TRAINTRAXX TRAXXID USER GUIDE

May 2018

This document guides the Model Railroader through the configuration and installation process of the TrainTraxx – TraxxID RFID Hardware

HiveID LLC

Table of Contents

List of Figures:

Introduction

TrainTraxx allows the Model Railroader to automate train operations by using RFID technology. RFID readers and NFC tags are used to identify locations of layout railcars in the various switch yards, sidings, and industries/spurs.

TrainTraxx provides a TraxxID starter kit. Coupled with Traxx Railcar Inventory System and Traxx Operation software, it allows the Model Railroader to get started in a BIG way– running train operations on a model railroad layout.

If you can install track on your layout, you can install TraxxID. It is very simple and comes with this step-by-step user guide for installation and instructions on all the pre-configured components.

TrainTraxx – TraxxID is a consolidation of hardware that has been configured to work in conjunction with the **new** TrainTraxx **Operations** and **Inventory** software. Although both the software and hardware can work independently of each other, by working together, the TrainTraxx solution gives the Model Railroader real-life and real-time experience of operations and dispatching.

This document will guide the user through the initial TraxxID hardware installation & Configuration. Visit https://www.traintraxx.com to download **Inventory** and **Operations** software.

Parts List

TraxxID starter kit provides all the hardware required for 100 railcars (additional railcars can be added), and 12 industries/spurs, sidings and switch yards (additional components can be added increasing the number of spurs, sidings and switch yards). Coupled with our Traxx Operations (sold separately) and Traxx Inventory software (free), this platform takes the Model Railroader to the next level of fun and automation.

The 12 Pack Starter Kit Includes:

1- Raspberry Pi + case – Used as a access point.

1 – Raspberry Pi power supply.

1 – Ethernet Cable

90 – NFC Tags – Placed at the bottom of each railcar-trucks. Contains all the pre-stored data of the model railroad railcar.

10 – 25mm Tags

12 – MFRC522 RFID Read/Writer – Reads the railcar data from the attached tag.

12 – 8266 WiFi Modules – Sends car data and location to Raspberry Pi aggregator.

12 – 12VDC to 5VDC converters – Powers the Readers and WiFi interfaces using the layout accessory power bus.

12 – 7 pins to 4+3 pin Wire Harness – Provides wire connection between RFID Reader and WiFi Module

1 – MFRC522 installation template – Used to outline the placement of the reader.

1 – Set of installation instructions – Makes installing the devices on your layout as easy as installing a switch and setting it up.

1 – Bag of screws and spacers

1. NFC Tags

NFC (near field communication) is a wireless technology that allows for the transfer of data such as text or numbers between two **NFC** enabled devices. **NFC tags**, which can be set on stickers, contain small microchips with small aerials that can store a small amount of information for transfer to another **NFC** device, such as an NFC tag reader.

The tags used for **TraxxID** come in two forms, 8mm and 25mm sizes as shown in Figure 1.

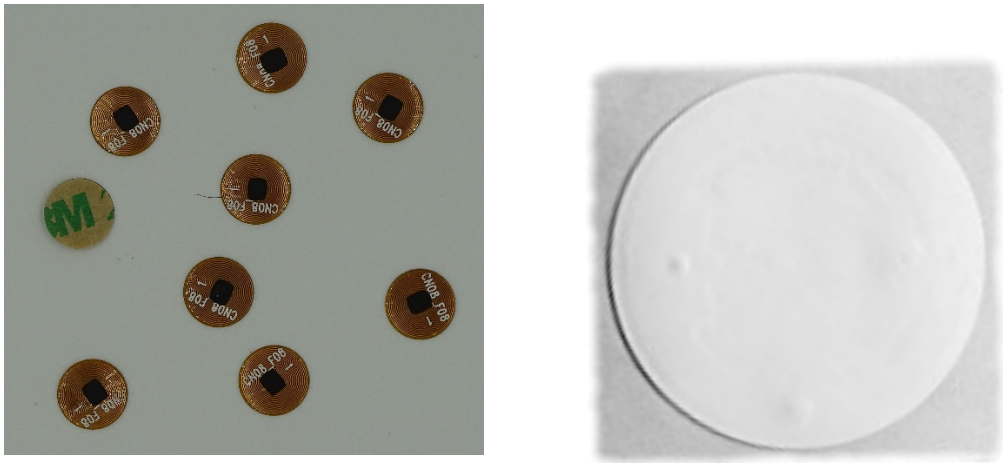


Figure 1 – NFC 8mm & 25mm Tags

Our 8mm NFC Tags are usually placed at the lowest point feasible on the railcar, which we have found 90% of the time to be located on the trucks as shown in Figure 2.

