



# WIRELESS I/O SYSTEM

## User Guide

### PART NUMBERS

BM-0900-RM1 / BM-0915-RM1 / BM-2400-RM1 / BM-2410-RM1 /

BM-0868-RM1 / BM-D100-144 / BM-A420-122 / BM-A010-122

Version 80-7046-001\_G



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# 1. PREFACE/SAFETY

## Welcome!

Thank you for choosing the WIO® System by OleumTech™. The WIO System is an intelligent, 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:

OleumTech Support Center

1-866-805-8586

[TechSupport@OleumTech.com](mailto:TechSupport@OleumTech.com)



**WARNING:** Ensure the installation of the system meets applicable state and national electrical code requirements. The installation of the system should only be performed by a qualified installer or a factory representative.



**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)

## Revision History

Revision	ECO Number	Date	Description
G	002773	06/16/2015	Added certification info. Revised part numbers in section 4.

## 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

- Wireless hardware replicator / rapid reliable wireless connectivity.
- Save money and time: WIO® System eliminates trenching and running conduit / deploys in minutes.
- Easy to use: no software configuration needed.
- Easy to install: mounts onto a 35 mm DIN rail without any tools.
- Flexible: place inputs and output on both ends of radio.
- Customize I/O using Digital, 0-10 V, and/or 4-20 mA options.
- Isolated: each Module provides field isolated inputs and outputs.
- 24-bit high-resolution Analog inputs.
- 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 Radio System (128-bit AES) keeps network protected from intrusions.
- Less wire clutter: single power termination per station.
- Wiring label on each device for quick reference.
- Color-coded labels for easy device identification.
- FailSafe: user can define 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](http://goo.gl/t67r3k)  
<http://goo.gl/t67r3k>

#### JUST PLAIN EASY

When faced with having to replace an existing hardwired system or installing new infrastructure, the WIO® System is the fastest, easiest, and most economical methods for wirelessly duplicating discrete, 4-20mA, or 0-10V signal wire. All I/O Modules feature isolated inputs and outputs. The WIO System requires no configuration or software and is extremely quick and easy to install. The WIO System mounts to 35 mm DIN rail. Then, you just need a screwdriver and a wire stripper to terminate input, outputs, and power.



## **FASTER DEPLOYMENT & LESS MAINTENANCE THAN HARDWIRES**

Significant amount of time and money can be saved by avoiding permitting and trenching to run wires. Because deployment time is so rapid using the WIO System, you can even use it as an emergency backup system when a hardwired system is down for repair or maintenance. And by removing the hardwire run, it also eliminates the potential cost for future wire failure replacement and maintenance due to natural disasters such as lightning. Troubleshooting also become much easier and quicker with the WIO System since there are less points of failure than a hardwire system.

## **WIRELESS, SIMPLY DONE SMARTER, FASTER, SECURE, FAILSAFE**

In the WIO System, the Radio Modules control and power everything. They manage all signal traffic and provide critical alarms and diagnostics when either RF link failure or I/O mismatch is detected and trigger NPN digital outputs for notification. At the same time, the Radio Module overrides all outputs into the user's predetermined FailSafe output states on each I/O Module. Each output is independently controlled. It also provides the ability to locally force outputs when setting up the system without needing a real signal source. The paired Radio Modules communicate at a default response time of 1 second. The Radio Modules can be put to Turbo Tx mode and the response time varies with the number of connected I/O Modules, up to 100 ms. The Radio Modules utilize AES encryption for securely delivering data and are offered in 900 MHz or 2.4 GHz (license-free ISM), in both domestic (US) and international versions. Antennas and antenna cables are sold separately so that you can select the appropriate antenna and cable lengths to fit your application.

## **CUSTOM, SCALABLE I/O EXPANSION**

The Radio Kit is the foundation of the WIO System that allows you to build your custom I/O solution. The two (2) factory-paired Radio Modules are packaged in the WIO Radio Kit. The Kit also includes all the mounting hardware so you simply need to add the I/O Modules of your choice. Up to five (5) pairs of I/O Modules of any kind can be operated using the Radio Kit. If additional I/O Modules are needed for expansion, the WIO System can support many more pairs of I/O Modules using a longer DataRail.

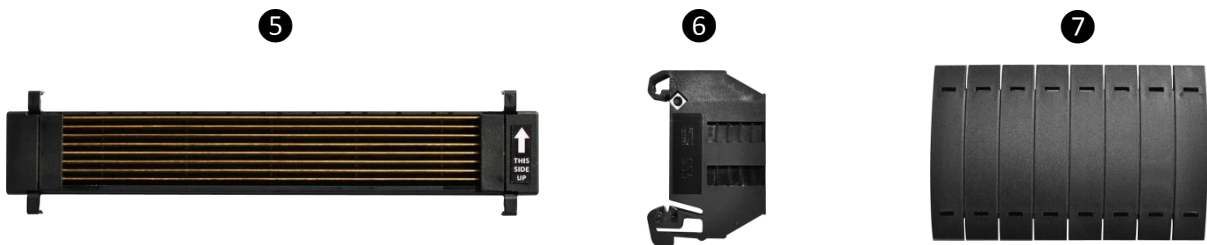
## **ADVANCED FEATURES**

The WIO System also offers an Advanced User Interface for PC. By connecting the PC to the Radio Module's mini-USB port, you can check vital system health such as RSSI (Received Signal Strength Indication), view input/output status, adjust transmit power level, and adjust RF timeout interval. You can also locally force local outputs, set FailSafe settings individually for analog outputs. Digital outputs are set using DIP switches that are physically on the device.

## 4. HARDWARE AT A GLANCE



1. Radio Module: BM-0900-RM1, BM-0915-RM1 (Aus), BM-2400-RM1
  - 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. SPECIFICATIONS




### A. HARWARE AND SYSTEM




HARDWARE & SYSTEM	
Unique System Features	Bi-Directional Wireless Communication System
	No Software or Programming Required
Maximum Network Capacity* 	<p>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</p> <p>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.</p>
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™ (Included with Radio Kit)	6.1" / 156 mm - Supports Up Five (5) I/O Modules, Other Lengths Also Available
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

SAFETY & COMPLIANCE	
Operational Temperature	-40 °C to 85 °C / -40 °F to 185 °F
Ambient Temperature	-20 °C to 85 °C / -4 °F to 185 °F
Humidity	0 to 99 %, Non-condensing
Degree of Protection / Housing Type	IP20 / Plastic
Hazardous Locations Classifications	Class I; Division 2 (Zone 2), Pending
RF Emissions	FCC Part 15/IC

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

RADIO MODULE 900 MHz or 2.4 GHz	
Frequency	902-928 MHz or 2.4 GHz License-Free ISM Band
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,
# of I/O Modules	7-11=500 ms, 12-16=1 second
Outdoor / Line of Sight Max Range	900 MHz: 4 Miles (6.4 Km) / 2.4 GHz: 1 Mile (1.6 Km) /
(900MHz@250mW/2.4GHz@63mW)	2.4 GHz International: 2500 ft (750 m)
Indoor / Urban Max Range	900 MHz: 1000 ft (305 m) / 2.4 GHz: 300 ft (90 m) /
(900MHz@250mW/2.4GHz@63mW)	2.4 GHz International: 200 ft (60 m)
Maximum Transmit Power	900 MHz: 24 dBm (250 mW) / 2.4 GHz: 18 dBm (63 mW) /
(Adjustable by Software)	2.4 GHz International: 10 dBm (10 mW)
Receiver Sensitivity	900 MHz: -101 dBm / 2.4 GHz: -100 dBm
Spread Spectrum	900 MHz: FHSS / 2.4 GHz DSSS
RF Security	128-bit AES
Manual FailSafe Override	Yes, via Provided Dry Contact Input
RF Link Alarm Digital Output	10-Second RF Timeout Trigger (NPN) - User Selectable
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 (± 5 %)
Protection Against Polarity	Yes
Advanced User Interface Features	Test RSSI, Tx Power Adjustment, Force Local Output(s), Set FailSafe Parameters, and Additional Diagnostics
Power Consumption	35 mA @ 12V AVG (10% Duty Cycle)
Kit Packaging Dimensions (WxHxD)	5.5x10.1x2.8-in / 140x257x72mm
Net Dimensions	0.7x3.9x4.5-in / 17.5x99x114mm
Kit Packaging Weight	1.3 lbs / 590 g
Net Weight (Single Radio)	0.3 lbs / 136 g

