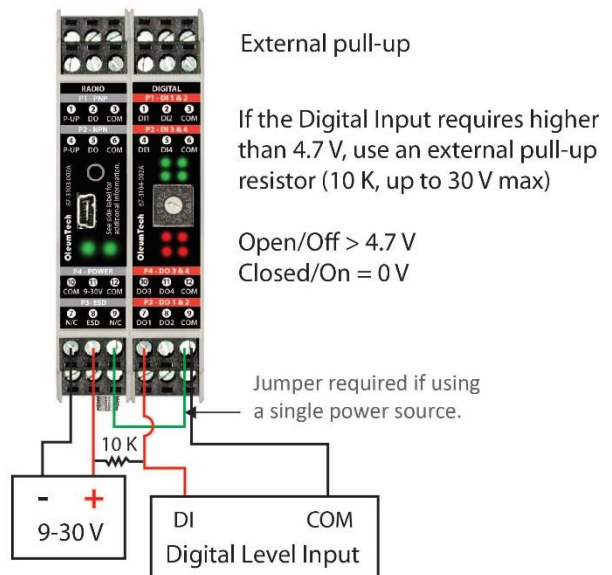
Digital Level Output - Active High



Digital Level Output - Active Low



Digital Level Output - Active Low



**D. Digital Module Signal Scheme**

The digital inputs are designed for use with dry contact switches and digital output devices (active low).

$$V_{ih} = 2.34V, V_{il} = 1.1 V, \text{ and } V_{in} = 30 V \text{ max}$$

**LED Behaviors**

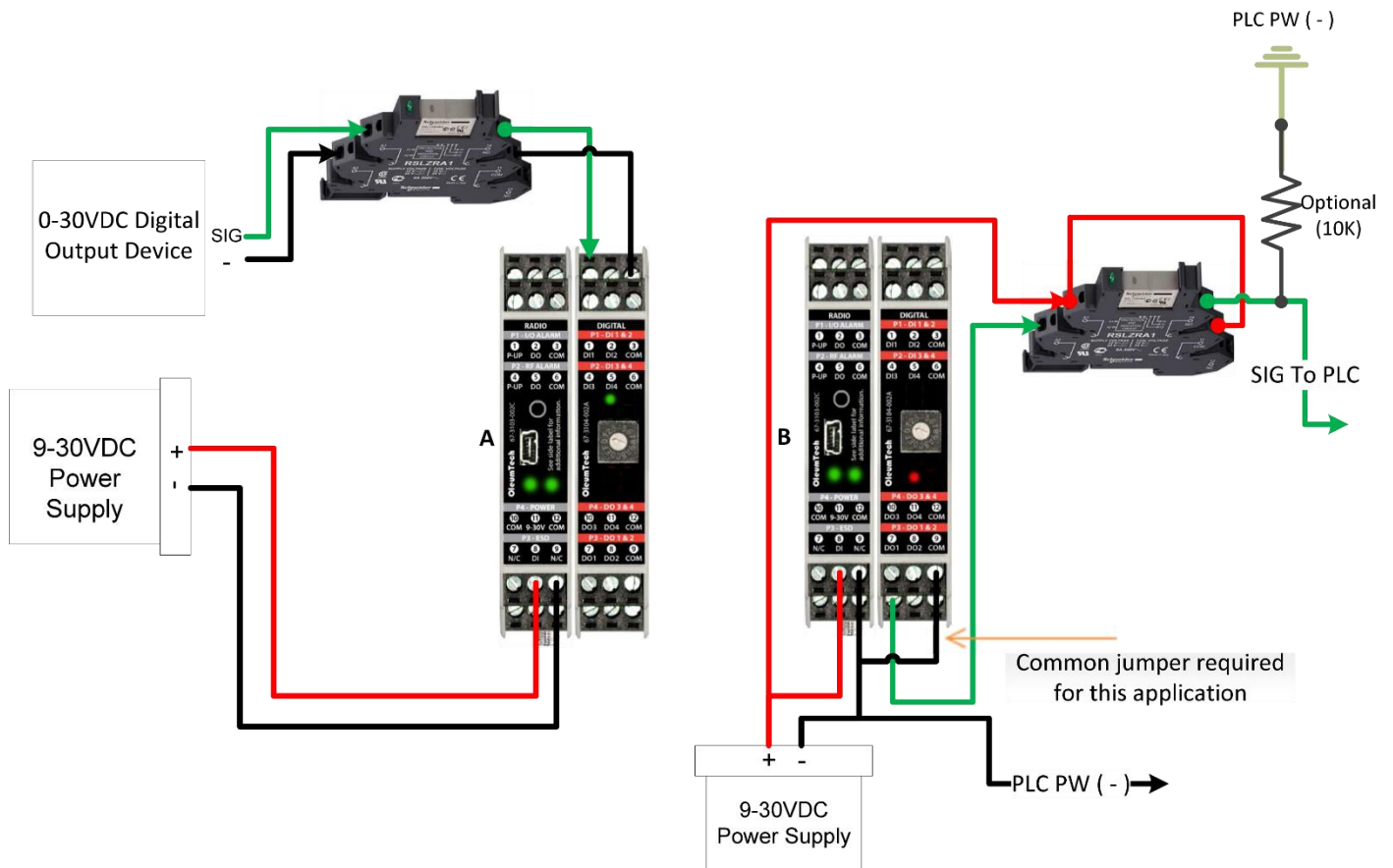
LEDs on this device (both inputs and outputs) are controlled using active low logic.

Input and Output LEDs will turn on when dry contact switch is closed or Digital Input Voltage is less than 1.1 V.

For active high digital output device, LEDs will have a reverse effect. When signal is greater than 2.4 V, LEDs will NOT turn on.

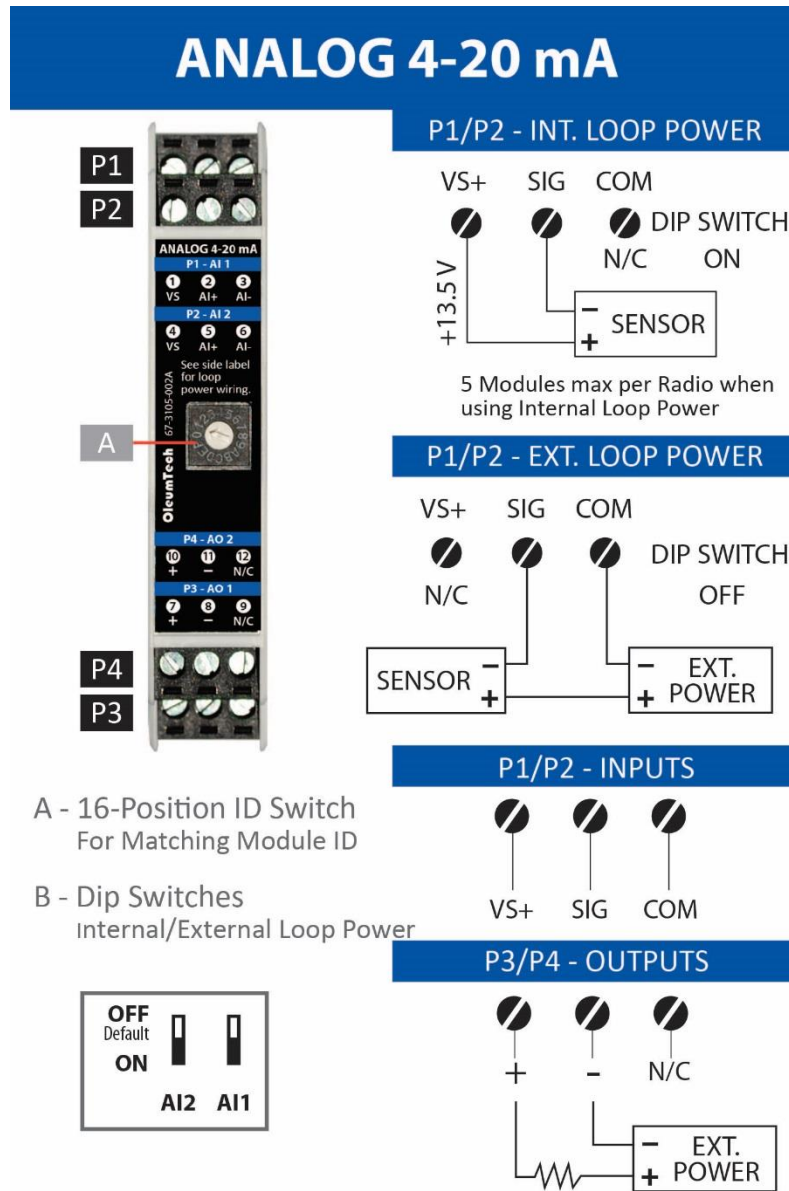
If LED are required for signal on = LED on operation, use interposing relays for both inputs and outputs for converting signals to dry contact inputs and open drain outputs.