Figure 2 – 8mm tag on the Trucks

Figure 3 shows the 8mm Tag placed at the lowest point on a 3-bay covered hopper gate. Note: The Tag cannot be seen once it is placed on the layout.

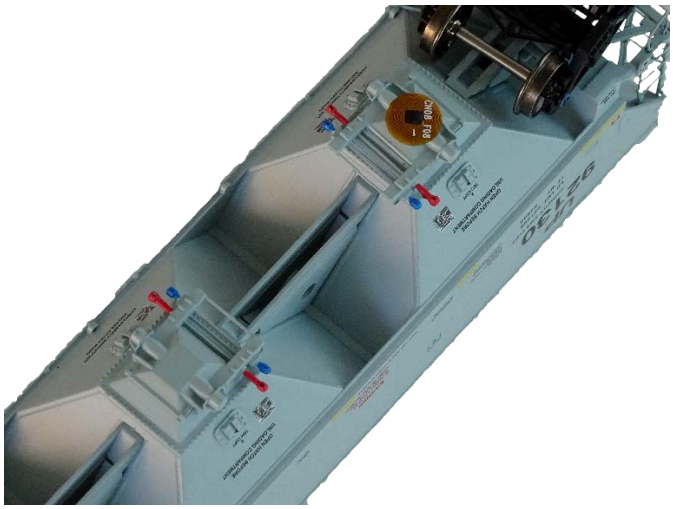
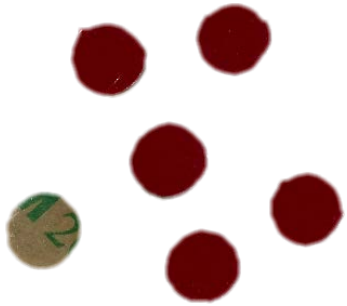


Figure 3 – Tag on Lowest Point

At times, you will find that due to the construction of the railcar, the 8mm NFC Tag may not work if they are placed on the trucks. Other options are available using the 25mm NFC Tags, as shown in Figure 4.

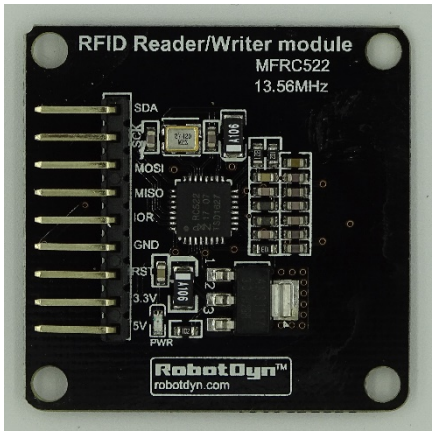
Figure 4 – 25mm Tag



If the 25mm tag is too large for the railcar or locomotive in this case, we have added 8mm 3M double sided tape to the TrainTraxx kit to extend the depth of the 8mm tag. Extending the depth even by 1mm has been shown to have a significant effect on reading the Tag data.

Although we have not been able to test all railcars and locomotives, TrainTraxx has been able to read 100% of various types of railcars and locomotives during our development phase. All options described above have been thoroughly tested.

2. Reader Module



The Radio-frequency identification (RFID) module creates an electromagnetic field. The tags contain electronically stored information. As the NFC tags comes in proximity to the Reader Module, the data that is stored on the Tag is read and sent to the TrainTraxx database.

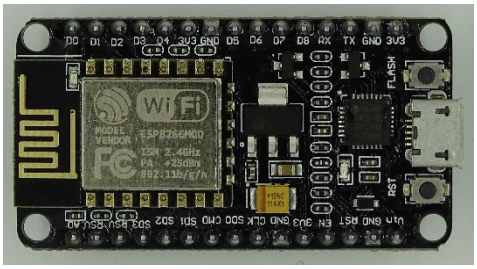
The Reader Module is used to read the NFC tags that will be attached underneath the railcar or locomotive. The reader is installed underneath the rail track.

The user can determine the number of readers needed based on the number of industries (spurs), sidings, and switch yards on a layout. Figure 5 shows how the Reader Module looks installed on a layout.

Figure 5 – RFID Reader Installed Under Tracks

The Reader Module can operate at 3.3VDC or 5 VDC. In this application, it will be configured to operate on 3.3VDC. Instructions on the installation process will be covered in section 6 of this User Guide.

3. ESP8266 WiFi Module



ESP8266 is an impressive WiFi module suitable for adding WiFi functionality to an existing microcontroller via a UART serial connection. The serial connection in this application comes from the MFRC RFID Reader. The ESP8266 requires 5vdc input which is powered through its USB micro connector.

