Flyin' Miata INSTALLATION INSTRUCTIONS

1990-2005 STAGE 2 AIRFLOW KIT
09-56211 & 09-56216

Thanks for purchasing our Stage 2 V2 airflow kit. Using a brushless fan allows this kit to flow massive amounts of air, but only does so when needed - it's nearly silent in normal operation. The installation is fairly straightforward, but it is a tight fit so be prepared to problem-solve. If you have any questions during installation or suggestions for improvement, to the product or the instructions, please don't hesitate to call or email.

WARNING: Not everyone can perform every installation. It is critical that you be honest with yourself in regards to your ability. We're more than happy to help, but there are only so many things we can do from the other end of a phone / computer. If in doubt, discuss the install with us before you dive in. Improper installation could cause injury and / or death!

Required tools:

- **Metric socket set**
- **Wire cutters**
- **Wire strippers**
- **Quality wire crimpers**
- **Heat gun**
- **Pliers**
- **ECU terminal pin crimpers (for standalone ECU control only, NOT the same as standard crimpers)**
- **Electrical tape**
- **Thread paste**
- **Heavy duty cutters**

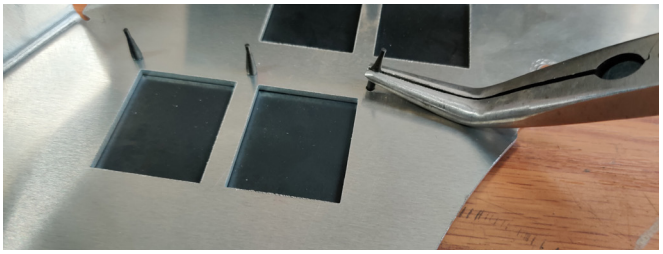
Torque specs:

- **Fan bosses: 40 lb-in (not ft!)**
- **M6 inserts in shroud: 40 lb-in (not ft!)**
- **Radiator mounting bolts: 14-20 lb-ft**
- **Sway bar brackets: 14-19 lb-ft**

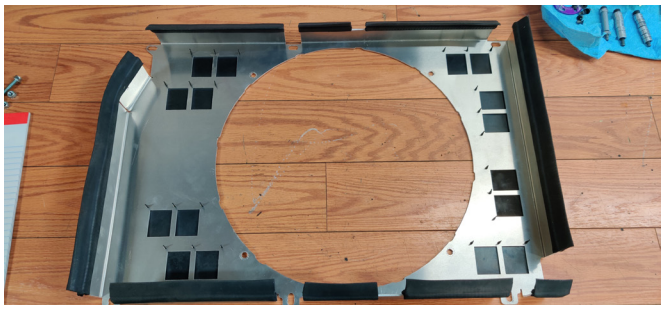
Note: there are two different fan shrouds available in this kit, one for our crossflow radiator and one for downflow radiators. Not all images will represent your kit.

1. First, get the car in the air and remove the splash pan. This fan is a tight fit and we'll need as much room as possible to maneuver things.
2. Drain the radiator (it will need to be removed and reinstalled). There should be a drain plug in the bottom of the radiator, remove it and use a drain pan to contain the fluid. Be sure your drain pan is clean if you intend to reuse the fluid. If you don't, be sure to dispose of it appropriately. Disconnect the negative terminal of the battery as well.
3. Disconnect the hoses and fan wiring carefully and remove the radiator and fans as one piece. On NAs, remove the bolts (see picture) that hold the radiator brackets to the chassis. On NBs, remove the two brackets on either side of the top of the radiator. Pull the radiator straight up and out of the car. From our experience, it's impossible to fully drain a radiator, so be prepared to pour some coolant on your shoes.

4. Remove the original fans from your radiator. If you have a fan setup with a separate shroud, leave the fans in the shroud and remove the shroud from the radiator. Set the radiator aside for the time being.
5. Grab the new shroud and the rubber flaps (09-59960). Line up the nipples of the flaps with the three tiny holes and carefully pull them through with pliers. Pull them gently and only far enough to make the flap flush on the opposite side. It is possible to pull the nipples off, so be careful.

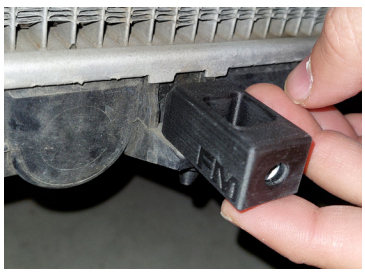


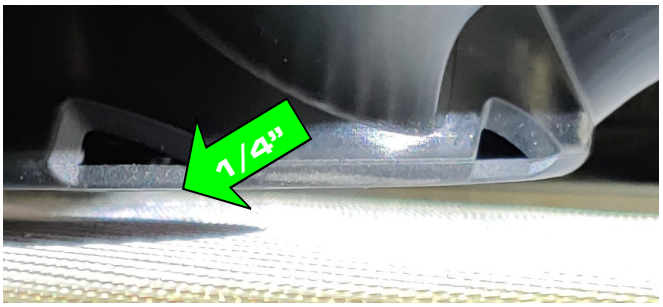
6. Line up the weatherstripping to the rear edges of the shroud. Using heavy duty cutters, cut the weatherstripping as needed to have it skip over any gaps in sidewalls of the shroud and press the weatherstripping into place.