Wiring diagram for Active High signal chain (Digital signal > 2.4 V, LED on input and output will be illuminated and mirror the input V value to the output.



## 10. ANALOG 4-20 mA I/O MODULE WIRING DIAGRAMS

### A. 4-20 mA Module Overview (BM-A420-122 Shown)



$$VS/\text{External Power (min)} = 10 + \text{Max Current (Amp)} * R_{\text{loop}}$$

$$R_{\text{loop}} = \text{Total Loop Impedance}$$

Use Solid / Stranded (AWG) 28-12 Wire Gauge



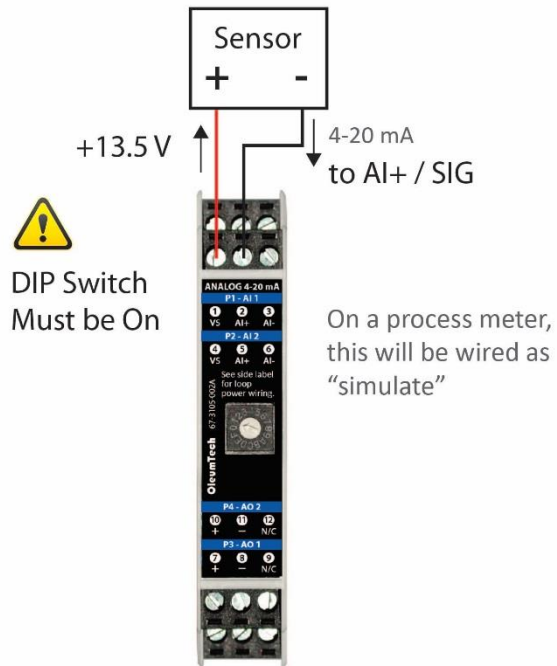
4-20 mA I/O Module does not share a common ground with Radio Module. All inputs and outputs on I/O Modules provide field isolation.



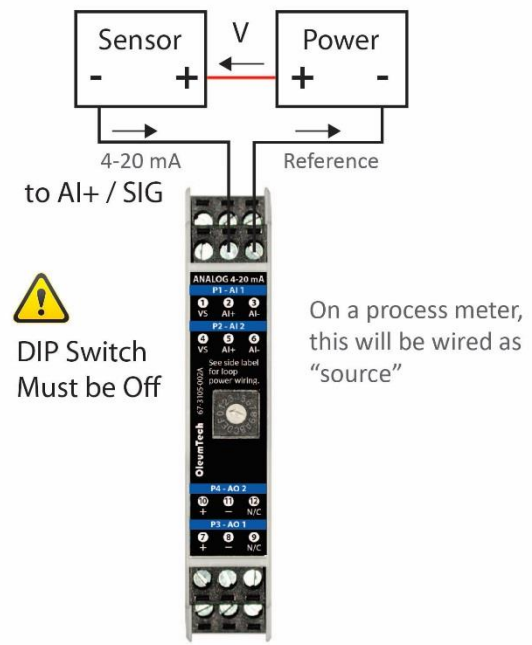
Le module d'E / S 4-20 mA ne partage pas une masse commune avec le module radio. Toutes les entrées et sorties des modules d'E / S fournissent une isolation sur le terrain.