## D. DIGITAL I/O MODULE

DIGITAL I/O MODULE	
Number of Inputs	4
Number of Outputs	4
Isolation Voltage	2500 V r.m.s.
Input Voltage Range	3-30 VDC
Input Voltage Threshold	1 Signal ("H"): > 2.3 VDC
	0 Signal ("L"): < 1.1 VDC
Output Rating	1 A Sink Current for
	Open-Drain Outputs / NPN
FailSafe 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 72mm
Net Dimensions	0.7 x 3.9 x 4.5-in / 17.5 x 99 x 114mm
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

ANALOG 4-20 mA I/O MODULE	
Number of Inputs	2 (24-bit Resolution)
Number of Outputs	2 (16-bit Resolution)
Isolation Voltage	2500 V r.m.s.
Signal Range	4 mA to 20 mA
Accuracy	< 0.28 % of Full Scale
Internal Loop Power	+13.5 VDC
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
FailSafe Modes	Any value on scale (Advanced UI required), or Last Known Value (default)
Packaging Dimensions	(WxHxD) 4.8 x 5.1 x 2.8-in / 123 x 129 x 72mm
Net Dimensions	0.7 x 3.9 x 4.5-in / 17.5 x 99 x 114mm
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

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

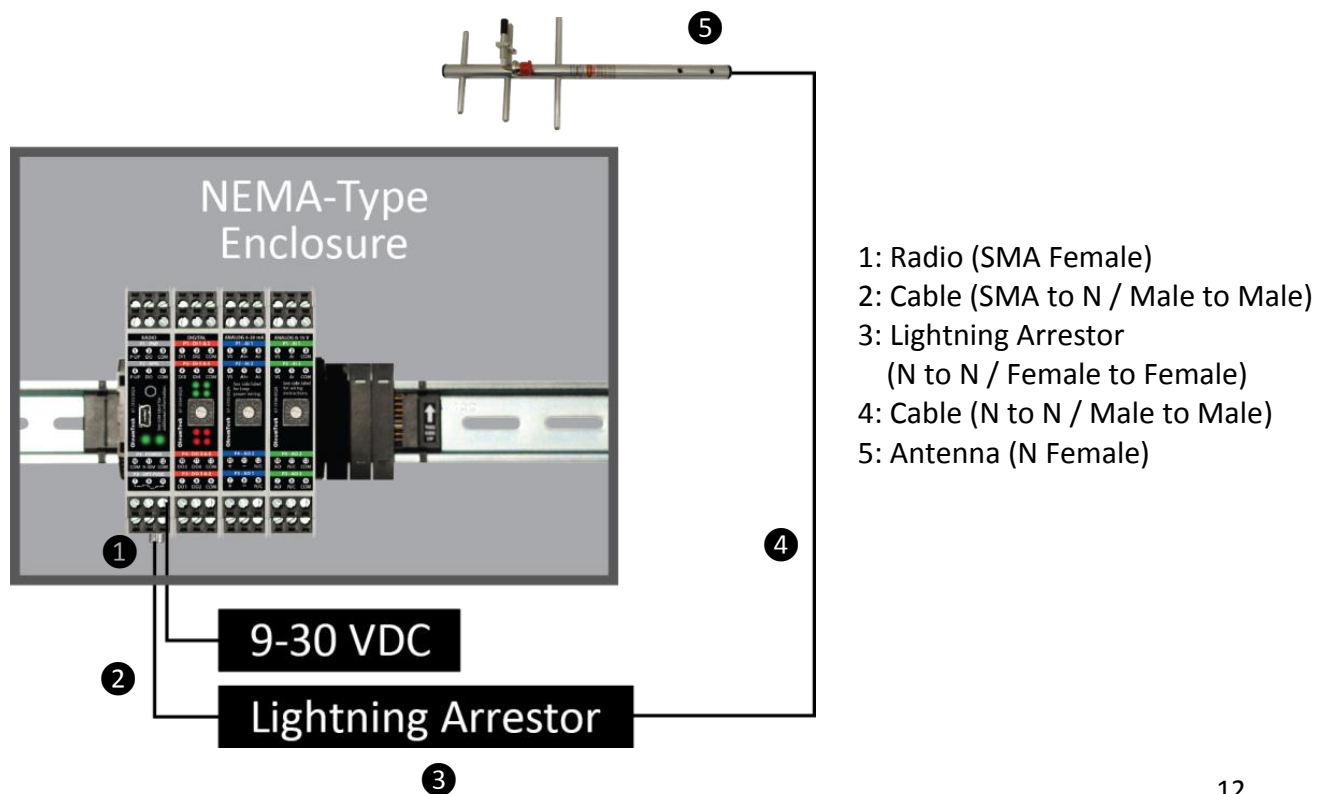
## G. ORDERING INFORMATION

ORDERING INFORMATION	
Radio Kit	US/N.Am: 900 MHz BM-0900-RM1K
	US/N.Am: 2.4 GHz BM-2400-RM1K
	Intl: 900 MHz BM-0915-RM1K
	Intl: 2.4GHz BM-2410-RM1K
Radio Kit Content	2x Radio Modules (Factory Paired),
	2x DataRails, 4x End Terminal Brackets,
	2x DataRail Covers, USB to Mini USB Cable,
	Quick Start Guide
Digital I/O	1-Pack: BM-D100-144S
	2-Pack: BM-D100-144D
4-20 mA I/O	1-Pack: BM-A420-122S
	2-Pack: BM-A420-122D
0-10 V I/O	1-Pack: BM-A010-122S
	2-Pack: BM-A010-122D

## 6. INSTALLATION

### H. Outdoor Enclosure Installation

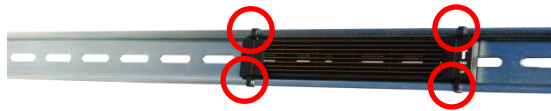
1. Install or use existing outdoor NEMA-type enclosure.
2. Be sure the WIO® System meets applicable grounding requirements in the enclosure.
3. Install a 35 mm x 7.5 mm DIN rail (at least 166 mm (6.5-inch) wide) inside the enclosure.
4. Provide external power supply: 9-30 VDC.
5. Provide antenna and 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.



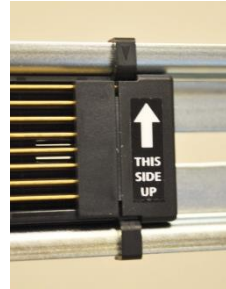
## I. WIO® System Assembly (attach from left to right)

**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 hardware.

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.

