



For Full Integration Configurations

Turntide Troubleshooting Guide for Smart Motor Systems, RMK, and EMK

July 14, 2022

Revision History

Document Revision Number	Description	Date
1.0	Initial Release	July 14, 2022

Conventions

Bold	Used in procedures for names of interface elements, such as buttons, fields, and menu items.
<i>Italics</i>	Used for emphasis, typically when introducing a new concept.
Note:	Indicates information that can help a customer make better use of a Turntide product.
Caution icon	Indicates an instruction that draws attention to the risk of damage to the product, process, or surroundings. 
Warning icon	Indicates an instruction that draws attention to risk of injury or death and tells the customer how to avoid the potential problem. 

Legal

The information in this document is subject to change without notice and should not be construed as a commitment by Turntide Technologies® or Software Motor Company. Turntide Technologies assumes no responsibility for any errors that may appear in this document. In no event shall Turntide Technologies be liable for incidental or consequential damages arising from use of this document or the software and hardware described in this document. © Turntide Technologies. All rights reserved.

Contact

877.776.8470 | support@turntide.com | 1295 Forgewood Avenue | Sunnyvale, CA 94089 www.turntide.com

Contents

Audience	3
Installation Prerequisite	3
Resources	3
Overview	4
System Components	4
Motor and Motor Controller Troubleshooting	5
Control Wiring Methods	6
Monitor Only Wiring	6
Full Integration	7
Where to start?	8
Troubleshooting Scenarios	8
If Motor Controller Offline from Cloud Services	9
If Motor Not Running	13
If Heating/Cooling Stages Not Active	18
Motor Alarms	25
Temperature Sensors	27
Noise Complaints	30
Motor and Motor Controller Wiring Diagram	33
Remote Monitoring Kit (RMK) Troubleshooting	37
Learn about the basic components	37
Preliminary Troubleshooting	37
In-Depth Troubleshooting	37
Basic Components of RMK-002	38
RMK-002 Wiring Diagram	40
Basic Components of RMK+ Long Range Wi-Fi Access Point	41
RMK+ Long Range Wi-Fi Access Point Wiring Diagram	43
Preliminary Troubleshooting Steps	44
Step 1: Verify unit control voltage	44
Step 2: Check the NEMA 4X enclosure	45
Step 3: Cycle power to the RMK	46
Step 4: Consider that something has changed	46
RMK In-Depth Troubleshooting Steps	47

Site Not Reporting Data - Troubleshooting Steps	48
Step 1: Conduct an initial inspection of the RMK	48
Step 2: Connect to cellular modem with your phone and test connectivity	49
Step 3: Troubleshoot the cellular modem	51
No Motor Controllers Reporting Data - Troubleshooting Steps	55
Step 1: Verify that the Turntide Supervisor is powered up correctly	55
Step 2: Troubleshooting the Supervisor when the RUN LED is not lit	56
One Motor Controller (of many) Not Reporting -Troubleshooting Steps	58
Steps: Use the Turntide Technician App to connect to the motor controller	58
Power Supply Issues – Troubleshooting Steps	60
Step 1: Verify power from the AC/DC adapter	61
Step 2: Verify power from transformer	62
Intermittent Connectivity - Troubleshooting Steps	64
Step 1: Verify the RRSI using the Turntide Technician App	64
Step 2: Change RMK-002 Placement	66
Step 3: Upgrade to RMK+ Long Range to increase Wi-Fi signal when relocation not possible	67
Check LEDs on PoE Injector for RMK+	69
Check LEDS on Router for RMK+	69
Troubleshoot Long Range Wi-Fi Access Point Using LED Color Status	70
Basic Components of EMK	73
EMK Wiring Diagram	75
Verify Wiring Connections	77
Appendix	83
How to Commission a Motor with the Turntide Technician App	83
Step 1: You must be connected to a motor controller with the motor home screen visible	83
Step 2: Configure motor parameters	85
Step 3: Configure the control mode	87
Step 4: RMK Connection	89
Motor Controller Jumper Pin Overview	91

Audience

This manual is intended for technicians servicing equipment retrofitted with the Turntide (formally Software Motor Company) Smart Motor System™. Contents include an overview of the Smart Motor System, sequence of operation, and step-by-step diagnostics.

You will have access to Remote Support from Turntide Technical Services:

877.776.8470 (877-PRO-TIP+)

support@turntide.com

Installation Prerequisite

Installers are required to complete our online training courses for this product prior to performing installations. See Turntide Academy: www.turntideacademy.com



REQUIRED

Follow all local and national electrical codes, safety compliance requirements, and common installation procedures.

Resources

Additional resources, such as data sheets, wiring diagrams, install guides, training resources, and much more are available at www.turntideacademy.com/.



Overview

The Turntide Smart Motor System delivers energy efficiency in a highly reliable switched reluctance design. This software-driven motor solution includes a Smart Motor and Motor Controller at a minimum. Many applications include a Remote Monitoring Kit complete with networking and connection capabilities to Turntide Cloud. The Energy Monitoring Kit is an accessory to the Remote Monitoring Kit.

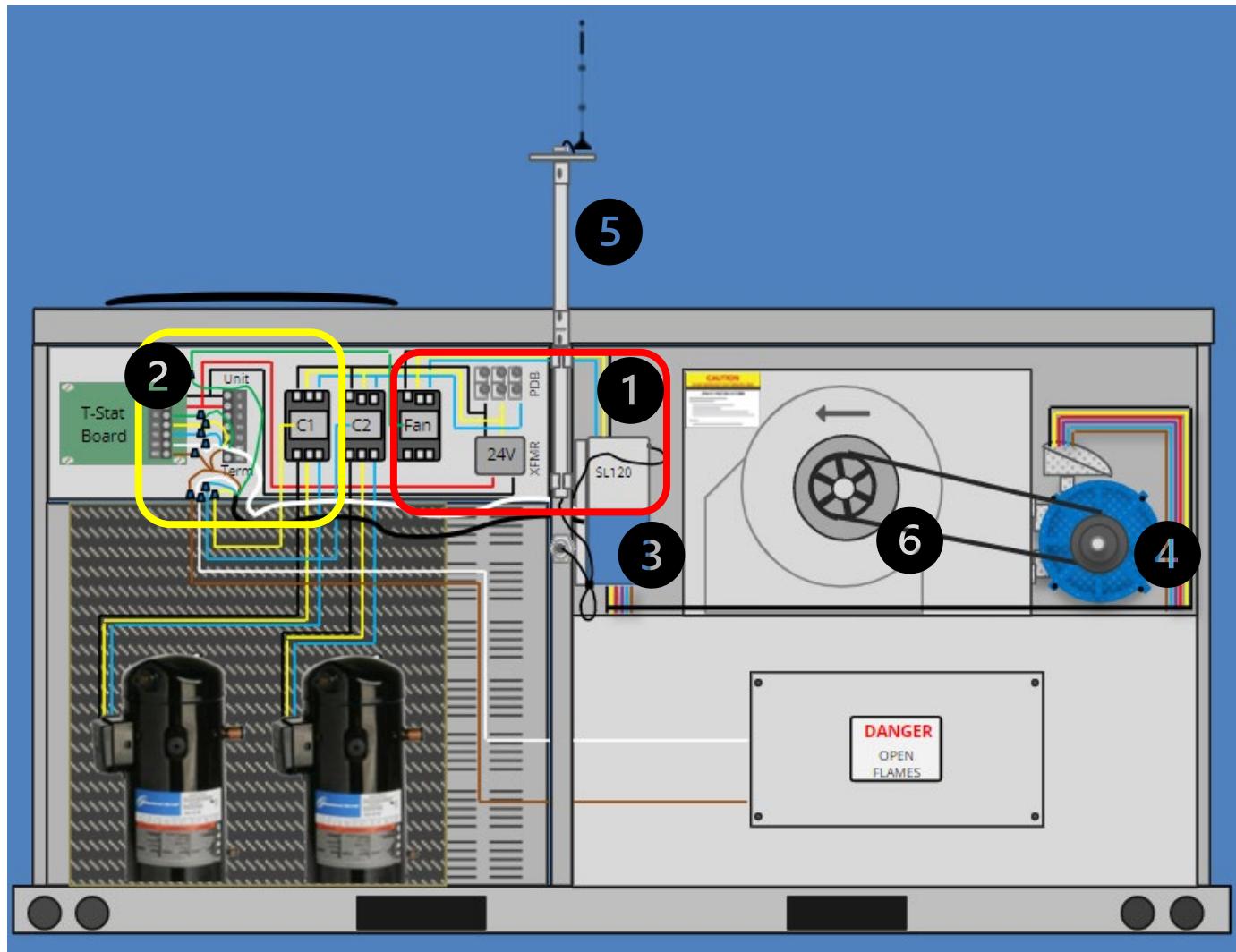
System Components

Motor The Turntide V and Q series motors are suitable for a range of new and retrofit HVAC, refrigeration, and pumping applications in both fixed and variable speed. Unlike traditional induction motors, the Turntide Switched Reluctance Motor (SRM) receives power from the Turntide Motor Controller rather than AC line power.	
Motor Controller The Turntide Motor Controller controls all operations of the Turntide Smart Motor and is required for motor operation. Its internal program ensures that the motor is operating at the highest efficiency at any speed in any application.	
Remote Monitoring Kit The Turntide Remote Monitoring Kit (RMK) connects multiple Smart Motor Systems on a site and provides connectivity to the Turntide Cloud or a Building Management System (BMS). The Turntide RMK contains a Supervisor and a modem. The Supervisor uses a Wi-Fi network provided by the modem to communicate to all Turntide motor systems installed on a site, connecting the motor systems to the Turntide cloud.	
Energy Monitoring Kit The Turntide Energy Monitoring Kit (EMK) is an accessory component to the RMK. The EMK consist of a power meter and three current transformers and is most often applied in pre-sale applications to determine original motor energy usage.	

Motor and Motor Controller Troubleshooting

Principal areas:

1. Power wiring to Motor Controller
2. Control wiring to Motor Controller inputs and outputs
3. Motor Controller
4. Smart Motor
5. Remote Wi-Fi Antenna Assembly
6. Belts and Pulleys

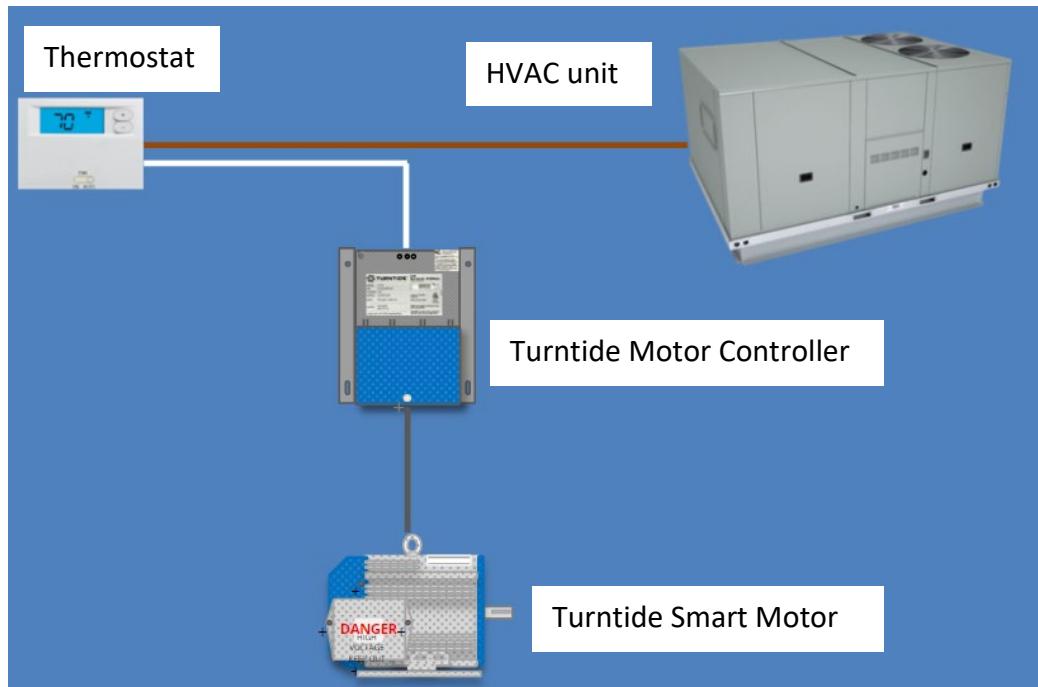


Control Wiring Methods

Two main control wiring methods for RTU applications: Monitor Only and Full Integration

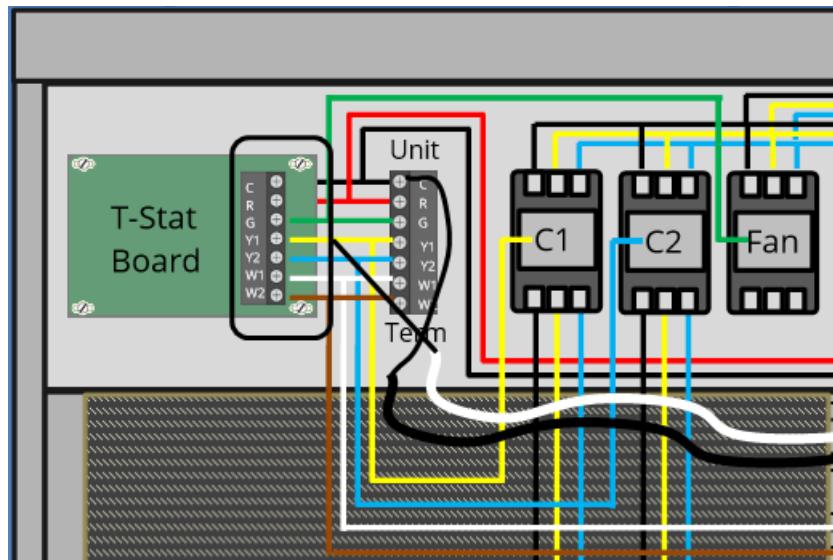
Monitor Only Wiring

Defined by a Motor Controller wired in parallel with the 24V signals from the thermostat. Thermostat still controls RTU heating and cooling stages.



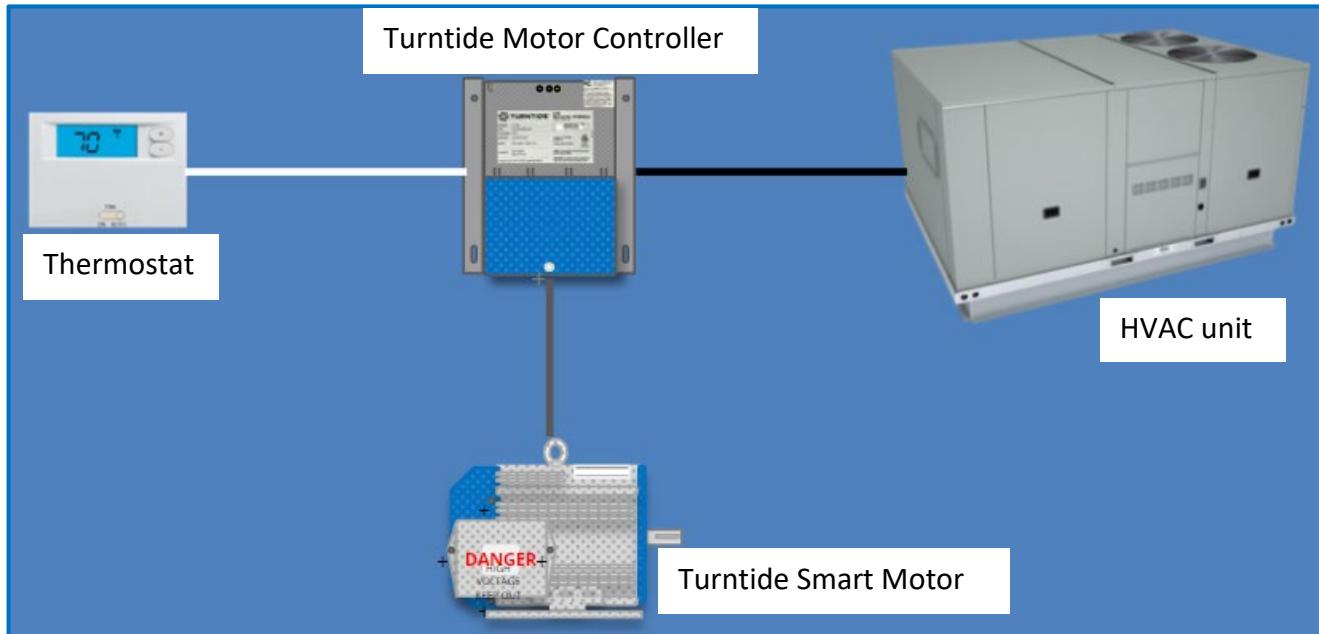
In Monitor-Only applications, the motor controller is prewired with a **white** input and **black** output cable.

- The **white** input wired in parallel with the thermostat 24V signals to the RTU.
- The **black** cable wired for 24V Common.



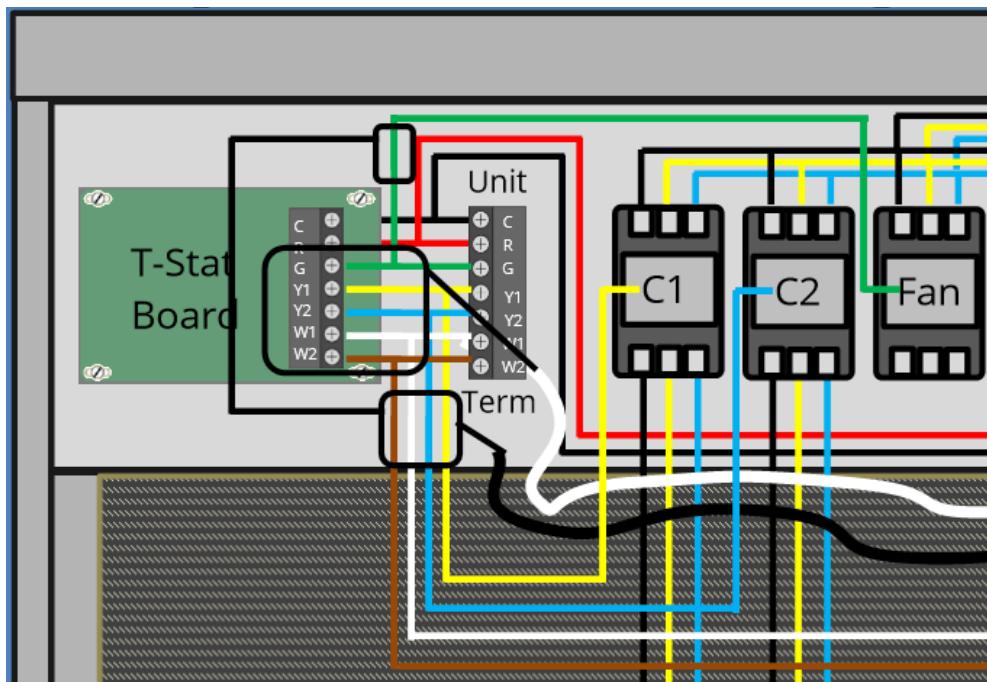
Full Integration

The motor controller interrupts the 24V signals between Thermostat and RTU. The thermostat sends stage signals to the motor controller via the **white** input cable. Once the motor reaches speed, the motor controller energizes the corresponding heating or cooling stage via the **black** output cable to the RTU.



The **white** input cable is wired to the thermostat, to receive the 24V signals.

The **black** output cable is wired to the RTU terminals to energize heating and cooling stages on the unit once the motor reaches stage speed.



Where to start?

- If Turntide dispatched you, then Turntide Technical Services has performed an initial analysis, defining probable issues like Motor Controller offline, Motor not running, Hi/Low torque alarms, etc.
- If a customer of the location initiated the site call, the issue will be less specific, and you should run through the following trouble shooting scenarios.

Troubleshooting Scenarios

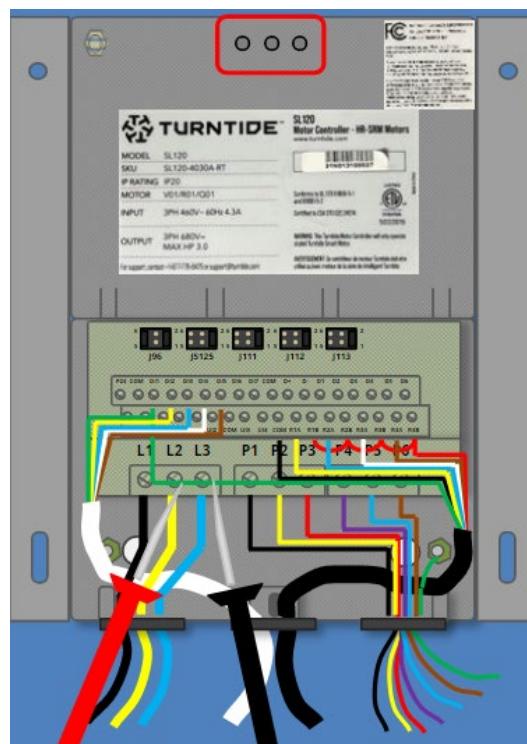
- [If Motor Controller Offline from Cloud Services on page 9](#)
- [If Motor Not Running on page 13](#)
- [If Heating/Cooling Stages Not Active on page 18](#)
- [Motor Alarms on page 25](#)
- [Temperature Sensors on page 27](#)
- [Noise Complaints on page 30](#)

If Motor Controller Offline from Cloud Services

- Dispatched from Turntide Technical Services.
- Motor Controller is not reporting to the remote monitoring kit (RMK) on site and is therefore offline.

1 Check Power

1. Verify the RTU disconnect is in the **ON** position.
2. If no LEDs are lit on the motor controller, then remove its junction box cover and check voltage from: L1 to L2, L1 to L3, and L2 to L3.
(For the P04 and P05 controllers, the terminals are designated as U, V, and W.)
You should read +/- 10% of unit voltage.
3. If proper voltage is present but no LEDs are lit, you must replace the motor controller.

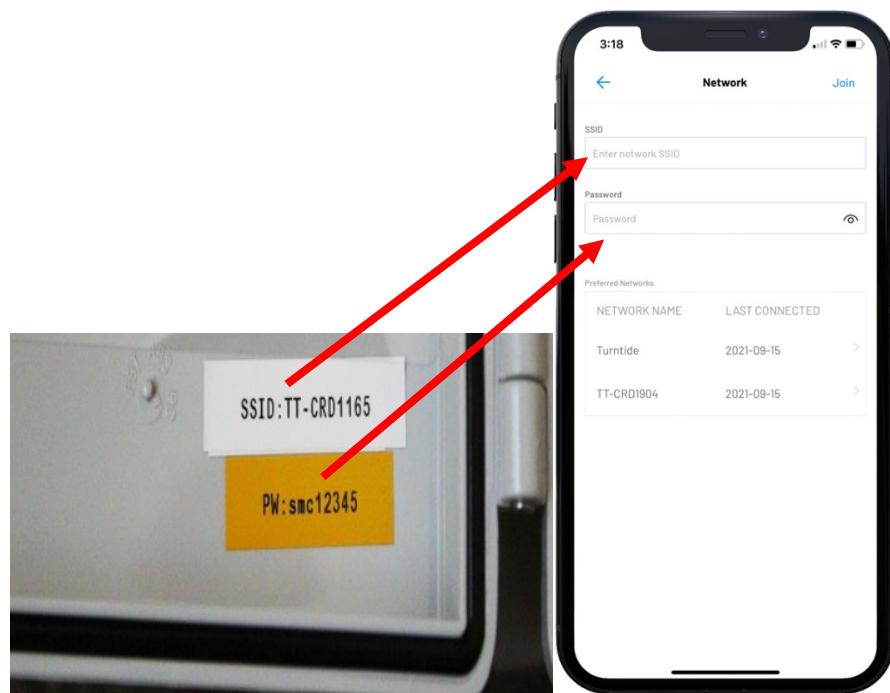
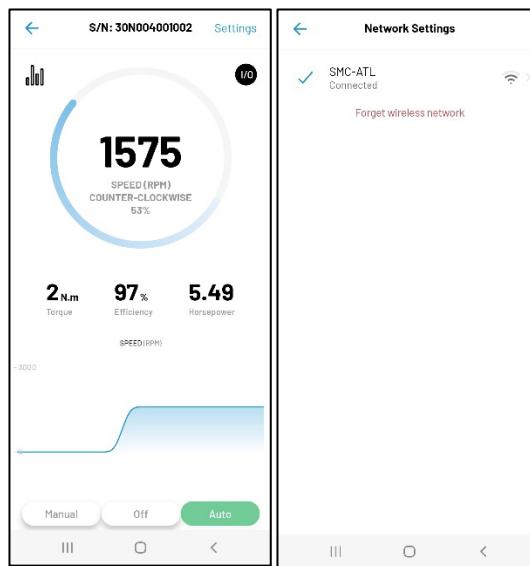


2	<p>Connect with Turntide Technician App</p> <p>Using your phone or tablet, try to connect to the motor controller with the Turntide Technician App.</p>  <p>For full instructions on how to download the app and more, see Turntide Academy, Turntide Technician App User Guide.</p> <ul style="list-style-type: none">• If you were NOT able to connect to the motor controller with the Turntide Technician App, go to the next step (3, Check Antenna).• If you were able to connect to the motor controller, go to step 4, Join Network.
3	<p>Check Antenna</p> <ol style="list-style-type: none">1. If you were NOT able to connect to the motor controller with the Turntide Technician App, verify that the antenna connection to the motor controller is finger-tight.<ol style="list-style-type: none">a. If the antenna connection is finger-tight (and still no connection), remove the remote antenna and try connecting using the standard antenna that arrived in the box with the motor controller.b. If you are able to connect now with the standard antenna, then the issue is with the remote antenna. You must replace the remote antenna.c. If you are NOT able to connect with the standard antenna, verify that you have Wi-Fi enabled on your mobile device. If you have Wi-Fi enabled, then the two antennas are NOT the issue, and you must replace the motor controller. <p>Note: Motor controller has a female antenna connection so the antenna itself must have a male connection.</p>

4 Join Network

Verify that the motor controller is joined to the RMK network using the Turntide Technician App:

1. In the motor screen, tap **Settings**.
2. Tap **Network**. The **Network Settings** screen appears and the RMK network name/SSID is displayed.
 - a. If a network isn't shown, then tap the **Join Wireless Network** option that appears.
 - b. Enter the **SSID** number and the **Password** exactly as they appear on the label (mix of uppercase and lowercase letters). Both are found inside the RMK enclosure cover.