B. 4-20 mA Input Wiring

**4-20 mA Internal Power Loop**

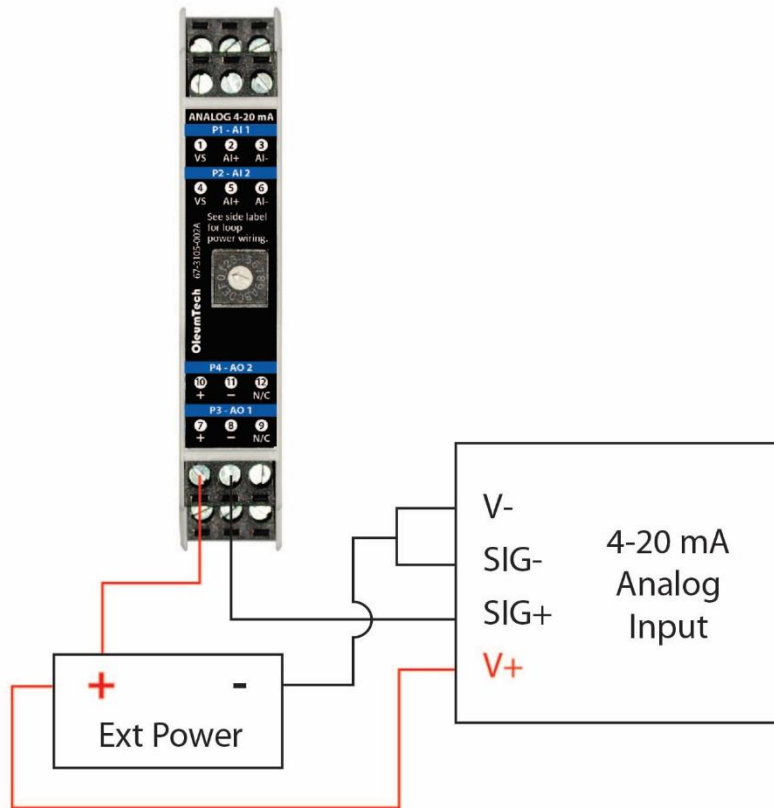


**4-20 mA External Power Loop**



C. 4-20 mA Output Wiring

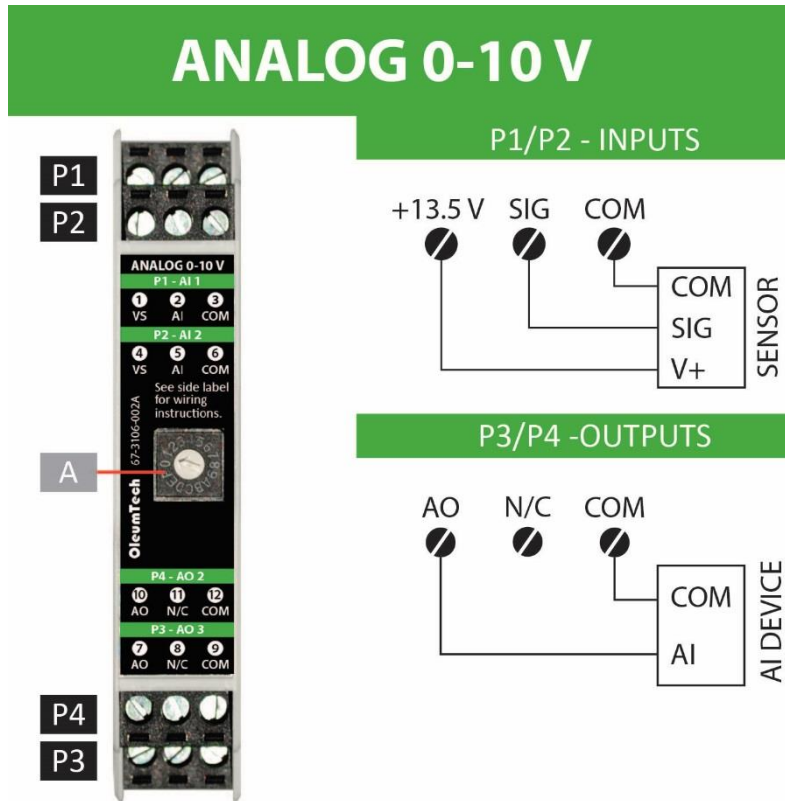
4-20 mA Output





## 11. ANALOG 0-10 V I/O MODULE WIRING DIAGRAM

### A. 0-10 V Module Overview (BM-A010-122 shown)



A - 16-Position ID Switch  
For Matching Module ID

Use Solid / Stranded (AWG) 28-12 Wire Gauge



0-10 V I/O Module does not share a common ground with Radio Module.  
All inputs and outputs on I/O Modules provide field isolation.



Le module d'E / S 0-10 V ne partage pas une masse commune avec le module radio. Toutes les entrées et sorties des modules d'E / S fournissent une isolation sur le terrain.

## 12. DIAGNOSTICS

### A. Radio Module

1. **RF LED (Left):**
2. **Green:** RF traffic / data rate
  - a. **Yellow:** RF link failure

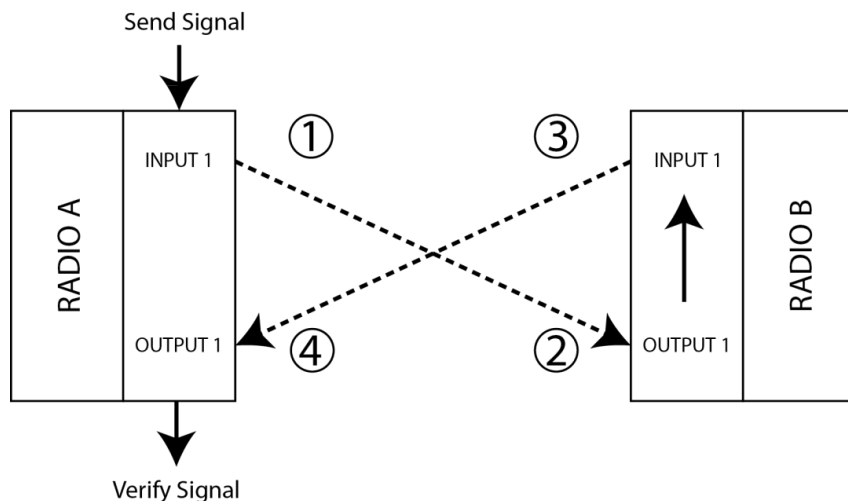


- i. Visual indication of RF link failure after 10 second RF timeout and showing the WIO® System is operating in FailSafe mode.
- ii. RF Link Alarm Output (P2 - NPN) is triggered to report failure status.
- iii. Check antenna connections and power at both Radio stations.
- iv. Check for clear line of sight, any obstruction in the path may negatively impact RF signal quality.

3. **I/O LED (Right):**



- a. **Green:** Modules detected, I/O ok
- b. **Red:** I/O link failure
  - i. Visual indication of I/O link failure
  - ii. I/O Link Alarm Output (P1 – NPN) is triggered to report failure status
  - iii. Functioning I/O will perform normally under alarm condition
  - iv. Any mismatched I/O Modules will be put to FailSafe mode
  - v. Check for I/O mismatch – check each pair of Modules is set to its own ID
  - vi. Check both Radio Stations have matching Modules
  - vii. Check DataRail condition – check for any sign of wear, debris, oxidation
  - viii. For signal integrity verification, perform Remote Loop Back diagnostics by wiring the based on diagram below.



### 13. ADVANCED USER INTERFACE FOR PC



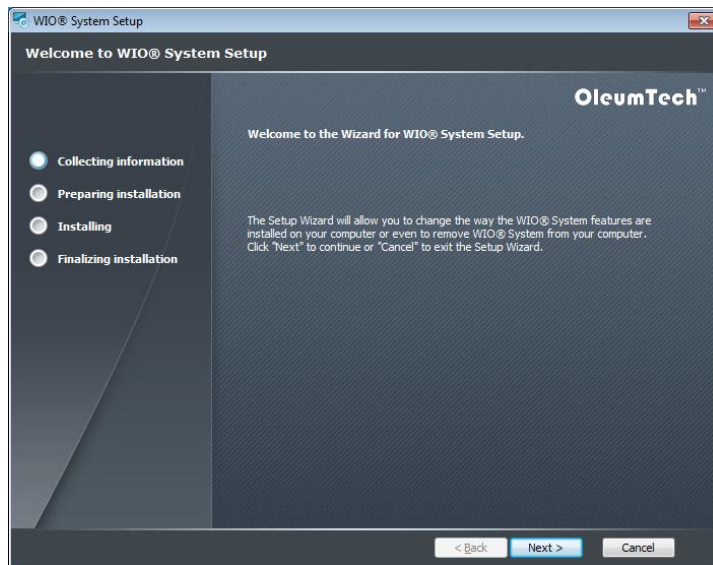
WIO® System Advanced User Interface is not required to operate or configure the system. This software is intended for users that want to fully take advantage of all the features available on the WIO System.



L'interface utilisateur avancée du système WIO® n'est pas requise pour utiliser ou configurer le système. Ce logiciel est destiné aux utilisateurs qui veulent profiter pleinement de toutes les fonctionnalités disponibles sur le système WIO.

#### A. Download and Install Software

- a. [Click here](http://wio.oleumtech.com) to download the latest version of the software or go to the web site <http://wio.oleumtech.com>
- b. Install Software on Windows®-based PC.
  - i. Follow the On-Screen Setup Guide.



- c. Run Software program on PC.

#### B. Connect USB to Mini USB Cable (Included with Radio Kit)

- a. First, plug-in USB end to PC.
- b. Plug-in Mini-USB end to Radio Module's Mini USB port last to avoid ESD damage.
- c. Wait for the completion of driver installation on PC (May take up to a few minutes).



**Avoid ESD damage!**

Always connect Mini-USB LAST.

Always disconnect Mini-USB FIRST.

**C. View of Graphic User Interface (GUI)**

- a. OFF – When PC is not connected to a Radio Module, all gauges and controls are disabled.
- b. ON - When PC is connected to a Radio Module (powered on), all gauges and controls will be enabled.