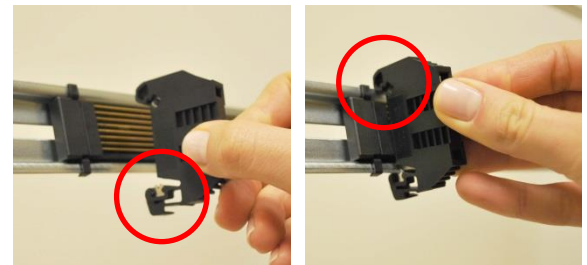


2. Secure DataRail to DIN rail by attaching an End Terminal Bracket.

- 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.

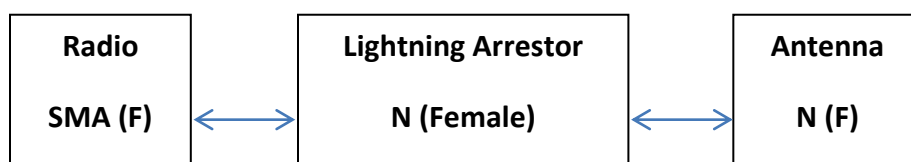


3. Attach Radio Module to DataRail (place it next to the Bracket without any gap).

- 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.

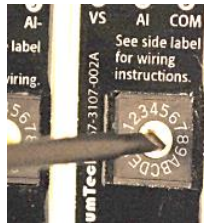


4. Attach I/O Module(s) to the system.
  - a. Place Modules in any combination (do not leave gaps between Modules).
  - b. When using more than five (5) I/O Modules, determine maximum I/O Module combination by using power budget calculator. [CLICK HERE http://goo.gl/t67r3k](http://goo.gl/t67r3k)



**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)

- 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.



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.



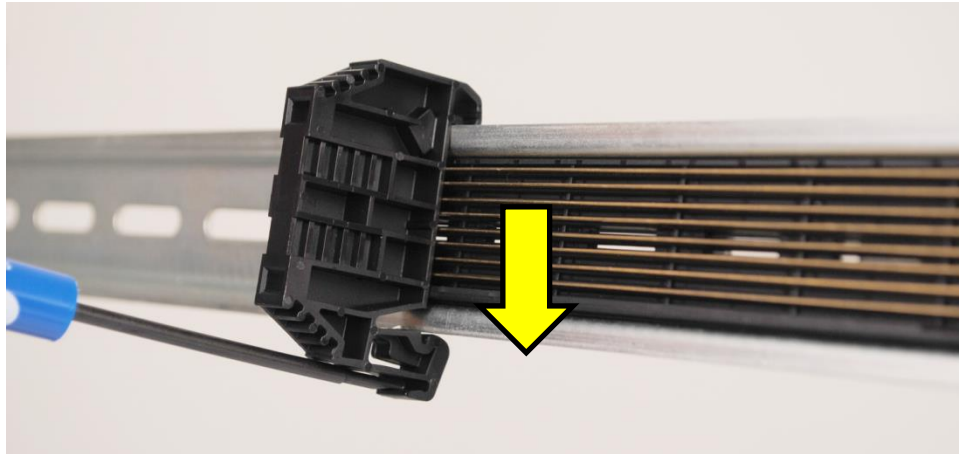
7. Terminate I/O and supply power as required. Use solid or stranded wire (AWG) 28-12.

## J. How to Detach Components from DataRail

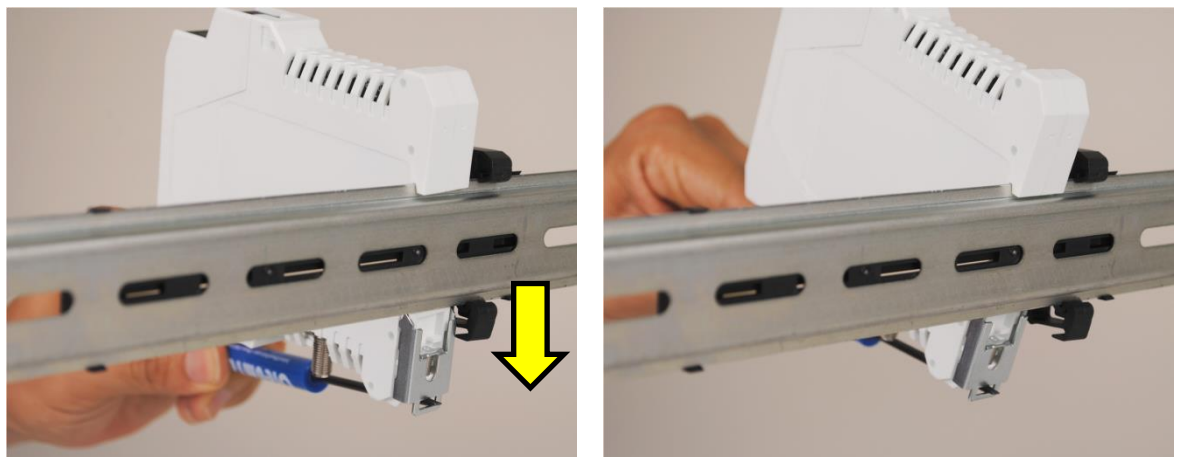


**WARNING:** All live wiring connections and power must be safely disconnected before taking any components off the DataRail or WIO® System!

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.

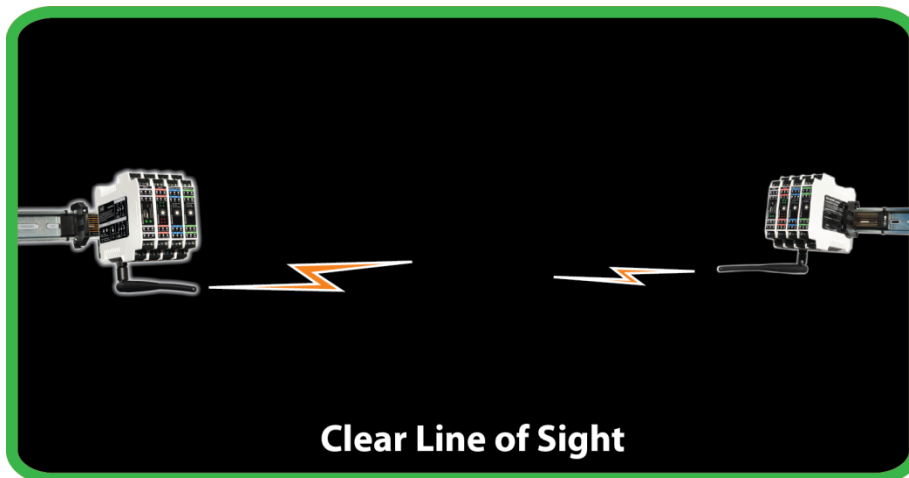
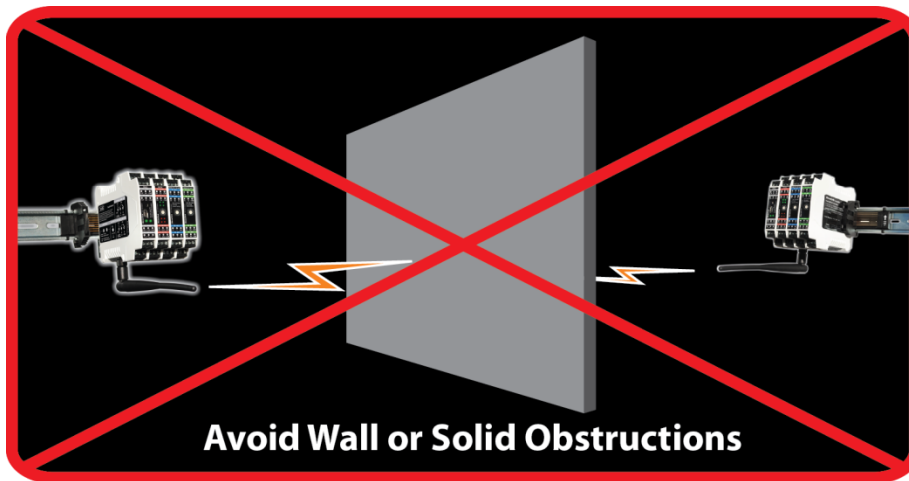


2. WIO® Modules can be removed from the din rail by inserting the tip of a flathead screwdriver into removal slot located on the metal clip. Lift-up on the screwdriver handle to pull the spring-loaded clip away from the din rail for safe removal.