4. DC to DC Converter

The DC to DC converter takes an input voltage of 8 to 22VDC (12VDC accessory power supply) and converts it to 5VDC output. The converter has a micro USB connector on the tip that plugs into the ESP8266 WiFi Module, powering the device.

The DC to DC converter is rated for 3 amps. Because of the other accessories on the layout that will be sharing the same 12VDC power supply, we recommend: **1)** The accessory power supply rating should be no less than 3 amps and no more than 5 amps**. 2)** When using more than 20 DC to DC converters, there should be another accessory power supply added to the layout. Figure 7 displays the Reader, WiFi module, and DC to DC connections.

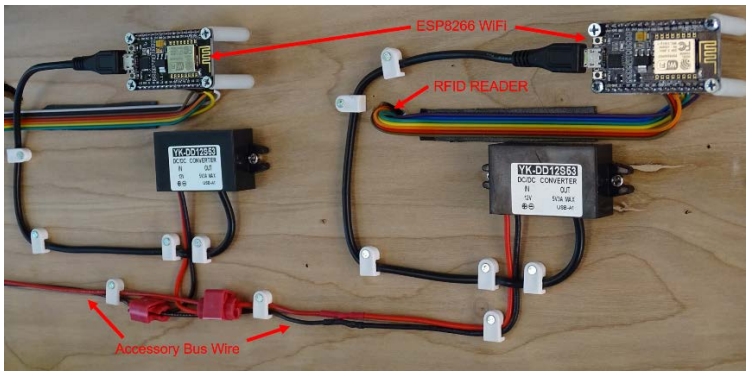
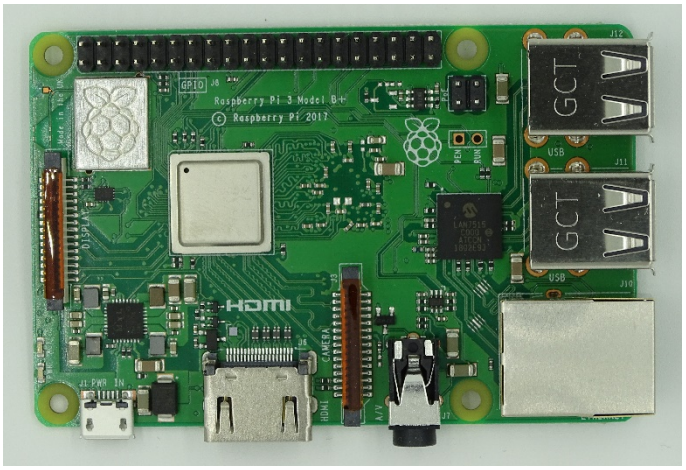


Figure 7 – ESP 8266/DC to DC Converter Wiring Configuration

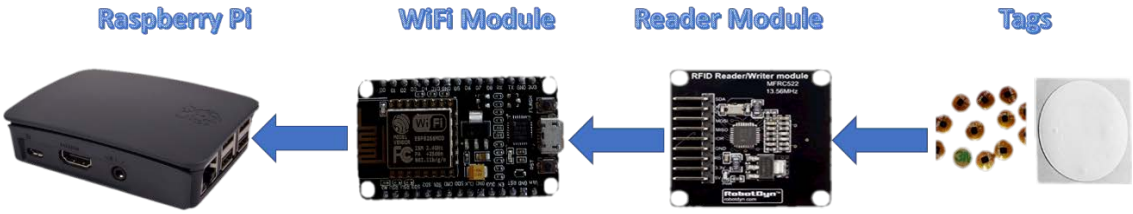
As the ESP8266 Powers up from the DC to DC converters, they immediately begin transmitting the data from the RFID Module,

5. Raspberry Pi Used as a Wireless Access Point



The Raspberry Pi is microcomputer the size of a credit card with a wireless/Ethernet interface for Internet connectivity. The Raspberry Pi is used for many applications. With the TraxxID application, we will be using the Raspberry Pi as an access point, to aggregate all the ESP8266 WiFi Modules on the layout. The 8266 WiFi modules and the Raspberry Pi will be preconfigured plug-n-play devices. The user will not have to configure or download anything to these devices.