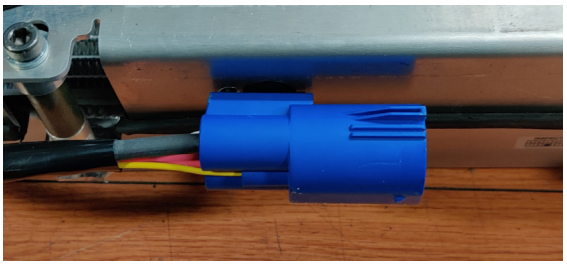
7. Insert the fan into the shroud and orient the plug pointing down and toward the driver side. To bolt the fan to the shroud, insert the cylindrical part of the supplied weld nut (36-20730) into the fan's mounting flange hole. Now, apply a drop of blue Loctite to the threads and install the M6x16mm bolts (36-10617) from inside the shroud until it threads into the weld nut. Use a 13mm wrench on the flats of the weld nut to prevent it from rotating while tightening, if necessary. Repeat this for each of the four fan mounting points and torque the bolts to 40 lb-in (NOT lb-ft!)

8. Now we're ready to mount the shroud to the radiator. The shroud is intended to be installed at a slight angle relative to the radiator for clearance. Each of the lower three mounting locations will use a 50mm long M6 bolt (36-10650), M6 washer (36-30120), and a 38mm spacer (36-15120). Each of the three upper mounting locations will use a 60mm long M6 bolt (36-10660), M6 washer (36-30120), a 38mm spacer, and two 4mm spacers (36-15122). On FM crossflow radiators, an additional 1/4" aluminum spacer (09-59965) is required on the lower driver's side mounting boss. Loosely mount the fan shroud to the radiator.
9. If you are installing a downflow shroud onto a radiator with stock style driver side lower fan mounts, you will need to use the bracket kit (09-59005) included. Install the peg of the bracket into the radiator, then the shroud should be bolted to the bracket. Be sure the bracket's peg is fully seated into the radiator mount when tightening the shroud hardware.



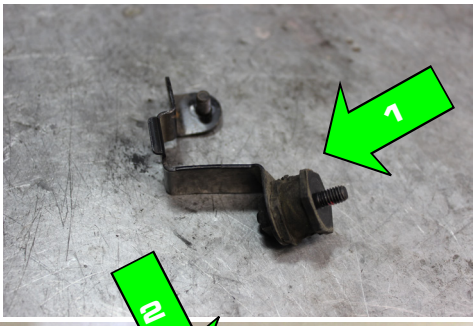


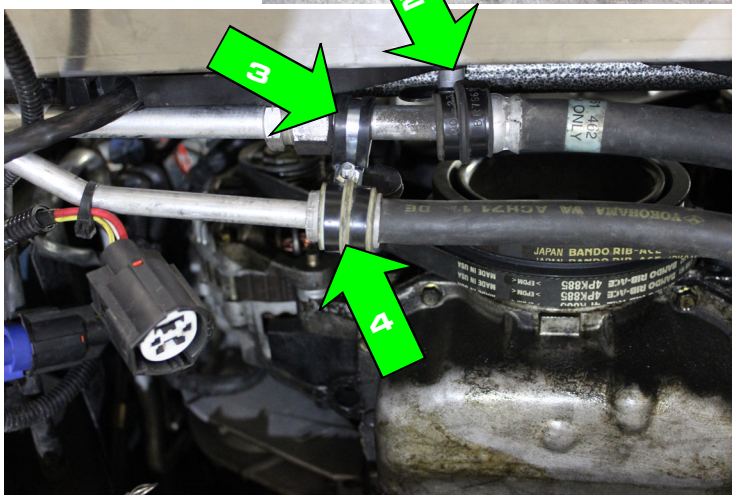
10. Check the gap between the fan and the radiator, an approximate 1/4" gap is required. If the gap is too small, three extra 4mm spacers are included to install at either the upper three or bottom three shroud mounting points to gain additional clearance. Look to see how well the weatherstripping seals against the radiator. The weatherstripping can be flipped to have the flap portion orient differently to the radiator to gain or take up clearance. With the variations found in after-market radiators, tweaks to the shroud may be necessary to have the best seal possible. Trim or bend the shroud's sidewalls for clearance as necessary. Once satisfied with the fitment of the fan shroud to the radiator, tighten down the six mounting bolts to 40 lb-in (NOT lb-ft!).