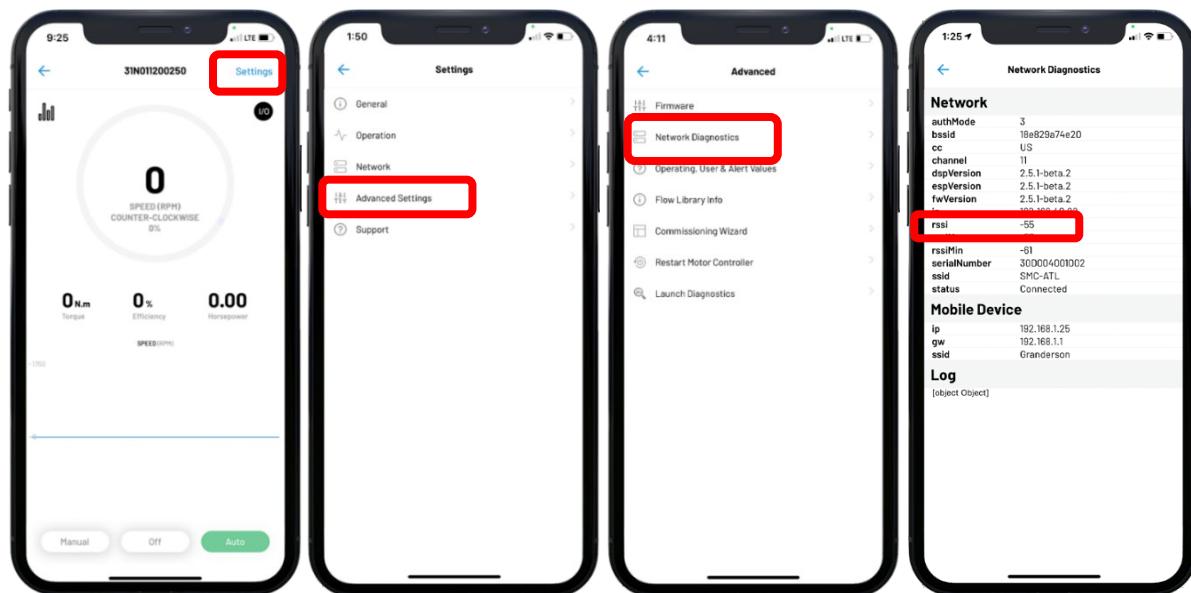


5 Check RSSI

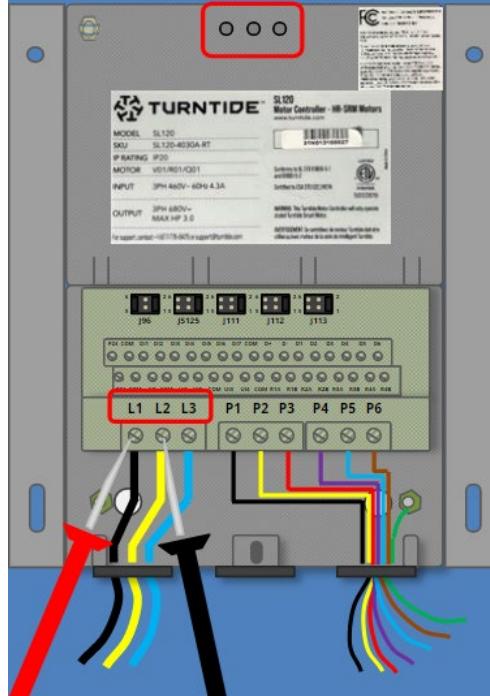
Once you have joined the network, verify the wi-fi network signal strength (RSSI) at the motor controller:

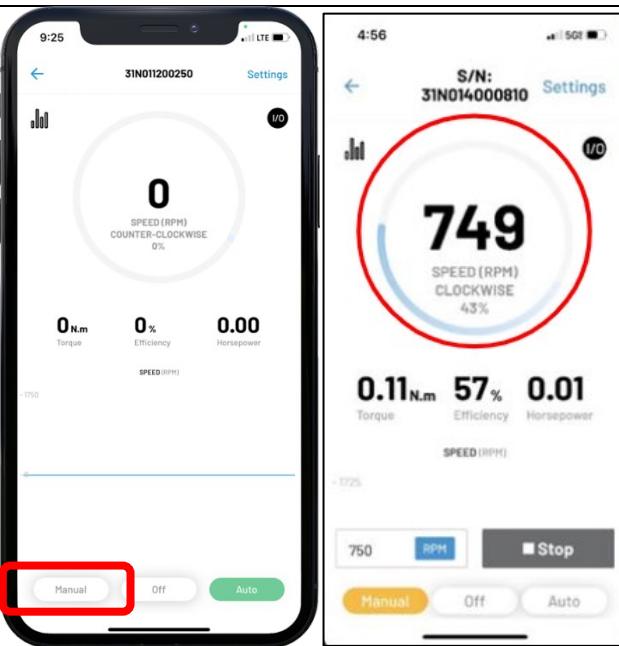
1. You must be connected to a motor controller with the motor home screen visible in the Turntide Technician App.
2. Tap **Settings** and then **Advanced Settings**.
3. Tap **Network Diagnostics**. The **RSSI** value is displayed.
 - If the RSSI is poor, contact Turntide Technical Support 877-776-8470 (877-PRO-TIP+) for RMK upgrade options.

RSSI Value	Strength Level of Wi-Fi Signal
-50 dBm	Excellent
-60 dBm	Very good
-70 dBm	Good (minimum)
-80 dBm	Low
-100 dBm	No Wi-Fi signal



If Motor Not Running

1	<p>Check power</p> <ol style="list-style-type: none"> Verify the RTU disconnect is in the ON position. If no LEDs are lit on the motor controller, then remove its junction box cover and check voltage from: L1 to L2, L1 to L3, and L2 to L3. You should read +/- 10% of unit voltage. (On the P04 and P05 motor controllers, the main voltage terminals (L1, L2, and L3) are labeled U,V, and W, respectively.) If proper voltage is present but no LEDs are lit, you must replace the motor controller. 
2	<p>Connect with Turntide Technician App to run the motor manually</p> <p>You must be connected to a motor controller with the motor home screen visible in the App.</p> <ol style="list-style-type: none"> Tap the Manual button. Enter 750 in the RPM field and tap Run. If the motor ramps to the selected speed, then the issue is NOT with the motor. If the motor does NOT ramp to the selected speed, then you must recommission the motor. Go to step 4 Recommission. If after recommissioning the motor does not ramp, try to observe what is prohibiting the ramp up. <i>Is the issue mechanical, is there an alert issued on the Turntide Technician App?</i> Contact Turntide Technical Support 877-776-8470 (877-PRO-TIP+) with your observations. Disconnect the App from the motor controller: Tap the back arrow icon in the upper left corner of the screen. Select Disconnect and switch to auto mode. The App must be left in Auto mode for the Turntide Smart Motor System to function correctly.



- Manual mode is mainly used to verify correct motor rotation and that the motor is responding to commands from the Turntide Technician App.
- Operating the motor in Manual mode does NOT ensure that wiring is correct, or that the setup is correct. *It is NOT equal to a function test.*
- Manual mode should be used ONLY after careful consideration.
- Manual mode does not force heating or cooling operation.

3 Jumper/Inputs

Verify that input mode jumpers are on pins 5 and 6 for 24V signal operation.

- On P04 and P05 motor controllers, this is jumper bank 96. (J96)
- On the SL120 motor controller, this is jumper bank 10. (J10)

Model	Input Mode	UI1	UI2	UI3	UI4
P04W	J96	J5125	J111	J112	J113
P05	J96	J5125	J111	J112	J113
SL120	J10	J11	J12	J13	J14

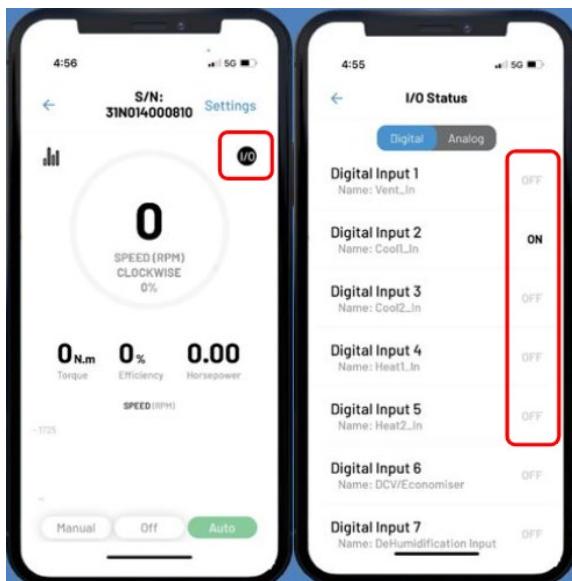


Note: If you are not doing 24V signal control (e.g., 0-10V BMS control) then see [Motor Controller Jumper Pin Overview](#) on page 91 in the [Appendix](#) to ensure you have the pins in the correct position for your special case.

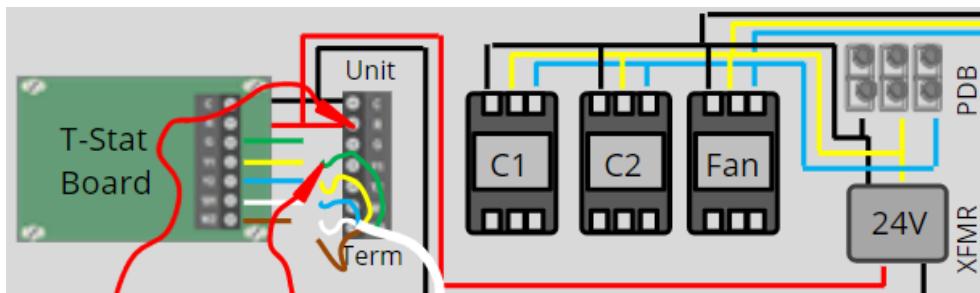
Once you have verified the input mode jumpers, view the status of the 24V inputs to the motor controller:

1. Using the Turntide Technician App, (you must be connected to a motor controller) from the motor home screen, tap the I/O icon.

2. The **I/O Status** screen opens. At least one input from 1 through 5 must have an **ON** status displayed next to a Digital Input on the **I/O Status** screen for the motor to run.



3. If you don't see **ON** status displayed next to a Digital Input on the **I/O Status** screen, use a jumper to apply 24V to any of the **white** cable input wires at the thermostat end of the cable. This should cause the motor to run.



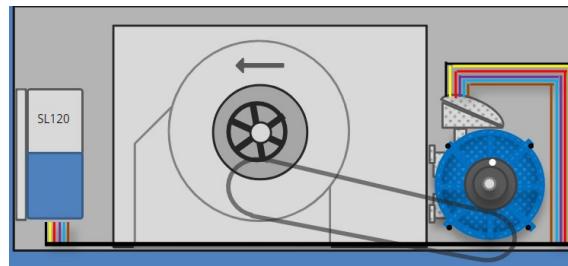
4. If the motor doesn't run, you will need to recommission the motor. Go to step 4 **Recommission**.

4 Recommission

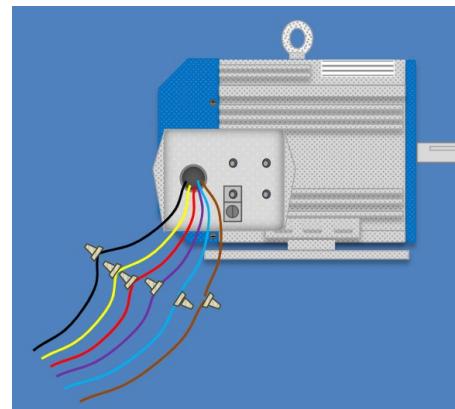
If the motor didn't run in the previous step, you must recommission the motor. Full instructions are presented in the [Appendix](#) on page 83 of this guide.

5 Physical exam of the motor

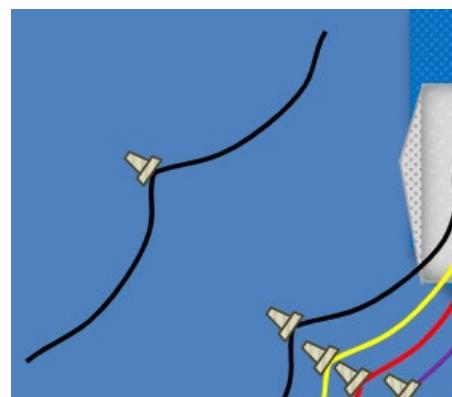
1. Remove the belt and verify the motor moves freely in both directions.
2. Check that the motor isn't making any unusual noise as it turns, for example, a metal to metal sound.
3. If it doesn't move freely or if it makes metal to metal sounds as it turns, you will need to replace the motor.



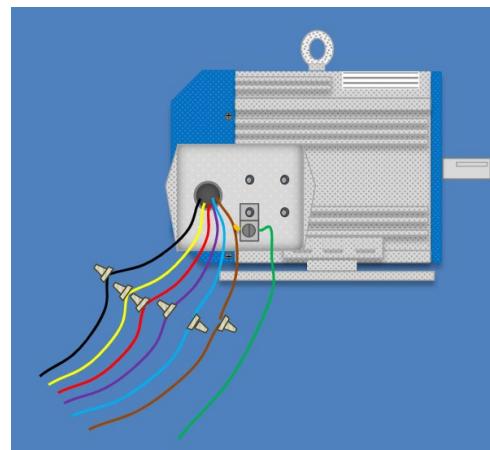
4. Verify the power wiring to the motor. Verify that the wire colors from the motor controller power whip are connected to matching colors of the wires at the motor.



5. Verify that **both ends** of each wire are touching within the wire nut and the wire nut is secure.



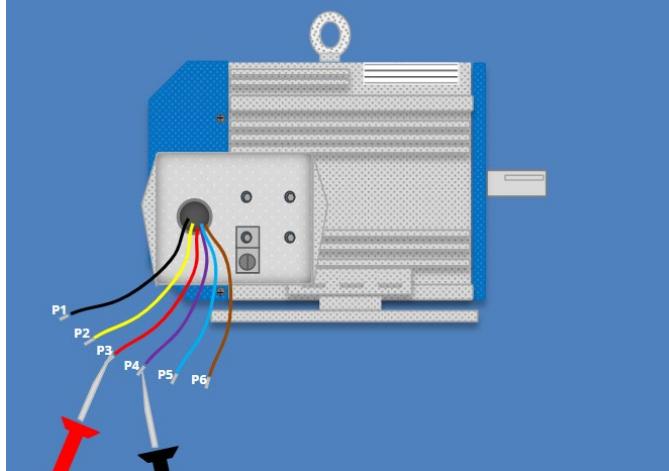
6. Verify that the ground wire has raw wire touching the ground lug and that the lug is secure.



7. At this point, if the motor is wired correctly and spun without any odd noise, check motor winding resistance. In the junction box, the motor windings are paired from P1 to P2, from P3 to P4, and from P5 to P6. Using the example of a V01 motor model with 460V, 4.1 Ohms should be between each motor winding pair.

Important: If you read a value +/- 25% of the Ohm rating shown in the following rating chart, the motor must be replaced.

Model	V01	V01	VO2	V02	V03
Voltage	208/230	460	208/230	460/575	460/575
Ohms	1.2	4.1	0.4	1.2	1.1



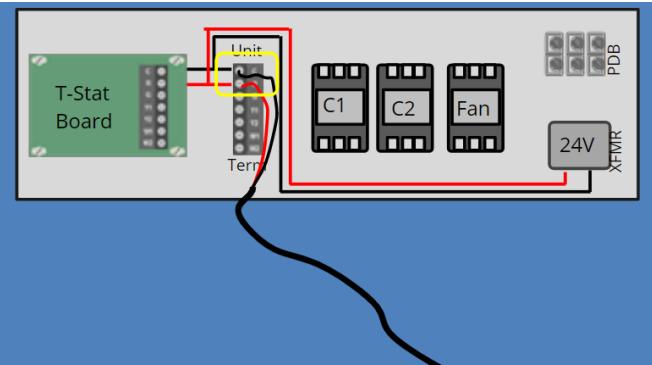
If Heating/Cooling Stages Not Active

Assumes that the fan is running but the heating or cooling is not activating.

1 24V to Relays

The output relays in the motor controller get 24VAC power from the unit control transformer.

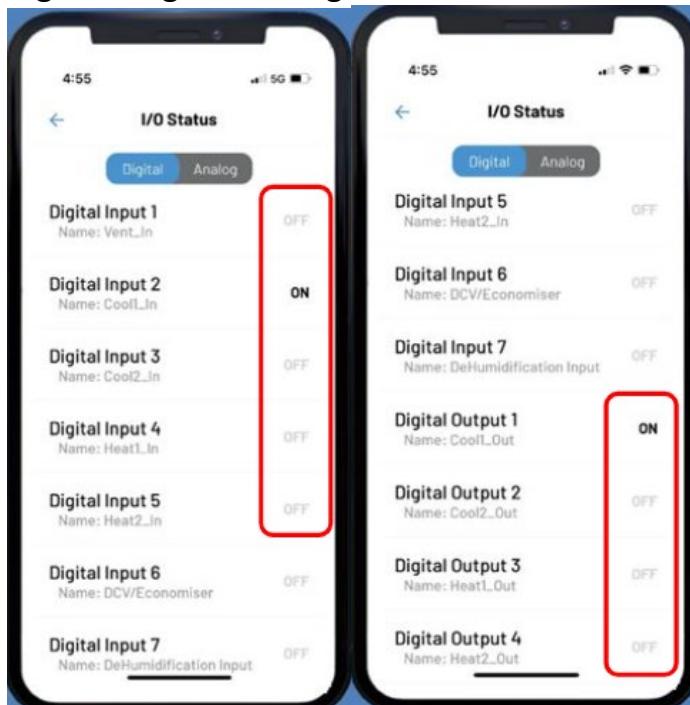
Verify the **red** and **black** wires from the **black** control cable are landed on continuous 24V power.



2 IO Status

This feature is available only for motor controllers with 2.5.1 firmware or higher. Using the Turntide Technician App, you must be connected to a motor controller with the motor home screen visible.

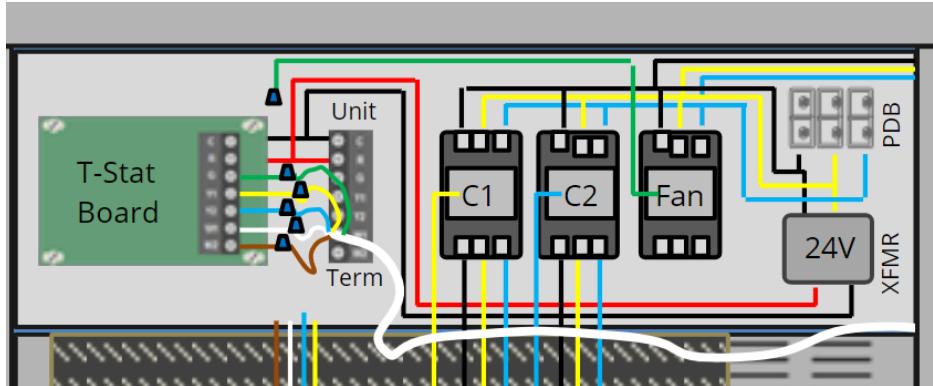
1. Tap the **I/O** icon in the upper right area of the screen to view the state of various motor controller input and output information. The **I/O Status** screen opens displaying Digital Input and Output.
2. Verify the inputs and outputs. In this example, **Digital Input 2** is **ON**. The motor controller is calling for Stage 1 cooling.



3 Control Wiring

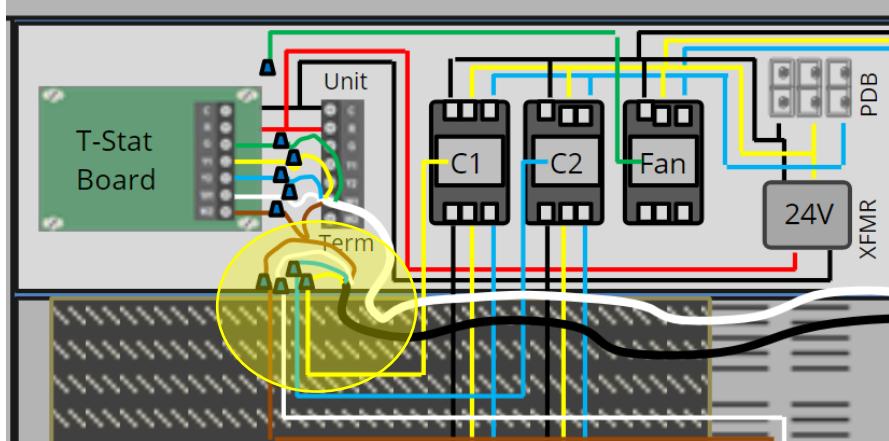
Verify the **white** input wiring connections:

- **green** wire goes to G terminal on the thermostat board
- **yellow** wire goes to Y1 terminal on the thermostat board
- **blue** wire goes to Y2 terminal on the thermostat board
- **white** wire goes to W1 terminal on the thermostat board
- **brown** wire goes to W2 terminal on the thermostat board

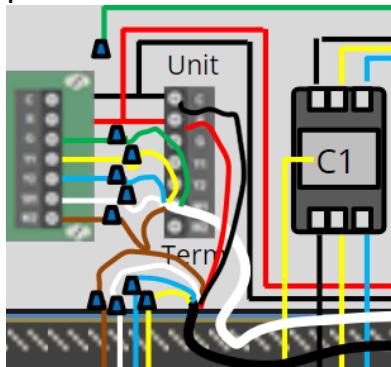


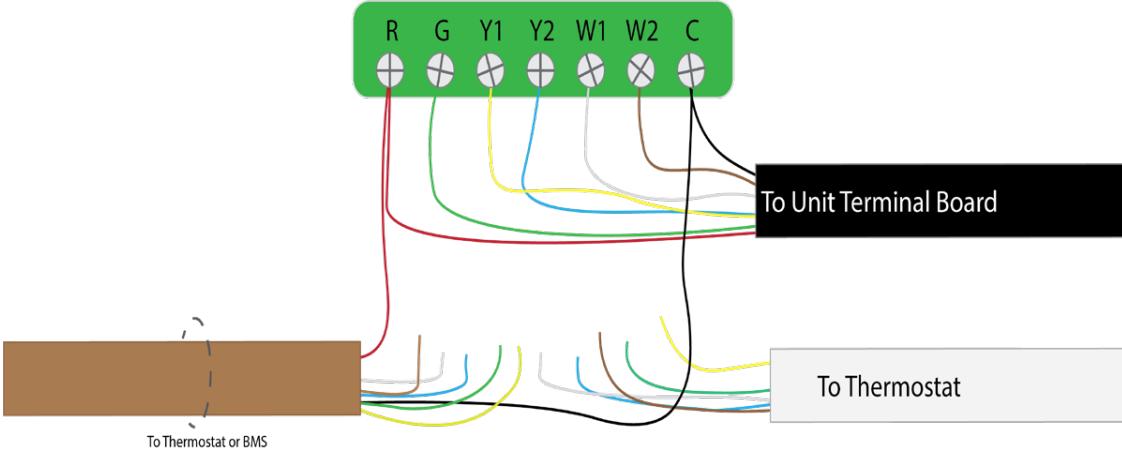
Verify the **black** output wiring connections:

- **yellow** wire goes to Y1 Unit terminal for cooling stage 1
- **blue** wire goes to Y2 Unit terminal for cooling stage 2
- **white** wire goes to W1 Unit terminal for heating stage
- **brown** wire goes to W2 Unit terminal for heating stage 2



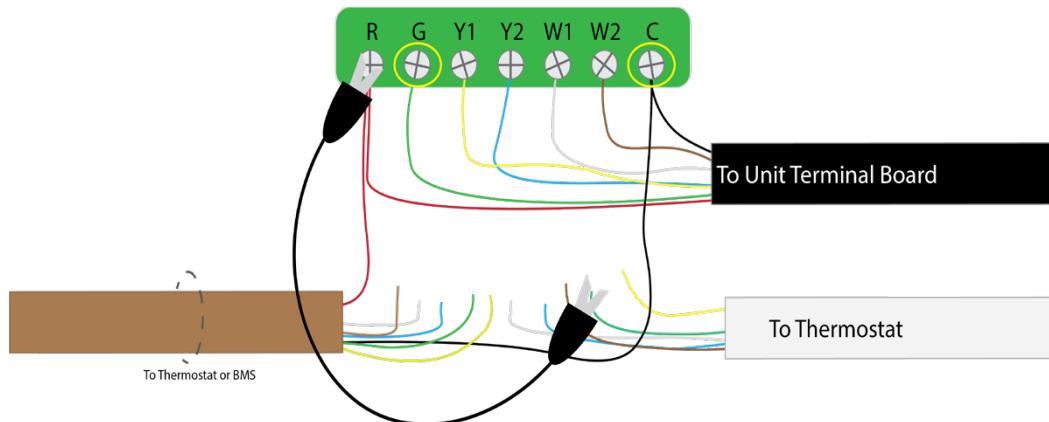
The **red** wire goes to Unit R and the **black** wire goes to Unit C to provide 24V AC power to motor controller output relay.



4	<p>Verify that the motor controller has a Logic Flow configured using the Turntide Technician App</p> <ol style="list-style-type: none"> 1. You must be connected to a motor controller with the motor home screen visible in the Turntide Technician App. 2. Tap Settings. The Settings screen appears. 3. Tap Operation. The Operation Settings screen appears. 4. If a logic flow is configured, it will appear on the list as Current Flow. 5. If you need to change the logic flow, (because an installer selected a single-stage flow on a two-stage unit or vice versa), tap Update Flow: <ol style="list-style-type: none"> a. In the example, Special Projects is used and AZ-2STG-2022.02 is selected. b. To read the sequence of operations and/or pinout diagram, tap Sequence of Operations and Pinout Diagram, respectively. Return to the previous screen by tapping the back arrow icon. c. Tap Load Flow.
5a	<p>Function Test</p> <p>Note: In Monitor Only Wiring method, you will verify ONLY whether the motor ramps to correct speed since no outputs are wired to the motor controller.</p> <ol style="list-style-type: none"> 1. Disconnect the white To Thermostat cable from the To Thermostat or BMS. 2. Keep the black cable connected to the Unit Terminal Board. 

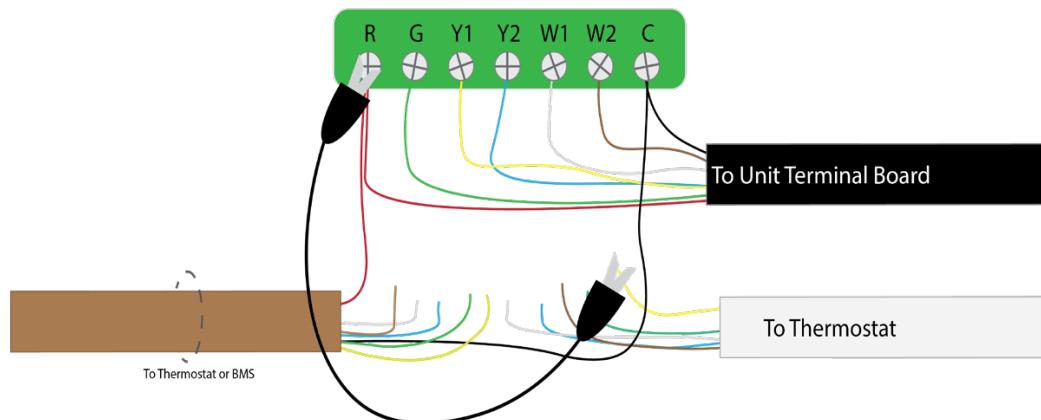
5b Fan Test

1. Connect one end the jumper wire to the **R** terminal of the Unit Terminal Board.
 2. Connect the other end of the jumper wire to the **green** wire of the **white** To Thermostat cable.
- Within a few seconds the motor should ramp up to Vent speed.
 - After several seconds, the motor should achieve approximately 40% speed.
- This is the Vent speed, which is also known as a continuous fan. The exact speed may vary by application. The motor starting and running is key to this function test.