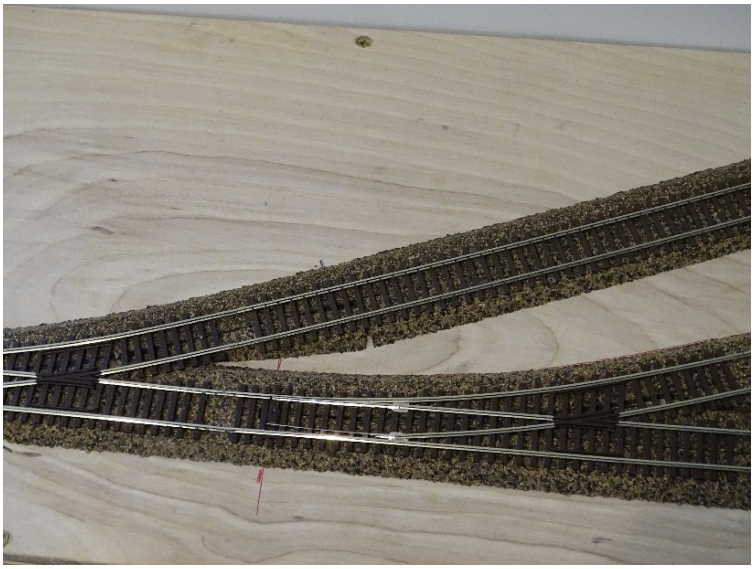
Connect the Ethernet port on the Raspberry Pi to a router or access point and the connection is instantly established. Register and sign in on the http://www.Trainraxx.com site and begin to see your locomotives and railcars appear.



6. Installation Preparation for Reader Module

6.1. Identify the locations on the layout where the Reader Modules will be placed.

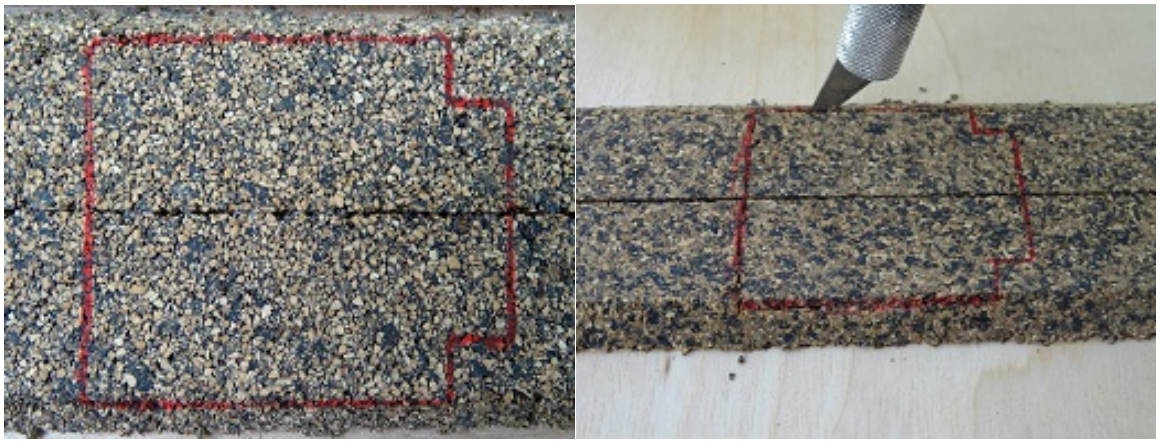
6.1.1. Normally they are placed at the: Switchyard, spur and sidings.



6.2. Once locations are identified, use the template to mark location of where the MFRC readers will be placed. The best placement of the reader should be centered just past the frog of the diverging route. This will be the entry/exit point of the diverging route.

6.3. Outline the placement of the template with a pen or pencil that could be seen on the roadbed. NOTE: THE READER COULD BE INSTALLED IN ANY DIRECTION.

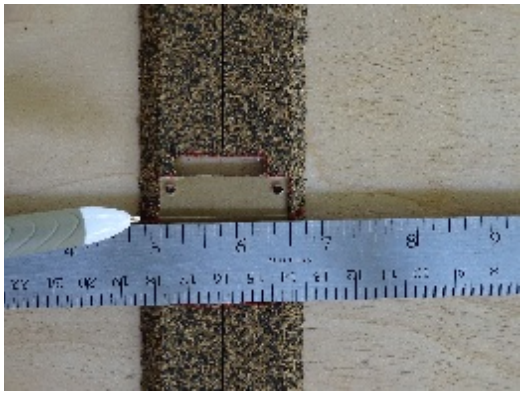
6.4. Remove the template. Using a utility knife, cut the area of roadbed out that was outlined in the previous step.