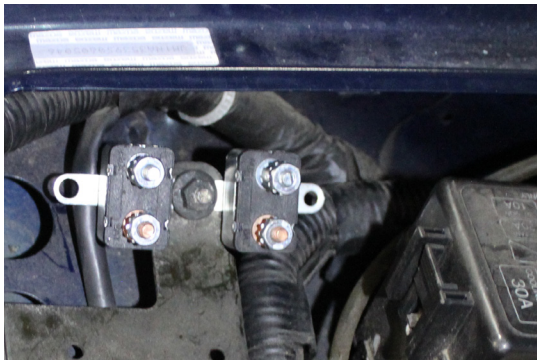
11. There are optional mounting holes on one of the bottom flanges to be able to secure the fan's connector using the retaining pins that came on the connector.
12. Under the car, loosen the front sway bar brackets and push the sway bar toward the back of the car to provide as much space for the new shroud as possible. Leave the hardware loose for now.
13. Install the assembled radiator into the car. Do this slowly and look out for any potential interferences. If any arise, make adjustment to either the shroud or the object causing the interference.
14. Once the radiator's lower mounts are fully seated, secure the top of the radiator and torque the fasteners to 14-20 lb-ft. Do one last double check for any contact, such as the sway bar against the fan, or an A/C line against the shroud. At this point tighten up the sway bar brackets and ensure that there is not hard contact between the fan and sway bar.
15. If everything looks good, go ahead and install the upper and lower radiator hoses. Again, check for any interference between the radiator hoses and the shroud. If major contact exists, either trim the shroud as needed or if your existing radiator hose has been cut short, a new radiator hose will likely fit better. Add some of the supplied rubber edge trim (36-90060) to any edges that are close to contacting a hose. Remember, hoses will expand when the car warms up.

16. **NA cars only:** The AC lines were originally attached to one of the lower fan mounting bosses, but that won't work with the new shroud. You'll need to disconnect the two metal and rubber clamps from this bracket (1), then remove the bracket from the car. The bracket won't be reused. Remove the clamp from the upper hose, flip it over, and reinstall it a bit to the left. This clamp's tab will bolt onto the shroud using the lower center mounting bolt (2). Slip a new clamp (36-70500) around the upper pipe (3). Use an M6 x 1.0 x 16mm bolt (36-10402), M6 washer (36-30120) and M6 locknut (36-20136) to hold the new clamp on the upper hose to the original clamp on the lower hose (4).



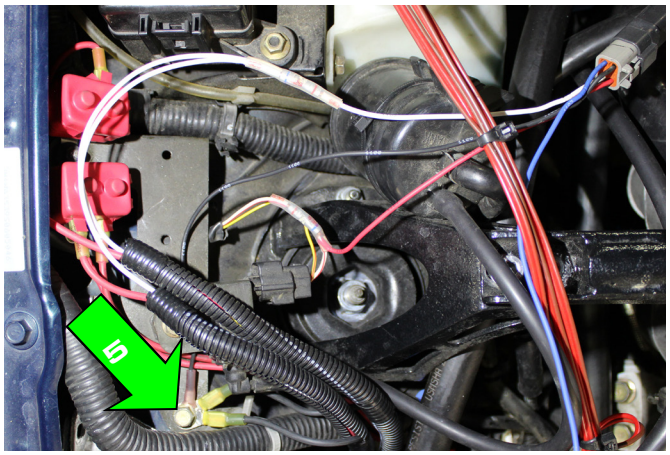


17. Mount the breaker (36-80327) as shown in the picture (Stage 2 V2s use a single breaker). This could be different but similar on your car. Use the M5 x 0.8 x 16mm bolt (36-10516), 2X washers (36-30020), and M5 nylock nut (36-20143). Slip a red breaker cover (36-80340) over the breaker, leaving the top open so the terminals can be secured. The studs on the breaker will have current flowing through them, so try to position them such that shorting them out would be as difficult as possible.



18. Plug the jumper harness (SBL-YAZ-PT) into the fan connector at the bottom of the radiator. Route it towards the right side (passenger side in the US), fastening as needed with the included zip-ties (don't go too far at this point). Don't pull the wires tight anywhere, allow a little slack for movement.
19. Route the red wire to the "AUX" (steel) stud of the breaker. Use the yellow ring terminal with the smaller eyelet (36-80061) for this wire.
20. Run a length of red 10ga wire (36-80220) from the breaker to the stud on the alternator. Connect this wire to the "BAT" (copper) stud on the breaker with the smaller yellow ring terminal (36-80061). Use the yellow ring terminal with a larger eyelet (36-80063) on the alternator side. Once the terminal on the breaker has been tightened, flip the top of the breaker cover up and press it over the studs.

21. Find a solid ground, and run the black wire from the jumper harnesses to that ground (5). The ground should be on the chassis and shouldn't be lightweight, small, or rusty. Use the smaller yellow ring terminal (36-80061) here as well.



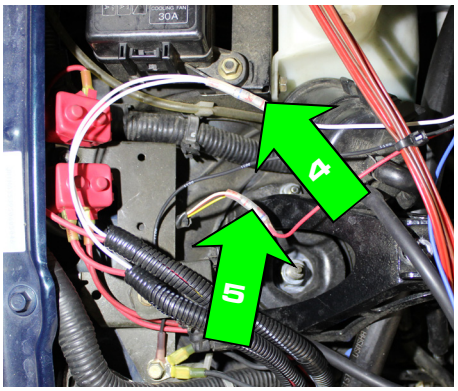
22. Proceed to the appropriate section based on how you'll be controlling the fan. Note that the yellow wire on the jumper harness is NOT used.
23. Clean up the wiring once you're done wiring the appropriate control (next sections).