## 7. RF SETUP – BEST PRACTICE

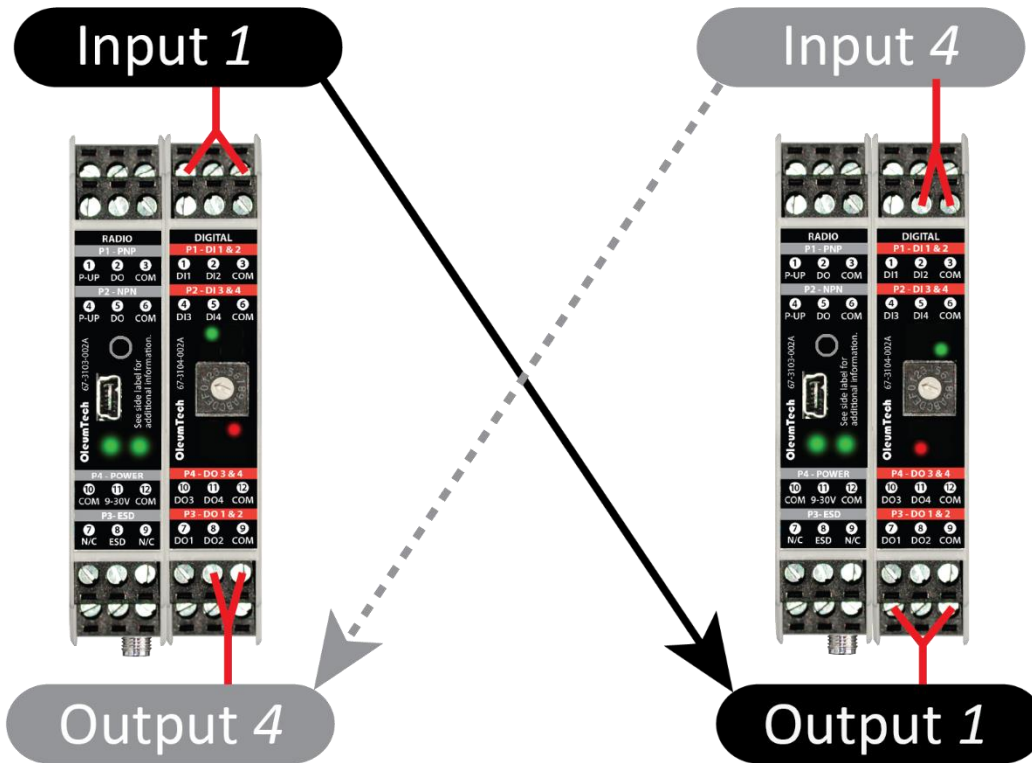


1. When setting up and installing antennas, avoid walls, tall buildings, trees, and other solid obstructions for improving RF signal quality.
2. Having a clear line of sight between antennas is ideal for best RF signal quality.
3. Use appropriate antenna and use high quality antenna cables with the WIO 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.