6.5. Remove the roadbed and scrape off shavings from the bottom, attempting to get a flush surface.

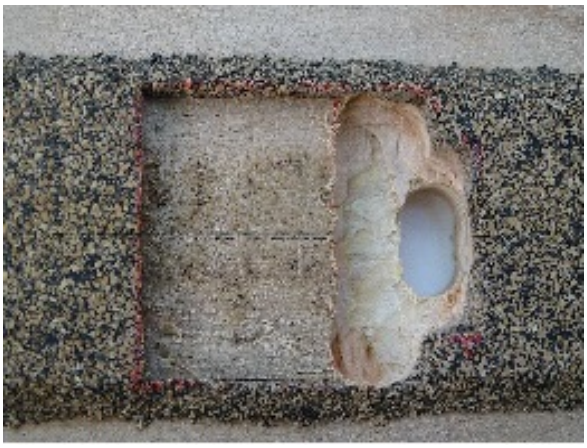
6.6. Align the backside of the template into the cut-away area.

6.7. Align ruler with the line on the template and make a mark on each side of the cork.

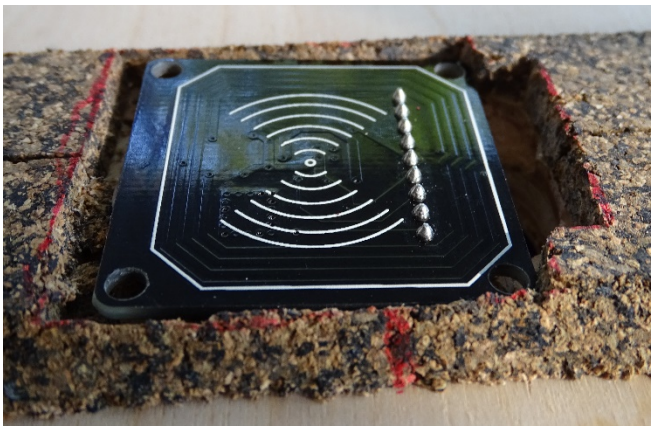


6.8. Remove the template and draw a line across where the marks were previously placed.

6.9. At the very top of the pattern, drill a hole ½” wide. The hole will be used to feed the 4 + 3 wires and connectors through.



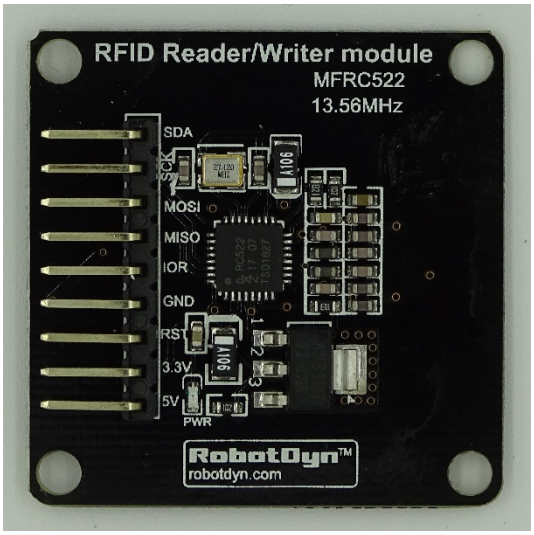
6.10. Place the RFID reader on the layout and it should now be slightly lower than the road bed allowing room for screw placement. The portion of the reader that will have the connectors and wires attached will be slightly lower than the rear portion of the reader, allowing enough space for the connectors.



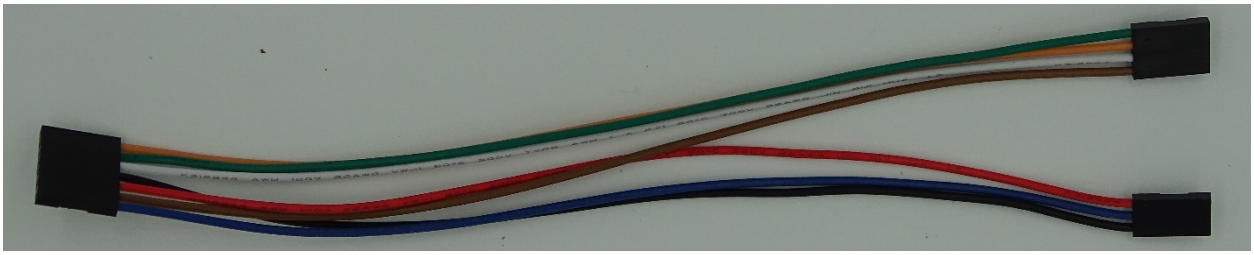
7. Wiring connections to the Reader Module

The reader module has 9 pins for connections, however, only 7 of them will be used. The number sequence 1 through 9 for the reader module pin connections start at pin 1 SDA at the top of the circuit board. The table below represents the pin connections for the Reader Module.