Integrated control pack

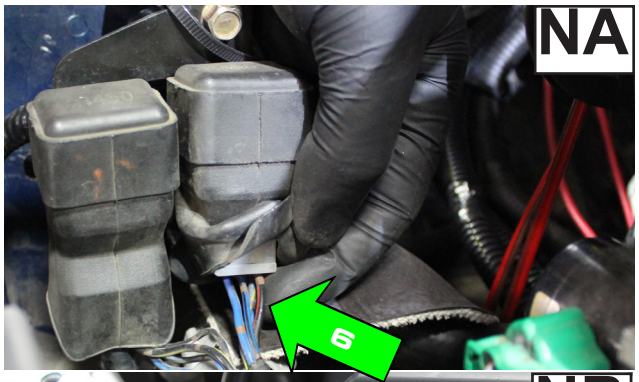
(Skip this section if you're controlling the fan with an ECU)

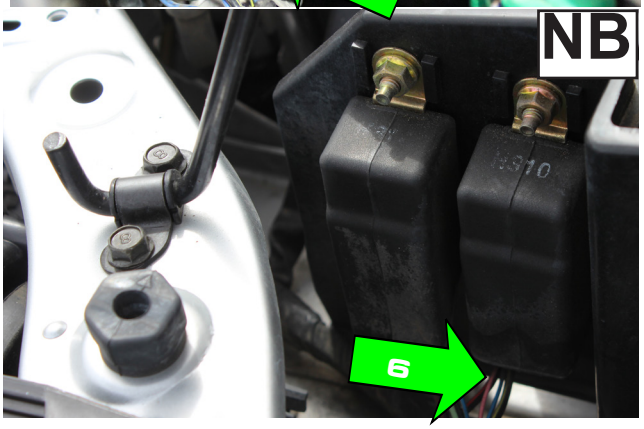
If ECU control isn't an option for you, or if you'd like to avoid any programming, the Spal controller will work fine. There's a bit more wiring involved, and you need a place to install the sensor, but it's pretty straightforward otherwise. Refer to the graphic on the page 9 for more clarification. Bear in mind that it's a generic picture and doesn't exactly match our instructions.

1. Install the four-wire sensor (SBL-TS-215P). This can be threaded into any 3/8" NPT hole in the hot side of the cooling system (e.g., upper radiator hose) with sufficient clearance for both sides of the sensor. The sensor should be placed in a hot portion of the cooling system - don't install it on the radiator outlet (i.e., lower radiator hose). One option is our hose splice (09-32035, available on our website (no separate ground needed)) or simply drill and tap somewhere in the system. Stock systems probably won't have a suitable place, systems with a reroute might. Be sure there's room for the sensor both inside where you're tapping and the sensor and its wiring on the outside. Be sure to seal the threads; we typically prefer thread sealant as opposed to thread tape, but it's less important on cooling systems.
2. Plug the Spal sensor harness adapter (SBL-TS-HARN) into the sensor.
3. Connect the white wire from the sensor harness adapter the white wire from the fan jumper harness (4). Use a pink butt connector included with the sensor kit.
4. Use the small red ring terminal (36-80054) to connect the black wire to the same grounding point as was used for the fan.
5. Use a three-way butt connector (36-80101) to connect the small red wire from the sensor to switched power. Leave it uncrimped for now if you want to run a separate fan switch (see step 7). You will add another wire to the butt connector in step 7.
   If you're not running a separate switch, go ahead and crimp and seal the butt connector now. White with a red stripe should be switched power, but confirm with a multimeter. We typically use the power for the charcoal canister solenoid (5, on the passenger side of the engine bay, near the shock tower).



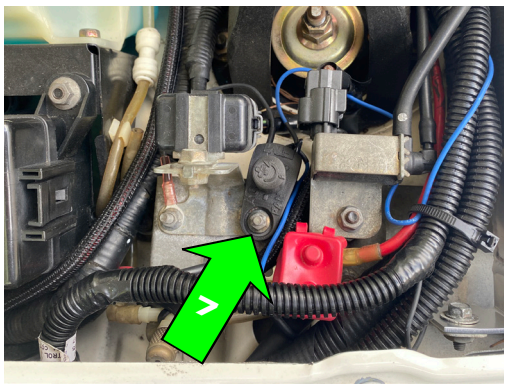
6. The blue wire from the Spal sensor triggers the fan to full speed. If you have AC, you MUST use this wire so that the fan comes on when the AC is engaged. Failure to ensure that the fan comes on with the AC will over-pressurize the system quickly (and make a horrible noise). Follow step eight to wire for AC.
7. If you don't have AC, you can connect the blue wire to a switch (not included) to allow you to command full speed as needed. Connect the blue wire to one side of the switch and connect the other side to the switched power source from step 5.