## 8. SIGNAL CHAIN DIAGRAM

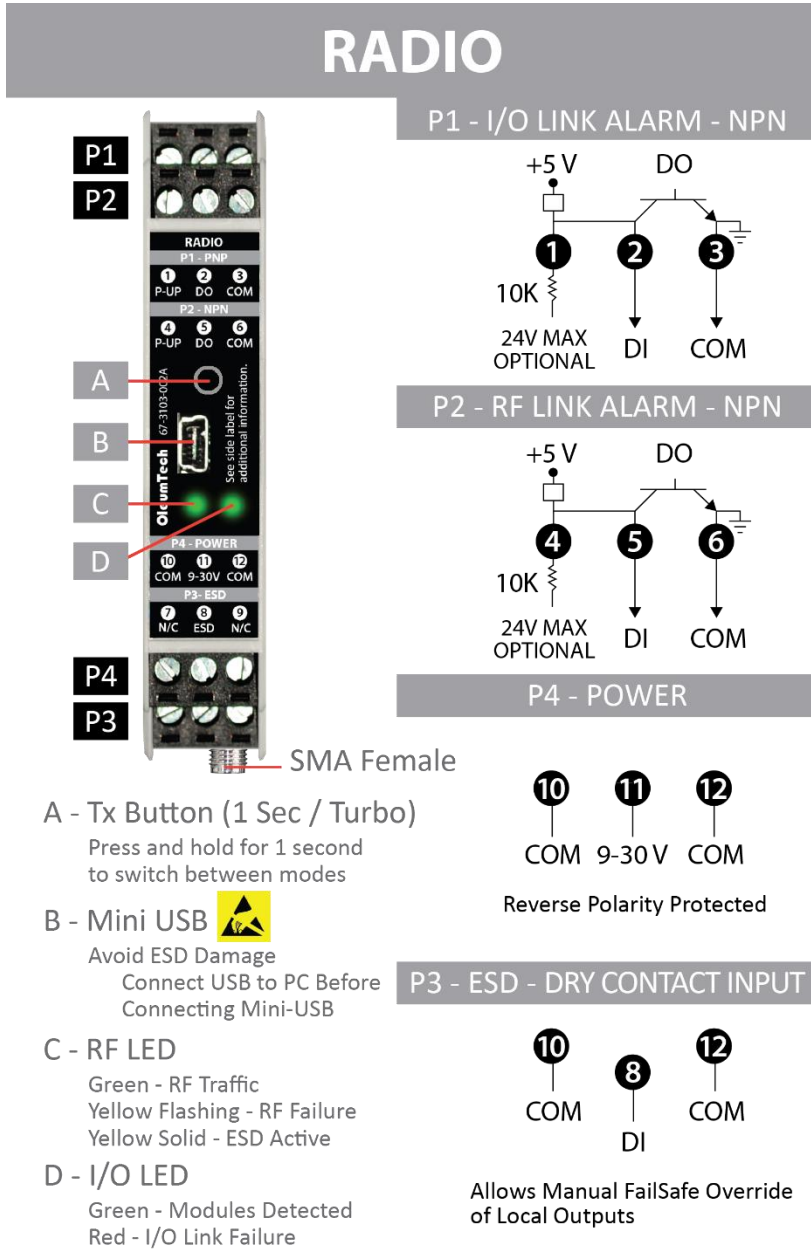
# Station A

# Station B



## 9. WIRING DIAGRAM

### a. Radio Module (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.

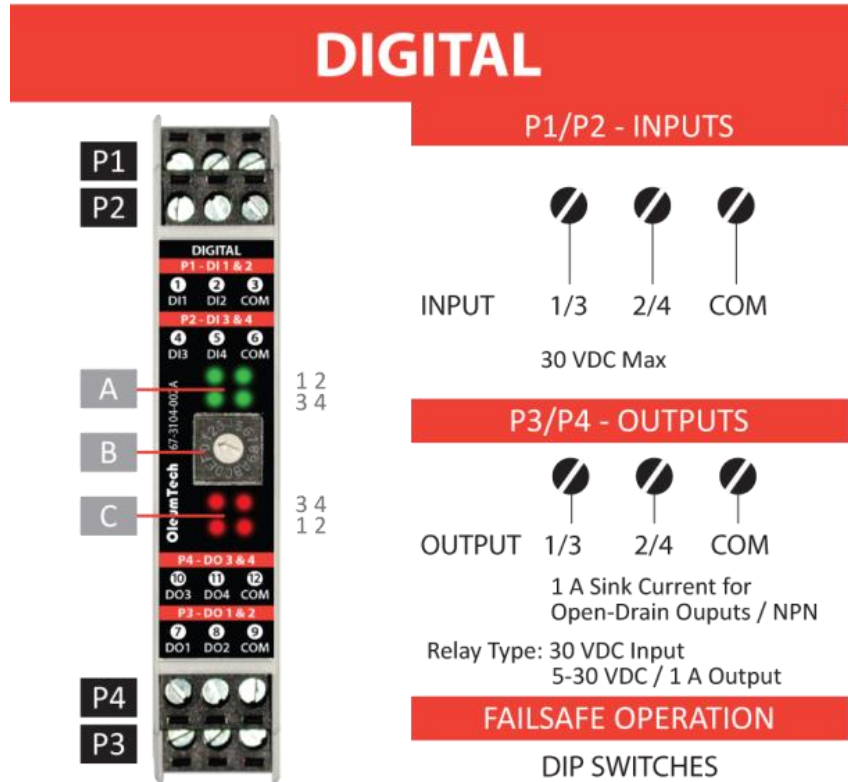
This Input allows connection of a dry contact switch for manually overriding system into FailSafe state for all outputs.

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.**

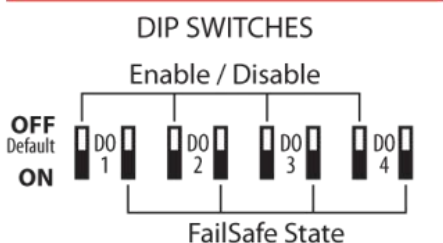
b. **Digital Module** (BM-D100-144 Shown)



- A - Input LEDs  
Illuminated When Active
- B - 16-Position ID Switch  
For Matching Module ID
- C - Output LEDs  
Illuminated When Active



1 A Sink Current for Open-Drain Outputs / NPN  
Relay Type: 30 VDC Input  
5-30 VDC / 1 A Output



**When Enabled:**  
FailSafe Mode selected for Output.  
Select On or Off.

**When Disabled:**  
Normal Mode selected for Output.  
Outputs last received value.

**FailSafe State:**  
Turns output to on or off when FailSafe enabled.

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.

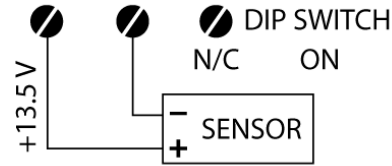


c. Analog 4-20 mA Module (BM-A420-122 Shown)

# ANALOG 4-20 mA

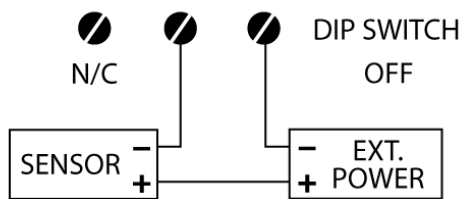


### P1/P2 - INT. LOOP POWER

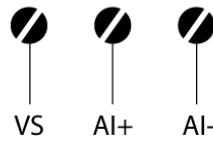


5 Modules max per Radio when using Internal Loop Power

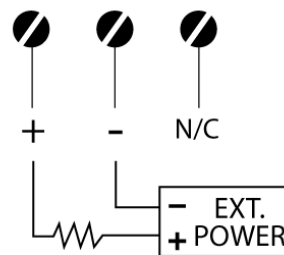
### P1/P2 - EXT. LOOP POWER



### P1/P2 - INPUTS

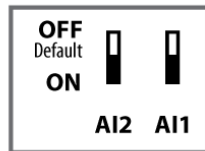


### P3/P4 - OUTPUTS



A - 16-Position ID Switch  
For Matching Module ID

B - Dip Switches  
Internal/External Loop Power



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

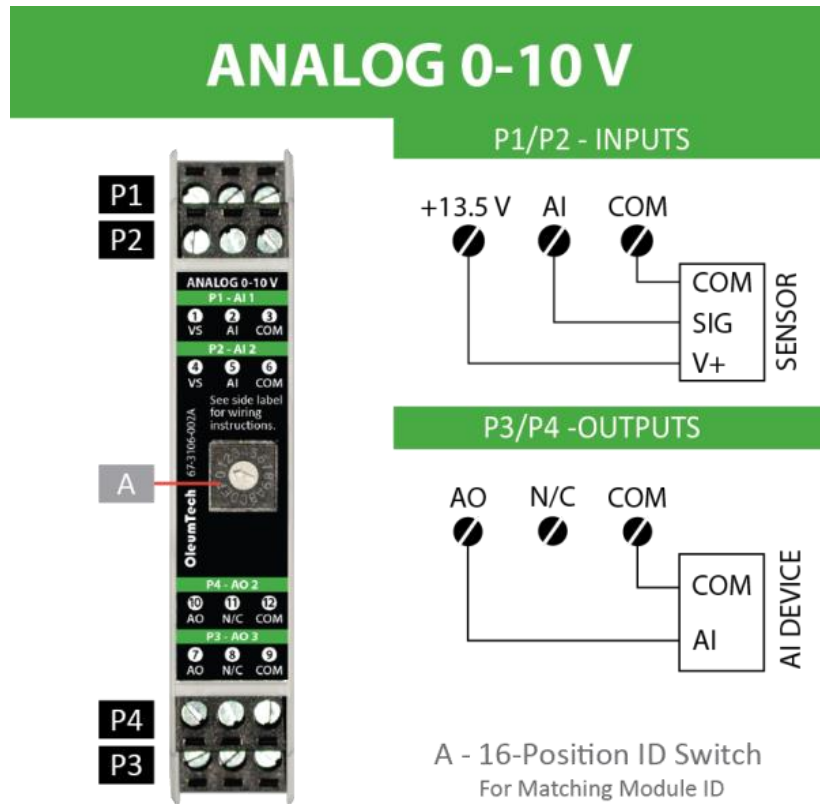
$$R_{loop} = Total\ Loop\ Impedance$$

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.

d. Analog 0-10 V Module (BM-A010-122 Shown)



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.

## 10. DIAGNOSTICS

### A. Radio Module

1. **RF LED (Left):**
2. **Green:** RF traffic / data rate

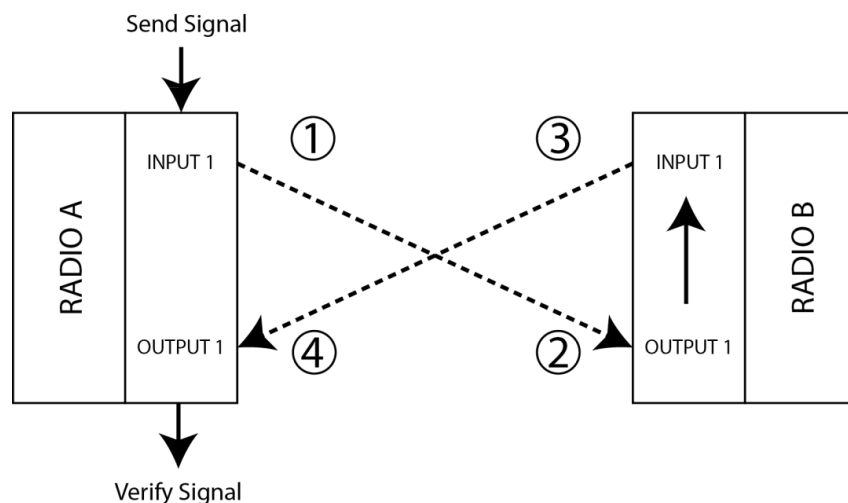


- a. **Yellow:** RF link failure
  - i. Visual indication of RF link failure after 10 second RF timeout and showing the WIO® System is operating in FailSafe mode.
  - ii. RF Link Alarm Output (P2 - NPN) is triggered to report failure status.
  - iii. Check antenna connections and power at both Radio 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.