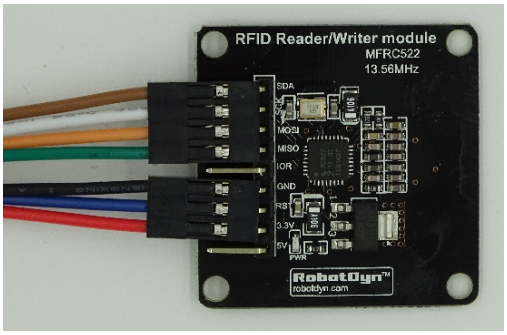
Pin #	Wire Color	Module Pin
1	Brown	SDA
2	White	**SCK**
3	Orange	MOSI
4	Green	MISO
5	Not Used	IOR
6	Black	GND
7	Blue	RST
8	Red	3.3V
9	Not Used	5V

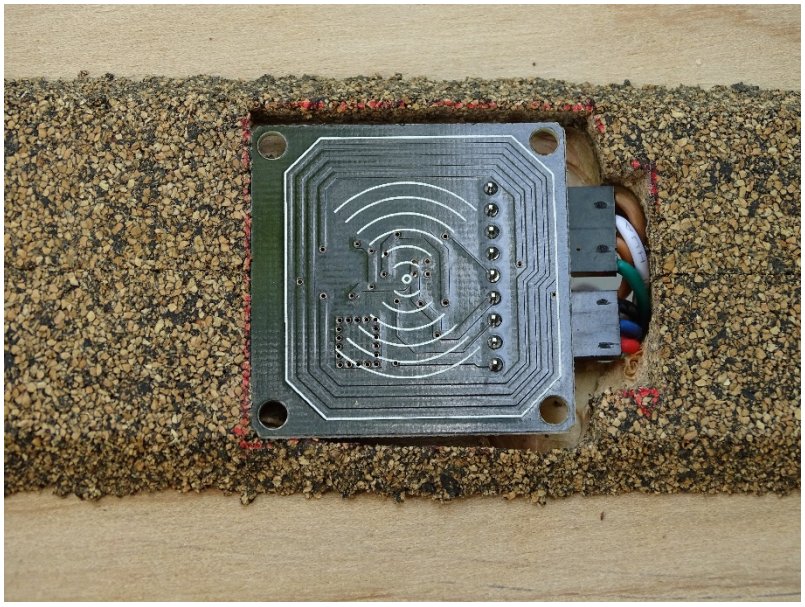


The wiring harness with the 7 block + 4+3 block pin connectors will be used as the interface cable between the Reader Module and the WiFi Module.

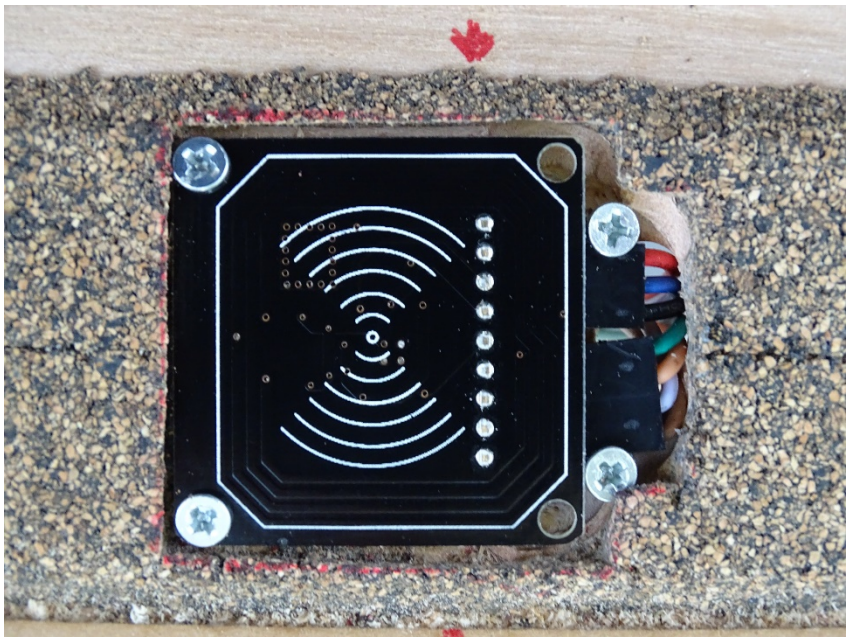


7.1. Insert 4+3 block connectors up through the RFID reader drilled hole. The 4 pin connector wires, starting with the brown wire, will be connected to the SDA pin (first pin at the top of the reader). The 3 pin connector wires, starting with the black wire, will be connected to pin 6 (GND). Turn the MFRC over so the component side of the reader is flush with the surface.