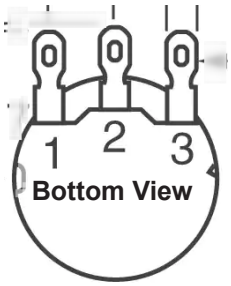




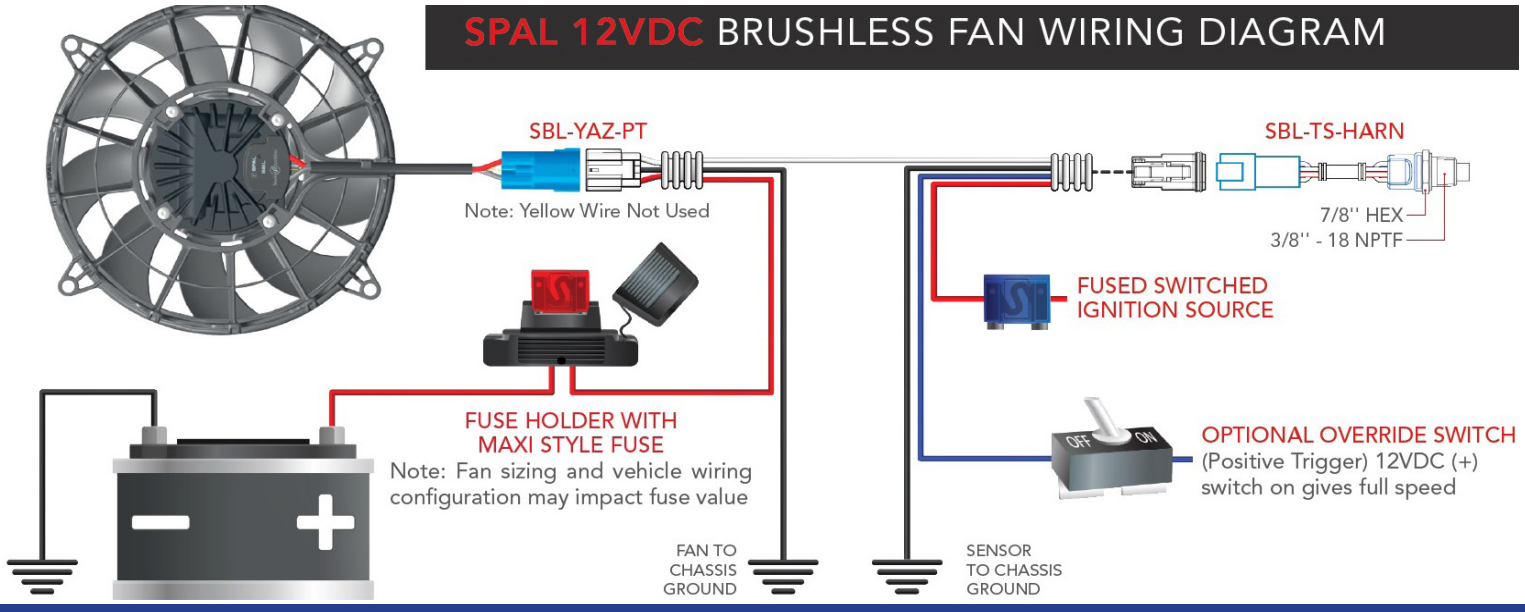
If you have AC, you MUST wire a separate trigger for the fan. Refer to steps 8 or 9 to see how to install the AC trigger.

8. **If you did NOT purchase our brushless fan AC controller kit,** use another three-way butt connector (36-80101) to connect the blue wire from the Spal sensor to the AC triggered power output from the AC relay (6). On a 90-93, the switched power output from the AC relay is a black wire with a blue stripe, 94-00 is black / red, 01-05 (including MSM) is black / yellow. The NA AC relay is at the front of the passenger side, the NB relay is at the front of the driver's side.
9. **If you purchased our brushless fan AC controller kit**, Install the potentiometer into the 3D printed housing and add the knob. The knob and bracket have matching ridges. One on the knob, three on the bracket. The bracket's ridges are for at each end of its rotation and one in the middle, these are there to help gauge where you are in the pot's rotation. We suggest that you spin the pot all the way in one direction, then install the knob with the ridge lined up with the appropriate ridge on the base. Determine where you wish to mount the potentiometer. It needs to share an existing M5 mounting bolt and should be easily accessible once installed. The image to the right shows an example location on an NA (7). Don't fully install it at this time. You just need to know where it installs since the next steps involve cutting wires to length to reach it at its installed location.





- Use a three-way butt connector (36-80101) to tee in the red wire supplied with the kit to the AC triggered power output from the AC relay (6, previous page). On a 90-93, the triggered power output from the AC relay is a black wire with a blue stripe, 94-00 its black / red, 01-05 (including MSM) is black / yellow. The NA AC relay is at the front of the passenger side. The NB relay is at the front of the driver's side.
- Route the wire from the AC relay to reach the potentiometer and attach it to terminal 1 after crimping on a supplied female spade (36-80162).
- Route the blue wire from the Spal controller to the potentiometer, lengthening it as needed with the white wire and pink butt connector (36-80100) supplied in the kit. Attach a supplied female spade (36-80162) and connect it to terminal 2.
- Add a female spade (36-80162) on the supplied black wire to one end and connect it to terminal 3. The other end will attach to chassis ground using the supplied eyelet (36-80054). Cut it to length before adding the eyelet.
- Terminal pin numbering appears on the body of the potentiometer and the diagram to the right.
- Now that all the wires are attached to the potentiometer, fully install it in the desired location.
- Adjust the fan speed to work for your setup using the following information as a guide: 2V on the blue wire = 30% fan speed, 10+V = 100%, and the speed varies linearly between the two voltage values. Adjust the voltage accordingly. 50% (~5V) will probably be okay, but you might need more on especially hot days. Bear in mind that there's no intelligent control here; you'll need to increase the voltage if you hear a terrible noise coming from your AC compressor. Most Miatas have no high-pressure switch to turn the AC off if the pressure is too high. The fan will always run at the highest speed commanded, so if your AC is set at 50%, but the temperature dictates 70%, the fan will run at 70%.