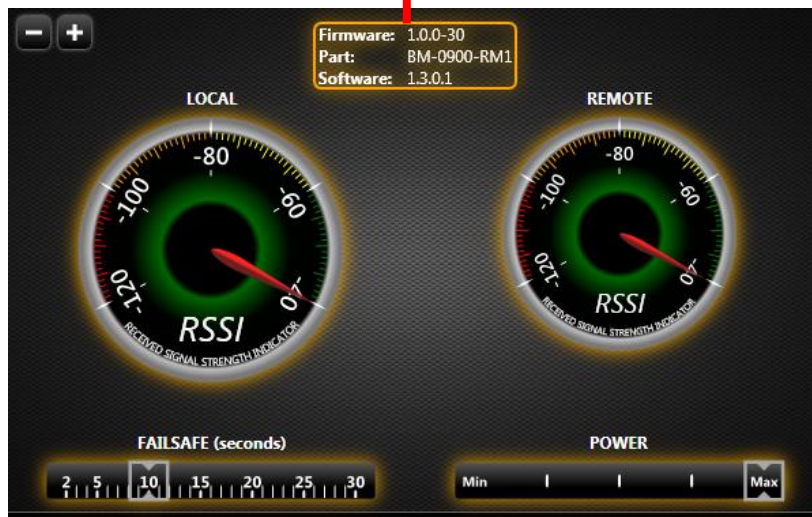
**OFF / DISCONNECTED**



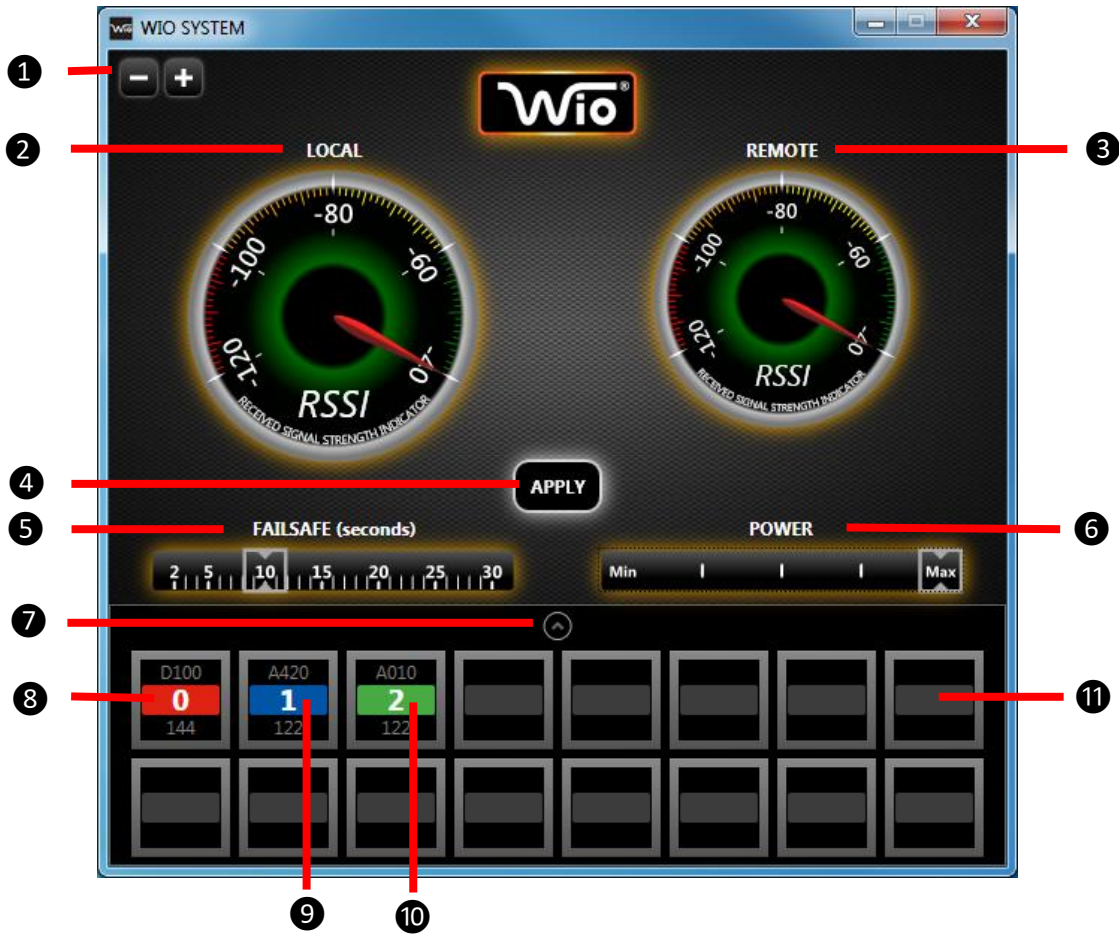
**ON / CONNECTED**



**Click on WIO® to view Radio Firmware Version, Radio Model, and Software Version.**



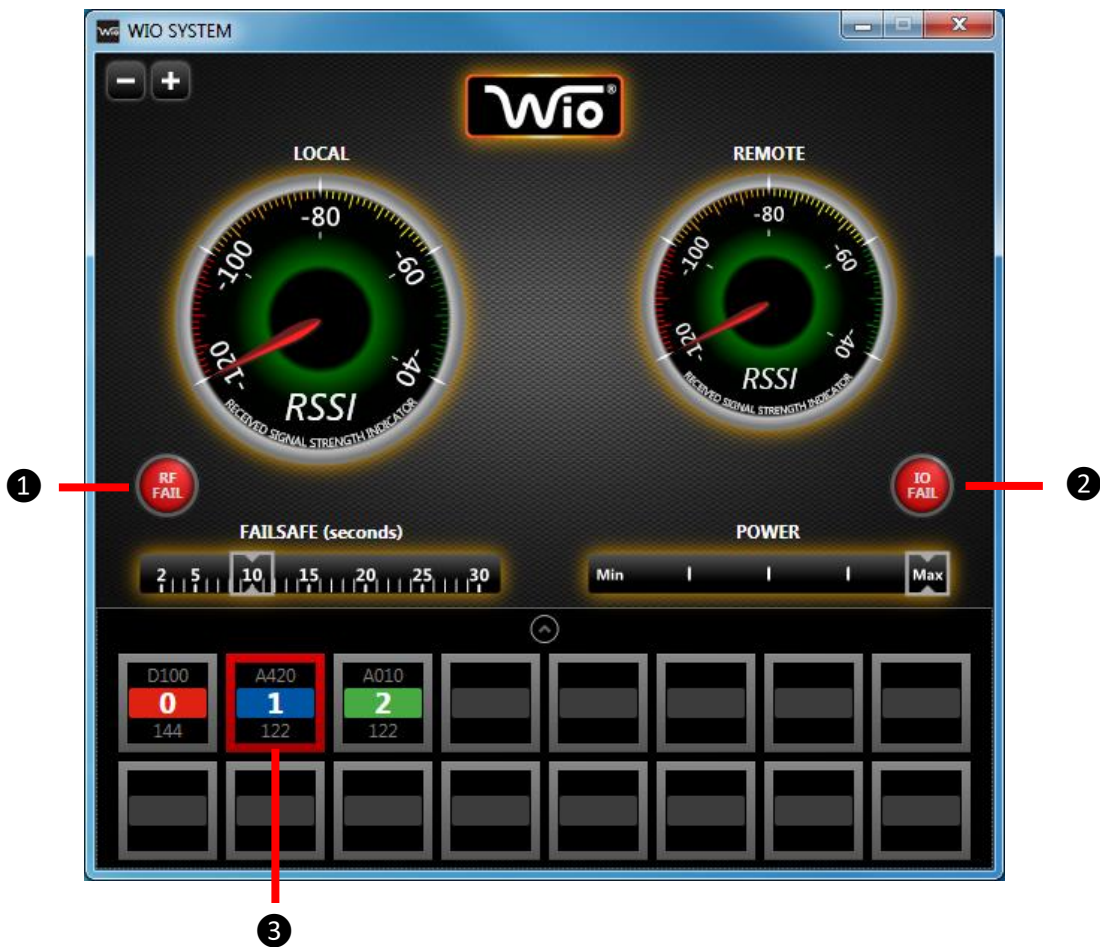
D. Main Window Guide



1. Screen Size – Zoom In/Out
2. Local RSSI (Received Signal Strength Indicator)
  - a. This level indicates the incoming signal strength received from remote Radio.
3. Remote RSSI
  - a. This level indicates the outgoing signal strength from local Radio to remote Radio.
  - b. Adjusting Transmit Power will impact Remote RSSI.
4. Apply button – Appears when any setting is modified.
 