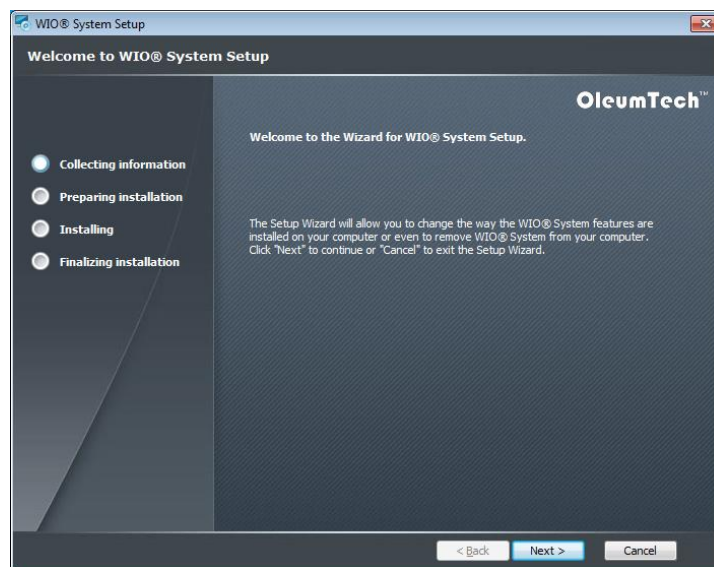
## 11. ADVANCED USER INTERFACE FOR PC



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.

### A. Download and Install Software

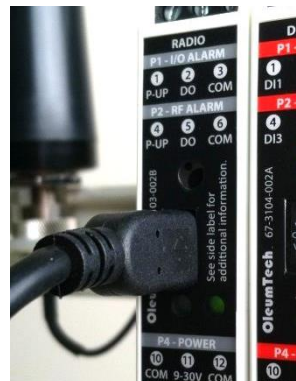
- a. [Click here](http://wio.oleumtech.com) to download the latest version of the software or go to the web site <http://wio.oleumtech.com>
- b. Install Software on Windows®-based PC.
  - i. Follow the On-Screen Setup Guide.



- 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.