**5c Cool 1 Test**

1. Keep one end of the jumper wire connected to the **R** terminal of the Unit Terminal Board. (To get 24VAC power)
2. Move the other end of jumper wire from the **green** wire to the **yellow** wire of the **white** To Thermostat cable.
 - For a two-stage flow, the motor should ramp to 65-75% of full speed.
 - For a one-stage flow, the motor should ramp to 83-90% of full speed.
 - The speed depends on what logic flow has been uploaded.

The change in motor operating speed is noticeable as compared to the Vent speed. Measuring the motor speed is seldom necessary. Because this test simulates a demand for cooling. As such, **the first stage compressor must start in order to pass this test**. Relay R1 should close and energize the compressor for stage 1.



5d Cool 2 Test

1. Keep one end the jumper wire connected to the **R** terminal of the Unit Terminal Board.
2. Move the other end of the jumper wire from the **yellow** wire to the **blue** wire of the To Thermostat cable.

Note that when the jumper disconnects from the **yellow** wire, the motor will continue to run. This is normal because the motor is entering the off time delay. **Do not wait for the motor to cycle off.**

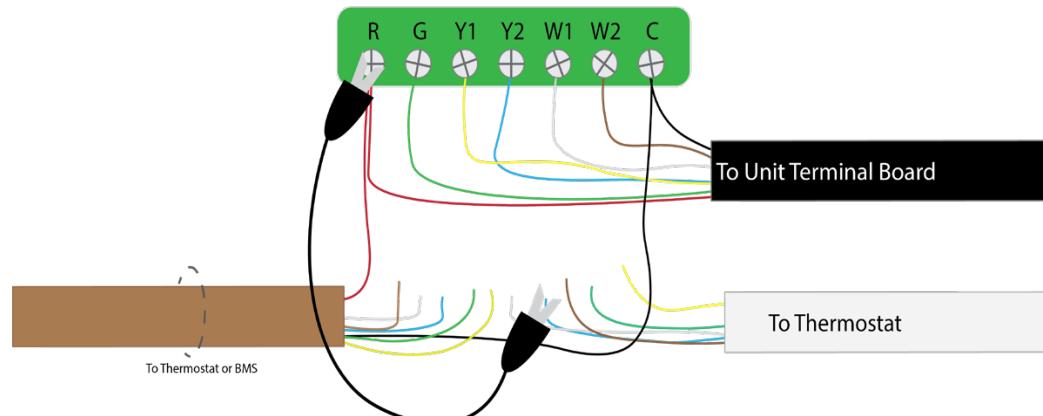
When the jumper is attached to the **blue** wire the **Y1** time delay is overridden.

- For a two-stage flow, the motor should ramp to 65-75% of full speed.
- For a one-stage flow, the motor should ramp to 83-90% of full speed.
- The speed depends on what logic flow has been uploaded.

The change in motor speed results in a slight change in the motor operating sound.
The second stage compressor may start.

Relay R2 should close and energize the compressor for stage 2.

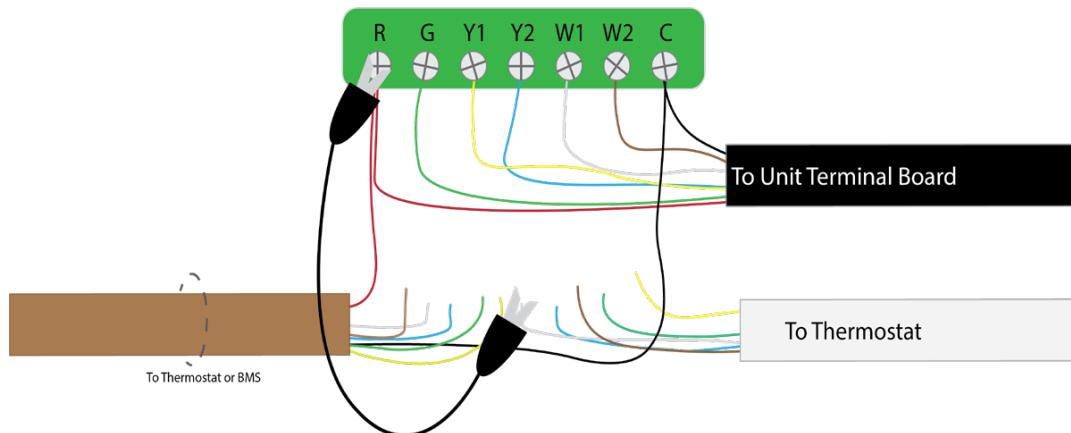
Once operation is validated, remove the jumper from the **blue** wire and allow the motor to time off. The time off delay is 240 seconds.



5e Heat 1 Test

Important: The second stage cooling test needs to exit its time off delay (up to 240 seconds) before starting the heat test.

1. Keep one end the jumper wire connected to the **R** terminal of the Unit Terminal Board.
 2. Move the other end other to the **white** wire of the To Thermostat cable.
- In some applications first stage heating speed is 65-75% of full speed.
 - Because this test simulates a demand for heating, the first stage heating must start.
 - Note that time delays built into the RTU control system may prevent the cooling or heating starting immediately.
 - Fan should ramp to Heat 1 speed.
 - Relay R3 should close and energize the heater for stage 1.



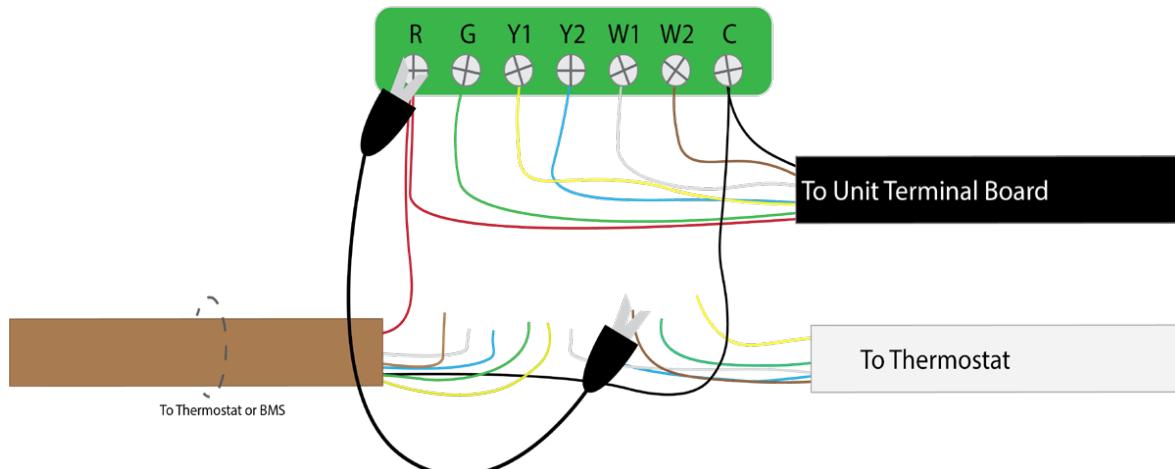
5f Heat 2 Test

1. Keep one end the jumper wire connected to the **R** terminal of the Unit Terminal Board.
2. Move the jumper from the **white** wire to the **brown** wire of the To Thermostat cable.

*For a two-stage system, the first stage heat must be energized before the second stage can energize. When testing second stage heating, the jumper from R to the **white** wire of the To Thermostat cable must remain in place. An additional jumper wire is needed from R to the **brown** wire of the To Thermostat cable. This allows both stages to energize.*

- The motor will enter an off-cycle time delay when the jumper disconnects. **Do not wait for the motor to cycle off.**
- When the jumper is attached to the **brown** wire, the **W1** time delay is overridden, and motor should ramp to approximately 83-90% of full speed if not. The change in motor speed results in slight change in motor operating sound. The second stage heating may or may not start.
- Relay R4 should close and energize the heater for stage 2.

Once operation is validated remove the jumper from the **brown** wire and allow the motor to time off. The time off delay is **up to** 240 seconds plus a 30 second ramp down period.



Motor Alarms

If the **red** LED is lit on the **motor controller**, there is an error that prevents the **motor** from running.



1 Check Input Voltage

Must be within +/- 10% of the motor voltage rating.

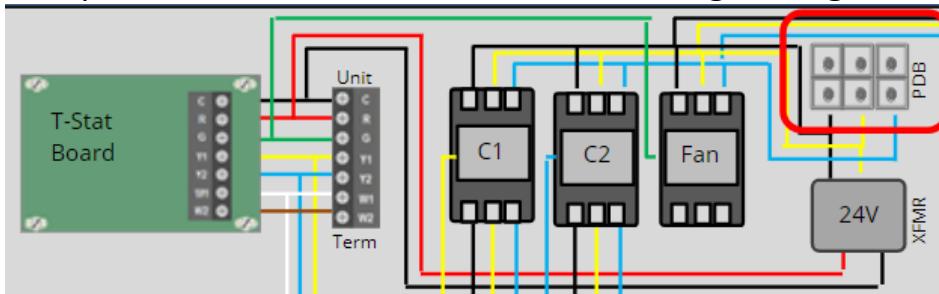
When the motor controller was originally commissioned, the installer had to select the motor input voltage.

1. Using the Turntide Technician App, verify the motor input voltage was set correctly. From the motor summary screen, tap **Settings**, then **General**.
2. In the **General Settings** screen, make sure the displayed **Input Voltage** matches the voltage noted on the nameplate of the Turntide motor.



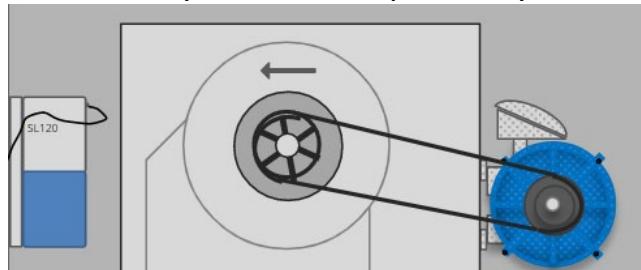
Note: 208VAC units have their own voltage setting and will not operate using the 230-240 setting.

3. If the input voltage setting was correct, check the incoming power to ensure all 3 phases are within **+/- 10% of motor voltage rating**.



2 Motor Torque

- A **low torque alarm** indicates that belt is extremely loose or broken OR the motor is turning in the wrong direction.
- A **high torque alarm** indicates the motor has much higher resistance than expected. This could be caused by a mechanical issue with the blower assembly or with the motor itself. Verify for proper belt tension and verify the blower fan assembly and motor spin freely.

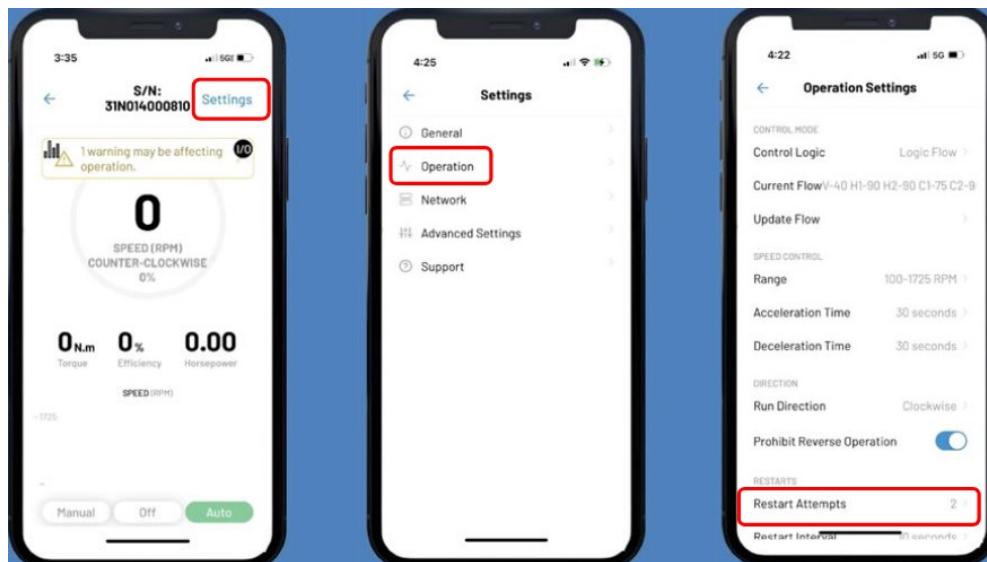


3 Restart Attempts

When a critical alarm occurs, the motor controller will attempt to restart the motor twice by default. If this operation setting was set to 0 in the Turntide Technician App, then any alarm condition would render the motor inoperable until the power is cycled OR the alarm is cleared using the Turntide Technician App.

To ensure that the motor **Restart Attempts** option is set to a default of 2:

1. Using the Turntide Technician App, from the motor summary screen, tap **Settings**, and then tap **Operation**.
2. In the **Operation Settings** screen, tap **Restart Attempts**. Enter 2 and tap **Done**.



Temperature Sensors

The supply and return air temperature sensors are on a flat mounting bracket. For troubleshooting, you will need to check jumper settings, wiring, and the locations of the sensors.

Notes:

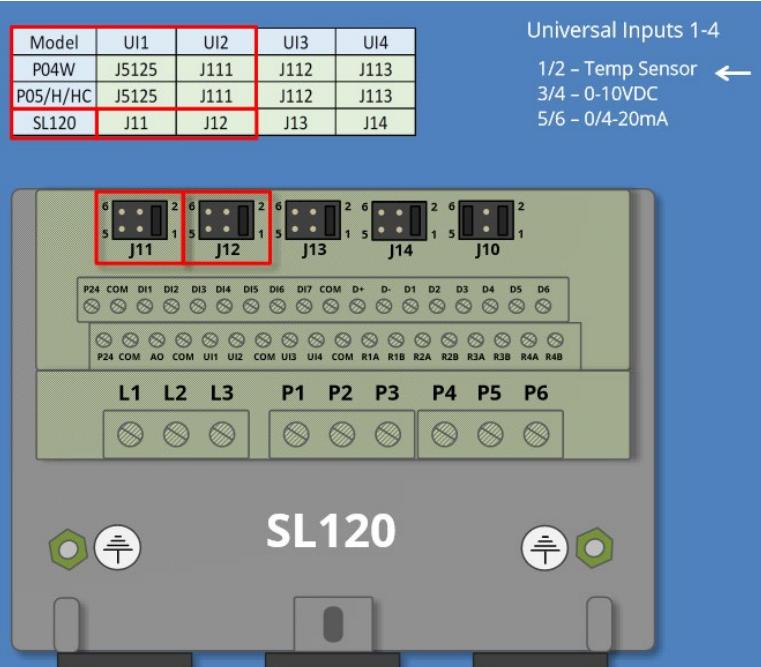
1. Not all sites will have temperature sensors.
2. You can use the Turntide Technician App to see the values of the temperature sensors. Your motor controller must be using firmware version 2.5.1 or higher. See the **Supply and Return Air Sensor Test** Section of the **Turntide Technician App User Guide** in www.turntideacademy.com/.

The following troubleshooting guidelines use the SL120 motor controller as an example.

1 Supply and Return Air Temperature Sensors are landed universal inputs 1 and 2 (**UI1** and **UI2**).

The jumper must be on pins 1 and 2 for the respective jumper bank for the sensor to provide correct readout.

For a complete jumper pin overview for all motor controller models, see **Motor Controller Jumper Pin Overview** on page **91** in the **Appendix** of this guide.

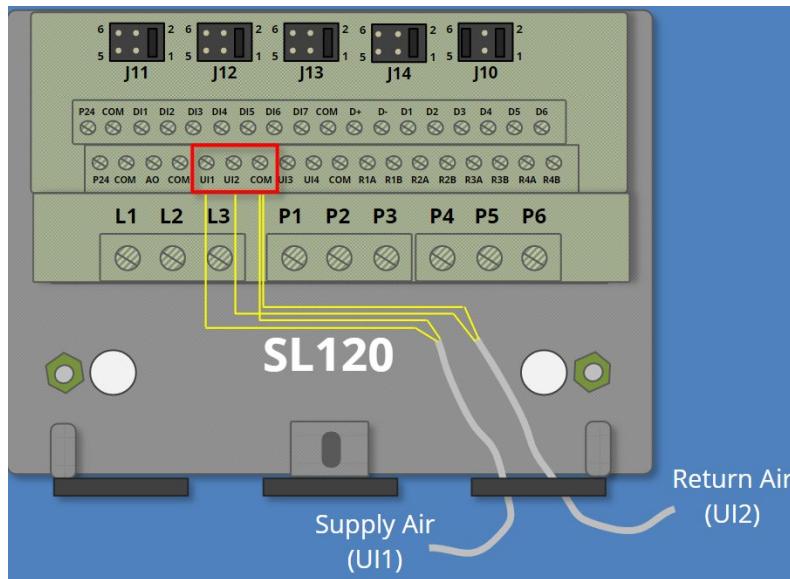


2 Sensor Wiring

Using the SL120 motor controller as an example.

Ensure the following:

- One wire of the Supply Air Sensor is wired to UI1 and the other to COM
- One wire of the Return Air Sensor is wired to UI2 and the other to COM

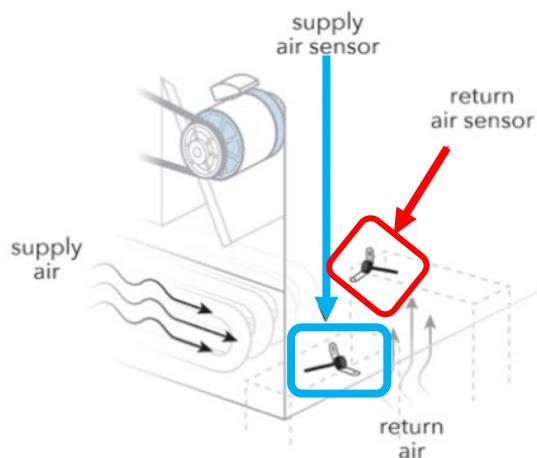


3 Location of Sensors

The supply and return air sensors are identical, so they can be used in either location (supply or return). These sensors are NOT rated for outdoor use.

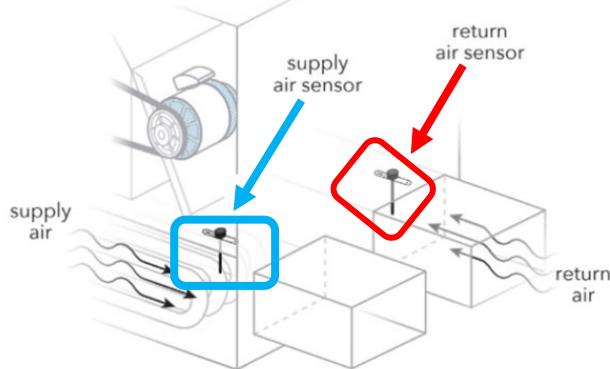
Standard Rooftop Units

1. Ensure that the supply air sensor is installed downstream of the coil and heat exchanger.
2. Ensure that the return air sensor is installed in the return duct inlet.



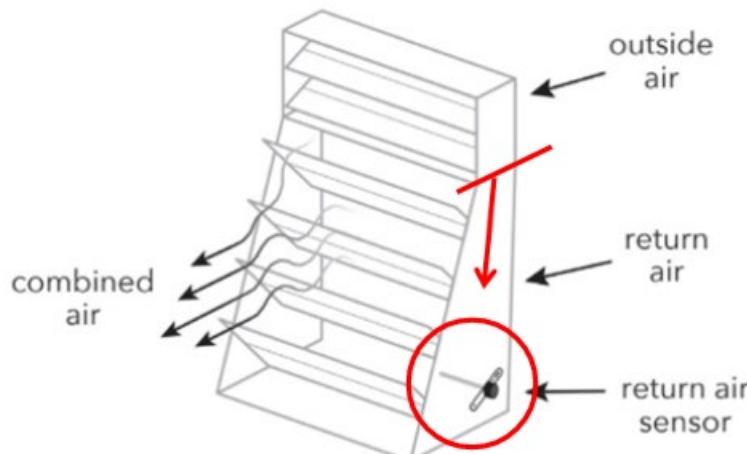
Rooftop Units with Horizontal Ductwork

1. Ensure that the supply air sensor is installed through the blower deck just beyond the heat exchanger.
2. Ensure that the return air sensor is installed in the return air inlet.



Units with an Economizer

1. Ensure that the return air sensor is installed upstream of the economizer such that it senses **indoor return air** and not the outside (fresh) air.
2. Ensure that you do not impede the damper blade operation.



Noise Complaints

Noise complaints typically occur when the motor is installed near frequently occupied areas. Here are four ways you can reduce noise.

1 Nuts & Bolts

In a retrofit (induction motor replaced with a Turntide Smart Motor), a minimum of 4 nuts and bolts are removed and reinstalled.

Check that all motor and motor mounting plate bolts and nuts are properly tightened.

2 Belt Tension

If the belt is too tight, this forces the motor to operate at a higher torque consequently increasing the noise level. **Measure the belt tension with a belt tension gage.**

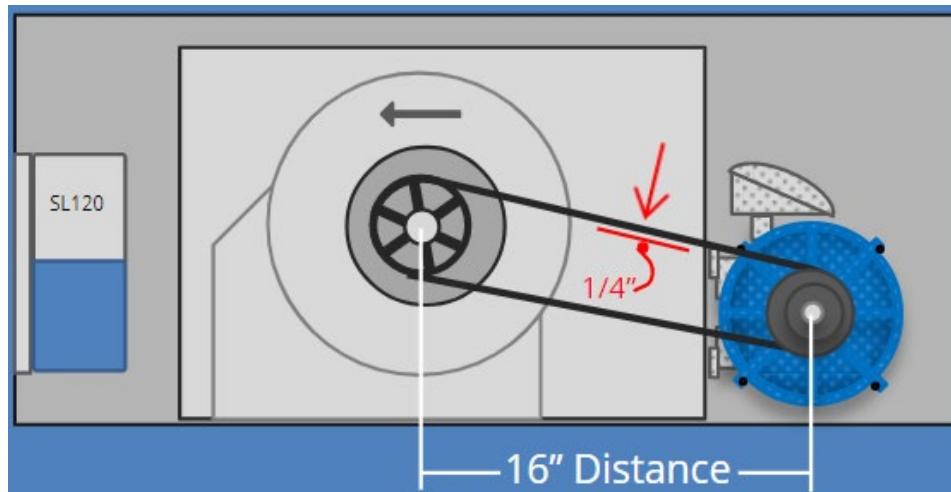
If you do not have a gage, keep this in mind:

1/64" of belt deflection is required for every 1" of distance between the motor and fan shaft.

Using an example calculation:

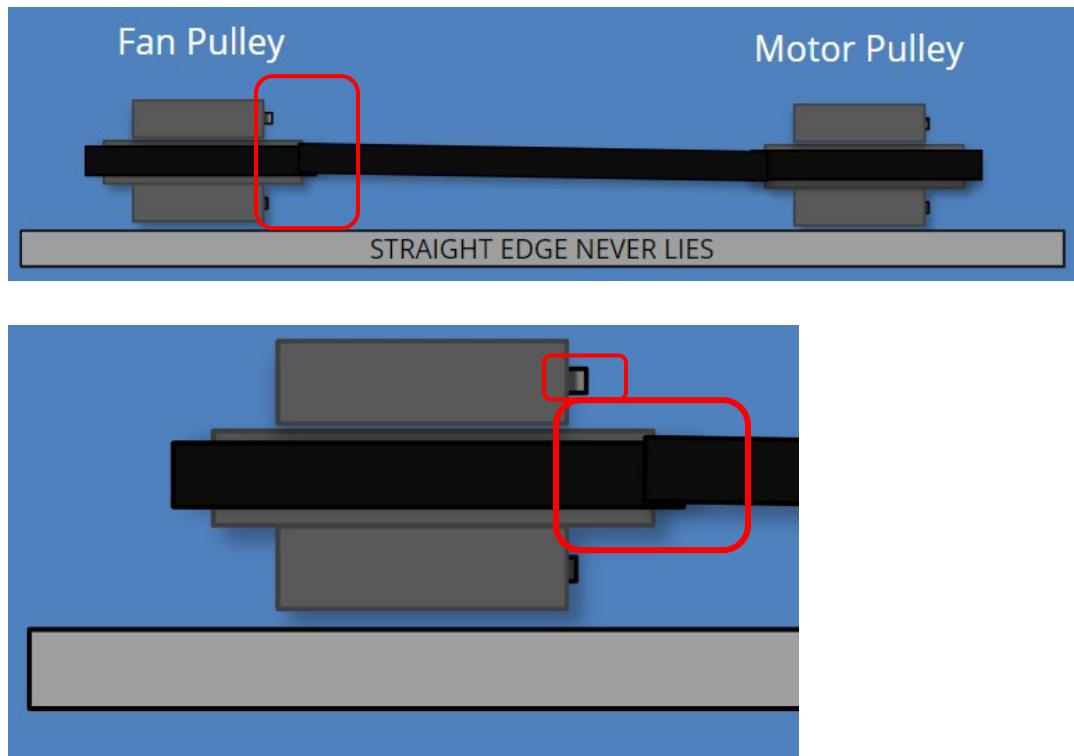
If the distance between the fan and motor shafts is 16", you should have $\frac{1}{4}$ " of deflection in the belt (64 divided by 16). Put downward pressure on the belt to see how far it will move.

- If less than $\frac{1}{4}$ " then the belt is too tight.
- If greater than $\frac{1}{2}$ " then the belt is too loose.



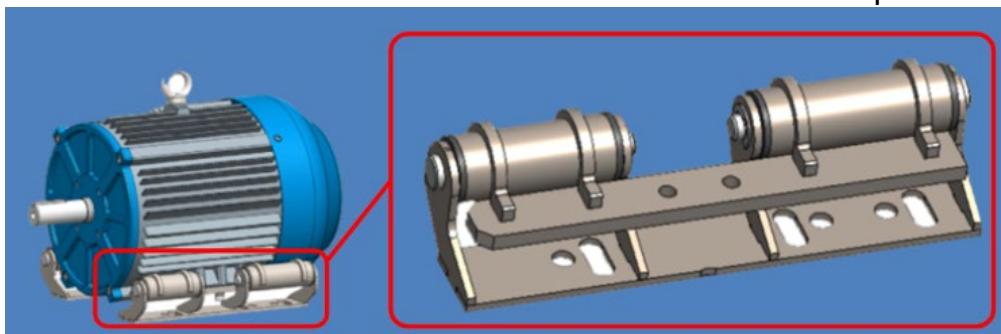
3 Fan Pulley and Motor Pulley Alignment

1. Use a straight edge to verify pulley alignment.
2. Verify that all pulley set-screws are secure.



4 Isolation Feet

Motor isolation feet can reduce the motor decibel level up to 50%.