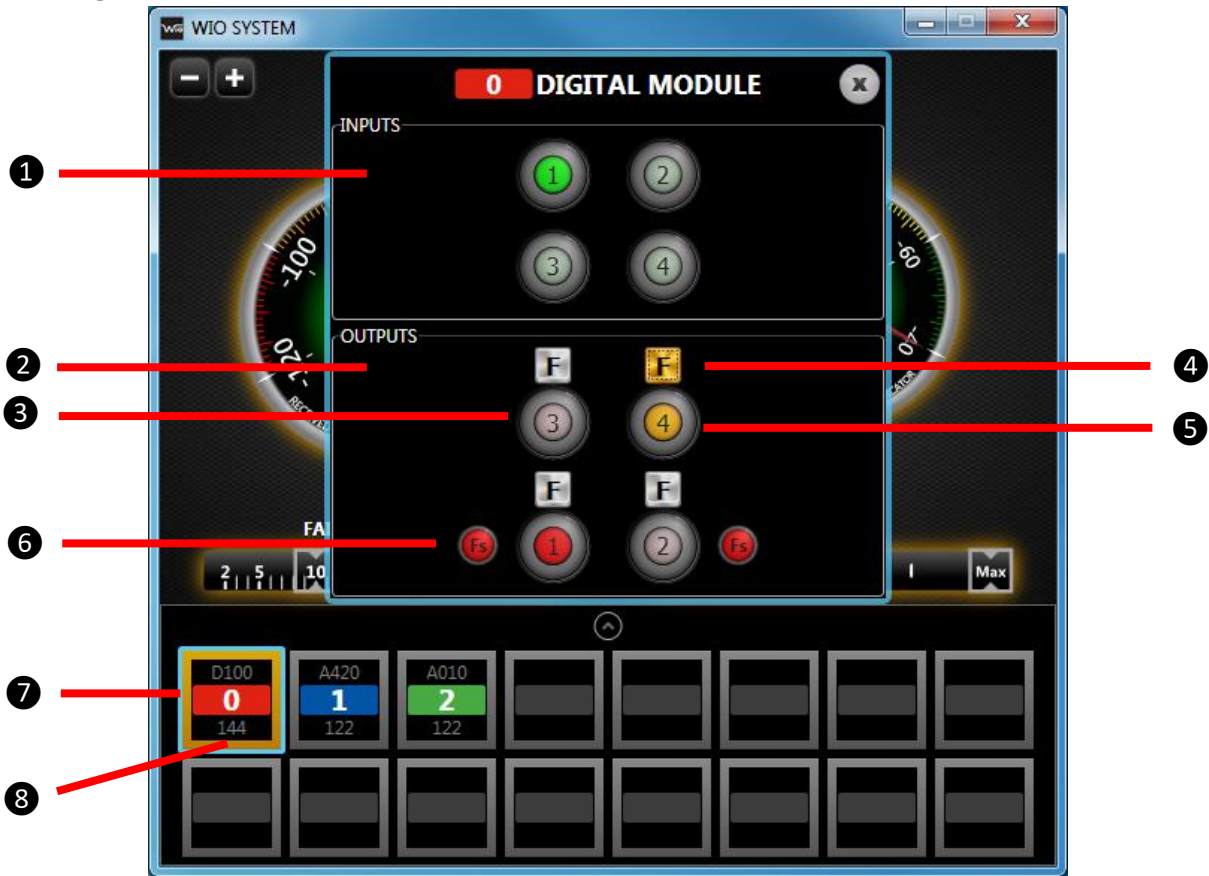
**Must click apply in order for any changes to become effective on the local device.**
5. RF Link Alarm Output and Operating in FailSafe mode is triggered by this RF timeout interval.
  - a. 10-second default RF timeout (adjustment can be made in 1-second increments: 2-30 second range)
6. Transmit Power Adjustor – for optimization of power level and power consumption.
7. I/O Module Tray – this tray displays all connected I/O Modules - use arrow button to expand or minimize I/O Module Tray view.
8. Green color code indicates 0-10 V Analog Module.
9. Blue color code indicates 4-20 mA Analog Module.
10. Red color code indicates Digital Module.
11. Empty Module Slot

E. Additional Diagnostics



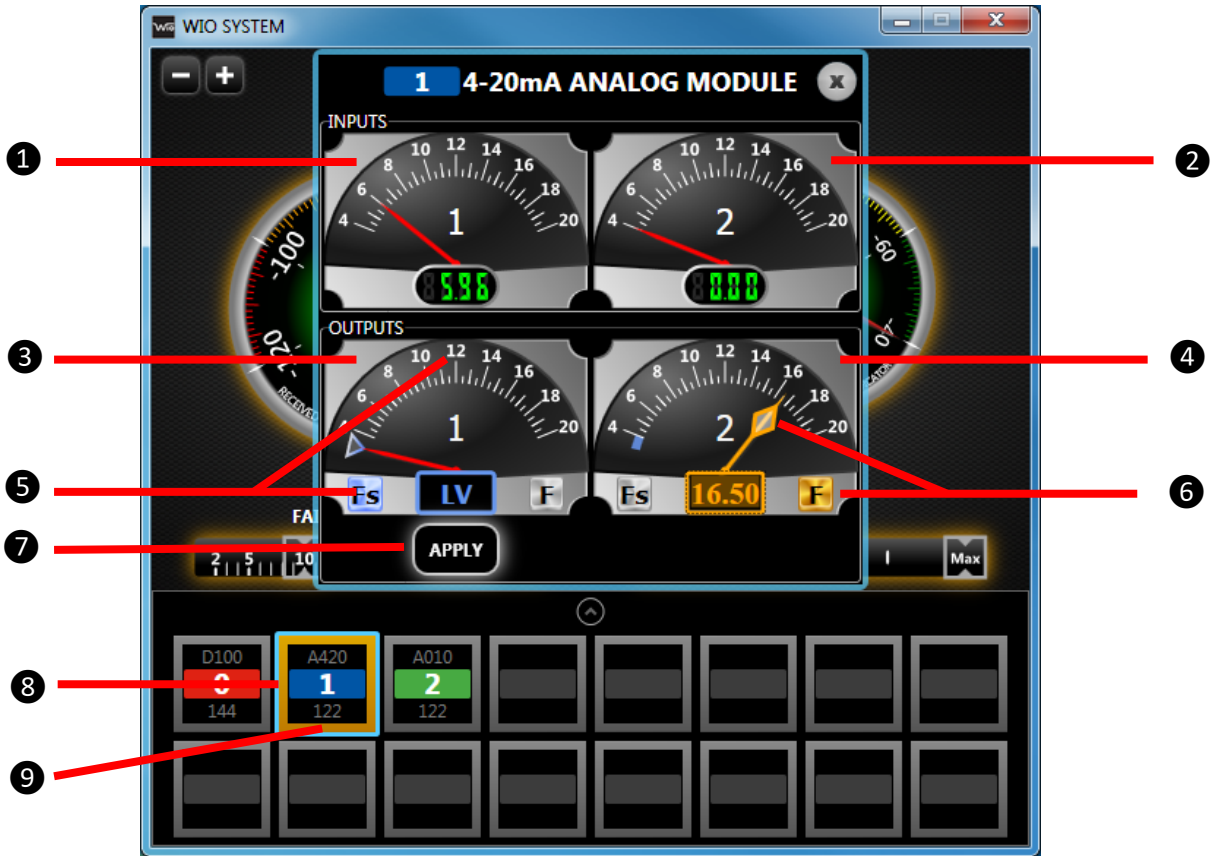
1. RF Link Failure Indicator
  - a. The RF Link Fail Output (NPN) on Radio Module also triggered when failure occurs.
  