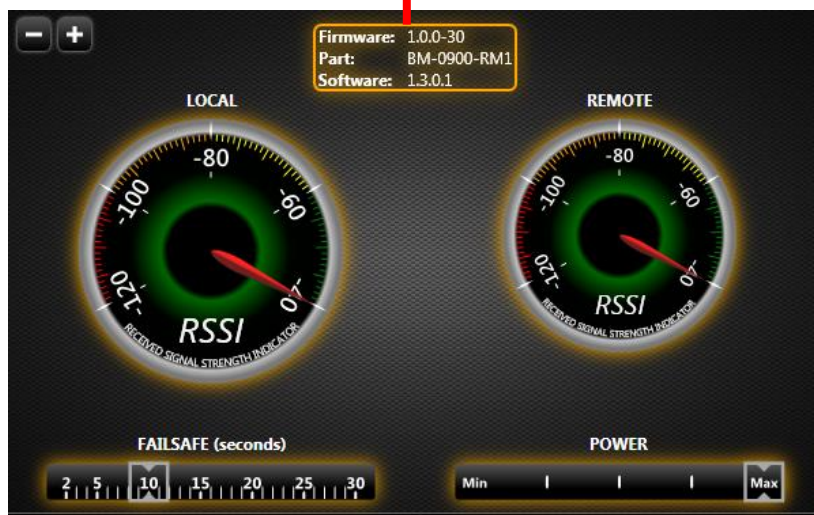
OFF / DISCONNECTED



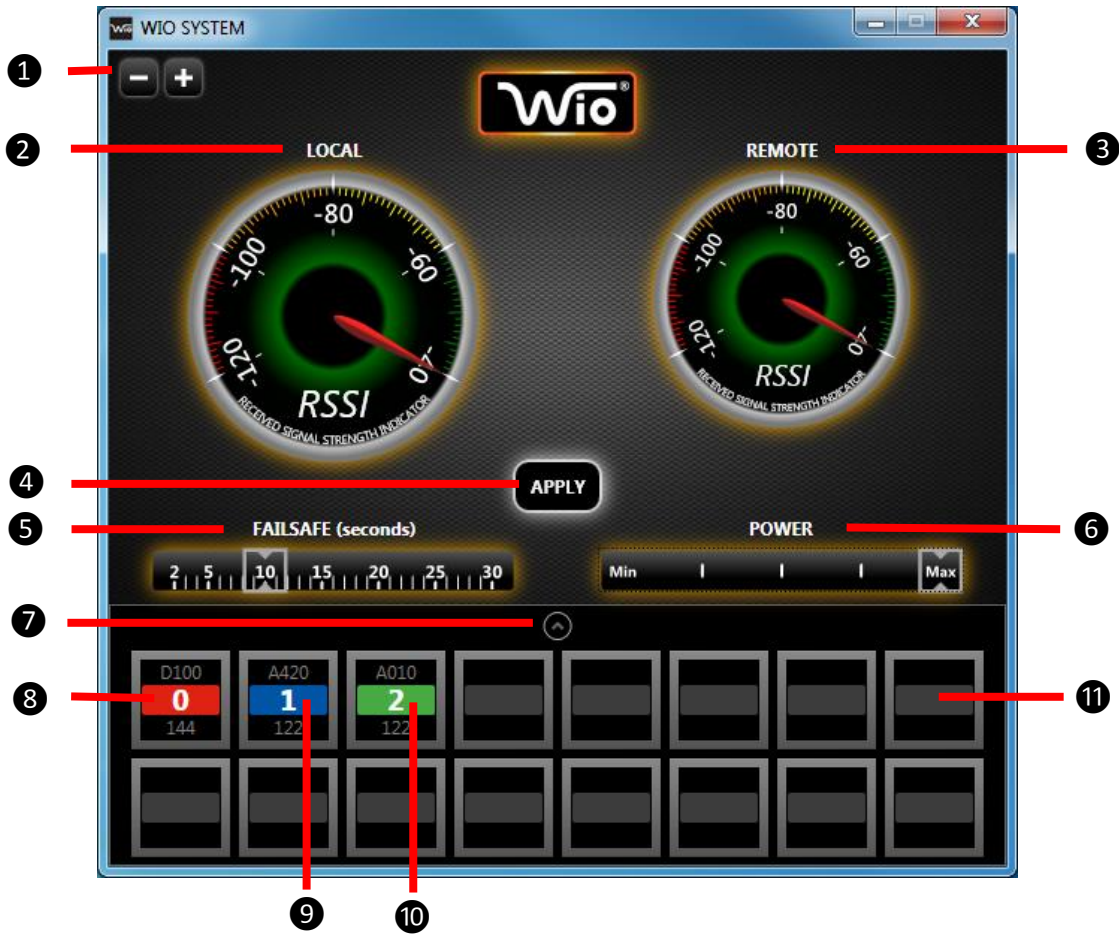
ON / CONNECTED




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

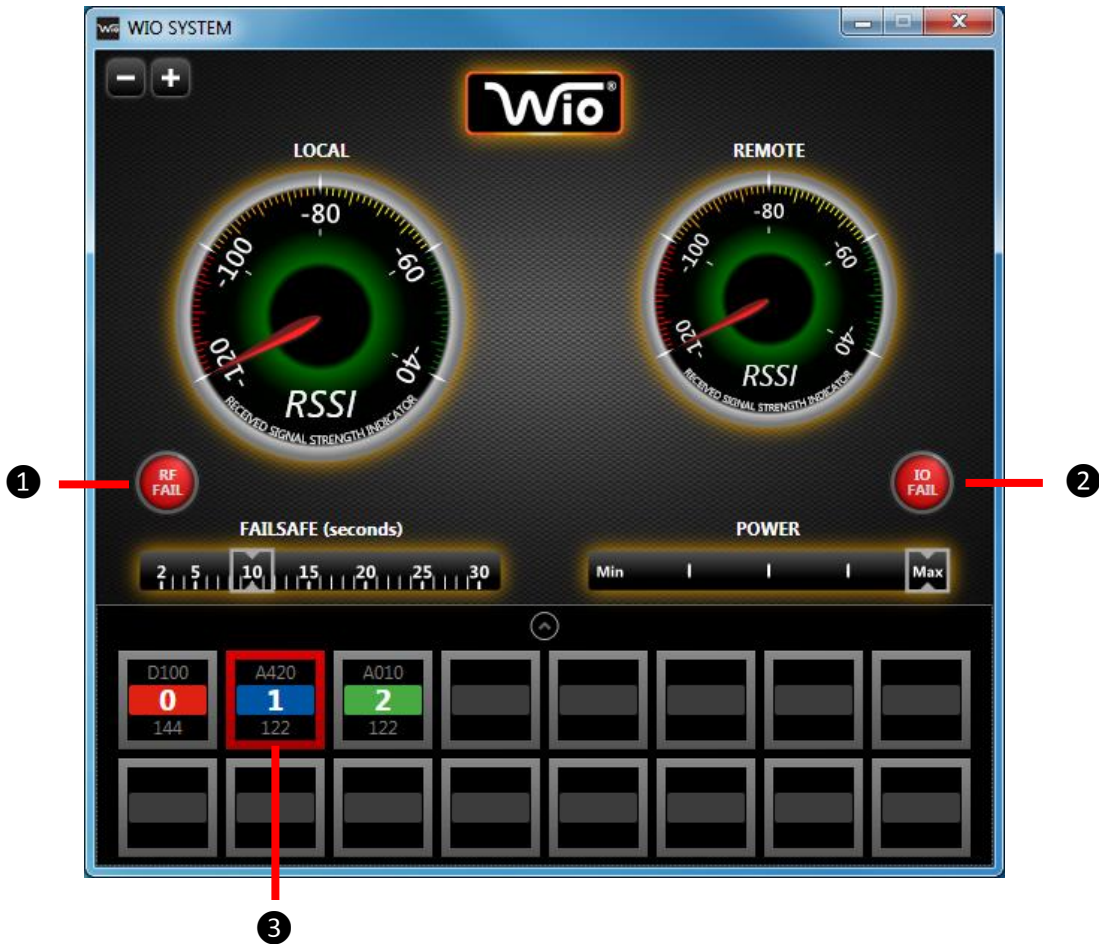


## D. Main Window Guide



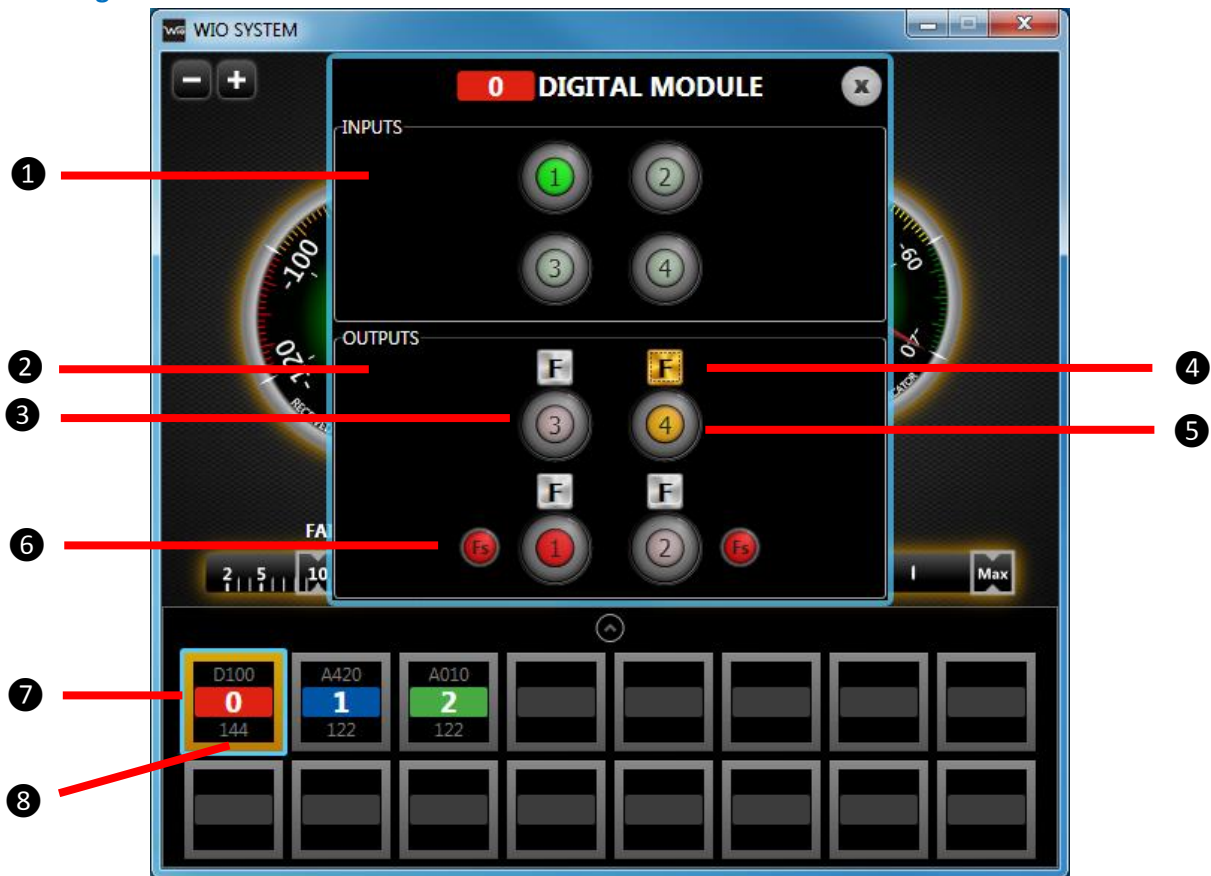
1. Screen Size – Zoom In/Out
2. Local RSSI (Received Signal Strength Indicator)
  - a. This level indicates the incoming signal strength received from remote Radio.
3. Remote RSSI
  - a. This level indicates the outgoing signal strength from local Radio to remote Radio.
  - b. Adjusting Transmit Power 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