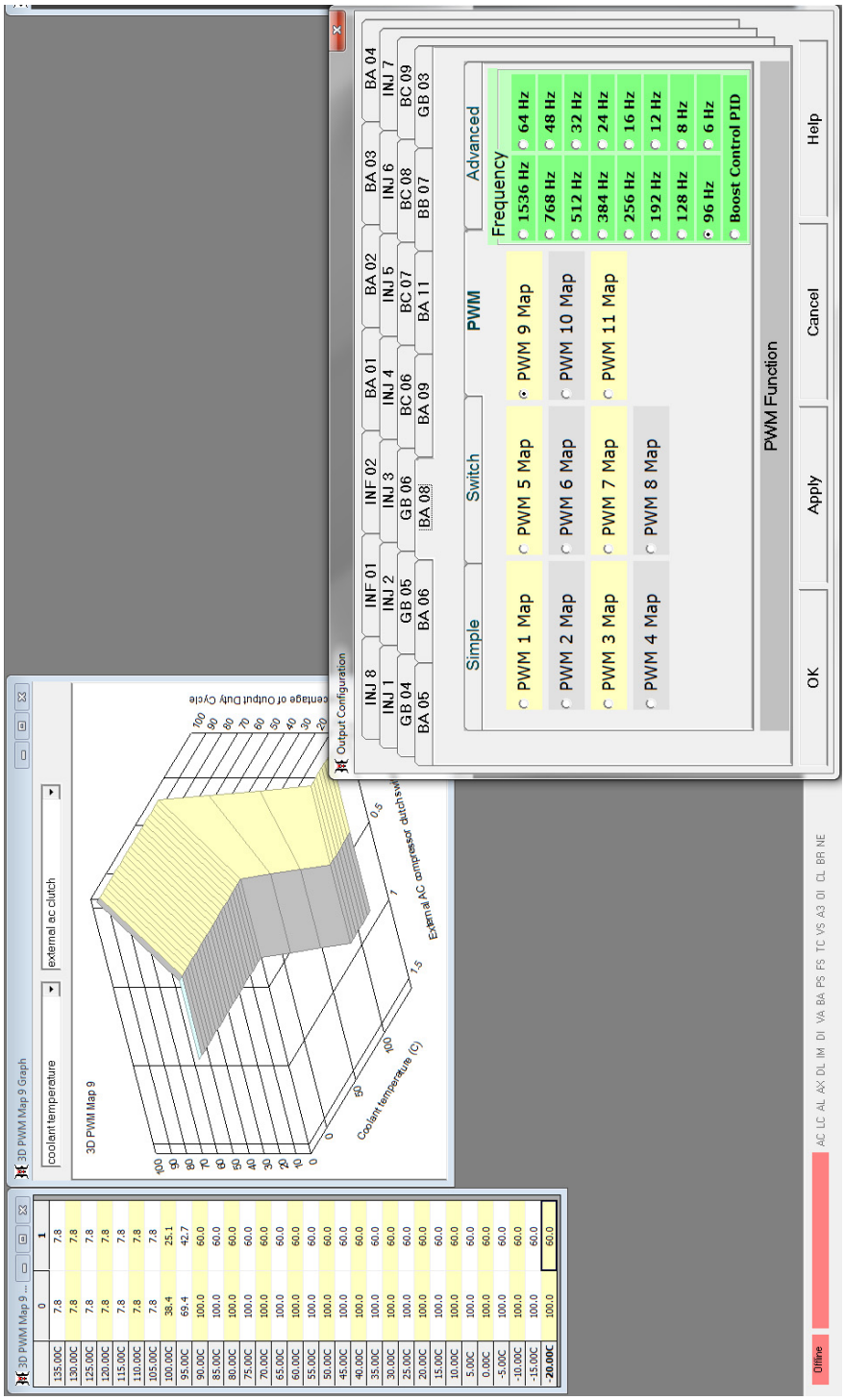
Hydra ECU control

(Skip this section if you purchased the control pack or are using a non-Hydra ECU)

ECU control of this fan works very well. Use of the Hydra means you need fewer parts and have an easier install. It also equates to more intelligent / less intrusive fan control with air conditioning.

1. The white wire from the jumper harness needs to be run back to the ECU. If the white wire does not reach the ECU, it will need to be lengthened. Install a pink butt connector (36-80100) to the white wire of the jumper harness. Cut off the exposed section of the yellow wire from the jumper harness (since it does not get used otherwise) and attach it to the other end of the pink butt connector and route the yellow wire to the ECU. You must source a single ECU terminal pin for the Hydra and **YOU MUST USE ECU TERMINAL-SPECIFIC CRIMPERS!!** Generic crimpers won't work for this terminal. Connect this wire to the appropriate output for the PWM map you're using (read the next step). Refer to the Hydra wiring diagram that was emailed with your Hydra originally for the output locations. If you don't have that diagram, email tuning@flyinmiata.com for another copy.
2. See the screenshot for how to set up your Hydra if you're using AC. If you don't have AC, use a 2D PWM map and only the left column plotted to coolant temperature. If you do have A/C, use a 3D PWM map as per the screen shot. Be sure to adjust the following:

- Match the frequency to 96 Hz.
- Choose the tab that refers to the output you've connected the white wire to. In the screenshot, you can see that we're using output BA 08 (small blue plug, top row, eighth location) which is an available linear ground in all year harnesses.
- Be sure to choose an unused PWM map. It doesn't have to be 9, but be sure that it's not used by anything else. PWM maps aren't used by default, if you don't already know that you're using a PWM map you probably aren't. 1-8 are 2D maps, 9-11 are 3D.
- We recommend matching our temperature:duty cycle numbers to start, but those can be adjusted to fit your needs. Any duty cycles from 5-10% are treated as full speed on by the fan, commanding less than 5% will turn the fan off. In other words, NEVER command less than 5%. NOTE THE PWM SLOPE IS INVERSE TO THE OUTPUT.
- Be sure one axis is "coolant temperature" regardless of whether you're running a 2D or 3D PWM map. If you're running a 3D map, the other axis should be "external ac clutch". The "0" column is the duty cycle without AC, the "1" column is with AC.


3D PWM Map 9 Graph
coolant temperature
external ac clutch
3D PWM Map 9
Coolant temperature (C)
External AC compressor clutch switch
Output Configuration
Simple
Switch
PWM
Advanced
PWM 1 Map
PWM 2 Map
PWM 3 Map
PWM 4 Map
PWM 5 Map
PWM 6 Map
PWM 7 Map
PWM 8 Map
PWM 9 Map
PWM 10 Map
PWM 11 Map
Frequency
1536 Hz
768 Hz
512 Hz
384 Hz
256 Hz
192 Hz
128 Hz
96 Hz
64 Hz
48 Hz
32 Hz
24 Hz
16 Hz
12 Hz
8 Hz
6 Hz
Boost Control PID
PWM Function
OK
Apply
Cancel
Help
Offline

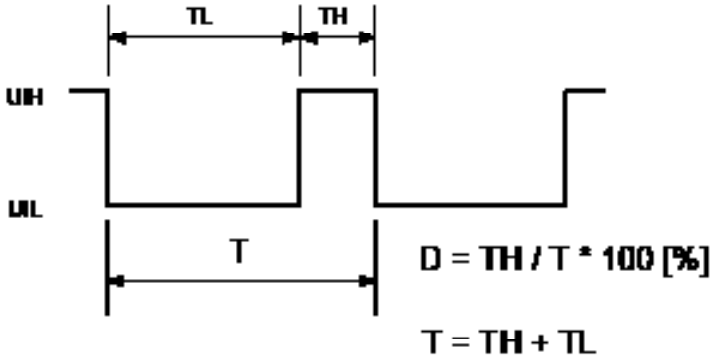
Non-Hydra standalone ECU control

(Skip this section if you purchased the control pack or are using a Hydra ECU)

ECU control of this fan can work very well, but the specifics are largely up to the end user. You'll need an ECU that has a 2D or 3D PWM map output, the fact that you have a standalone is NOT necessarily enough to control this fan. Many standalones don't have PWM outputs. For example, our FM221 can't output a PWM map.

1. The white wire from the jumper harness needs to be run back to the ECU. Install a pink butt connector (36-80100) to the white wire of the jumper harness. On the other end of the butt connector, attach the supplied white 18ga wire (36-80200) and route the wire to the ECU. You must source the appropriate ECU terminal pins to work with your brand of ECU. **YOU MUST USE ECU TERMINAL-SPECIFIC CRIMPERS!!** Generic crimpers won't work for this terminal.
2. Since you're not using our Hydra ECU (if you are you're reading the wrong section), you'll have to modify your PWM map yourself. The fan must run with AC (but not necessarily at full speed all the time), be sure to account for that in your programming. Any time the AC clutch is engaged, the fan should be spinning at no more than 60%. Refer to the Hydra section for an idea of how we program the output. We use a 3D PWM map with the Hydra to account for both coolant temp and AC. Any duty cycles from 5-10% are treated as 100% by the fan, **commanding less than 5% will turn the fan off.** In other words, NEVER command less than 5%. Refer to the Hydra section for our temperature:duty cycle curve, as well as how we increase the duty cycle based on the AC clutch. If you're unable to create a second (or 3D) map for AC control, follow steps eight and nine in the "Integrated control pack" section of the instructions.
3. We can't support parts we don't sell or know, so we won't be of any help in setting up your non-Hydra ECU beyond what's above. Contact your tuner or the ECU provider for additional assistance. You can always add the integrated control pack after the fact as well, it will work with any form of engine management.
4. See the Spal brushless PWM requirements on the following page for additional details.