2. I/O Link Failure Indicator
  - a. The I/O Link Fail Output (NPN) on Radio Module also triggered when failure occurs.
  
3. Red Border I/O Link Failure Indicator
  - a. Indicates specific Module that has failed or is mismatched.

F. Digital Module Window Guide



1. Digital Input(s) Status: Green – On ; Dimmed - Off
2. Digital Output(s) Status
3. Red LED: displayed when output is normally operated; Dimmed - Off
4. Force Output Button
  - a. Once activated, user has the option of turning output on or off by pressing on virtual output buttons.
  - b. To disable forcing an output, press “F” again to deactivate force mode.
  - c. Closing the User Interface or unplugging the mini USB cable will automatically deactivate any forced output(s).
5. Orange LED: displayed when output is forced on.
6. Displays FailSafe mode that has been set using DIP Switches located on the Digital Module.
  - a. In example shown, DO 1 output will turn on when RF or I/O link fail detected (Fs indication on).
  - b. DO 2 output will turn off when RF link fail detected (Fs indication off).
  - c. DO 3 and 4 will output last known value when RF link fail detected (No Fs indication).
7. Blue border indicates selected I/O Module.
8. Orange border indicates forced output is active.

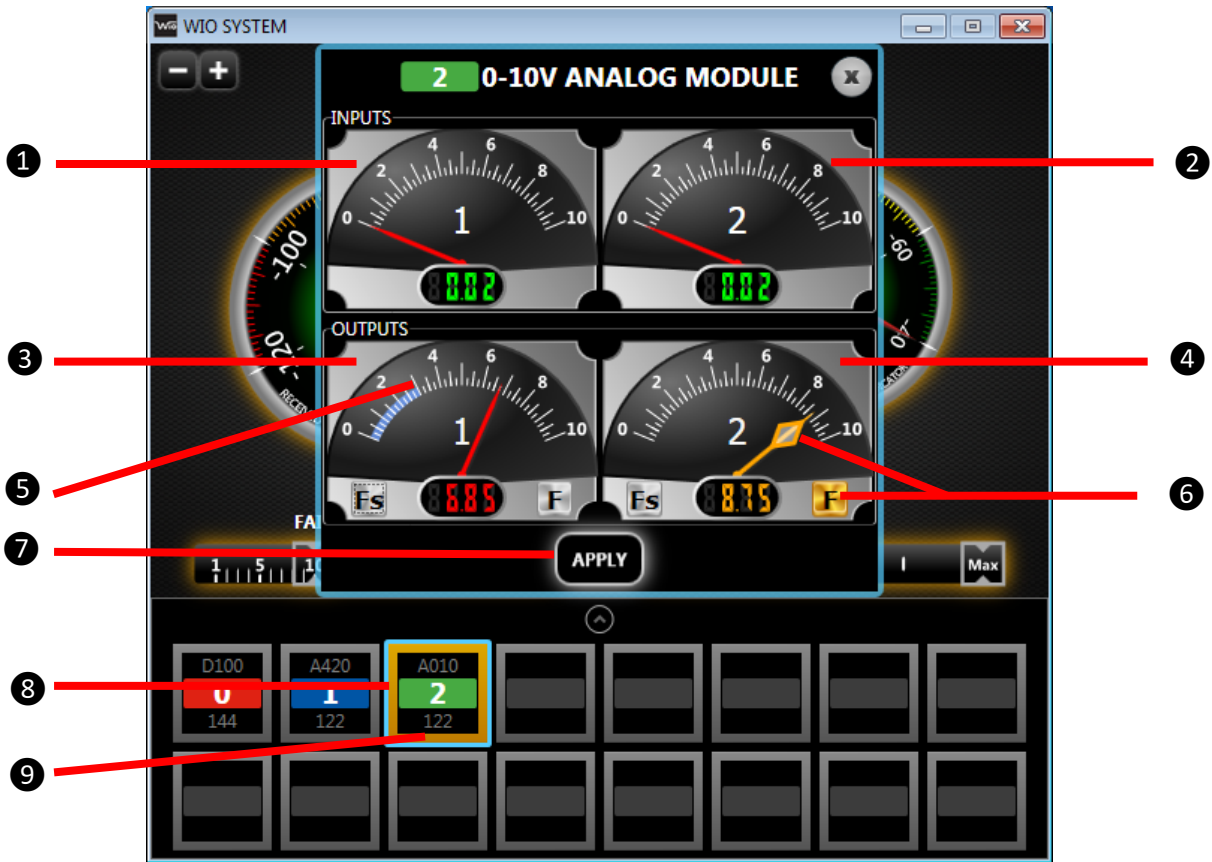
G. 4-20 mA Module Window Guide



1. Input 1 Status
2. Input 2 Status
3. Output 1 Status (Red Needle)
4. Output 2 Status (Red Needle)
5. FailSafe
  - a. Without the User Interface (default), the output reports last known value when RF or I/O failure occurs.
  - b. Press “Fs” button and specific value can be assigned for output when RF failure occurs: use Blue Triangle needle to set specific value. Set value is indicated in blue on dial and numeric display including last known value.
  - c. Apply button – must click apply for changes to take effect.
6. Force Output Button
  - a. Press “F” button to manually force a specific output. Forcing an output bypasses normal signal: use Yellow needle for adjustment.
  - b. To disable forcing an output, press “F” again to deactivate force mode.
  - c. Closing the User Interface or unplugging the mini USB cable will automatically deactivate any forced output(s).
7. Apply button – must click in order for changes to take effect.
8. Blue border indicates selected I/O Module.
9. Orange border indicates forced output is active.



H. 0-10 V Module Window Guide



1. Input 1 Status
2. Input 2 Status
3. Output 1 Status (Red Needle)
4. Output 2 Status (Red Needle)
5. FailSafe
  - a. Without the User Interface (default), the output reports last known value when RF or I/O failure occurs.
  - b. Press “Fs” button and specific value can be assigned for output when RF or I/O failure occurs: use Blue Triangle needle to set specific value. Set value is indicated in blue on dial and numeric display.
  - c. Apply button – must click apply for changes to take effect.
6. Force Output Button
  - a. Press “F” button to manually force a specific output. Forcing an output bypasses normal signal: use Yellow needle for adjustment.
  - b. To disable forcing an output, press “F” again to deactivate force mode.
  - c. Closing the User Interface or unplugging the mini USB cable will automatically deactivate any forced output(s).
7. Apply button – must click in order for changes to take effect.
8. Blue border indicates selected I/O Module.
9. Orange border indicates forced output is active.




## 14. SPECIFICATIONS




### A. HARWARE AND SYSTEM

Unique System Features	Bi-Directional, Paired, Wireless I/O Communication System No Software or Programming Required
Maximum Network Capacity	Max Capacity Depends on I/O Combination Impacting Power
When Using More Than 5 Modules	Use Power Budget Calculator <a href="http://goo.gl/t67r3k">http://goo.gl/t67r3k</a>
DIN Rail Mounting Compatibility	35 mm x 7.5 mm DIN Rail
DataRail® (2x Included with Radio Kit)	6.1" / 156 mm - Supports Up to Five (5) I/O Modules Other Lengths Also Available
I/O Module Slave ID Selection	16-Position Rotary Switch
DataRail Mounting Hardware	4-Claw Attachment to 35 mm DIN Rail with End Terminal Bracket
Built-In Mounting Hardware	Spring-Loaded Clip-On System
Wire Gauge	Solid / Stranded (AWG) 28-12 Gauge
Wire Rating	UL: 300 V RMS, 80 °C and 300 V, 105 °C CSA: 300 V RMS, 105 °C
Warranty	2-Year Limited

**B. SAFETY AND COMPLIANCE**

Operational Temperature	-40 °C to 80 °C / -40 °F to 176 °F
Ambient Temperature	-20 °C to 80 °C / -4 °F to 176 °F
Humidity	0 to 99 %, Non-condensing
Degree of Protection	IP20 / Plastic
Hazardous Locations Classifications	Class I; Division 2 (Zone 2): CSA, ATEX, IECEx
RF Emissions	FCC Part 15 (USA), IC ICES-003 (Canada), ACMA (Australia) AS/NZS CISPR 32 (Australia), EN55032 & EN55024 (EU)