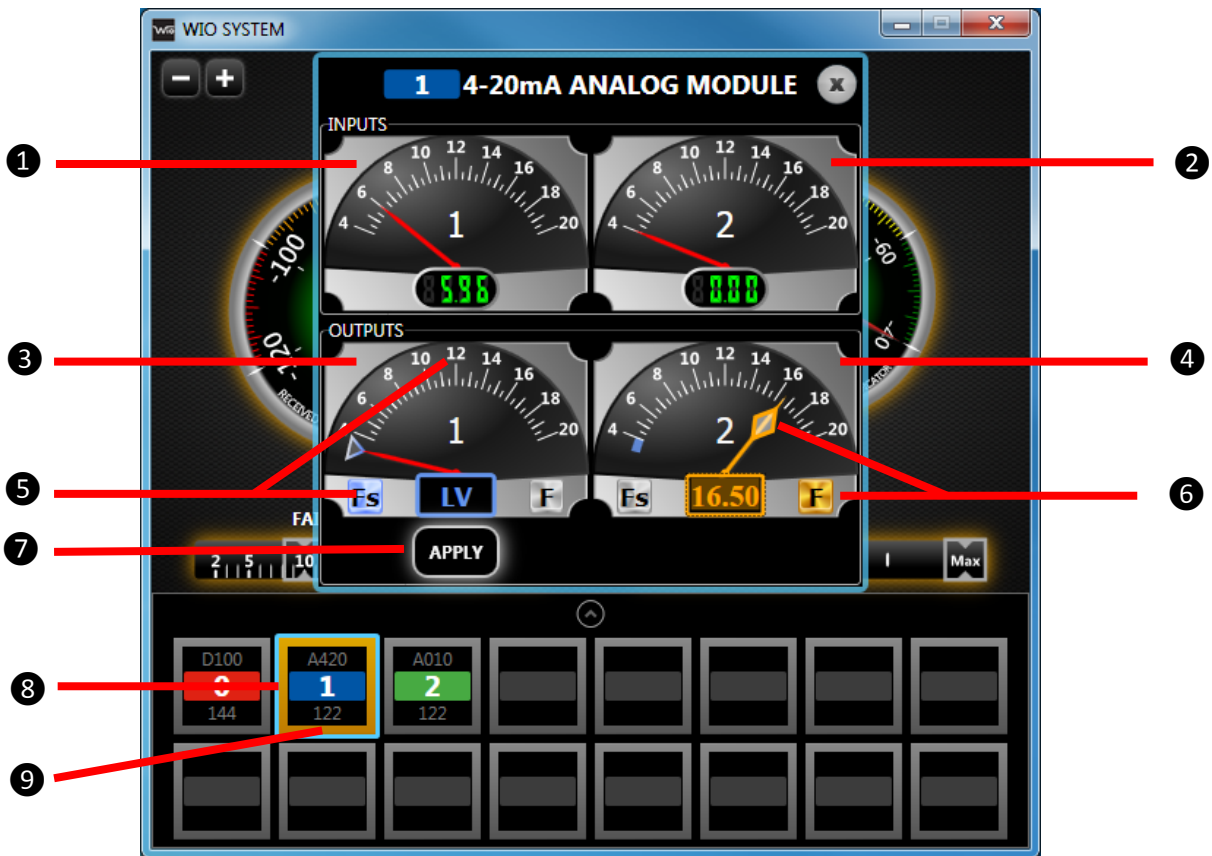
1. RF Link Failure Indicator
  - a. The RF Link Fail Output (NPN) on Radio Module also triggered when failure occurs.
2. I/O Link Failure Indicator
  - a. The I/O Link Fail Output (NPN) on Radio Module also triggered when failure occurs.
3. Red Border I/O Link Failure Indicator
  - a. Indicates specific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

## F. Digital Module Window Guide



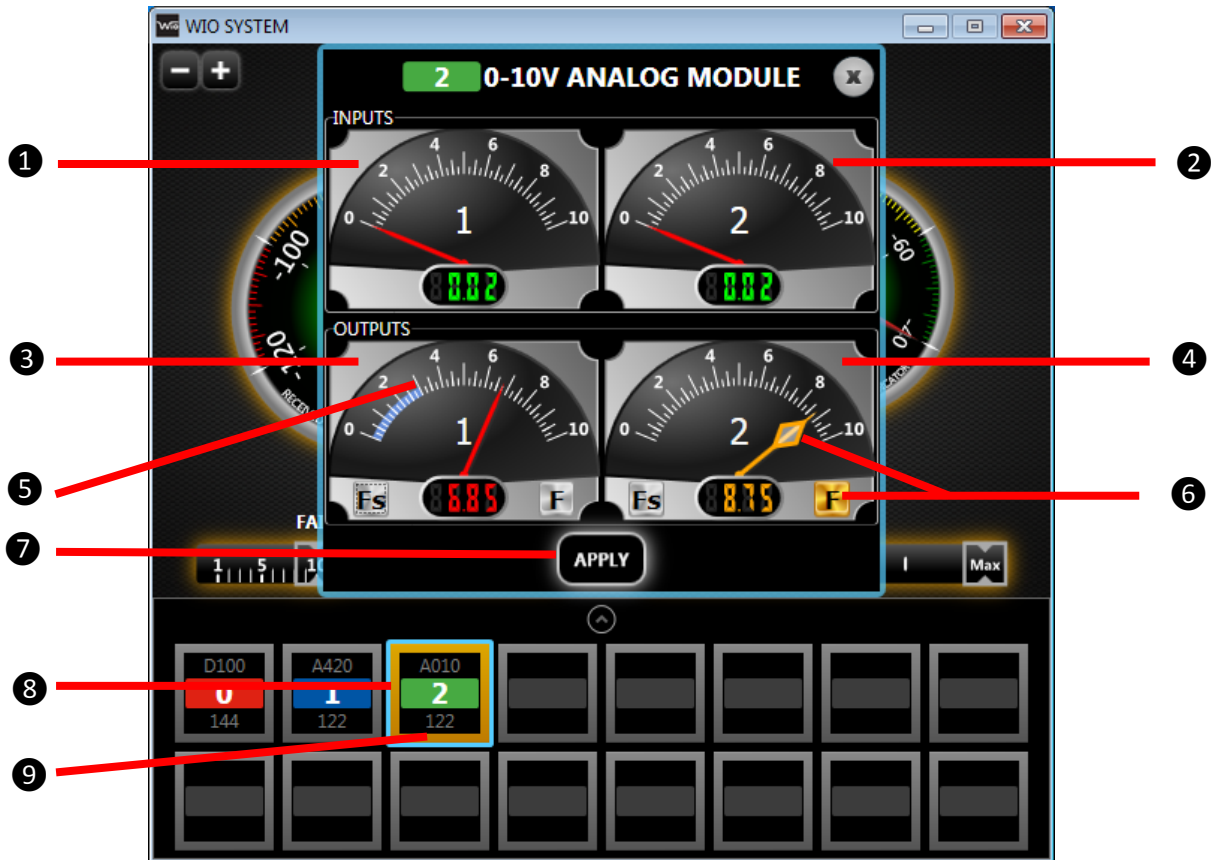
1. Digital Input(s) Status: Green – On ; Dimmed - Off
2. Digital Output(s) Status
3. Red LED: displayed when output is normally operated; Dimmed - Off
4. Force Output Button
  - a. Once activated, user has the option of turning output on or off by pressing on virtual output buttons.
  - b. To disable 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 triangle 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.

## 12. 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](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.



## 13. 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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## 14. 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](#)



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WIO® System User Guide

06/16/2015

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