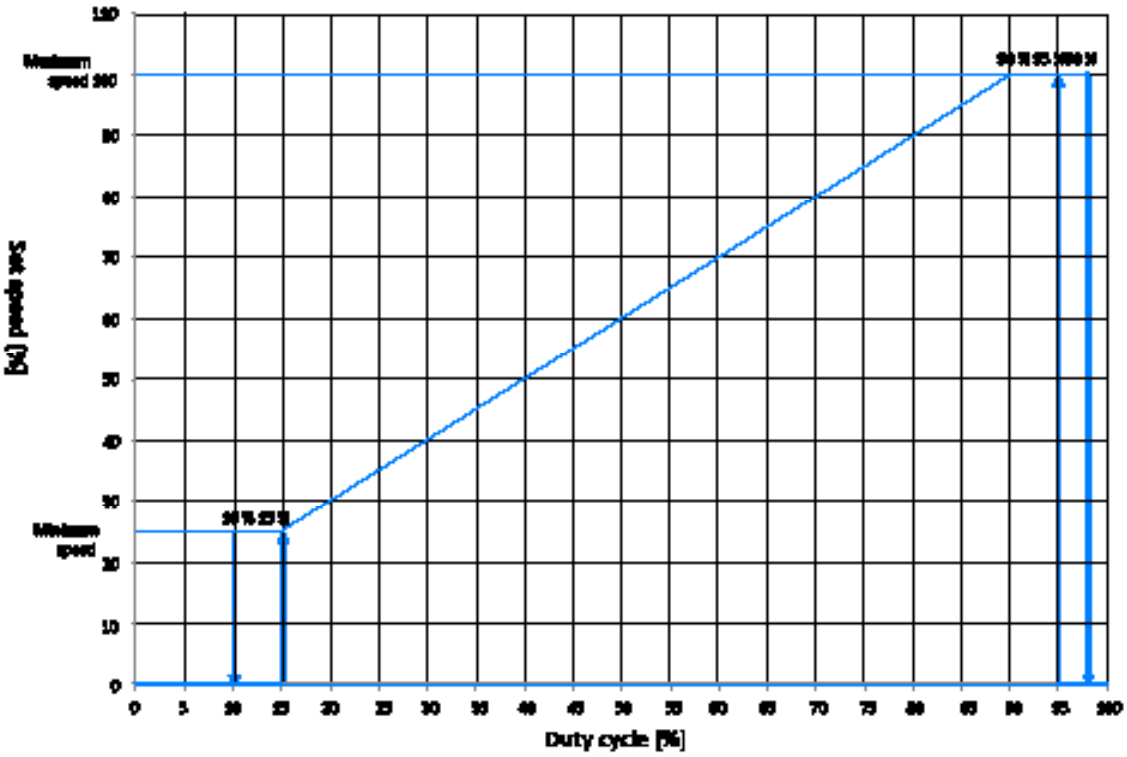
SPAL Brushless Fan PWM Requirements



Duty cycle definition "positive logic duty cycle definition"

Considering this definition,

- continuous low voltage is 0 % duty cycle (dominant level)
- continuous high voltage is 100 % duty cycle (recessive level)



Digital PWM input parameters:

Parameters	Min	Typical	Max	Unit
PWM frequency range	50	100	500	Hz
PWM duty cycle range	0		100	%
PWM high level voltage				V
PWM low level voltage				V
PWM resolution		1		%
PWM accuracy		1		%
PWM wire current load	-10 %	4.8	+10 %	mA

Usage info

- When the fan is first powered, it will twitch then stop. This is the “parking phase” and is normal. The same happens if you flip the switch for full speed, it will take 5-10 seconds for the fan to park then ramp up to the requested speed.
- The fan gradually speeds up, it doesn’t instantly accelerate to the requested speed. This is true whether you’ve flipped the override switch or turned the ignition on when the car is hot. This helps limit the surge load, and makes the fan less likely to pop breakers than smaller “normal” fans that are simply on or off. It also lessens the likelihood of idle droop due to the fan turning on.
- Be prepared to hear the fan MUCH less often than you’re used to. Don’t be surprised if you don’t hear the fan at all during normal operation. This is partially because it’s very quiet at slow speeds and partially because it moves massive amounts of air, requiring less noise for a given coolant temperature. Remember, it only spins as fast as necessary, unlike most fans that are either on or off. Of course, at full speed it’s hard to miss.
- Between the brushless design and PWM control, it’s not unusual to see an increase in hp and mpg. It won’t be a big difference, but roughly 1 mpg and 0.5 hp is possible.
- The fan at full speed will pull a bit over 40 amps. Stock alternators are typically rated at 65 (NA) - 80 (NB) amps, so you may not have much headroom. This fan doesn’t often run at full speed, and pulls far less current at slower speeds, so this most likely won’t be an issue. That having been said, bear in mind that if you have it switched to full speed for many consecutive hours (probably close to double-digit hours), you might see an issue. This is a good reason to connect the AC trigger appropriately as opposed to using a switch when you turn the AC on - the fan will cycle on and off with the AC compressor if they’re wired appropriately, giving the alternator a chance to recharge the battery if there’s a deficit, but it will continue to drain the battery if it’s simply switched on. This is the kind of thing that isn’t worth stressing about too much, but it is worth remembering should you have the symptoms of a dead battery after (very) extended full-speed fan use. With a normally-sized (and healthy) battery and a functional alternator it should be a non-issue.

- You can test the function of the fan by connecting the four wires from the fan connector to +12V and ground as indicated below:

- Red -> Battery Positive +12V
- Black -> Battery Negative (Ground)
- White -> Battery Negative (Ground)
- Yellow -> Battery Positive +12V

- The fan will pulse, soft start, and ramp all the way to full speed. It normally takes about 15 seconds for the fan to reach full speed so don't be afraid to connect the wires and wait several seconds. If the fan functions from the test described above, then any issues likely lie elsewhere in the system.