SAFETY & COMPLIANCE	RADIO
	<b>BM-0900-RM1</b> Class I Division 2, Groups A, B, C, D T3 Ex nA IIC T3 Gc Class I Zone 2 AEx nA IIC T3 Gc Tamb: -40 °C to +80 °C
	<b>BM-2400-RM1, BM-0915-RM1, and BM-0868-RM1</b> ATEX: Sira 15ATEX4134X Ex nA IIC T3 Gc Tamb: -40 °C to +80 °C
	IECEX: SIR 15.0055X Ex nA IIC T3 Ga Tamb: -40 °C to +80 °C

SAFETY & COMPLIANCE	I/O MODULES (BM-D100-144, BM-A420-122, and BM-A010-122)
	Class I Division 2, Groups A, B, C, D T4 Ex nA IIC T4 Gc Class I Zone 2 AEx nA IIC T4 Gc Tamb: -40 °C to +80 °C
	<b>BM-2400-RM1, BM-0915-RM1, and BM-0868-RM1</b> ATEX: Sira 15ATEX4134X Ex nA IIC T4 Gc Tamb: -40 °C to +80 °C
	IECEX: SIR 15.0055X Ex nA IIC T4 Ga Tamb: -40 °C to +80 °C

**C. RADIO MODULE**

Frequency	868-870 MHz   902-928 MHz   915-928 MHz   2.4 GHz
Antenna Connector Type	SMA (Female Connector)
Default Transmit Speed / Update	1 Second
Turbo Tx Speed Based on	1=100 ms, 2-3=200 ms, 4= 250 ms, 5-6=333 ms,
Number of I/O Modules	7-11=500 ms, 12-16=1 second
Outdoor / Line of Sight Max Range	868 MHz: 5.2 Miles (8.4 Km) / 900 MHz: 6.3 Miles (10.1 Km) / 2.4 GHz: 4.3 Miles (7 Km)
Indoor / Urban Range	868 MHz 370 ft (113 m) / 900 MHz: 1000 ft (305 m) / 2.4 GHz: 300 ft (90 m)
Maximum Transmit Power (Adjustable with Advanced UI)	868 MHz: 25 mW (14 dBm) / 900 MHz: 250 mW (24 dBm) 2.4 GHz: 63 mW (18 dBm)
Receiver Sensitivity	868 MHz: -101 dBm / 900 MHz: -101 dBm / 2.4 GHz: -100 dBm
Spread Spectrum	868 MHz: LBT, AFA / 900 MHz: FHSS / 2.4 GHz DSSS
RF Security	128-bit AES Encryption
Controlled Local Shutdown (ESD)	Yes, via Provided Dry Contact Input
RF Link Alarm Digital Output	Adjustable 2 to 10-Second RF Timeout Trigger (NPN)
I/O Link Alarm Digital Output	I/O Mismatch, Bus or Module Failure (NPN)
RF Link Diagnostics (Left LED)	Green = RF Traffic / Yellow = RF Link Fail
I/O Link Diagnostics (Right LED)	Green = I/O OK, Modules Detected / Red = I/O Link Fail
Supply Voltage Range	9-30 Vdc ( $\pm 5\%$ )
Reverse Polarity Protection	Yes
Advanced User Interface Features	Test RSSI, Tx Power Adjustment, Force Local Output(s), Set Fail-Safe Parameters, and Additional Diagnostics
Power Consumption	35 mA @ 12 V AVG (10% Duty Cycle)
Packaging Dimensions (WxHxD)	5.5 x 10.1 x 2.8-in / 140 x 257 x 72 mm
Net Dimensions	0.7 x 3.9 x 4.5-in / 17.5 x 99 x 114 mm
Packaging Weight	1.3 lbs / 590 g
Net Weight (Single Radio)	0.3 lbs / 136 g

**D. DIGITAL I/O MODULE**

Number of Inputs	4
Number of Outputs	4
Input Voltage Range	3-30 Vdc
Isolation Voltage	2500 V r.m.s.
Input Voltage Threshold	Signal ("H"): > 2.3 Vdc 0 Signal ("L"): < 1.1 Vdc
Output Rating	1 A Sink Current for Open-Drain Outputs / NPN
Fail-Safe Output Modes	On, Off, or Last Known Value (Default)
Green LEDs	Line-Driven Input Indicators
Red LEDs	Output Indicators
Power Consumption	Typical: 18 mA / Max: 26 mA @12 Vdc
Packaging Dimensions	(WxHxD) 4.8 x 5.1 x 2.8-in / 123 x 129 x 72 mm
Net Dimensions	0.7 x 3.9 x 4.5-in / 17.5 x 99 x 114 mm
Packaging Weight	Single: 0.5 lbs / 227 g; Double: 0.8 lbs / 363 g
Net Weight (Single)	0.3 lbs / 136 g

**E. 4-20 mA I/O MODULE**

Number of Inputs	2 (24-bit Resolution)
Number of Outputs	2 (16-bit Resolution)
Signal Range	4 mA to 20 mA
Isolation Voltage	2500 V r.m.s.
Accuracy	< 0.2 % of Full Scale
Internal Loop Power	+13.5 Vdc
Maximum Current	84 mA @ 12 Vdc
Fail-Safe Output Modes	Last Known Value (Def.) or Any Value on Scale
AI Input Impedance (loop)	128 ohm
AO Terminal Voltage Range	10 Vdc Min. / 31.5 Vdc Max.
Power Consumption	Typical: 50 mA / Max: 75 mA @12 Vdc
Packaging Dimensions	(WxHxD) 4.8 x 5.1 x 2.8-in / 123 x 129 x 72 mm
Net Dimensions	0.7 x 3.9 x 4.5-in / 17.5 x 99 x 114 mm
Packaging Weight	Single: 0.5 lbs / 227 g; Double: 0.8 lbs / 363 g
Net Weight (Single)	0.3 lbs / 136 g

**F. 0-10 V I/O MODULE**

Number of Inputs	2 (24-bit Resolution)
Number of Outputs	2 (16-bit Resolution)
Signal Range	0 Vdc to 10 Vdc (10.5 V Max)
Isolation Voltage	2500 V r.m.s.
Accuracy	< 0.1 % of Full Scale
Fail-Safe Output Modes	Last Known Value (Def.) or Any Value on Scale
AI Input Impedance	40K ohm
AO Output Impedance	10 ohm
Power Consumption	Typical: 40 mA / Max: 45 mA @12 Vdc
Packaging Dimensions	(WxHxD) 4.8 x 5.1 x 2.8-in / 123 x 129 x 72 mm
Net Dimensions	0.7 x 3.9 x 4.5-in / 17.5 x 99 x 114 mm
Packaging Weight	Single: 0.5 lbs / 227 g; Double: 0.8 lbs / 363 g
Net Weight (Single)	0.3 lbs / 136 g

**G. ORDERING INFORMATION**

WIO Modular Radio Kit	868 MHz: BM-0868-RM1K (Europe) 900 MHz: BM-0900-RM1K (N. America) 915 MHz: BM-0915-RM1K (Australia/NZ) 2.4 GHz: BM-2400-RM1K (N. America/ME)
0-10 V I/O Modules	2-Pack: BM-A010-122D
4-20 mA I/O Modules	2-Pack: BM-A420-122D
Digital I/O Modules	2-Pack: BM-D100-144D