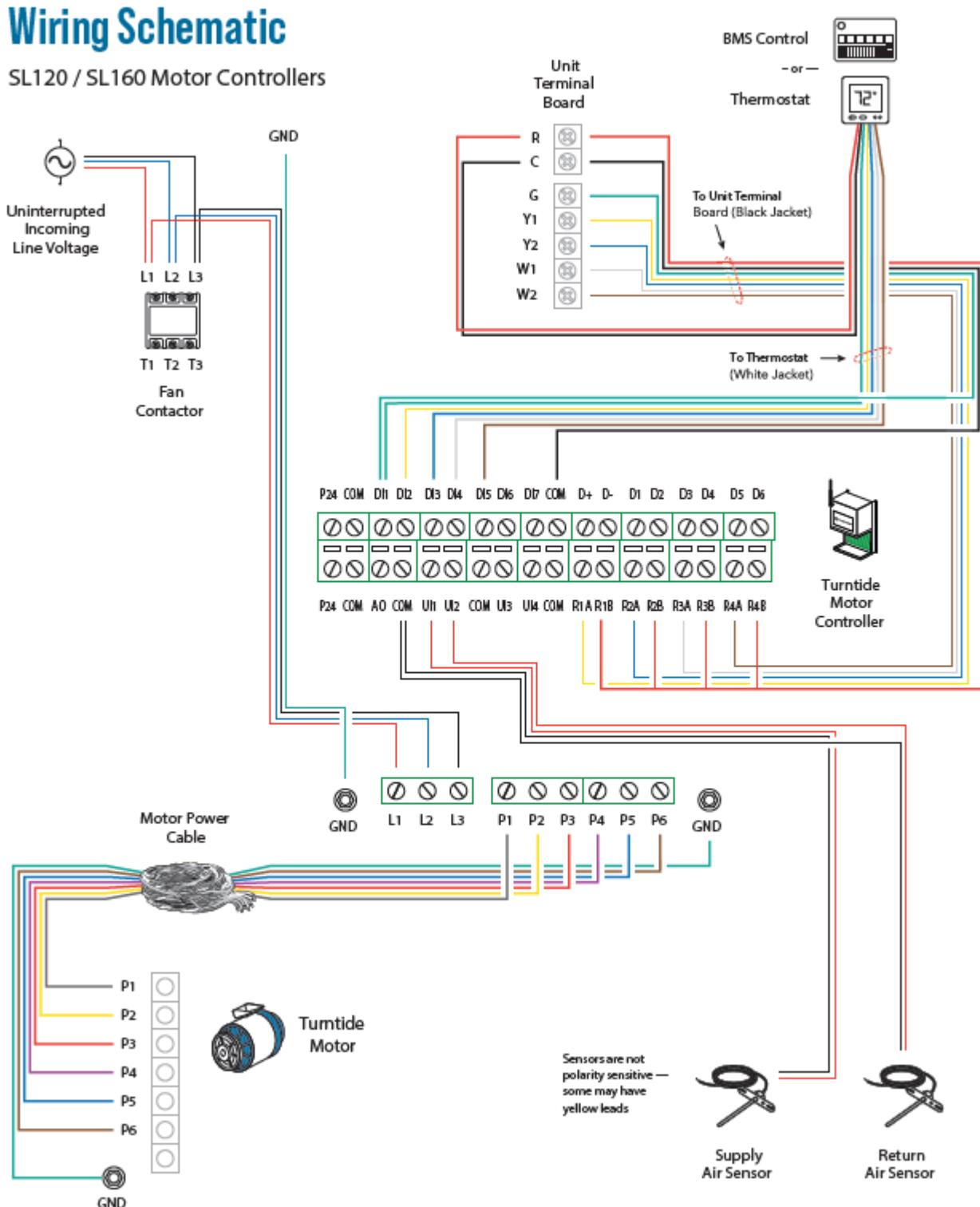
To learn more about this option, access the [Turntide Academy](#) for the Motor Isolator Kit Installation Guide.



Motor and Motor Controller Wiring Diagram

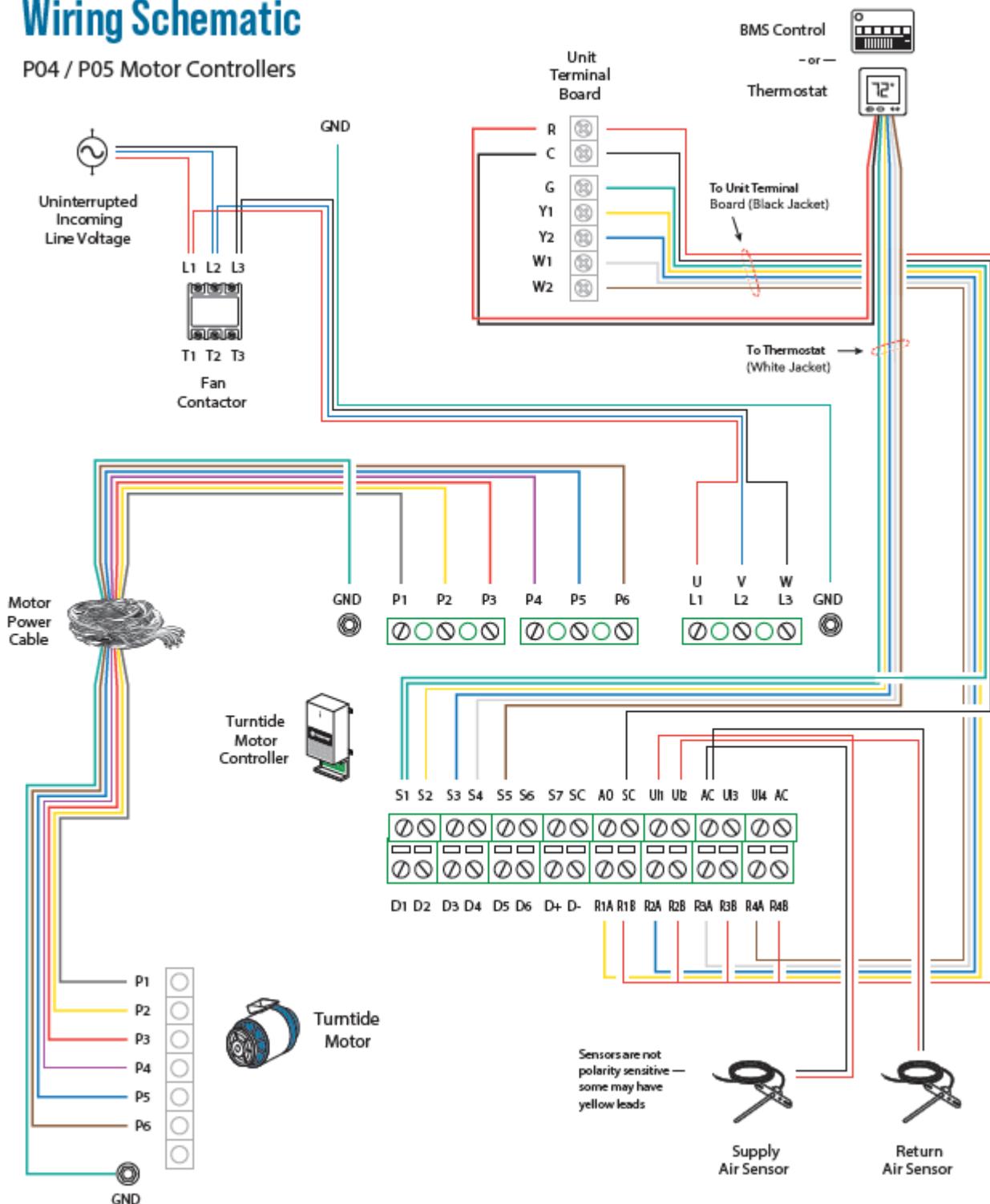
Wiring Schematic

SL120 / SL160 Motor Controllers



Wiring Schematic

P04 / P05 Motor Controllers



Remote Monitoring Kit (RMK)

Item Number	Description
RMK-002-US	Standard range cloud monitoring kit (USA)
RMK-002-CA	Standard range cloud monitoring kit (Canada)
RMK-003-US	Standard range cloud energy monitoring kit (USA)
RMK-003-CA	Standard range cloud energy monitoring kit (Canada)
RMK-002-US-LR	Long-range cloud monitoring kit (USA)
RMK-003-US-LR	Long-range cloud energy monitoring kit (USA)
RMK-002-CA-LR	Long-range cloud monitoring kit (Canada)
RMK-003-CA-LR	Long-range cloud energy monitoring kit (Canada)
KIT-RMK-US-LR	Kit for upgrading RMK to RMK+ Long-Range Wi-Fi (USA)
KIT-RMK-CA-LR	Kit for upgrading RMK to RMK+ Long-Range Wi-Fi (Canada)

WWW -	XXX -	YY -	ZZ
Family RMK - Remote Monitoring Kit KIT - Kit of parts for field install	Type 001 - Cloud Monitoring via customer internet 002 - Cloud Monitoring via cell modem 003 - Cloud Energy Monitoring via cell modem 004 - Cloud Energy Monitoring via customer internet RMK - RMK+ upgrade kit for standard RMK Only used when WWW = KIT	Country Code CA - Canada US - United States CO - Columbia CL - Chile None - United States	Range None - standard range <= 40ft (12 m) LR - RMK+ long range <=250ft (76 m) Only available in US and Canada

Remote Monitoring Kit (RMK) Troubleshooting

Learn about the basic components

- Basic Components of RMK-002 on page 38
- RMK-002 Wiring Diagram on page 40
- Basic Components of RMK+ Long Range Wi-Fi Access Point on page 41
- RMK+ Long Range Wi-Fi Access Point Wiring Diagram on page 43

Preliminary Troubleshooting

Before you begin the in-depth troubleshooting, try these three ways to investigate and potentially resolve a connectivity issue:

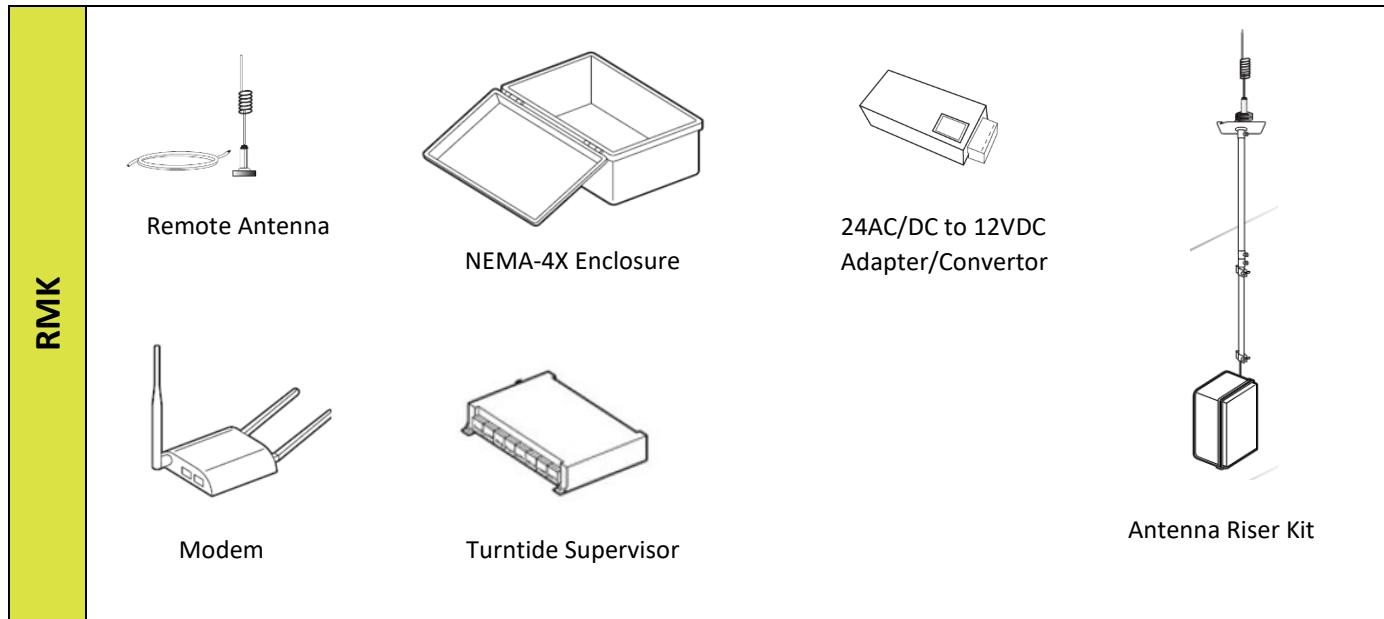
- Step 1: Verify unit control voltage on page 44
- Step 2: Check the NEMA 4X enclosure on page 45
- Step 3: Cycle power to the RMK on page 46

In-Depth Troubleshooting

After trying the preliminary suggestions, go to:

- RMK In-Depth Troubleshooting Steps on page 47

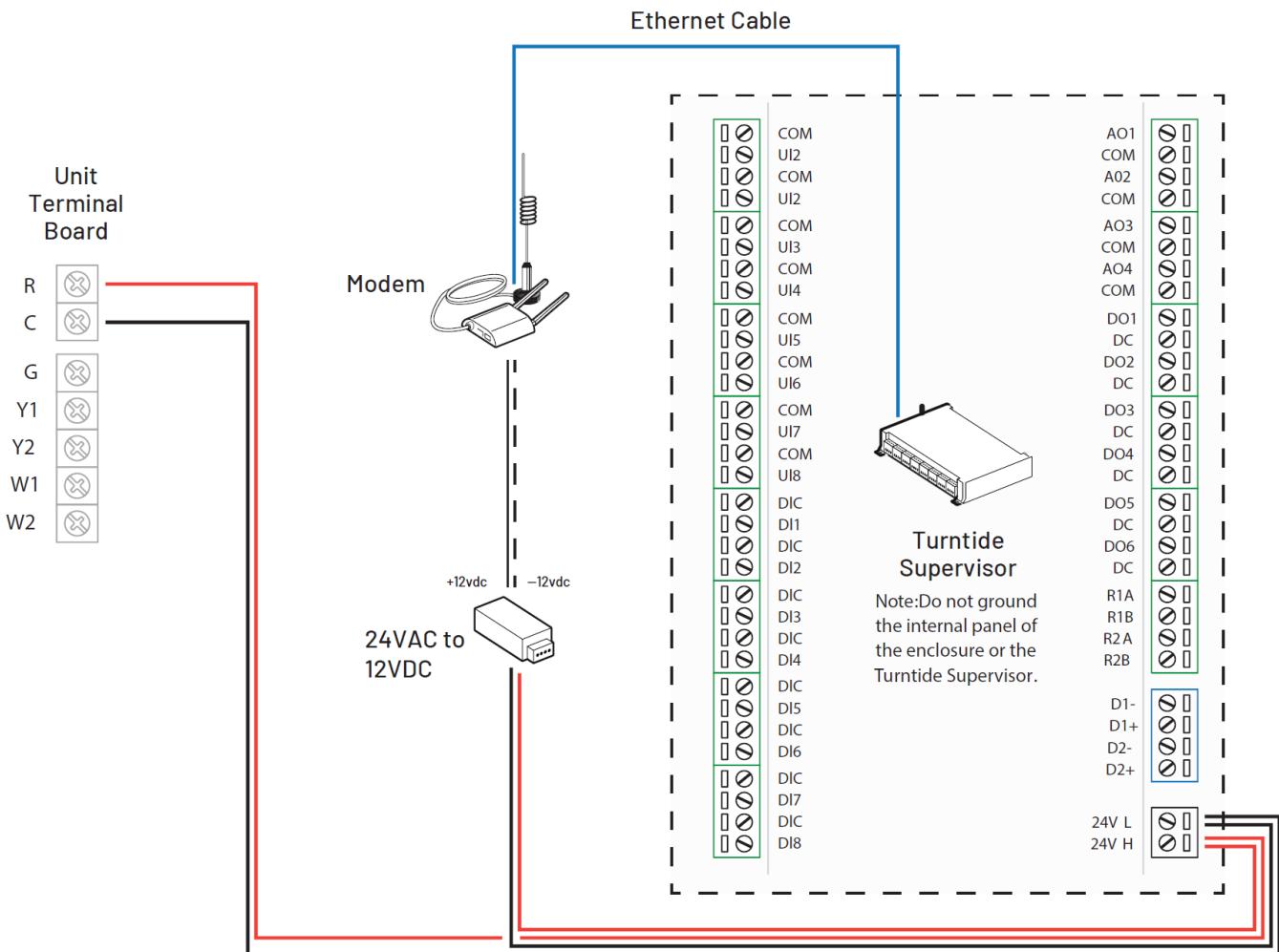
Basic Components of RMK-002



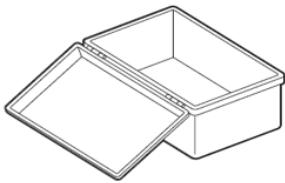
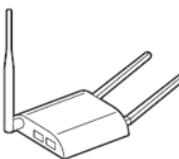
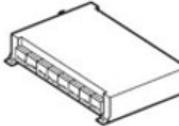
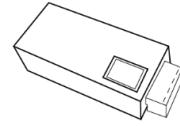
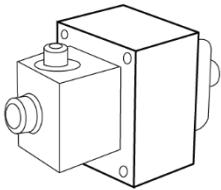
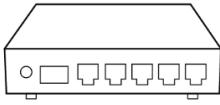
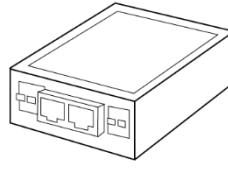
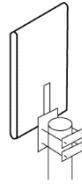
1	Remote Wi-Fi Antenna Installed on riser assembly to allow minimum 8" distance from bottom of antenna to roof of Rooftop Unit. The modem's existing antenna, located on the left side of the device, is removed during installation, and replaced with this remote antenna. The Turntide Supervisor uses the Wi-Fi signal to bind to the motor controllers.
2	Cellular Modem Establishes the external cellular signal so the data can reach the Cloud. In the original RMK models, the modem also provides the Local Area Network (LAN), allowing the Turntide Supervisor and Motor controllers to communicate wirelessly to one another. Provides the Turntide Supervisor with: <ul style="list-style-type: none"> • Cellular connectivity to the Turntide Cloud platform. • Wi-Fi connectivity to the motor controllers on site. The standard RMK-002 provides a Wi-Fi signal radius of 40 feet.

3	<p>NEMA-4X Enclosure</p> <p>Weatherproof housing for all the components within the RMK. Comes with the Turntide equipment mounted in place using the integral backplate and weather-tight connectors for easy penetration of wiring.</p> <p>Any penetrations to the enclosure for power or communications wiring MUST use weather-tight electrical connectors. Grommets or holes with silicon are NOT approved entry methods.</p>
4	<p>AC/DC Adapter/Converter</p> <p>The 24V AC/DC adapter/converter takes 24V incoming power, typically sourced from the new control transformer or an existing control transformer and transforms that power to 12VDC for the Modem.</p>
5	<p>Turntide Supervisor</p> <p>The Turntide Supervisor is a flexible gateway product that connects Turntide smart motors to the modem and keeps the motors running up-to-date by delivering firmware upgrades and integrating with other protocols and systems. It has a full complement of control and monitoring inputs and outputs (I/O) to enable you to flexibly configure your Turntide Smart Motor System</p> <p>Uses the Wi-Fi signal generated by the cellular modem to connect to the motor controller it serves to report motor control operational data to the Turntide Cloud platform.</p> <p>Important: If your site has more than one RMK, you will need to know which motor controller reports to which Supervisor.</p>
6	<p>Antenna Riser Kit</p> <p>Allows you to elevate the antenna to increase line of site to the motor Wi-Fi antenna. Protects antenna against snow accumulation on the roof of the RTU. Installed on riser assembly to allow minimum 8" distance from bottom of antenna to roof of RTU.</p>

RMK-002 Wiring Diagram



Basic Components of RMK+ Long Range Wi-Fi Access Point

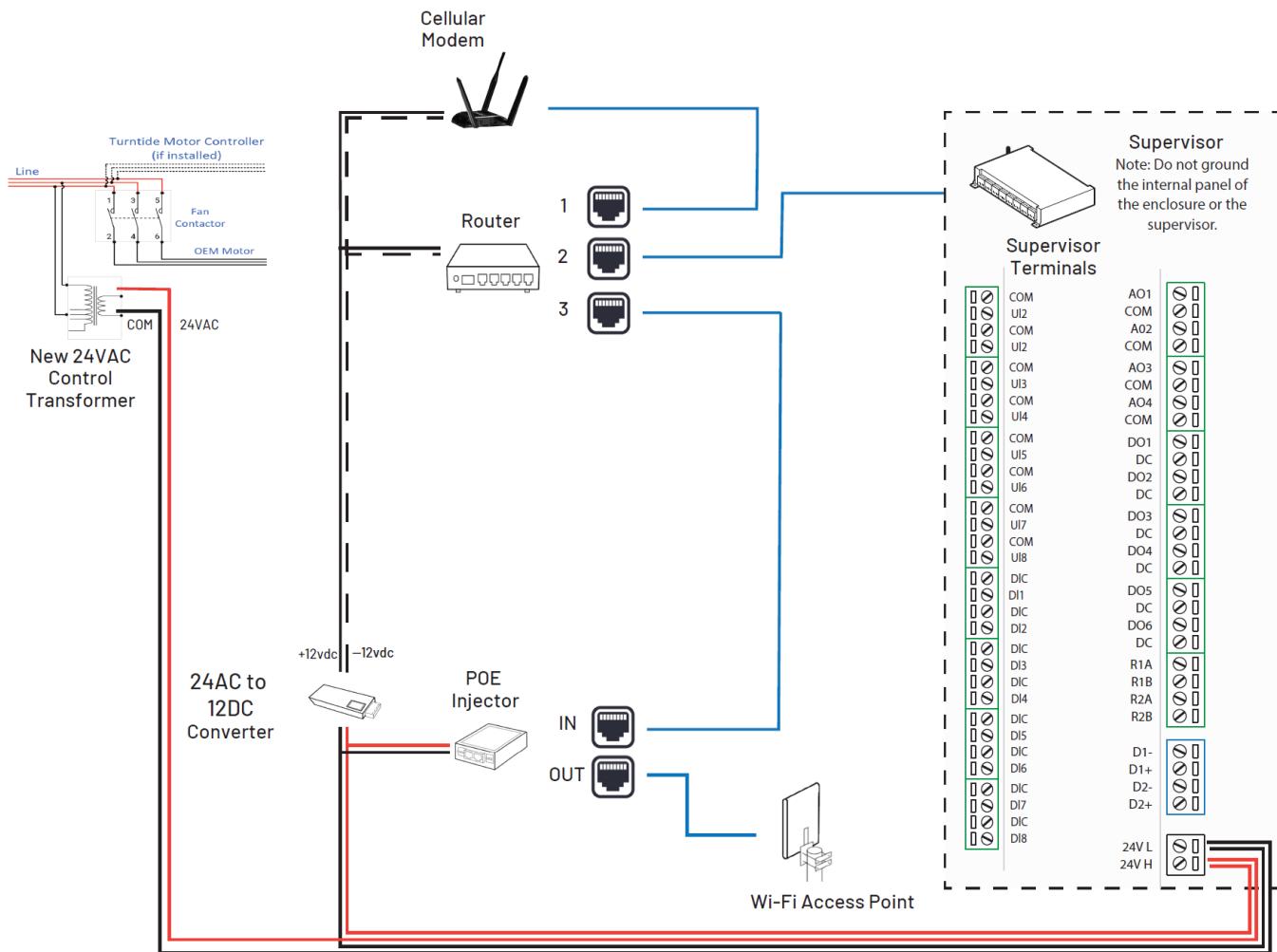
RMK				
RMK+ Long Range	 1	 2	 3	 4

In addition to the RMK-002 components:

1 24VAC Control Transformer	<p>The Control Transformer is supplied by Turntide on the RMK+ applications. This transformer is intended to receive primary power from the existing fan motor contactor, or similar line power source, and transform that to 24VAC to power the Turntide Supervisor and other RMK devices.</p> <p>Installed in the existing RTU control panel with power from the RTU power supply. You power all RMK+ components from this transformer. This ensures that you're not overloading the existing 24VAC control transformer in the unit.</p>
2 Ethernet Router	<p>Receives and forwards data packets from the multiple ethernet devices within the RMK. Allows the Long Range Wi-Fi Access Point (antenna), Turntide Supervisor, and Modem all to distribute information. Provides three CAT6 ethernet cable connections to the Modem, Turntide Supervisor, and PoE injector.</p>
3 PoE Injector	<p>The PoE (power over ethernet) Injector takes a standard CAT6 ethernet cable and injects 48VDC power into it. This allows the Long Range Wi-Fi Access Point to communicate and receive power from one ethernet cable and passes its data through the router to the Turntide Supervisor.</p>

4	<p>Long Range Wi-Fi Access Point</p> <p>Extends the RMK signal radius to 150 feet.</p> <p>The Long Range Wi-Fi Access Point is a dual-band omni directional antenna that provides the LAN (local area network) Wi-Fi signal on RMK+ applications for the motor controller and supervisor to communicate with one another. The device is also capable of mesh networking, which can extend motor controller data communication through a Wi-Fi extender/repeater antenna.</p>
---	---

RMK+ Long Range Wi-Fi Access Point Wiring Diagram



 Note: 24 volt wiring is polarity sensitive. If wiring is terminated incorrectly, it will damage the supervisor or the control transformer.

Preliminary Troubleshooting Steps

Step 1: Verify unit control voltage

Check the unit control voltage at the transformer.

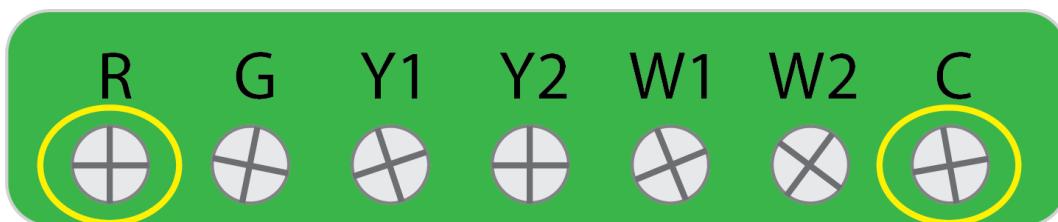
- Measure the transformer primary voltage.
- Measure the transformer secondary voltage.

The expected secondary voltage is a nominal 24VAC:

- 24VAC +/-10%
- 21.6VAC to 26.4VAC)

Confirm 24VAC is present at the unit control board R and C terminals.

Any issue with the unit control power must be resolved before moving forward.



Unit control board



Measuring control voltage

Tip: Check transformer fuses and circuit breakers. Once high voltage is determined not to be the issue, move on to the low voltage power.

Step 2: Check the NEMA 4X enclosure

<p>Check if water got into the NEMA 4X enclosure. If YES, that could be the cause of communication issues.</p> <p>How did the water get in?</p> <ul style="list-style-type: none"> • Door wasn't closed properly • Door latch is broken • Rubber weather strip is missing or damaged • Weather-tight connectors weren't used for wiring entry points • History Lesson: Until recently we permitted the use of PVC nipples in the back of the RMK (between the RMK and the unit). But it was hard to get a watertight seal. We told technicians to caulk the gap between the RMK and unit at the top of the RMK. If the RMK is to be replaced and the existing one has a back entry, do not use a back entry. 	<p>Solution</p> <p>You need to replace the RMK. Contact Turntide Technical Support 877-776-8470 (877-PRO-TIP+).</p> <p>.</p>
<p>Is the back plate of the enclosure grounded? If YES, that's a problem!</p> <p>If the RMK has 24V AC power to the Turntide Supervisor and no LED activity visible on other components, then your back plate is likely grounded and causing the communication issue.</p> <p>The back plate should NEVER be grounded.</p>	<p>Solution</p> <p>You need to replace the RMK. Contact Turntide Technical Support 877-776-8470 (877-PRO-TIP+).</p>

Step 3: Cycle power to the RMK

This often resolves connectivity issues because it reboots the modem and reboots the Turntide Supervisor.