7.2. Using 4 screws, gently screw down the MFRC reader to the surface. Double-sided tape can also be used in place of the screws. Note: Do not overtighten the screws--they are only used to hold the board in place.



7.3. Once the screws are in place, take the track and secure it over the reader. This section of track can now be permanently secured.

8. Installing the 8266 WiFi Module

The ESP8266 WiFi module, collects the Tag data from the RFID reader module and hands it off to the wireless access point (Raspberry Pi). The WiFi module has been pre-configured with the SSID and Password for the Raspberry Pi access point, creating a plug-n-play experience for the user.

There are 7 pins that are used on the WiFi module; pins D3 to D7 with 3.3v & GND pins also used, found in-between D3 – D7.

The 8266 will be co-located with each reader. The power source for the reader will come from the 3.3v & GND pins of the ESP8266 as shown in figure 6.

Pin #	Wire Color
D3	Blue
D4	Brown
3v3	Red
GND	Black
D5	White
D6	Green
D7	Orange

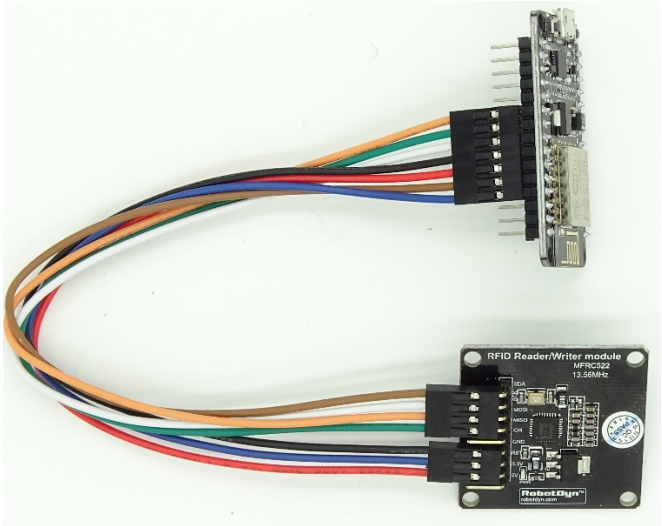
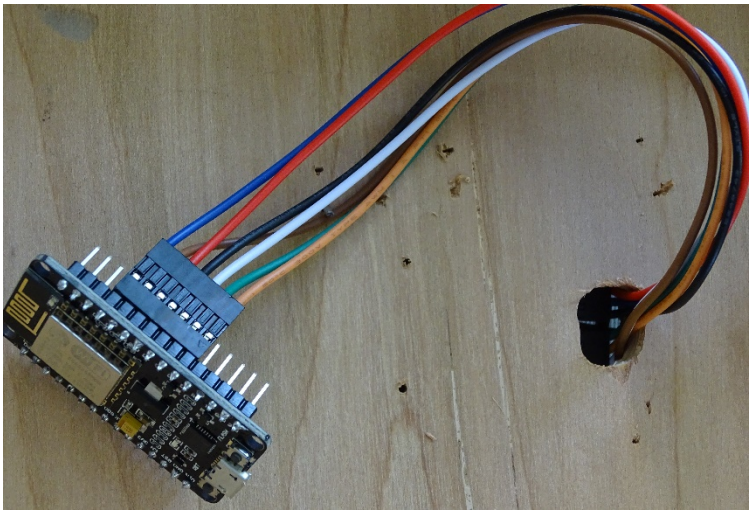
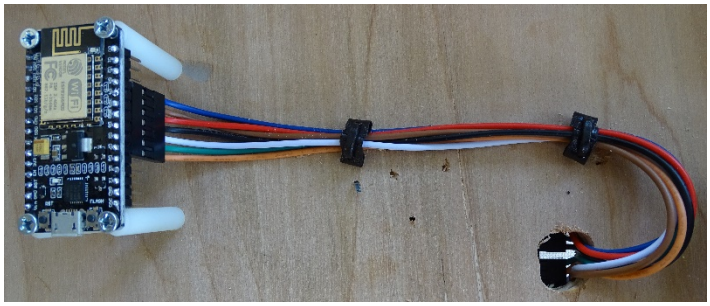