## 15. FREQUENTLY ASKED QUESTIONS (FAQs)

1. What is WIO®?
  - a. It stands for Wireless Input Output.
2. What does the WIO® System do?
  - a. It allows replacement of hardwires.
  - b. Point-to-point / bi-directional system.
  - c. Eliminate trenching and running conduit.
  - d. Ultimately helps save money and time.
  - e. It's easy to use.
3. What type of I/Os are available?
  - a. Digital/discrete
  - b. Analog 4-20 mA
  - c. Analog 0-10 V
4. Does WIO System follow a certain communication protocol?
  - a. No, it's simply an I/O mirroring solution. What comes in is what goes out.
  - b. It does not speak Modbus or any other protocol.
  - c. Inputs received are replicated on the end of the radio spectrum as outputs.
5. Does WIO System require any software for programming or configuration?
  - a. No, it requires absolutely no software. It is ready out of the box to install.
6. Is WIO offered in 900 MHz license-free ISM band?
  - a. Yes, both US and International versions are available.
7. Is WIO offered in 2.4 GHz license-free ISM band?
  - a. Yes, both US and International versions are available.
8. At max RF power of 250 mW, what is the expected RF range?
  - a. Up to 4 miles using 900 MHz
  - b. Up to 1 mile using 2.4 GHz
9. Does the WIO System support point-to-multipoint communication?
  - a. The Radios come paired and secured and is meant for point-to-point applications only.
  - b. For more advanced networking solutions, OleumTech offers a different, more advanced wireless sensor network for setting up a sophisticated network that can handle point-to-point, point-to-multipoint, and peer-to-peer.
10. How much power does WIO Modules consume?
 

a. Radio	35 mA @ 12 VDC AVG (10% Duty Cycle)
b. Digital	26 mA @ 12 VDC MAX
c. 4-20 mA	82.5 mA @ 12 VDC MAX
d. 0-10 V	58 mA @ 12 VDC MAX
11. How many I/O modules can be connected to a Radio Module?
  - a. It depends on the type and number of Modules.
  - b. Please use the Power Budget Calculator to determine maximum I/O Module capacity per Radio when using more than five (5) I/O Modules.
  - c. **CLICK HERE** <http://goo.gl/t67r3k>

12. How many I/O modules can be connected with the standard DataRail (6.1") shipped with Radio Kit?
  - a. Standard DataRail supports up to five (5) I/O modules in addition to one Radio module.
13. How do I setup each I/O module once connected to the Radio module?
  - a. Use a small flat screwdriver (technician's screwdriver) and turn ID switch to select desired ID number.
  - b. Be sure the matching module at the other Radio station is also assigned to the same device ID.
14. Does the Radio module automatically detect new I/O modules when connected to DataRail?
  - a. Yes, but only during hardware reset by power cycling the Radio module.
15. What is the mini USB port on the Radio module used for?
  - a. The mini USB port is designated to plug in a PC running WIO Software Tool for users wanting to take full advantage of all the features the WIO System has to offer.
16. What types of features are available with the WIO Advance User Interface (UI)?
  - a. Perform RF strength test (RSSI), change RF channel, adjust RF power level to balance power consumption and performance, change RF timeout interval, force local outputs, or set FailSafe settings for Analog outputs.
17. Can the WIO® System be used in hazardous locations?
  - a. Yes, the system can be used in Class 1, Division 2 or Zone 2 locations.
18. Can Radio modules be reprogrammed?
  - a. Radio Module firmware can be upgraded when updates become available via mini USB port.
  - b. For security reasons, once two Radio modules are paired together from factory, they cannot be unpaired.
19. Is the WIO System compatible with WirelessHART protocol?
  - a. No, the WIO System is a proprietary RF protocol developed by OleumTech to provide superior reliability and ease of use for the sake of replacing conduit and wires.
20. In case of an emergency, how can I manually force the WIO System into FailSafe condition for managing outputs (ESD)?
  - a. Radio Module provides a discrete input for connecting a dry contact switch
  - b. When dry contact is closed or active, Radio Module will instantly operate in the FailSafe mode.
  - c. User can configure the Discrete Module by manipulating the FailSafe dip switches located directly on the device.
  - d. Analog Modules defaults to last known value. The Advanced UI, the FailSafe output point can be set to any value.
21. In the unlikely event my Radio Module gets damaged, can I just buy one module to replace into my system?
  - a. No. Since the Radio Modules are a fixed pair system, a new pair of Radio Modules are needed for replacement.
22. In the unlikely event one of my I/O Module gets damage, can I just buy one module to replace into my system?
  - a. Yes. You do not need to purchase it in pairs like the Radio Modules. I/O Modules are sold as singles and pairs to fit your need.
23. How can I obtain tech support or RMA?
  - a. Please email us at [techsupport@oleumtech.com](mailto:techsupport@oleumtech.com) or give us a call to begin the service process. You will be guided by our helpful customer service staff member to help you get through any issue you are having with the WIO System.



## 16. WARRANTY

- a. OleumTech warrants that goods described herein and manufactured by OleumTech are free from defects in material and workmanship for two (2) years from the date of shipment. Batteries are expressly excluded from this warranty. Battery life and replacement batteries may be warranted under separate agreement depending on specific customer needs and applications.
- b. OleumTech warrants that goods repaired by it pursuant to the warranty are free from defects in material and workmanship for a period to the end of the original warranty or ninety (90) days from the date of delivery of repaired goods, whichever is longer.
- c. Warranties on goods not manufactured by OleumTech are expressly limited to the terms of the warranties given by the manufacturer of such goods.
- d. All warranties are void in the event that the goods or systems or any part thereof are (i) misused, abused or otherwise damaged, (ii) repaired, altered or modified without OleumTech's consent, (iii) not installed, maintained and operated in strict compliance with instructions furnished by OleumTech, (iv) worn, injured or damaged from abnormal or abusive use in service time, (v) subjected to acts of God, or extreme weather phenomenon including, but not limited to, flood, lightning, tornado or hurricane, or (vi) intentional acts including, but not limited to vandalism, sabotage, explosion or acts of terrorism.
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## 17. REVISION HISTORY

**Rev. A:**

Original Release

**Rev. B:**

Added loop power wiring diagram for 4-20 mA I/O Module.  
Added Power Budget Calculator hyperlink.

**Rev. C:**

Updated system overview.  
Updated product technical specifications including power consumption.

**Rev. D:**

Revised RF security spec.

**Rev. E:**

Replaced Radio Module Wiring Diagram.

**Rev. F:**

RF timeout minimum interval changed to 2 seconds.  
Analog I/O Modules under FailSafe reports last known value as default.

**Rev. G:**

Revised part numbers and added DataRail part numbers.

**Rev. H:**

LED behaviors: active high and low information added to Digital I/O Module section.  
Warning added to Sec 6 B. Entire system with Radio and I/O Module(s) must be fully assembled before supplying power to the Radio Module for the system to boot and operate properly. Failure to do so may cause RF link and I/O link to fail.

**Rev. J:**

Revised document template and replaced WIO logo.  
Added 868 MHz radio option.  
Updated Radio Module technical specifications.  
Revised system overview information.  
Added warnings in French.  
Added high vibration warning.

**Rev. K:**

Moved Specifications section to the back of the guide.  
Added additional wiring diagrams for Radio, Digital, and Analog 4-20 mA Modules.  
Separated sections for each Module wiring diagrams.

**Rev. L:**

Revised 2.4 GHz RF range.  
Revised Digital Level Output - Active High wiring to include a pull-down 10 K resistor.  
Change section 9.c dry contact output wiring to NPN output wiring.

**Rev. M:**

Updated the Radio Module frontal image throughout the document with corrected P1 – NPN labeling.  
Improved document outline formatting.

**OleumTech®**

19762 Pauling Way  
Foothill Ranch, CA. 92610  
Phone: 866.508.8586 • 949.305.9009  
Fax: 949.305.9010  
<https://oleumtech.com>  
<https://wio.oleumtech.com>

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