- Disconnect/reconnect the 24VAC plug on the Turntide Supervisor
OR
- Power cycle the RTU disconnect

Step 4: Consider that something has changed

Consider that something has changed since you last examined the RMK, or something changed at the site:

Issue	Solution
Modem issue Repeated power supply issues (brown outs on unit) can cause the modem to get hung up during its start sequence.	Cycle power.
Damaged components Water got into the enclosure and damaged one or more components.	The entire RMK must be replaced.
Another person had access Inadvertently loosened wiring connection.	Check for any loose wiring and cycle power to the RMK again.
Component Failure	The entire RMK must be replaced.
New equipment or wall blocking the Wi-Fi signal.	Relocate the RMK.
RTU housing the RMK was replaced and the RMK was removed.	Call Turntide Technical Support 877-776-8470 (877-PRO-TIP+).

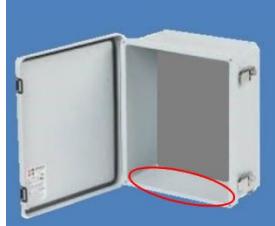
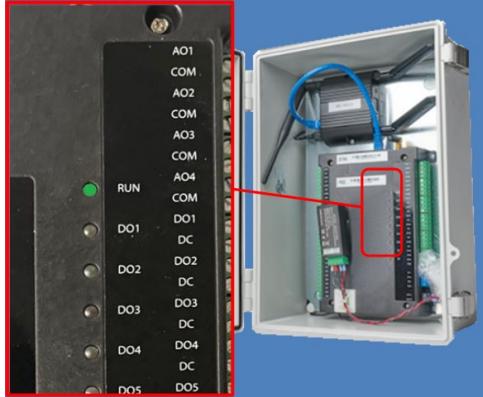
RMK In-Depth Troubleshooting Steps

Issue	What this means
Entire site is NOT reporting to the Cloud	<p>What: RMK component failure.</p> <p>Why: Could be because power to the unit is OFF or the modem is bad.</p> <p>Next Steps: Follow the instructions in the Site Not Reporting Data - Troubleshooting Steps section.</p>
Site online, but all motor controllers are NOT reporting to the Cloud	<p>What: No motor controller activity reported to Turntide Cloud Services.</p> <p>Why: Issue with Turntide Supervisor because it is the gateway between motor controller and Cloud Services.</p> <p>Next Steps: Follow the instructions in the No Motor Controllers Reporting Data - Troubleshooting Steps section.</p>
Site online, but one motor controller (of many) is NOT reporting	<p>What: Only one motor controller is offline.</p> <p>Why: Motor controller not connected to Wi-Fi signal.</p> <p>Next Steps: Follow the instructions in the One Motor Controller (of many) Not Reporting -Troubleshooting Steps section.</p>
Power supply issues	<p>Why: Any of the following:</p> <ul style="list-style-type: none"> • Issue with power cable from AC/DC adapter to the modem • AC/DC adapter is faulty • 24VAC multi-tap transformer (RMK+ Long Range) in the RTU is tapped incorrectly. <p>Follow the instructions in the Power Supply Issues – Troubleshooting Steps section.</p>
Intermittent (spotty) connectivity	<p>What: An entire site with intermittent connectivity issues.</p> <p>Why: Low Wi-Fi signal strength.</p> <p>Follow the instructions in the Intermittent Connectivity - Troubleshooting Steps section.</p>

Site Not Reporting Data - Troubleshooting Steps

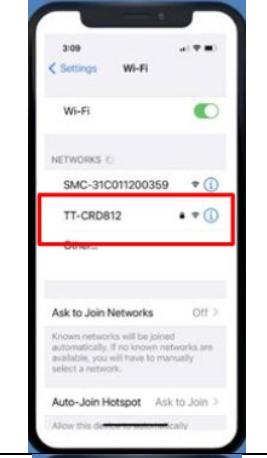
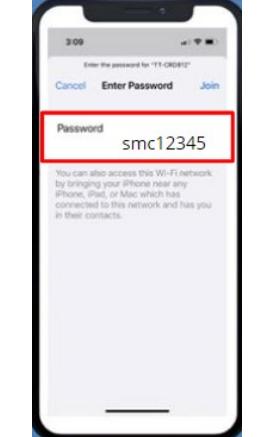
- Step 1: Conduct an initial inspection of the RMK
- Step 2: Connect to cellular modem with your phone and test connectivity
- Step 3: Troubleshoot the cellular modem

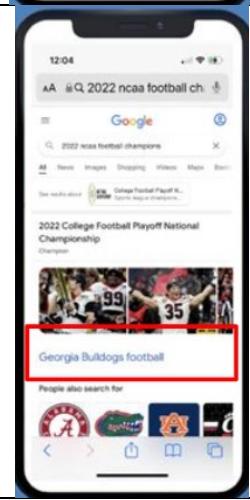
Step 1: Conduct an initial inspection of the RMK

1	<p>Confirm the unit disconnect or breaker is in the ON position. <i>(Rooftop unit powered on.)</i></p>	
2	<p>Verify that no water has accumulated at the bottom of the enclosure.</p>	
3	<p>Verify that the Run LED on the Turntide Supervisor is lit and solid green (and NOT flashing.)</p>	
4	<p>Verify that cellular modem LED from left to right, three green and three blue.</p>	
5	<ul style="list-style-type: none"> • If the RMK passed this initial inspection, go to Step 2: Connect to cellular modem with your phone and test connectivity on page 49. • If the RMK did NOT pass this initial inspection, examine other potential issues in RMK In-Depth Troubleshooting Steps on page 47. 	

Step 2: Connect to cellular modem with your phone and test connectivity

Premise: You will add the cellular modem Wi-Fi network to your phone and then use your phone to browse the internet, therefore confirming the modem is capable of transmitting and receiving a signal.

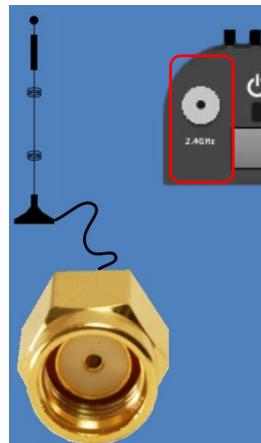
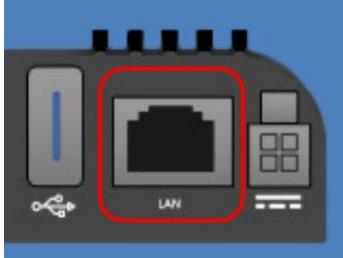
1	<p>Locate the modem SSID* on the NEMA 4X enclosure door.</p> <p><i>*The SSID (Service Set Identifier) is the name of your wireless network, also known as Network ID.</i></p>		 <p>The image shows the front panel of a NEMA 4X enclosure. A small white label is attached to the bottom right corner. The label has "SSID:TT-CRD812" and "PASS:smc12345" printed on it. A red rectangular box highlights this label.</p>	
2	<p>Using your phone, locate the modem SSID on the Wi-Fi list.</p>		 <p>The image shows a smartphone displaying its Wi-Fi settings. The screen lists available networks, with "TT-CRD812" highlighted by a red box. Other networks listed include "SMC-31C011200359" and "3:09". Below the network list, there are options for "Ask to Join Networks" (Off), "Auto-Join Hotspot", and "Allow this device to automatically...".</p>	
3	<p>Enter the SSID password from the label on the NEMA 4X enclosure door. The password is usually smc12345.</p>		 <p>The image shows a smartphone displaying a password entry dialog for the "TT-CRD812" network. The password "smc12345" is entered into the "Password" field, which is highlighted by a red box. Below the password field, there is a note: "You can also access this Wi-Fi network by bringing your iPhone near any person who has their phone connected to this network and has you in their contacts."</p>	

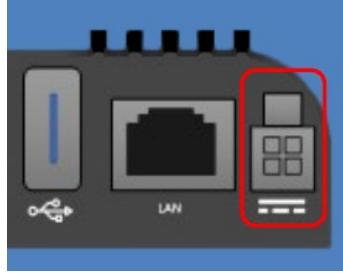
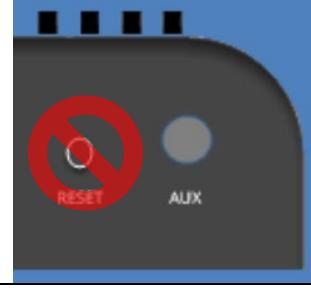
4	<p>Ensure you have a connection. (Depending on your brand of phone, a checkmark might appear next to the SSID.)</p>	
5	<p>Browse the web using the Wi-Fi. If you can reach a site, then the modem is working.</p> <p><i>In the example, the browser found the site of the 2022 NCAA football champions.</i></p>	
5	If the modem is NOT working, continue troubleshooting the cellular modem. Go to Step 3: Troubleshoot the cellular modem on page 51.	

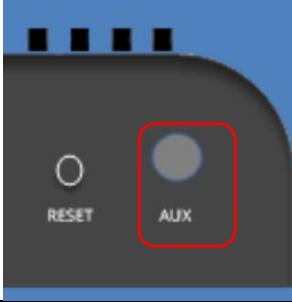
Step 3: Troubleshoot the cellular modem

Familiarize yourself with the following features of the cellular modem.

 <p>WiFi Antenna Connector (R-SMA)</p> <p>LEDs</p> <p>10/100 Ethernet Port</p> <p>USB Port</p> <p>Power Port</p> <p>2.4GHz</p>	 <p>LTE Antenna Connectors (SMA)</p> <p>SIM Card Slot in Door</p> <p>MAIN</p> <p>RESET</p> <p>AUX</p>
<p>Features identified from left to right:</p> <ul style="list-style-type: none"> • Wi-Fi antenna connector • Power LED • Wi-Fi LED • Cellular LED • Cellular strength LEDs (4 bars) • USB Connection – Not used by Turntide • CAT6 ethernet cable connection • Power cord connection <p>A properly functioning modem will have three green and at least three of the four blue signal strength LEDs lit.</p> 	<p>Features identified from left to right:</p> <ul style="list-style-type: none"> • Main cellular antenna connection • SIM Card door • Modem RESET button • Auxiliary cellular antenna connection

1	Check the power LED 	Not lit = No power to the modem – (no 12V DC power) Yellow = The modem is NOT properly configured Green = Powered on – (proper 12V DC power)
2	Check the Wi-Fi LED 	Not lit = Wi-Fi is NOT operating Green = Wi-Fi is operating normally
3	Check the cellular LED 	Not lit = Modem is NOT initiating → Check SIM Card door Yellow (solid or flashing) = Modem is NOT active or has connection errors Green = Active connection = Good Red = Modem is resetting
4	Check the cellular signal strength LED 	Not lit = No signal → Verify that the antenna is properly installed Blinking blue LED = $\frac{1}{2}$ bar One blue LED lit = Weakest signal Four blue LEDs lit = Best signal Less than three blue signal LEDS → Verify that the antenna is properly installed
5	Check that the correct antenna was used on the modem and that the Wi-Fi antenna is finger-tight on the modem.	Should be ANT-002 (female) modem antenna for the modem. 
6	Verify that the CAT6 ethernet cable is snapped into the port (LAN) on the modem.	

7	Verify that the power cord is snapped into the modem.			
8	Verify that the main cellular antenna connection is finger-tight.			
9	Open the SIM Card door and verify it contains a SIM card. Ensure the door is completely shut. The modem will not initiate if the SIM Card door is open even slightly!		 	
10	Do NOT use the modem RESET button in the field.			

11	Verify that the auxiliary cellular antenna connection is finger-tight.		
If the modem is connected but the problem have not been resolved, examine the issues listed in RMK In-Depth Troubleshooting Steps on page 47 .			

No Motor Controllers Reporting Data - Troubleshooting Steps

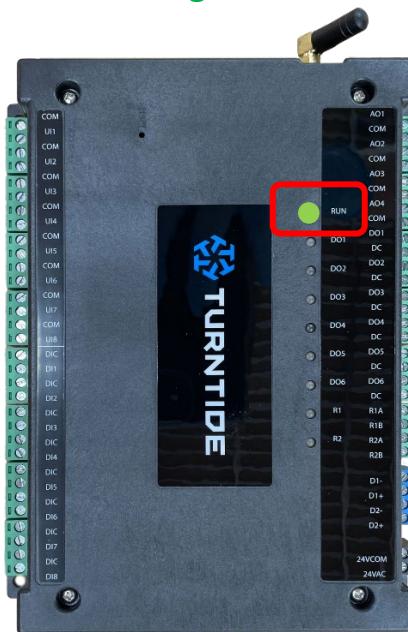
If the modem can be seen remotely but no motor controller activity is being reported to Cloud services, the issue is likely the Turntide Supervisor because it is the gateway between the motor controller and Cloud services.

- Step 1: Verify that the Turntide Supervisor is powered up correctly
- Step 2: Troubleshooting the Supervisor when the RUN LED is not lit

Step 1: Verify that the Turntide Supervisor is powered up correctly

Verify Supervisor Powered Up Correctly

When first powered up, the Supervisor will have a flashing **green** RUN LED. The boot process takes approximately 15 seconds. Once the Supervisor completes the boot process, the RUN LED will be **solid green**.



Results:

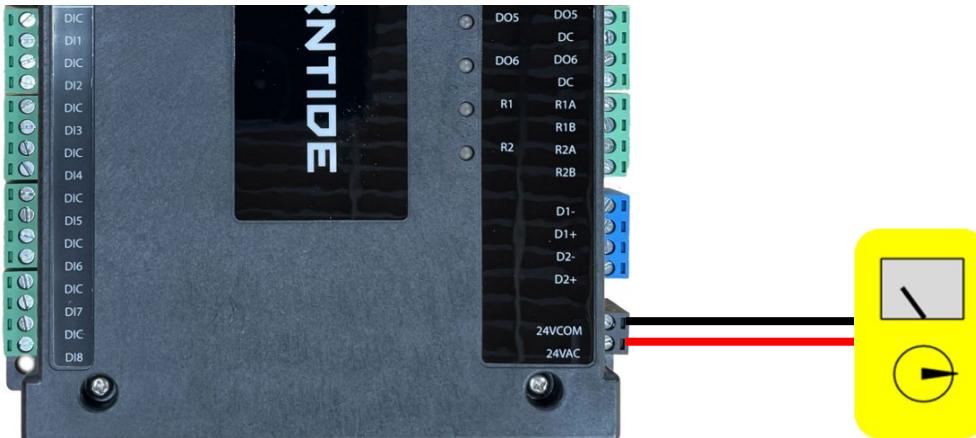
- If the RUN LED continues flashing and is NOT solid, the Supervisor failed the boot process and **needs to be replaced**. Contact Turntide Technical Support 877-776-8470 (877-PRO-TIP+).
- If the green RUN LED is **NOT** lit on power up, go to [Step 2: Troubleshooting the Supervisor when the RUN LED is not lit on page 56](#).

Step 2: Troubleshooting the Supervisor when the RUN LED is not lit

1 Verify AC voltage on the Turntide Supervisor using a multimeter:

- 24VCOM (formerly 24V L)
- 24VAC (formerly 24V H)

You should be getting within +/- 10% of 24VAC. The Supervisor runs normally between 21.6 to 26.4 VAC.

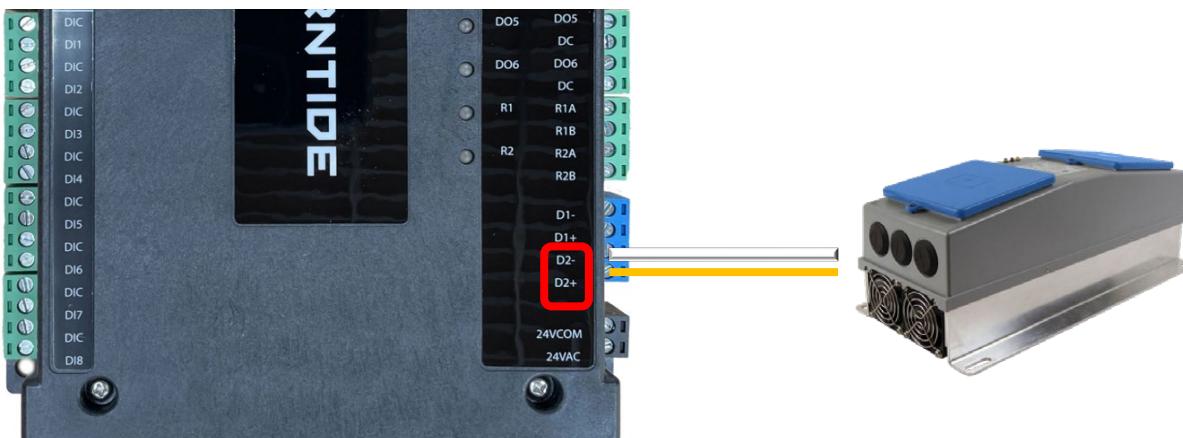


2 Verify polarity of 24VAC wiring going into Turntide Supervisor terminals.

- Power wire (+) is 24VAC (formerly 24V H)
- Common wire (-) is 24VCOM (formerly 24V L)

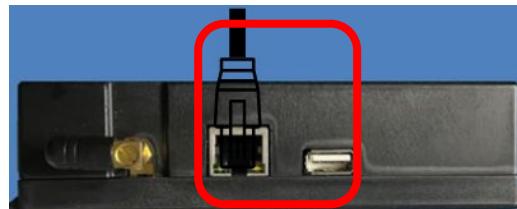
Improper termination can cause issues with the Supervisor.

If the motor controller is wired to Turntide Supervisor (uncommon in today's installations), verify the polarity on the D2+ and D2- terminals.



3 Check the CAT6 cable

Verify that the CAT6 ethernet cable is snapped into the Turntide Supervisor port correctly.



Verify the connection of the ethernet cable between the cellular modem and the Turntide Supervisor.

If connected properly, you will see lights on both sides of the ethernet cord. Sequence: One light solid yellow and the other will be flashing green, confirming communication.

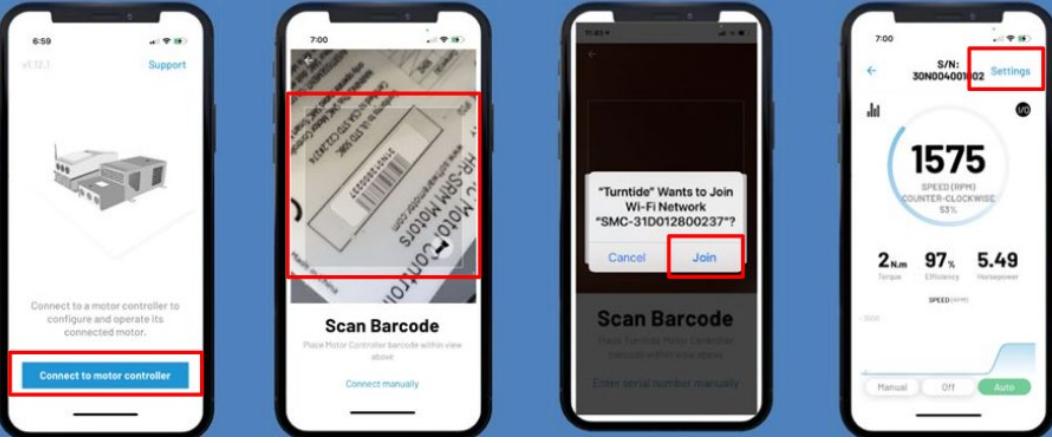
If the problem have NOT been resolved, examine the issues listed in [RMK In-Depth Troubleshooting Steps on page 47](#).

One Motor Controller (of many) Not Reporting -Troubleshooting Steps

You will need to use The Turntide Technician App on your mobile device (phone) to test motor controller connectivity to Cloud Services. The Turntide Technician app is a free download on the Google Play Store and App Store. Simply search for the Turntide Technician app. More than one app is associated with Turntide. The correct app for Turntide Smart Motor Systems is the Turntide Technician app.

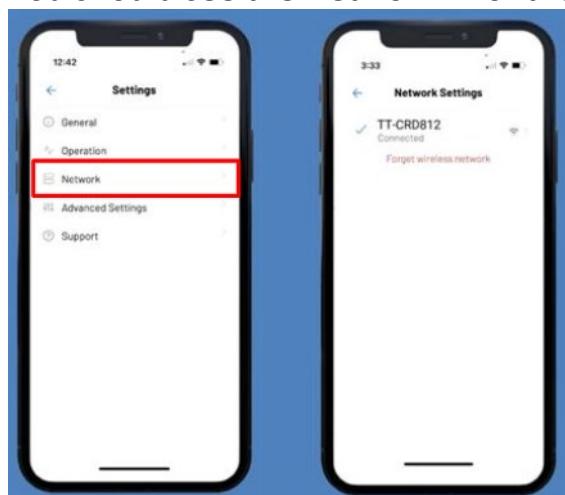
	
Apple Devices - (iPhone) require iOS 12.0 or later  	Android Devices - require Android 9 (Pie) or later  

Steps: Use the Turntide Technician App to connect to the motor controller

1		<ol style="list-style-type: none"> 1. Open the Turntide Technician app. 2. Tap Connect to motor controller. 3. Scan the motor controller barcode. 4. Tap Join to connect to the motor controller Wi-Fi network. 5. Tap Settings.
----------	--	--

2

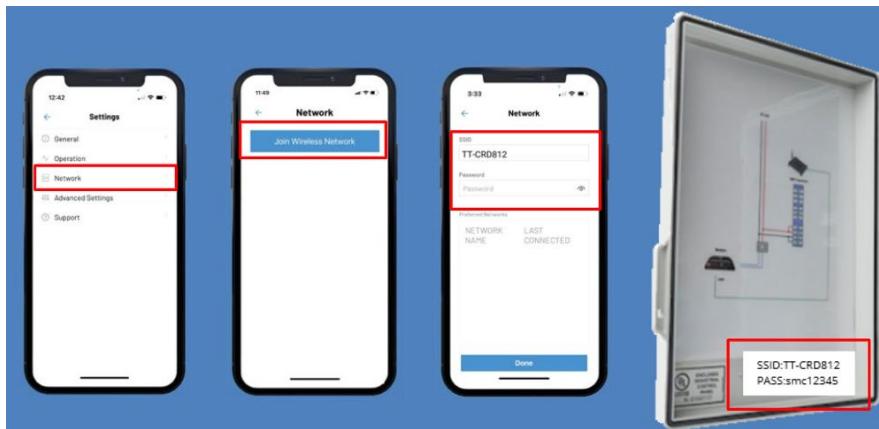
1. In the **Settings** screen, tap **Network**.
2. You should see the Network ID of the motor controller.



3. Call Turntide Technical Support to verify that the motor controller is reporting to Cloud services: 877-776-8470 (877-PRO-TIP+).

If a network ID does not appear:

1. In the **Network** screen, tap **Join Wireless Network**.
2. Enter the **SSID** and **Password** shown inside the RMK enclosure and tap **Done**.

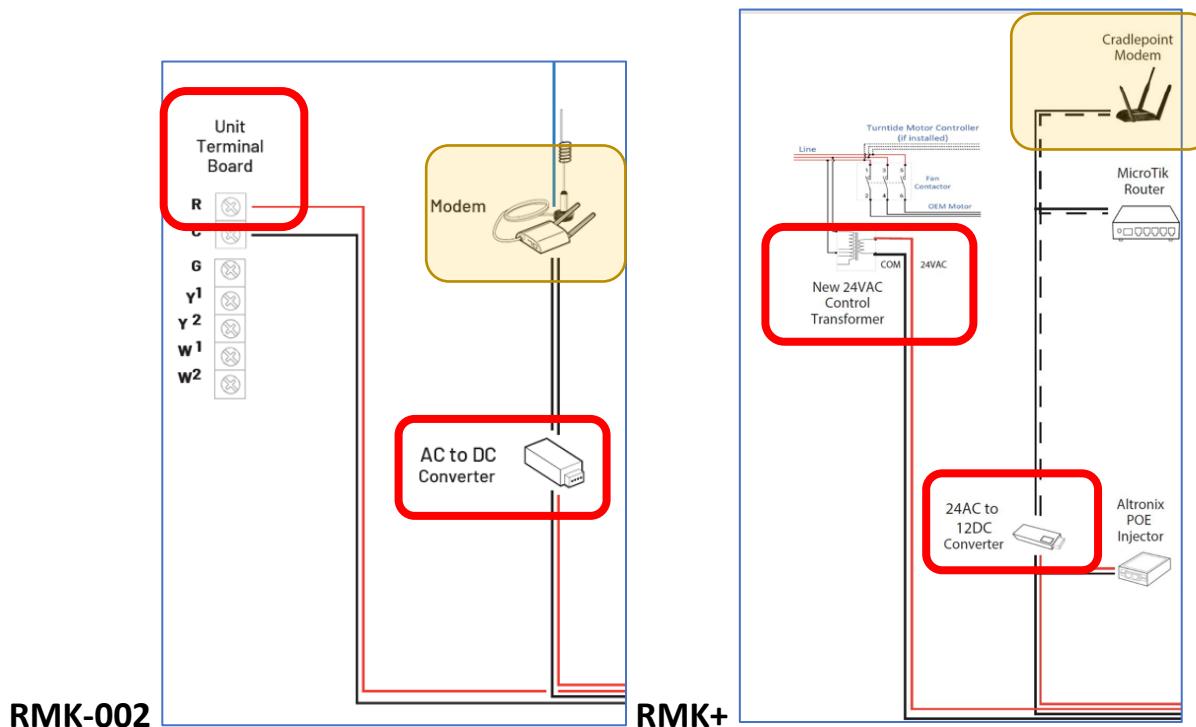


3. Call Turntide Technical Support to verify that the motor controller is reporting to Cloud services: 877-776-8470 (877-PRO-TIP+).

If the motor controller is reporting to Cloud Services but you are still experiencing a problem, examine the issues listed in [RMK In-Depth Troubleshooting Steps on page 47](#).

Power Supply Issues – Troubleshooting Steps

- In RMK-002, the **AC/DC adapter** converts 24V AC from the RTU control transformer to 12V DC to power the modem.
- In RMK+ Long Range, the **AC/DC adapter** converts 24V AC from 24VAC Xfmr Multi-Tap Primary Transformer to 12V DC to power the modem.



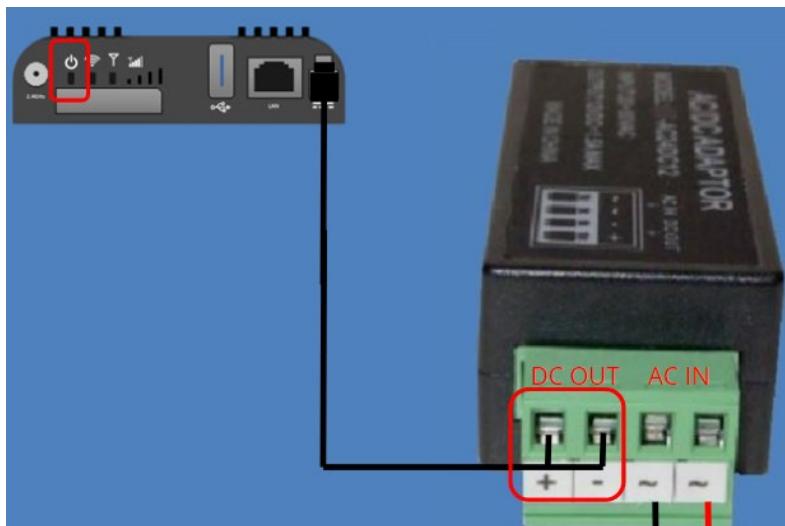
Power IN and Power OUT:

- 24VAC at the AC IN of the adapter
- 12V DC at the DC OUT of the adapter (polarity sensitive)



Step 1: Verify power from the AC/DC adapter

1



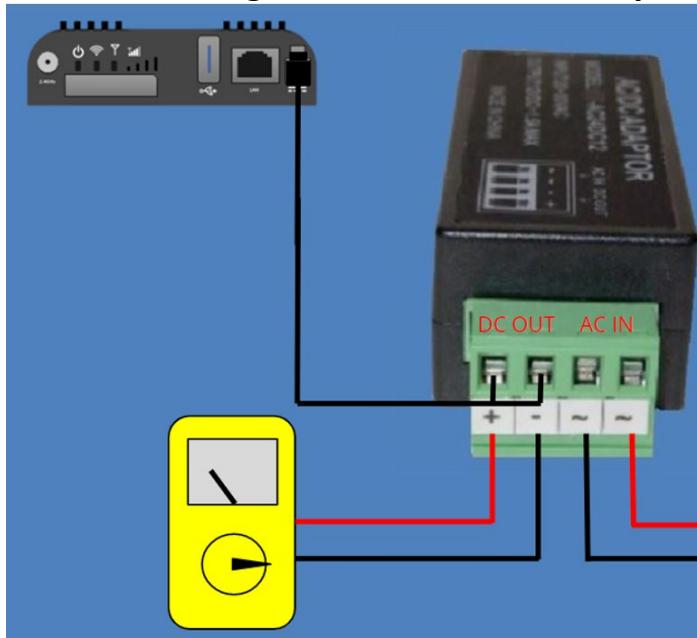
If the power LED on the modem is NOT lit:

1. Verify that the power cable from the AC/DC adapter is snapped into the modem.
2. Verify that the 12V DC wiring connection to the AC/DC adapter is correct. (The 12V DC is polarity sensitive.)