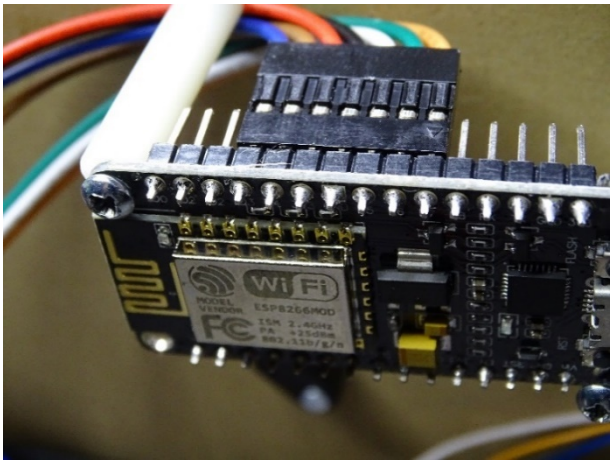
Figure 6 – WiFi Module & MFRC522 Reader Wiring Diagram

8.1. Connect the 7-pin connector block to the WiFi Module. **Note**, the blue wire is inserted onto pin D3 of the WiFi Module. The D3 pin on the WiFi module is labeled and shown in the picture below.



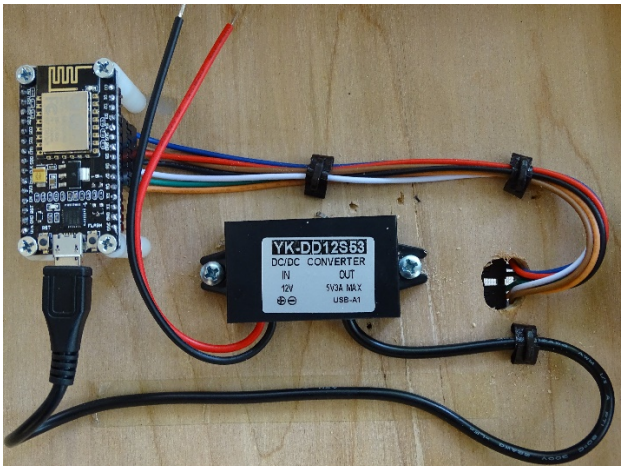
8.2. Install the WiFi module using the four screws and standoffs supplied in the kit.
Note: The 8266 WiFi Module comes pre-configured with the Raspberry Pi access point SSID and password.



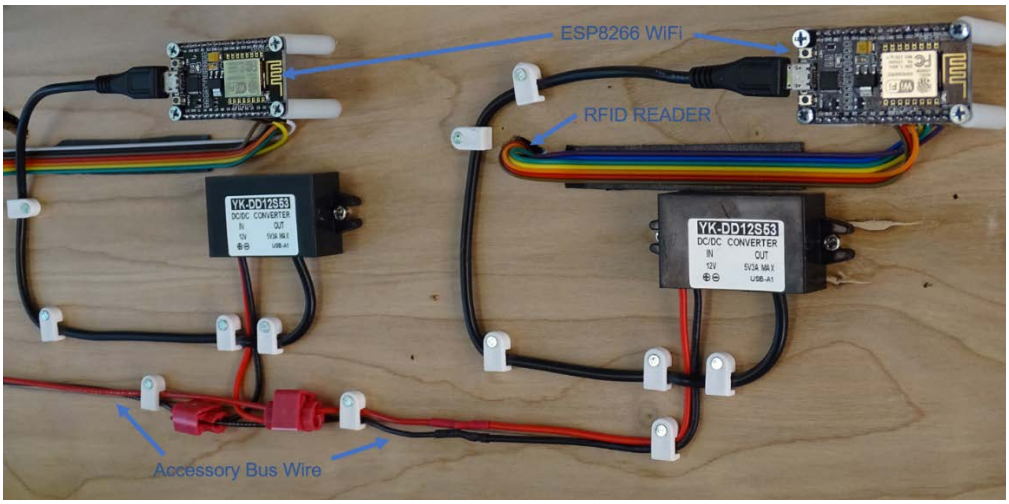


9. Installing the DC to DC Converter

9.1. Co-locate the DC converter alongside of the WiFi Module and connect the micro USB cable.



9.2. Connect the DC converter power leads to the 12vdc power BUSS underneath the layout. Note: Be sure you connect the + red wire to the positive wire of the DC BUSS.



The installation process is completed for the layout once all Readers, WiFi Modules, and DC to DC converters have been Installed.

The layout installation process is straightforward and not complicated.

The last step for full connectivity to the Internet, accessing the TrainTraxx Cloud, is to connect the Raspberry Pi to the router or access point.

11. Raspberry Pi Configuration

There is no need for the user to configure the Raspberry Pi for SSID and password. The Raspberry Pi and WiFi module are pre-configured and plug-n-play. Place the Raspberry Pi by a router or access point, connect the Ethernet cable supplied with the Raspberry Pi, and you are off and running.

If you have any questions please feel free to visit our Website www.traintraxx.com, for additional instructions and contact information.