2

Using a voltmeter, verify the adapter is sending 12V DC to the modem.

If it isn't sending 12V DC to the modem, you will need to replace the entire RMK.



Step 2: Verify power from transformer

1



In RMK-002, power from RTU transformer (common in rooftop HVAC units)



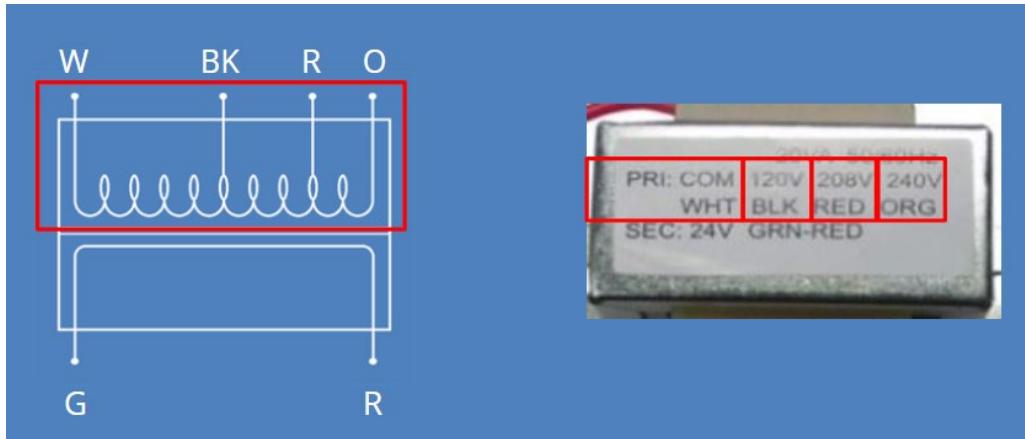
In RMK+ Long Range, power from the 24VAC Xfmr Multi-Tap Primary Transformer

2

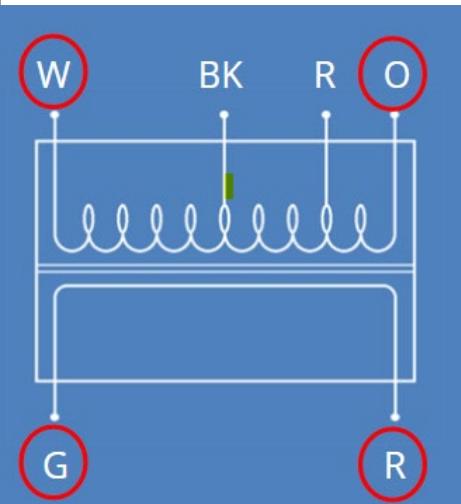
Check that the transformer is tapped correctly because the RMK's voltage range is 21.6 to 26.4 VAC. An incorrectly tapped transformer can exceed that maximum or not reach the minimum required voltage.

Using an example transformer:

This transformer can accommodate 120V, 208, or 240V. (See Primary side values outlined in red on the transformer in this screenshot:



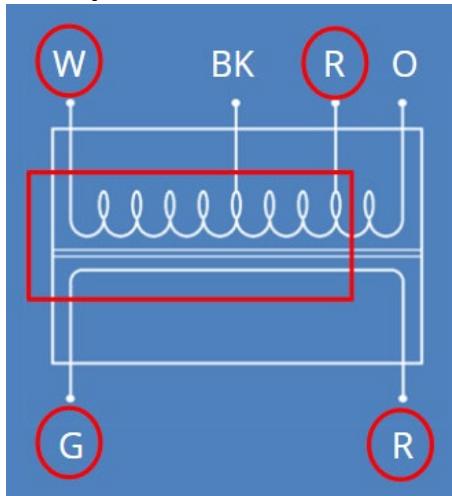
The Primary side of the transformer has 10 times as much copper as the Secondary side. (The Secondary side voltage is noted on the transformer as SEC:24V GRN-RED.)



BK= Black
 G= Green
 O= Orange
 R=Red
 W=White

When 240V is wired to the Primary side and divided by 10, the resulting Secondary voltage is 24V. **That is correct for the RMK.**

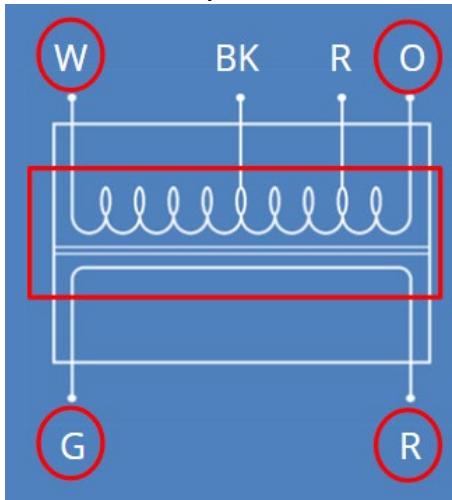
Example where maximum is exceeded:



When 240V is incorrectly tapped to 208V. Primary side has 8.6 times as much copper as the Secondary.

$240V \div 8.6 = 28V$, which is too much for the RMK!

Note: Moving the (R)red connection to (O) orange on the primary would decrease the secondary to 24V.



Intermittent Connectivity - Troubleshooting Steps

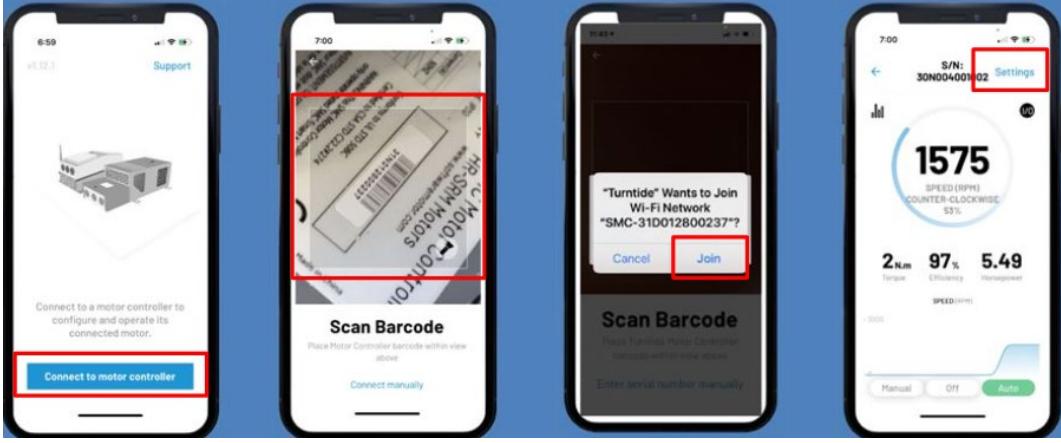
Wi-Fi Signal strength is measured in RSSI (Received Signal Strength Indicator), which is measured in decibels per milliwatt (dBm).

The smaller the dBm value, the better the signal. Your signal should be -70 dBm or better.

RSSI Value	Strength Level of Wi-Fi Signal
-50 dBm	Excellent
-60 dBm	Very good
-70 dBm	Good (minimum)
-80 dBm	Low
-100 dBm	No Wi-Fi signal

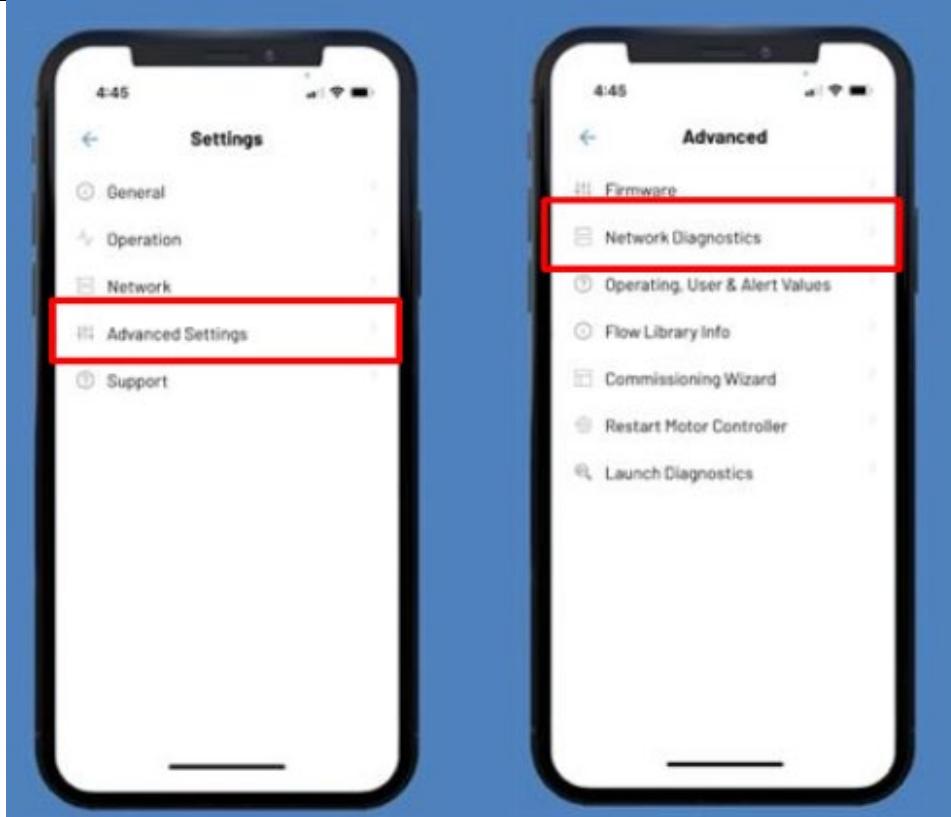
Step 1: Verify the RSSI using the Turntide Technician App

1



1. Open the Turntide Technician app.
2. Tap **Connect to motor controller**.
3. Scan the motor controller barcode.
4. Tap **Join** to connect to the motor controller Wi-Fi network.
5. Tap **Settings**.

2



1. In the **Settings** screen, tap **Advanced Settings**.
2. Tap **Network Diagnostics**.

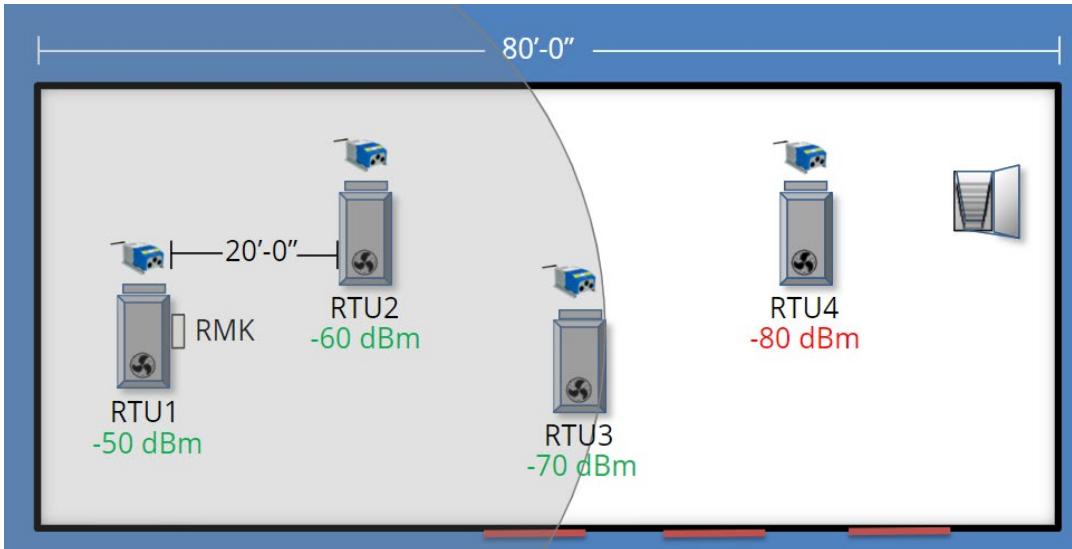
3



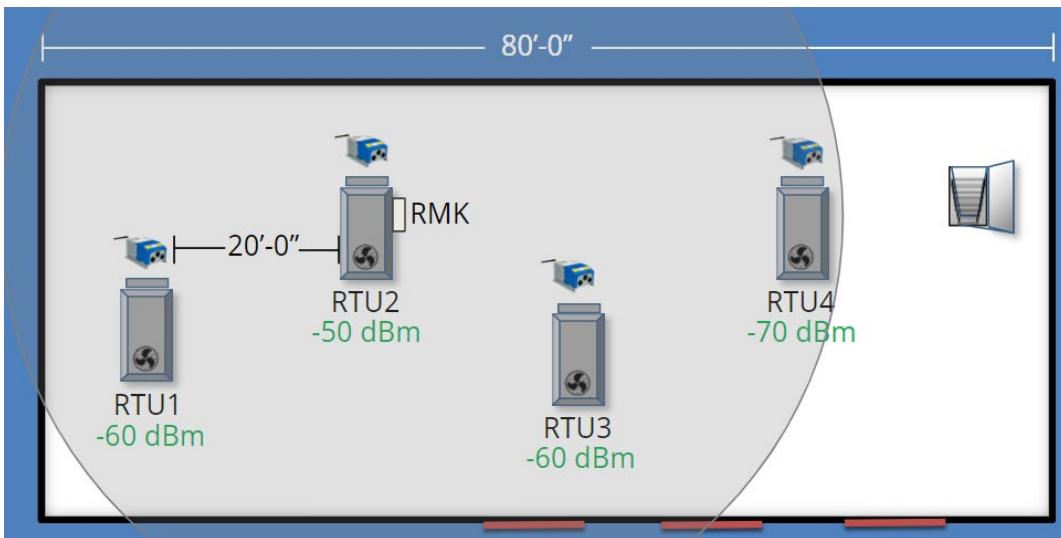
You can now see the signal strength rssiAvg/rssiMax/rssiMinu and the SSID. (Note that the SSID should match the one on the label of the RMK enclosure door.)
The Turntide Technical Support team can verify the RSSI remoted if necessary.

Step 2: Change RMK-002 Placement

- 1 Standard RMK-002 provides a Wi-Fi signal to accommodate a 40 foot radius. In the following example, RTU4 is reporting intermittently because of a weak signal.

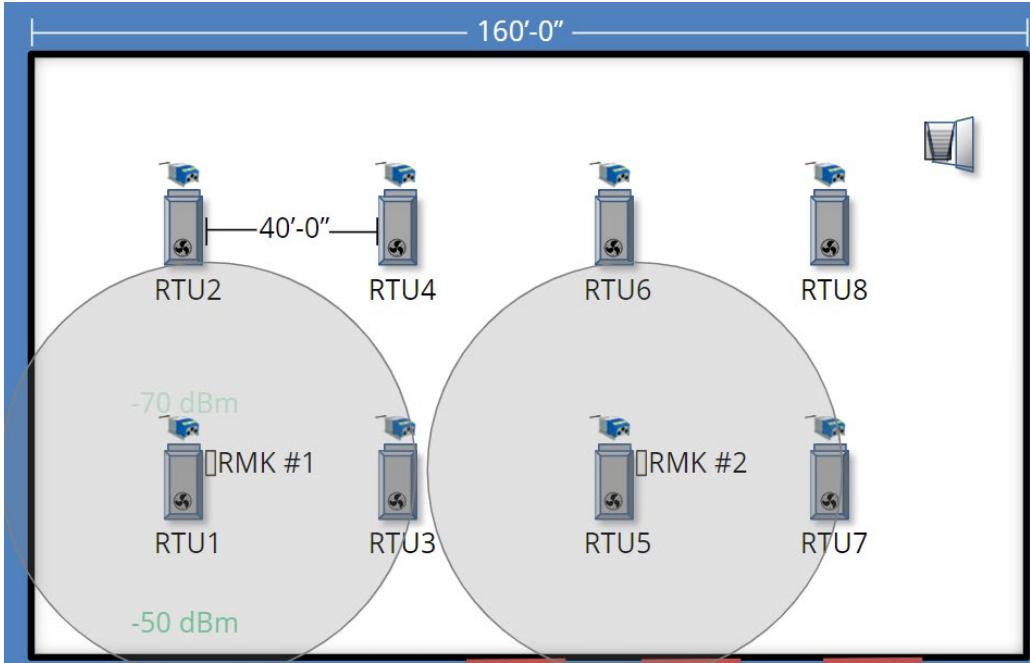


- 2 Moving the RMK (20 feet) to RTU2 results in good RSSI for all units.

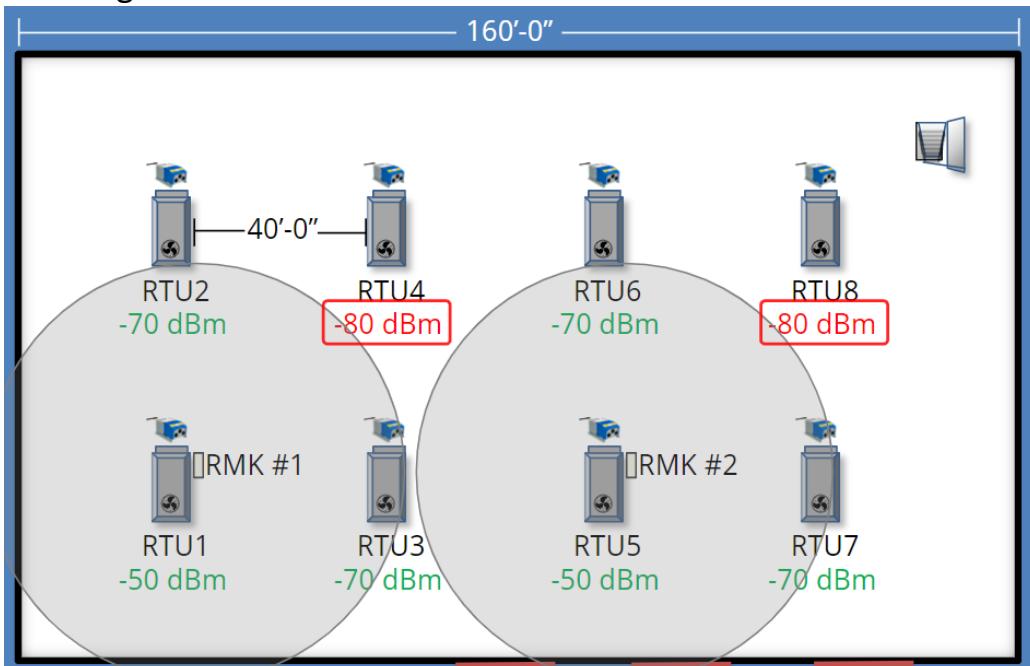


Step 3: Upgrade to RMK+ Long Range to increase Wi-Fi signal when relocation not possible

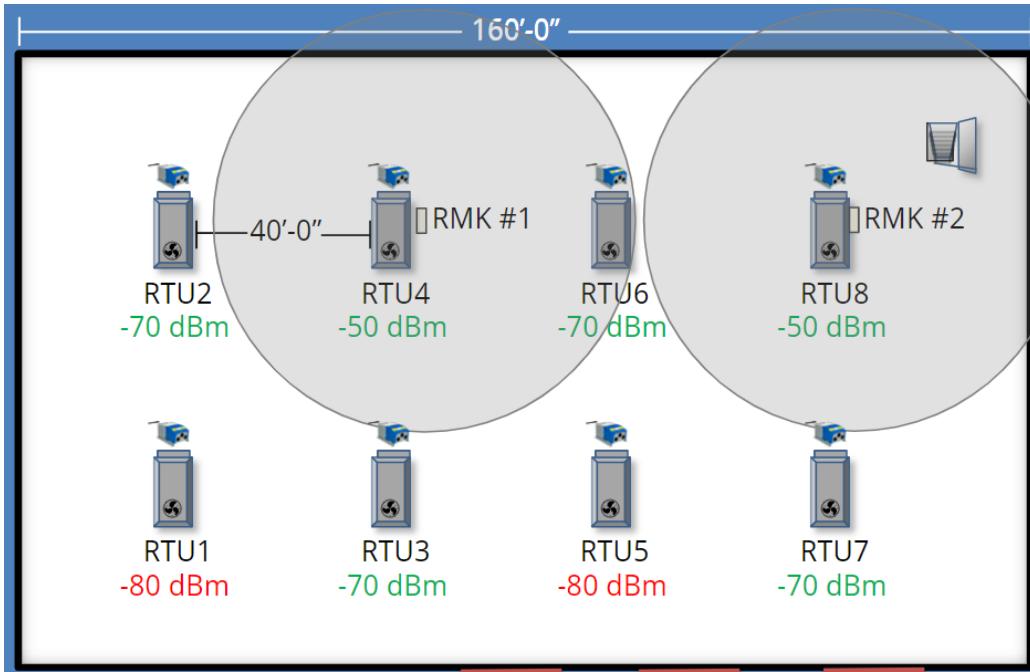
- 1** Standard RMK-002 provides a Wi-Fi signal to accommodate a 40 foot radius. In the following example, the RMK are located on RTU1 and RTU5.



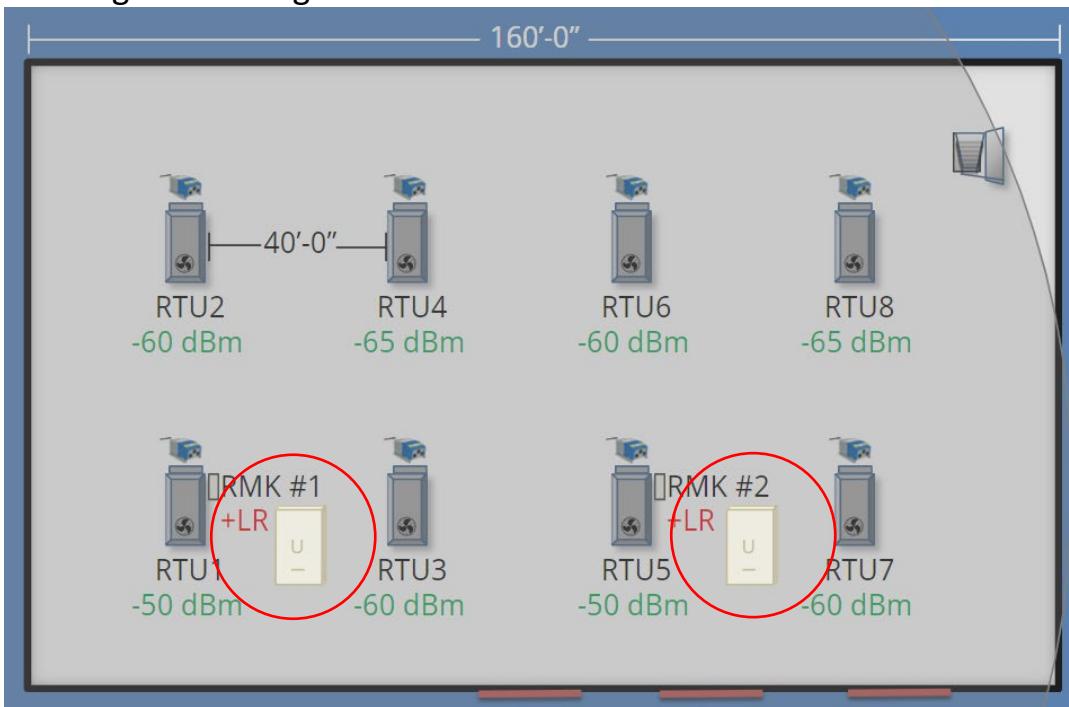
- 2** In the following example, RTU4 and RTU8 are reporting intermittently because of a weak signal.



- 3** You could move RMK1 and RMK2 to RTU4 and RTU8, respectively.
But now RTU1 and RTU5 now have a low RSSI (we signal).



- 4** The solution is to upgrade to RMK+ Long Range Wi-Fi Access Point so as to increase the standard RMK signal radius to **150 feet**.
By upgrading to RMK+ LR (long range) on RTU1 and RTU5, all motor controllers now have a good RSSI signal.



Check LEDs on PoE Injector for RMK+

If the PoE Injector LEDs are not lit, this typically means the 24VAC power was connected with the polarity crossed.

Check LEDs on Router for RMK+

(Specific for Micro Tik brand)

- On startup (when powered on) a programmed/configured MicroTik makes a single beeping sound.
- An unprogrammed/unconfigured MicroTik makes a sound followed by a beeping sound

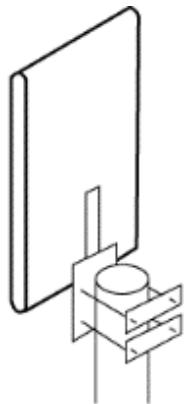
LED	Indicates
	Blue = powered ON. Red = Voltage level incompatible. Check the 24VAC to 12 VDC power adapter or wiring.
SFP	Not used
1	Ethernet port 1 to be connected to the cell modem Green = Cell router connected Off = Not connected. Check ethernet cable connection to the cell modem.
2	Ethernet port 2 to be connected to Turntide Supervisor Green = Turntide Supervisor connected Off = Not connected. Check ethernet cable connection to the Turntide Supervisor or verify that the Turntide Supervisor has power.
3	Ethernet port 3 to be connected to POE Injector Green = POE Injector connected Off = Not connected. Check ethernet cable connection to the PoE Injector or verify that the PoE Injector has power.

Once everything is connected correctly and functioning, the following LEDs should be visible: Power=Blue, 1=Green, 2=Green, 3=Green. (The yellow light around ports 1,2, and 3 will flash green.)



Troubleshoot Long Range Wi-Fi Access Point Using LED Color Status

Ubiquiti Antenna UniFi AC AP Mesh Pro **long-range**



To Reboot the antenna: Unplug and plug the ethernet cable to reboot the antenna.

Important: If the **RESET button** on Ubiquiti UniFi AC AP Mesh Pro long-range Wi-Fi access point is pressed and held for five seconds before releasing, it sets the antenna back to factory defaults.

Do NOT perform the factory reset in the field unless Turntide Technical Services requests it. Do NOT press the REST button.

LED Color	Status
Flashing white , off every ½ second	The antenna is initializing and booting up
Steady white	The antenna is awaiting adoption (?)
Steady blue	The device is adopted and in normal operation mode. (Access point is broadcasting SSIDs)
Strobing white / Off	If this happens, power cycle the antenna. If this doesn't help, contact Turntide Technical Support 877-776-8470 (877-PRO-TIP+). See also: https://help.ui.com/hc/en-us
Quickly flashing white / blue	The device firmware is currently being upgraded. Do NOT interrupt this process.
blue and flashing Off every 5 seconds	Antenna has lost network connectivity and is search for the wireless uplink
Rapid flashing blue / Off	The antenna “locate” feature was activated in the UniFi network application

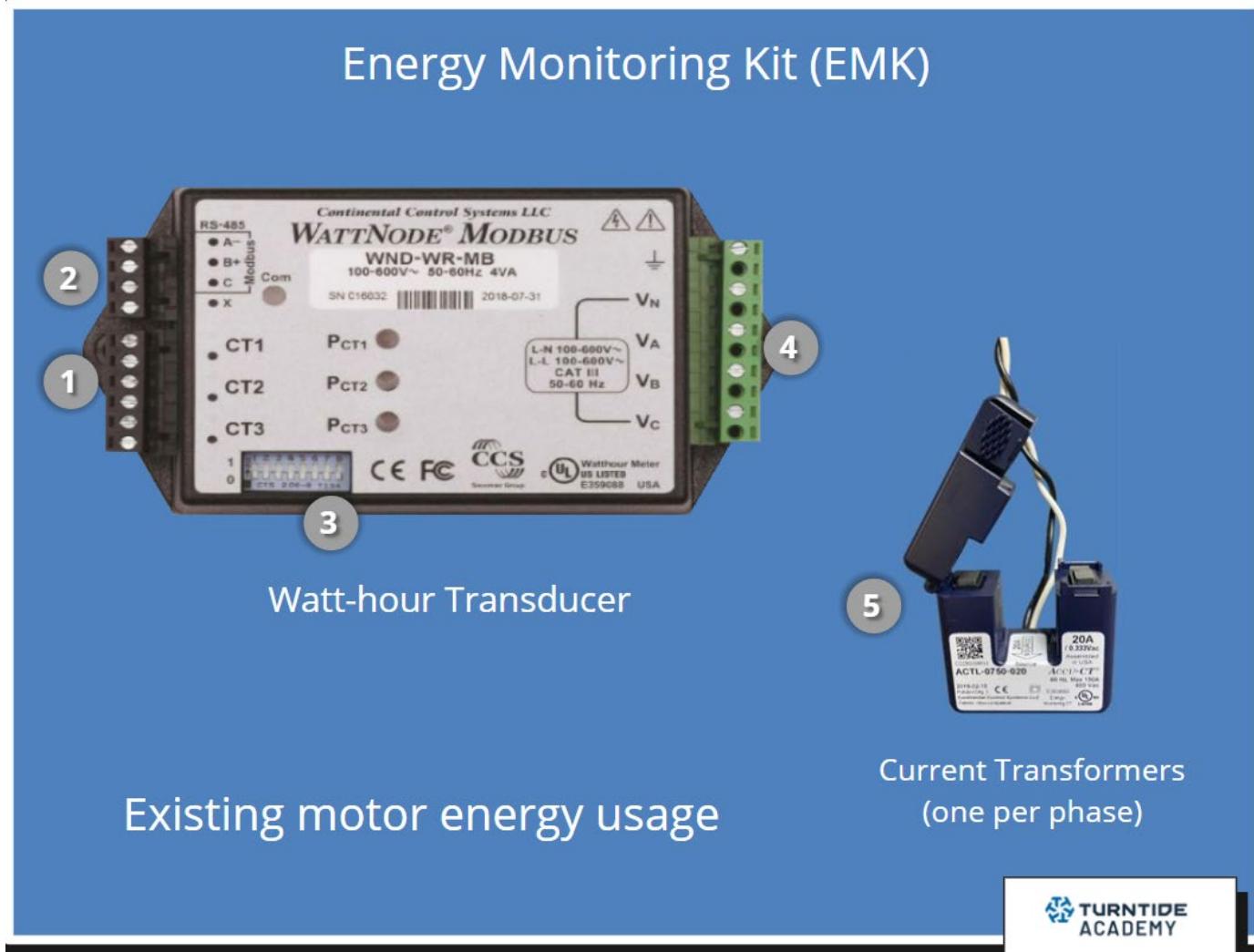
LED Color	Status
Flashing white - blue - Off	<p>The antenna is in TFTP* mode. <i>If this mode wasn't intentional, check if the antenna's Reset button is jammed. The button should click when pushed.</i></p> <p>To enable TFTP mode:</p> <ol style="list-style-type: none"> 1. Hold the reset button before applying power. 2. Continue to hold the rest button until this LED of white - blue -OFF appears.
LED Off	<p>The antenna is offline. Verify the power, POE, and ethernet cables to troubleshoot.</p>

* TFTP = Ubiquiti's **Trivial File Transfer Protocol (TFTP)** recovery method is the process followed to recover firmware on Ubiquiti devices. This method is useful when an unstable device connection exists or when the device cannot be accessed. These difficulties are typically due to some form of firmware corruption.

Energy Monitoring Kit (EMK)

Basic Components of EMK

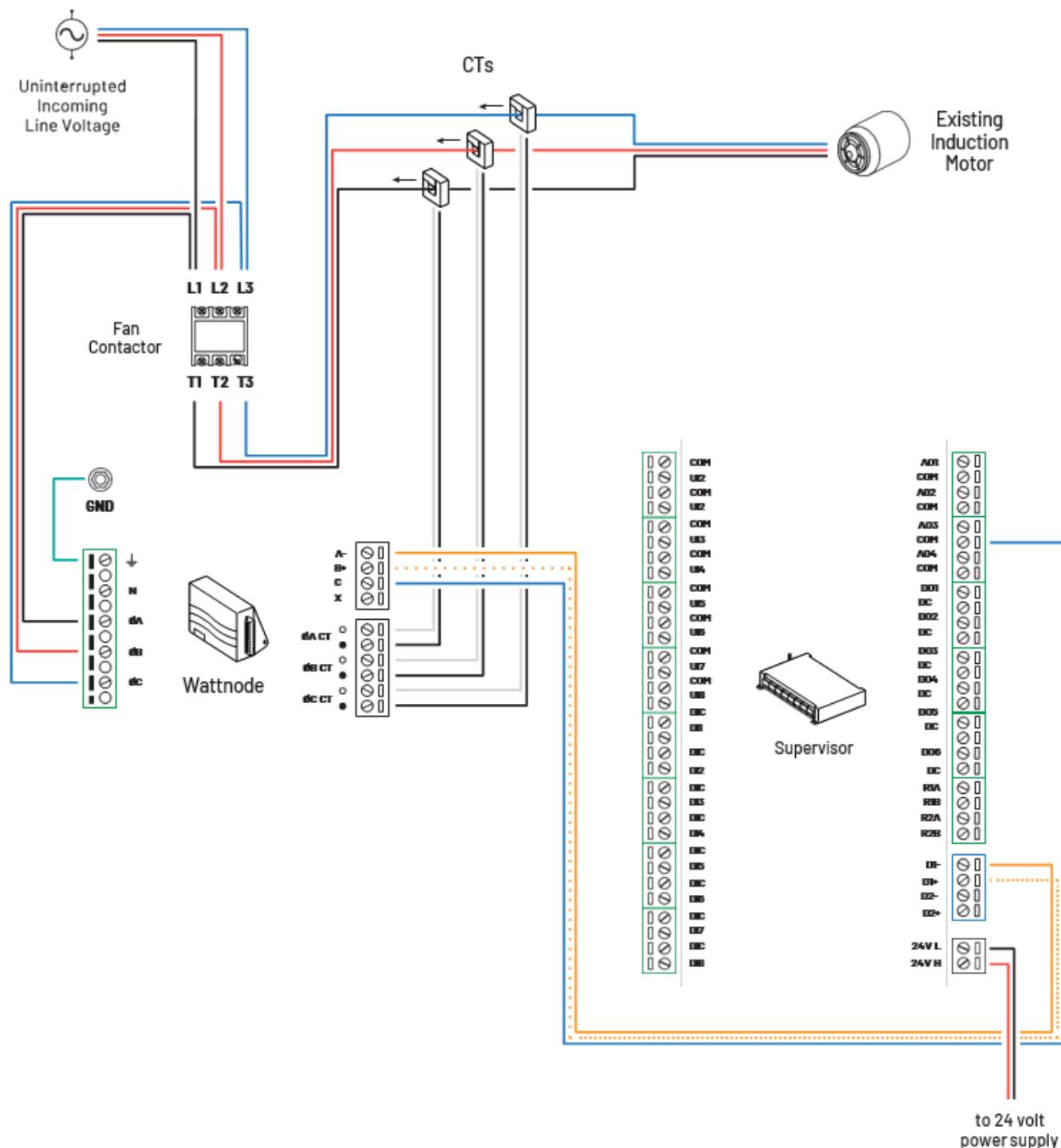
Energy Monitoring Kit (EMK)

TURNTIDE
ACADEMY

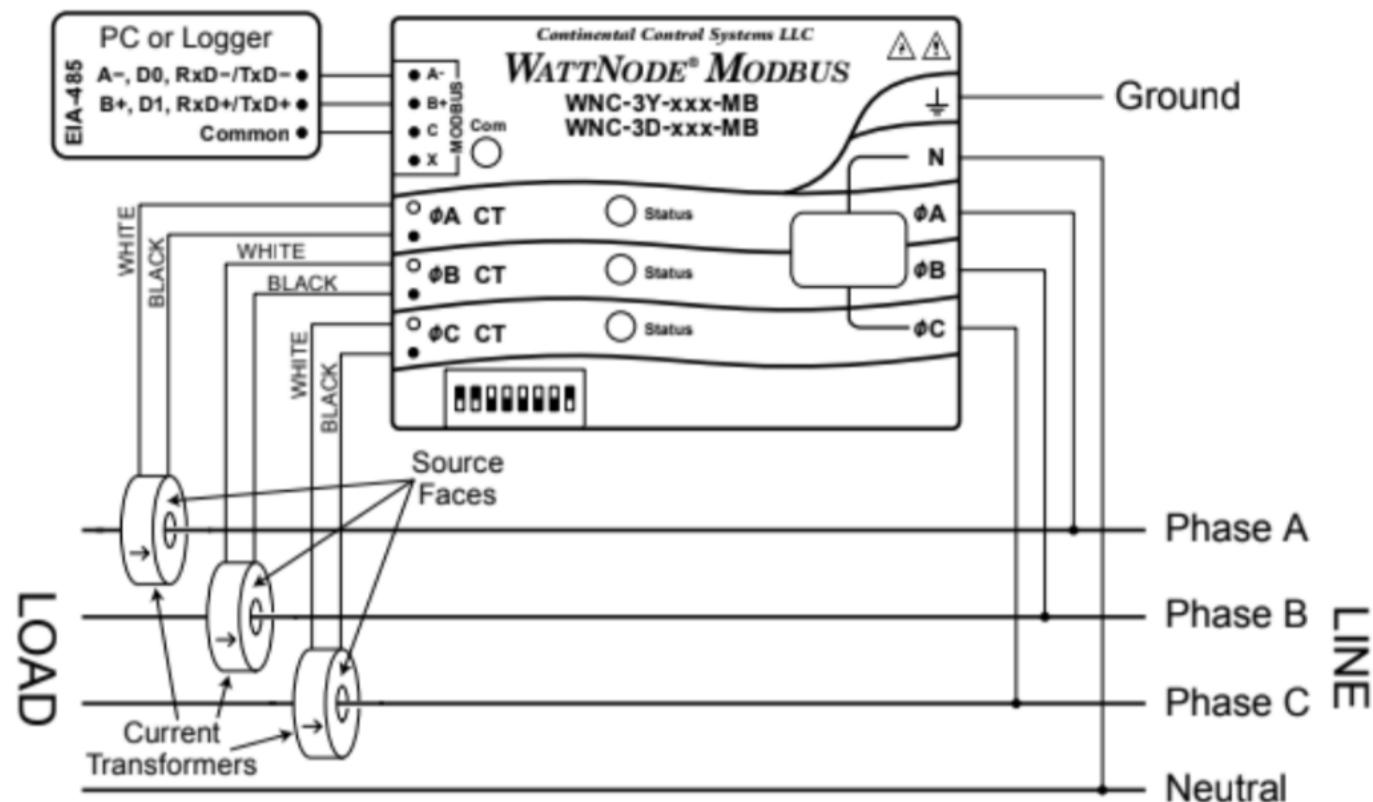
1	Current Transformer Connections Installed around the existing power wiring being monitored. Must be in order with the voltage connections CT1 installed on Phase A(L1) CT2 installed on Phase B(L2) CT3 installed on Phase C(L3)
2	MODBUS Connection MODBUS +/- and common terminals wire to D1+/D1- and common on the Turntide Supervisor
3	Communication DIP-Switches Switches 4 and 8 will always be in the UP position and the other switches will be in the DOWN position. Switch 4 being UP represents device ID #8. Switch 8 being UP represents 19200 baud rate.

4	<p>Line Voltage Connections</p> <p>Terminals A, B, & C represent L1, L2, and L3, respectively. The power wiring should come from the same voltage source that serves the existing motor.</p> <p>Make sure to ground the device to the unit ground block.</p>
5	<p>Current Transformer</p> <p>One current transformer (CT) per phase. Make sure that the arrow on the CT label is pointing towards the power source and AWAY from the motor.</p>

EMK Wiring Diagram



WattNode Wiring



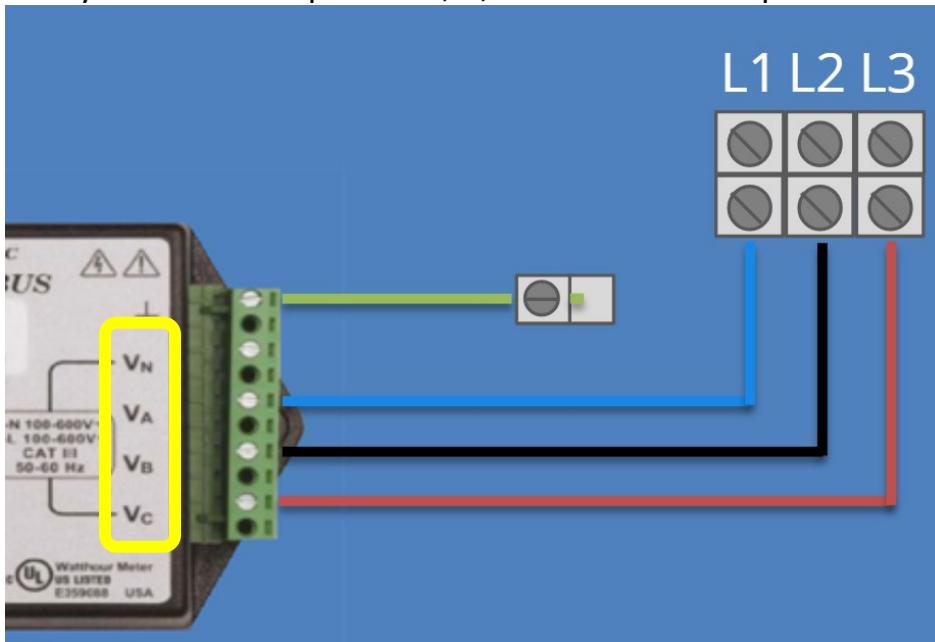
Verify Wiring Connections

1



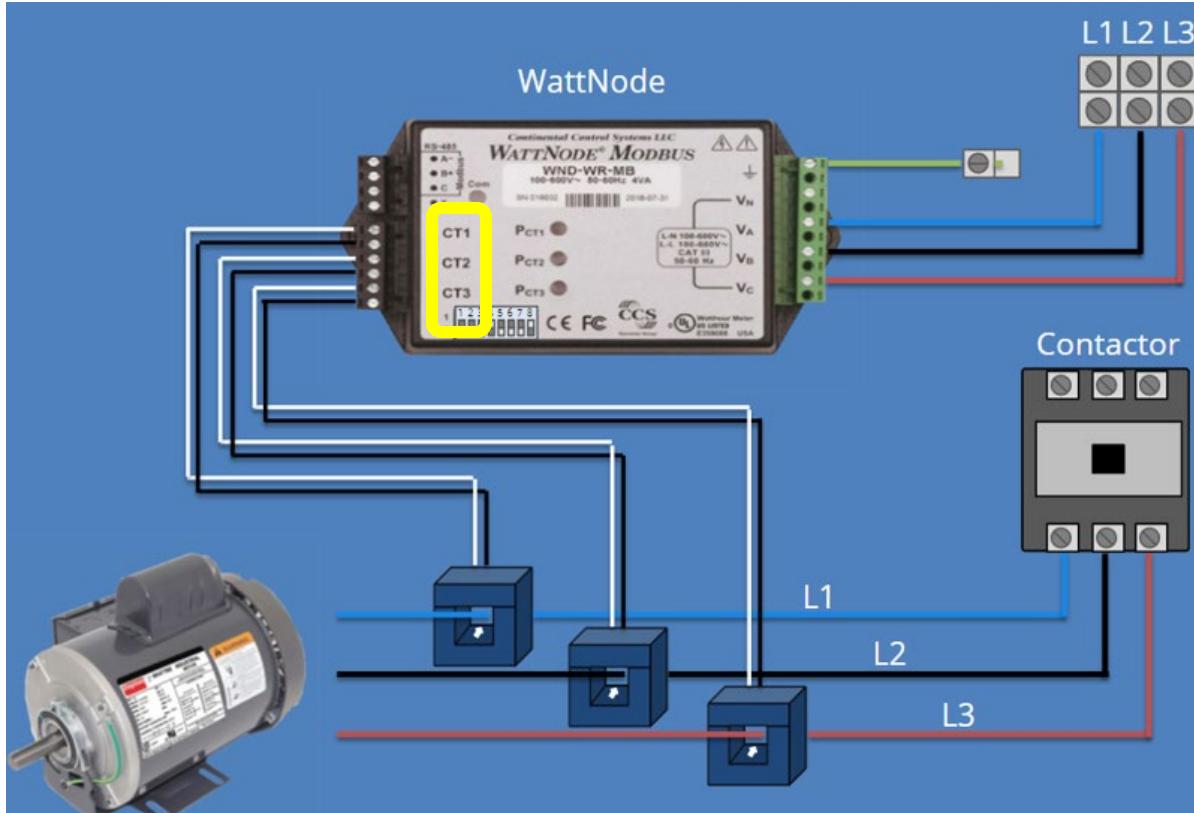
Verify that the WattNode is properly grounded to the unit.

Verify terminals for phases A, B, and C to the unit power distribution block.



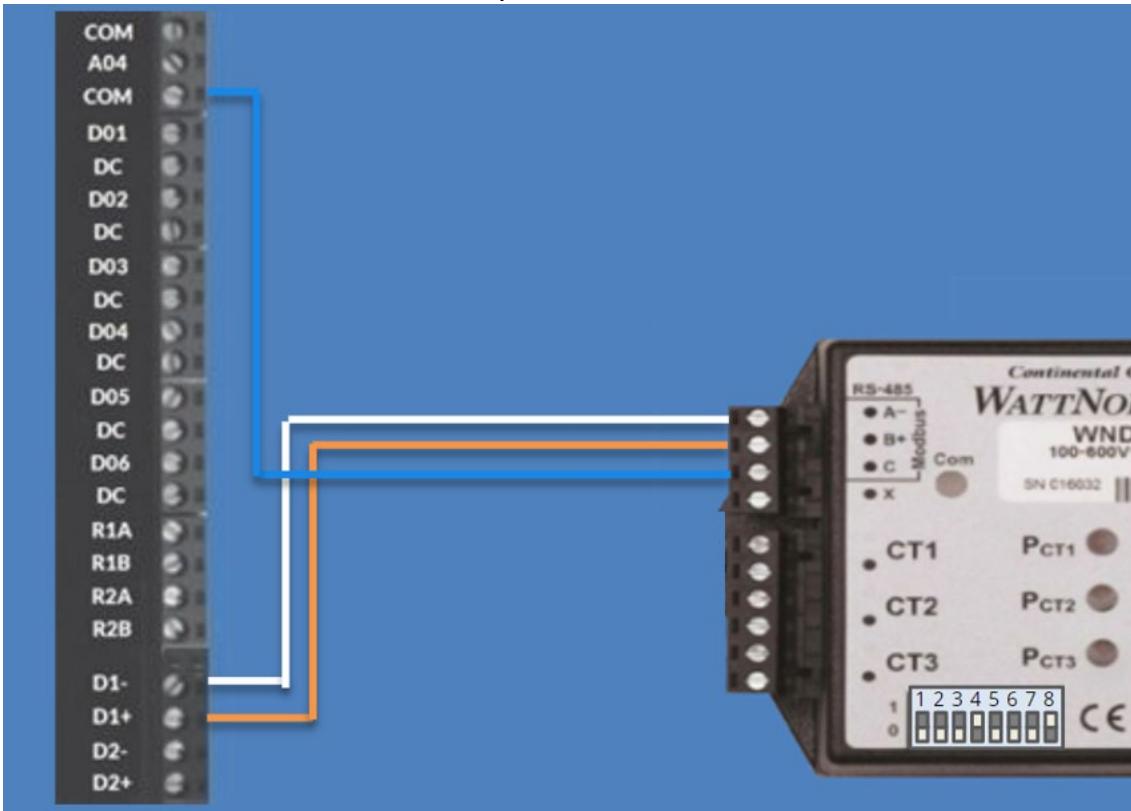
2 Verify that the current transformers (CTs) are installed properly:

- Terminal CT1 on WattNode corresponds with CT located on existing motor power L1
- Terminal CT2 on WattNode corresponds with CT located on existing motor power L2
- Terminal CT3 on WattNode corresponds with CT located on existing motor power L3
- Verify that the arrows on the CTs are facing away from the motor and towards the power source. If one of the CTs isn't operating normally, replace the CT.



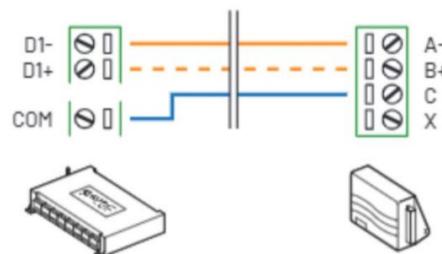
3 Verify the Modbus connections.

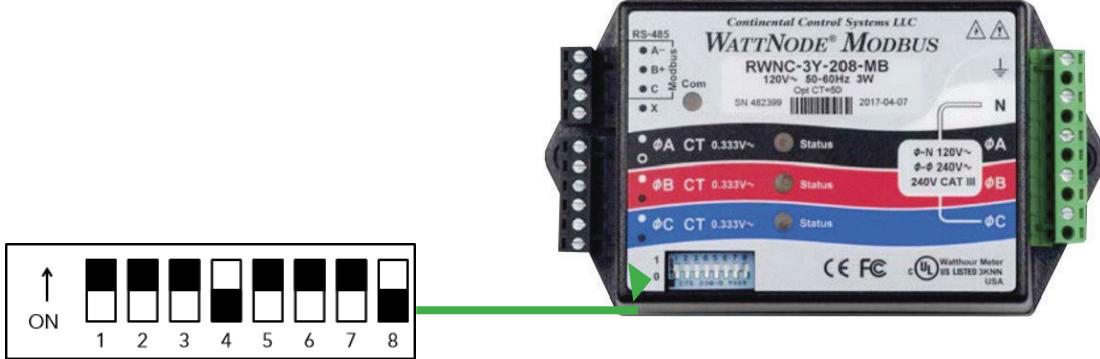
Positive, Negative, and Common on the WattNode must wire to Positive, Negative, and Common on the Turntide Supervisor.



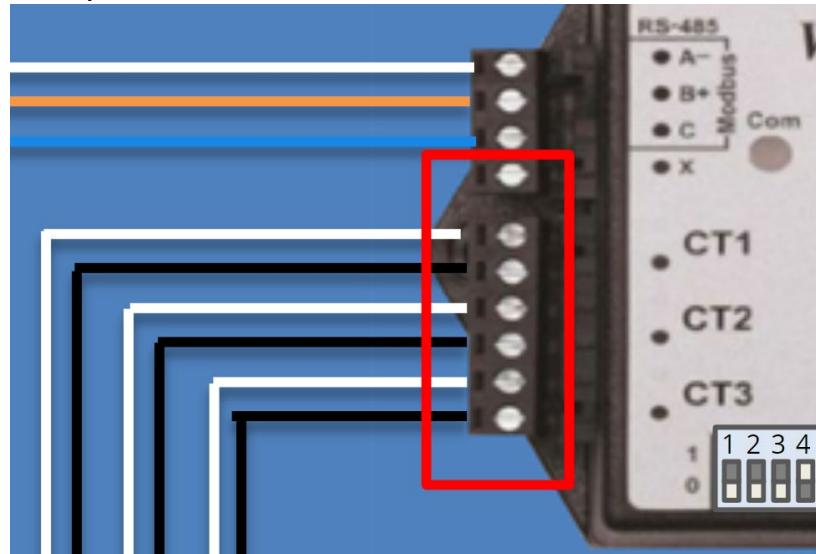
Check the Modbus cable for polarity:

- WattNode A- to Supervisor D1-
- WattNode B+ to Supervisor D1+
- WattNode C to Supervisor COM



- 4** Confirm the WattNode DIP switch configuration.
 Make sure Modbus address and baud rate are correct.
- Switches 4 and 8 DIP are in the **UP** position – **ON**
 - All other switches in the **DOWN** position - **OFF**
 - Switches 1-7 set the device address
 - Switch 8 sets the baud rate (S8 down=9600, S8 up=19200)
- 
- The image shows the front panel of a WattNode Modbus RWNC-3Y-208-MB device. It features a 16-pin DIP switch array labeled 1 through 8. An arrow points upwards from the first two switches, indicating they are set to the 'ON' position. The remaining six switches are shown in the 'OFF' position. Below the DIP switch array, there is a digital display showing the number '1'.
- 5** Do a tug test on all the 20 wiring connections made when installing the WattNode to make sure they are secure.
- 
- The diagram illustrates the wiring connections between a WattNode and a Contactor. On the left, a vertical stack of terminals is labeled with pins: COM, A04, COM, D01, DC, D02, DC, D03, DC, D04, DC, D05, DC, D06, DC, D07, DC, R1A, R1B, R2A, R2B, D1-, D1+, D2-, D2+. A red box highlights the connection between the top COM terminal and the A04 terminal. The WattNode itself is shown in the center, with its pins labeled: RS-485 (A-, B+, C, Com), X, CT1, CT2, CT3, and a digital display showing '1'. A red box highlights the connection between the WattNode's RS-485 pins and the corresponding pins on the right. On the right, a Contactor is connected to the L1, L2, and L3 lines. A red box highlights the connection between the Contactor's coil and the V_N terminal on the WattNode. Other connections include the neutral line (V_N) and phase lines (V_A, V_B, V_C) from the Contactor to the WattNode's V_A, V_B, and V_C terminals respectively.

- 6 Verify the CTs are wired to the WattNode with the white wire on top.

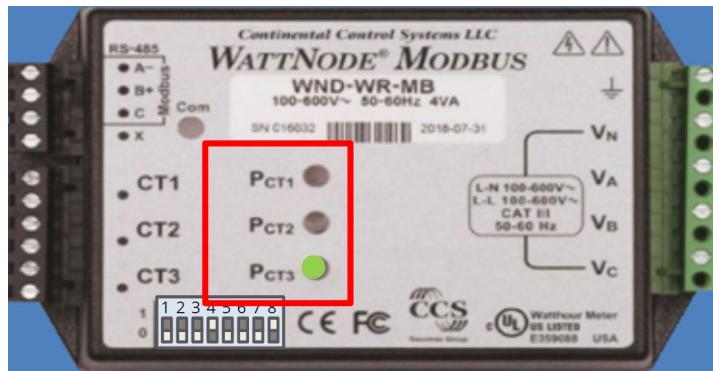


- 7** When power is first applied to the WattNode, verify the status the LEDs:

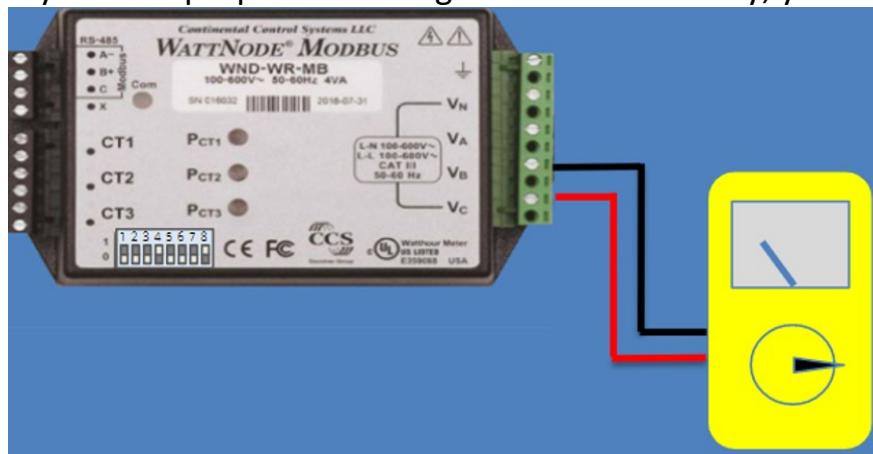
If the LEDs are flashing **red-green- red-green** continuously, then **disconnect the power immediately!** This indicates the line voltage is too high for the WattNode.



- If ALL the LEDs are *blinking green*, the motor is **ON**.
- If only one LED is **green**, the motor is **OFF**.
- Verify that the Com (Modbus) LED is flashing green. If other devices are connected in a daisy chain, the Modbus LED will alternate green and yellow.



If you have proper line voltage but no LED activity, you must replace the WattNode.



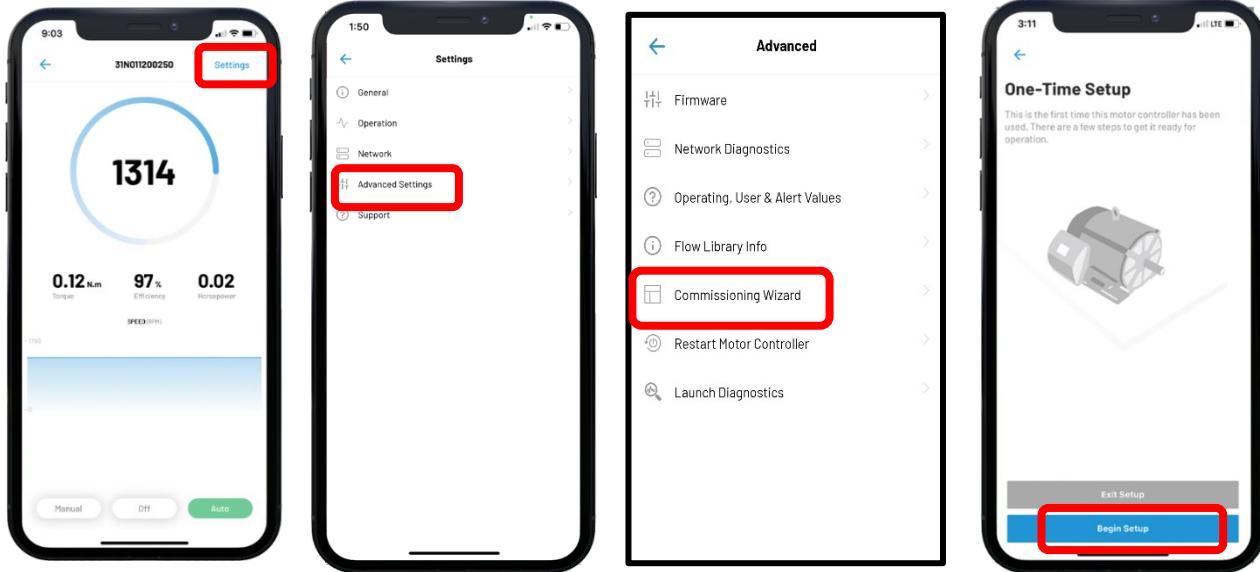
Appendix

How to Commission a Motor with the Turntide Technician App

The motor commissioning wizard guides you through the process with information or instructions displayed at the top of the app screen.

Step 1: You must be connected to a motor controller with the motor home screen visible

1. Tap **Settings**, then **Advanced Settings**, and the **Commissioning Wizard**.
2. The **One-Time Setup** instruction appears. Tap **Begin Setup**.

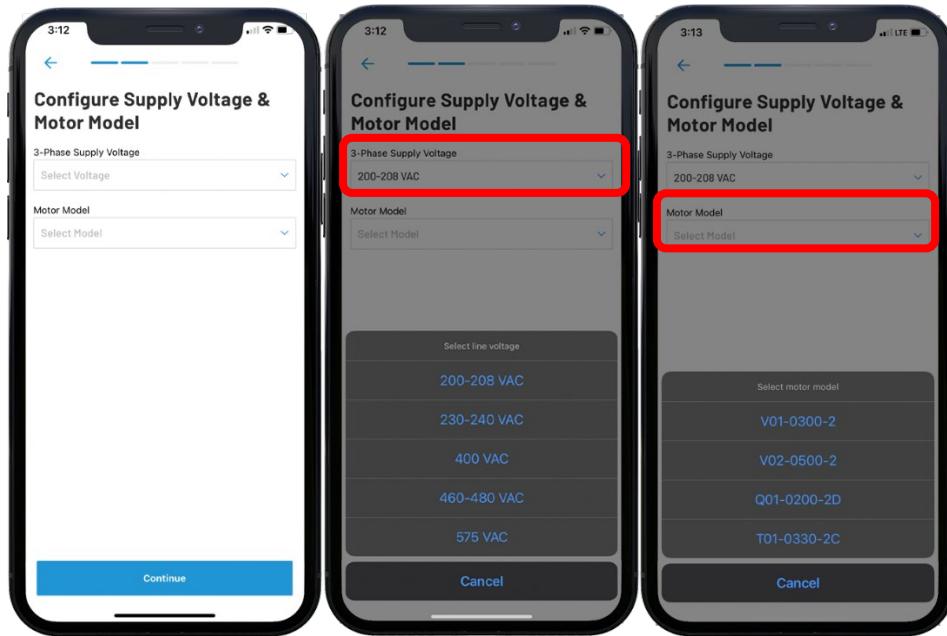


3. The **Scan Motor Barcode** instruction appears. Scan the barcode on the Turntide motor nameplate. (Optionally, you can tap **Enter serial number manually** to enter the barcode number.) Scan the Turntide motor controller barcode.

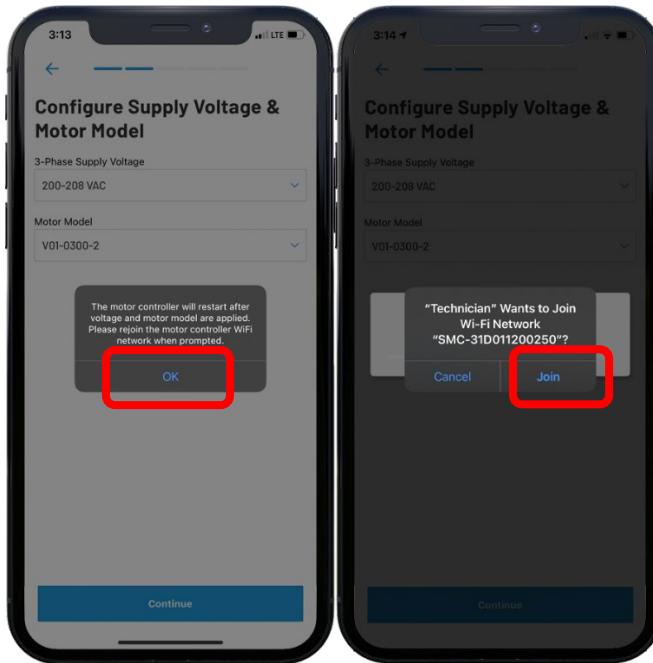


If necessary, tap the light icon to turn on your phone's light. Use two fingers to pinch-n-zoom the screen for an optimal view.

4. The **Configure Supply Voltage & Motor Model** message appears. From the dropdowns:
 - a. Select the correct voltage. *Selecting the incorrect voltage may result in over/under voltage errors.*
 - b. Select the correct Turntide **Motor Model**. Only models with compatible voltage are displayed. *The model number is found on the motor nameplate.*
 - c. Tap **Continue**.



5. A restart message appears. Tap **OK** to acknowledge that the motor controller will restart. This may take several seconds.
6. After the motor controller restarts, tap **Join** to rejoin the motor controller WI-FI network.



Step 2: Configure motor parameters

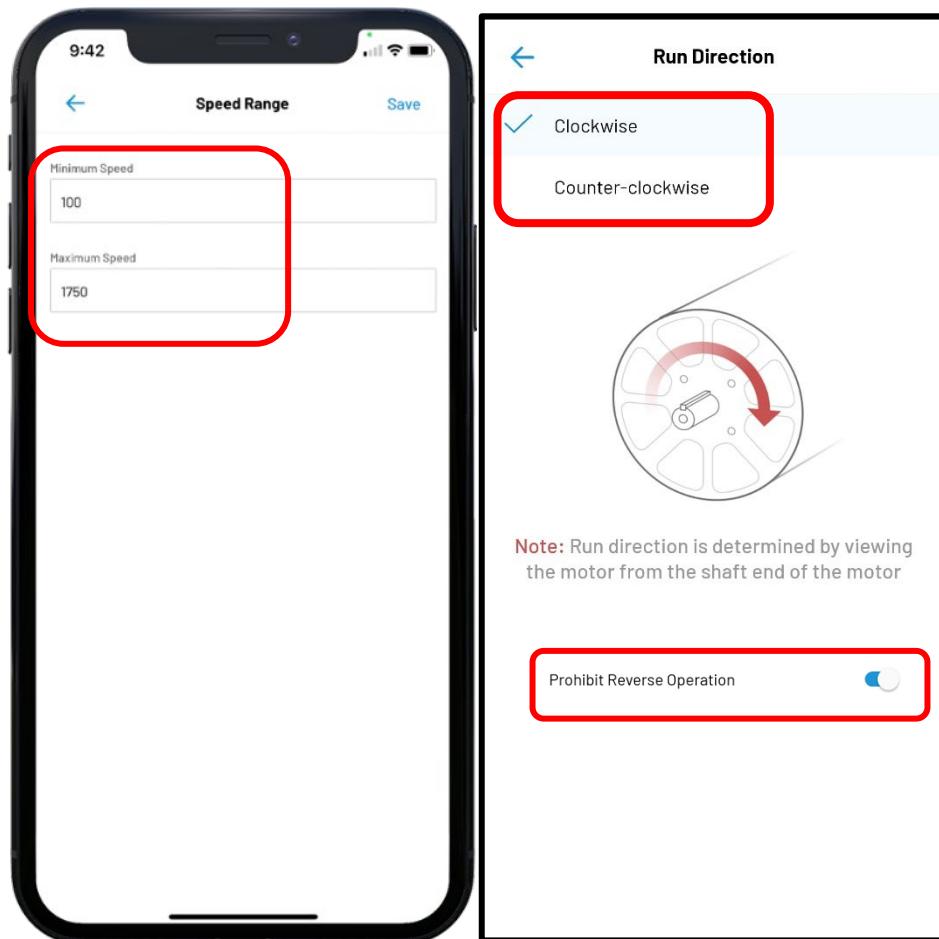
After you rejoin the motor controller WI-FI network, the **Configure Speed Range** instruction appears.

1. Leave the default **Minimum Speed** of 100 and enter a **Maximum Speed** as listed on the original induction motor nameplate.



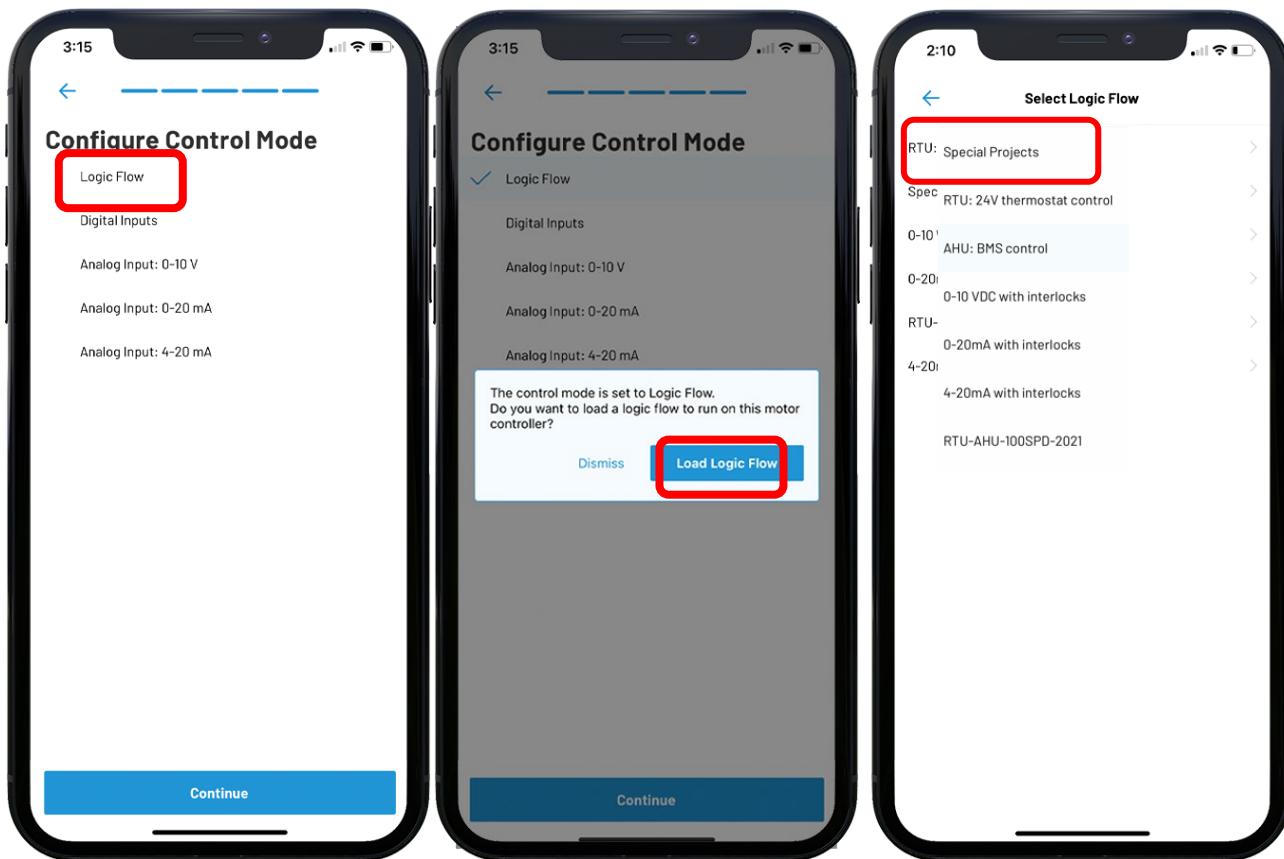
Speed range should never be set below 100 or above that listed on the original induction motor.

2. Click **Continue**. The **Configure Direction** instruction appears in the **Run Direction** screen.
3. By default, the direction is **Clockwise** and **Prohibit Reverse Operation** is set to **ON**.
4. Click **Continue**.



Step 3: Configure the control mode

1. After you have finished configuring direction, the **Configure Control Mode** instruction appears.
2. Tap **Logic Flow**. (Logic Flow is the most common controller mode for RTU and AHU applications.)
3. Tap **Load Logic Flow** to confirm that you want to load a logic flow to run on the motor controller.
4. The **Select Logic Flow** screen appears. Use one of the following logic flows:
 - a. For an RTU, select **RTU: 24V Thermostat Control**
 - b. If your Turntide representative has informed you to use a Special Projects logic flow, use **Special Projects**
 - c. For an Air Handling Unit (AHU), select **AHU: BMS control**.

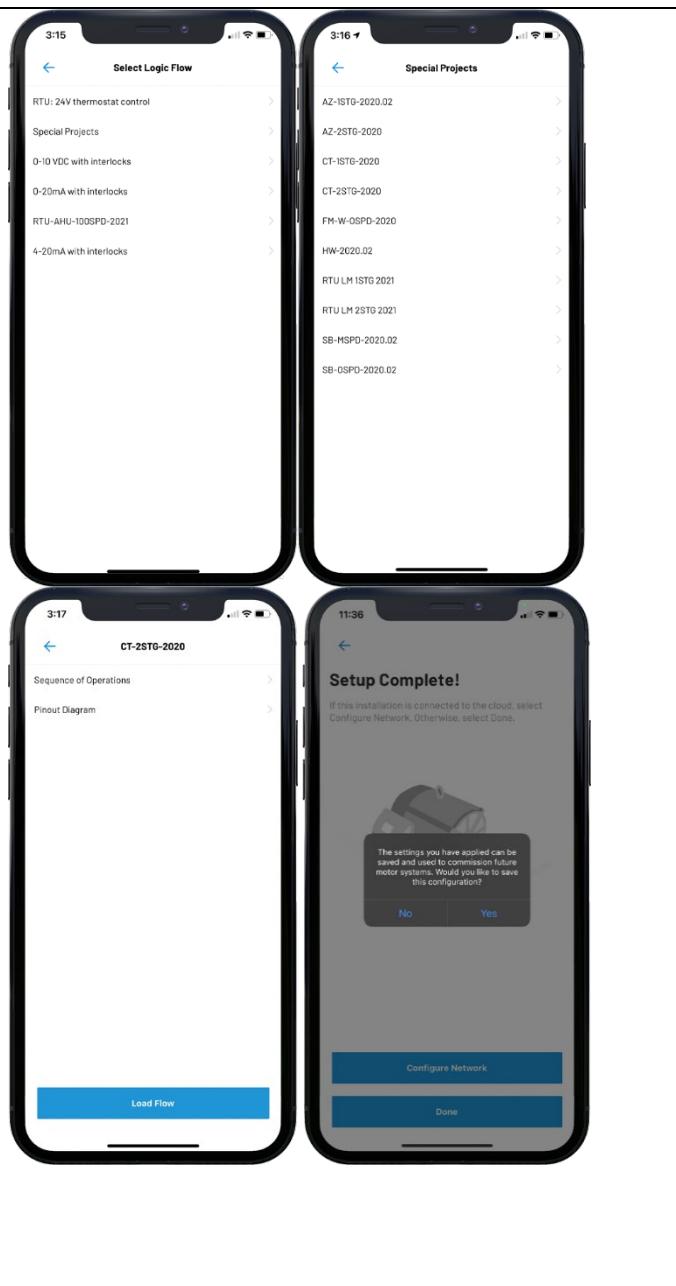


For this example, we are using Special Projects.

Special Projects

Logic flows for large rollouts with pre-specified unit operation parameters. A Turntide representative advises technicians if they are working on special project and which logic flow is necessary.

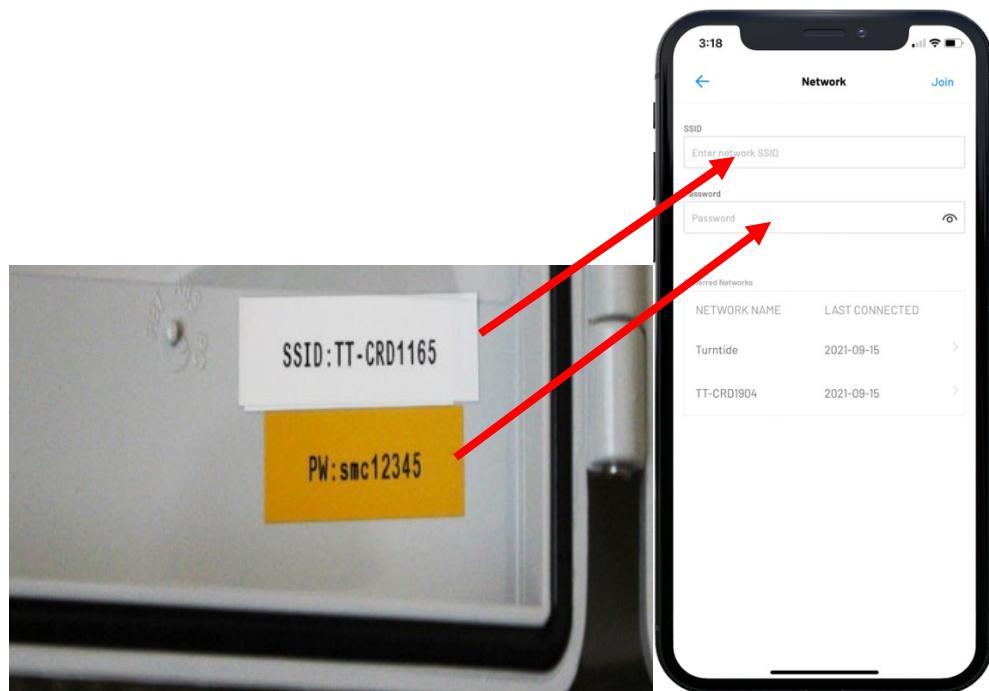
- a. In the **Select Logic Flow** screen, tap **Special Projects**.
- b. The **Special Projects** screen appears with specific logic flows listed.
- c. Select (tap) the flow name given to you by your Turntide representative.
- d. A screen with the logic flow name at the top appears. Tap the **Load Flow** button.
- e. The **Setup Complete!** message appears. Tap **Yes** to save the applied settings.
- f. If your project does **NOT** include an RMK, tap the **blue Done** button to complete the setup.
If your project does include an RMK, proceed to [Step 4: RMK Connection](#).



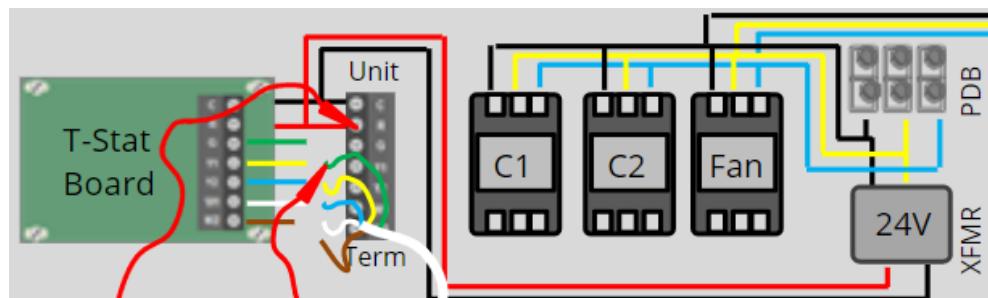
Step 4: RMK Connection



1. After the logic flow is loaded, the **Setup Complete!** message appears. If the project includes an RMK, tap **Configure Network**.
2. Ensure the RMK unit is powered on. Tap **Join Wireless Network**.
3. Enter the **SSID** number and the **Password** exactly as they appear on the label (mix of uppercase and lowercase letters). Both are found inside the RMK enclosure cover.



4. The screen now displays a check mark confirming that the motor controller is now connected to the RMK.
5. Tap **Home** in the upper right of the screen to return to the motor home screen.
6. Tap **Done** to return to the motor controller home screen.
7. Try to run the motor again:
 - a. Use a jumper to apply 24V to any of the **white** cable input wires at the thermostat end of the cable. This should cause the motor to run.



Motor Controller Jumper Pin Overview

Turntide motor controllers are designed for several applications. The jumpers are used to configure the motor controller for a specific application.

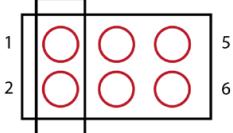
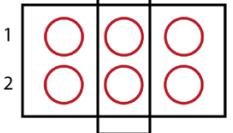
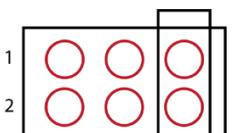
The **Digital Input Mode** jumpers determine the inputs the motor controller recognizes.

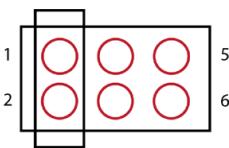
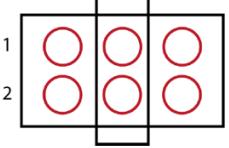
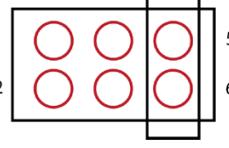
- The most common configuration is a jumper across pins 1&2 and another across pins 5&6.
- Pins 1&2 enable the MODBUS EOL resistor.
- Pins 5&6 set the motor controller to respond to 24VAC inputs.

The **Universal Input (UI)** jumpers define the connected device type.

- Currently UI3 and UI4 are used in applications with Supply and Return Air sensors.
- Setting the respective jumpers across pins 1 & 2 configure the control to respond to the resistive load of the thermistor.

Important: Mode Input Selection must be jumpers 1&2 and 3&4 OR 1&2 and 5&6.

Motor Controller Model	Modbus EOL Jumper	Digital Input Mode Jumper	Universal Input Mode Jumpers			
			UI1	UI2	UI3	UI4
P04W	J96	J96	J5125	J111	J112	J113
P05	J96	J96	J5125	J111	J112	J113
SL120	J10	J10	J11	J12	J13	J14
Modbus EOL Selection						
Pin Selections		Mode			Examples	
1 & 2		Installed: Enables EOL Resistor (End of line) Removed: Disables EOL Resistor (End of line0			Install if wiring to terminals D+/D is end of daisy chain.	
						
Digital Input Mode Selection						
Pin Selections		Mode			Examples	
3 & 4		Enables digital inputs LOGIC or dry contact mode.			Install if S1 through S7 will be used to receive contact closures for control.	
						
5 & 6		Enables digital inputs 24VAC signaling mode.			Install if S1 through S7 will be used to received 24VAC input signal from existing BMS or thermostat.	
						

Universal Input Mode Selection		
Pin Selections	Mode	Examples
1 & 2 	Resistive/LOGIC: Returns resistance of connected element or ON/OFF if declared as resistive or LOGIC mode, respectively.	Resistive: 2 wire 10K Ω thermistor LOGIC: Dry contact closure = ON Dry contact open = OFF
3 & 4 	Voltage: 0-10V signal ended voltage input.	3-wire device with external power source that provides 0-10V signal. (1 signal, 1 common, 1 power)
5 & 6 	Current: 0-20mA current input.	3-wire device with external power source that provides a 0-20mA signal. (1 signal, 1 common, 1 power)

TURNTIDE TECHNOLOGY FOR SUSTAINABLE OPERATIONS

Our breakthrough technologies accelerate electrification and sustainable operations for energy-intensive industries.