

A Simple View of Fuel Injection

Your engine is an air pump, the more air you pump through it, the more power you make.

Figure 1

Any internal combustion engine will flow air at a rate determined by many factors like cam profiles, port shape and size, air box, exhaust, etc, and of course RPM. This graph shows a diagram of what the airflow curve might look like for an unmodified (stock) motorcycle engine (air flow by weight over RPM).

Figure 2

To keep a hypothetical air fuel ratio of 14:1 (air to fuel by weight) the fuel curve would need to have a similar shape as the air curve. The shape of the fuel curve for a fuel-injected bike is built into the ECU/ECM (Electronic Control Module) as a fuel map. Various sensors allow the ECU to shift the curve/map up or down (richer or leaner) to compensate for altitude (air pressure) changes, air temperature changes, and engine temperature changes. These sensors do not really change the shape of the curve; they just move it up and down.

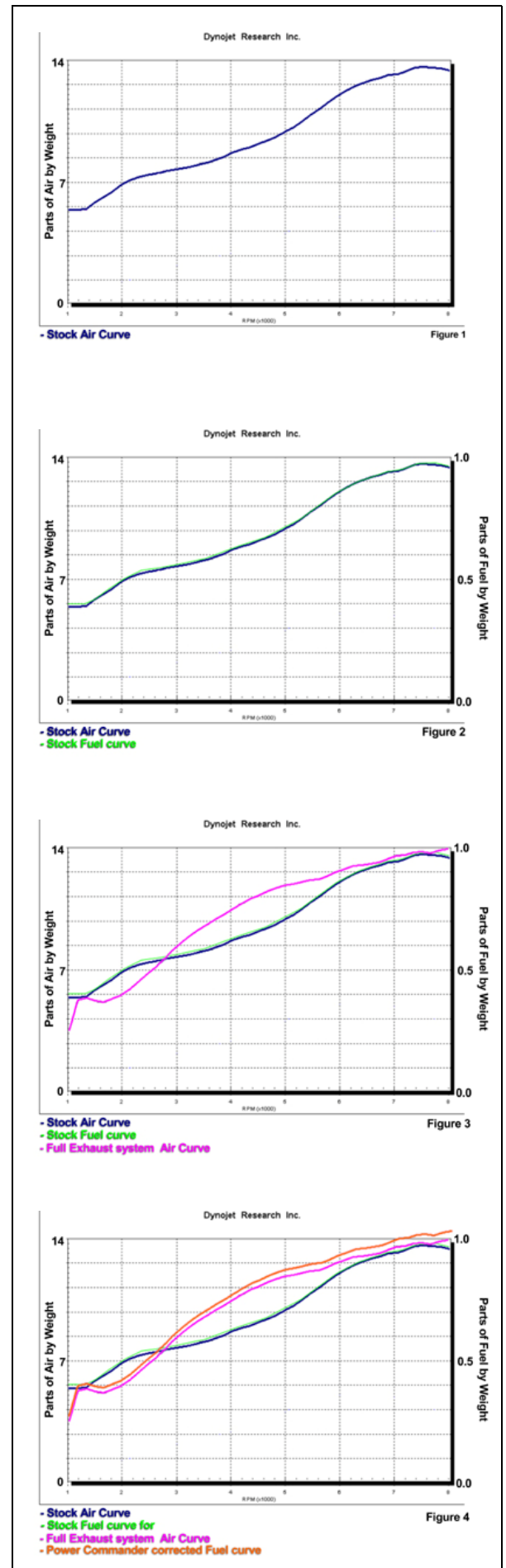
Figure 3

When you change something that affects the airflow like an exhaust system, it changes the shape of the air curve. On a carbureted bike, the shape of the fuel curve is based on the airflow through the carburetor, so installing a pipe will change the shape of the fuel curve, but typically requires re-jetting to keep the ratio correct. However EFI equipped bikes have no way to change the shape of the fuel curve to match the new air curve so the ECM continues to deliver the stock fuel curve. The bike in figure 3 would run too rich below 2800 RPM and too lean above 2800 RPM.

Figure 4

The Power Commander (with the proper map installed) can reshape the fuel curve to match the new air curve.

The Power Commander gives you the ability to shape your fuel curve for any engine modifications you do to your Motorcycle.



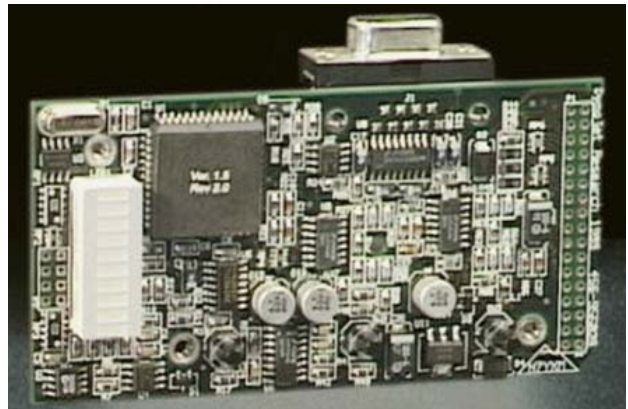
Introduction to the Power Commander

What is a Power Commander?

The Power Commander is a fuel injection adjustment module that plugs "in-line" with the bikes stock ECU/ECM.

The Power Commander is produced with "state of the art" electronics which include a four layer surface mount circuit board with a built in Microprocessor.

Each unit is lightweight, compact and sealed for maximum durability and reliability.



The Power Commander is fully adjustable, with a wide variety of maps available for most applications, to provide maximum results in the minimum time.

The Power Commander makes changes in real time going down the road. It makes no permanent changes to the stock ECU/ECM.

The Power Commander plugs in using O.E.M. style connectors. There is no splicing required.



Ducati 996



Suzuki GSXR1000

Power Commander Versions

Power Commander II

The Power Commander II was introduced in 1999 and featured the latest in surface mount electronics. Additional features were added such as faceplate button adjustment, and ignition timing adjustment on select models. The PCII utilizes "sensor offset" technology to adjust the fuel curve. Signals from key sensors on the bike are monitored by the PCII and these signals are recalculated and sent to the ECU in order to achieve the required fuel curve.



Power Commander III

The Power Commander III was introduced in 2000 and is externally similar to the PCII. The PCIII utilizes "direct injector control" technology to control the fuel curve for models that do not have the appropriate sensors to allow sufficient fuel adjustment using the PCII technology. The PCIII takes the injector pulse from the ECU and changes the pulse width signal to the injectors.



Power Commander III r

The Power Commander III r was introduced in November 2000 and utilizes the same "direct injector control" technology as the PCIII. The " r " version contains additional circuitry and in some cases, additional connectors, which allow ignition adjustment as well as fuel adjustment. Ignition adjustments can provide very positive results on the racetrack, where factors like special fuel and highly tuned engines are used.



All future Power Commanders will be based on "direct injector control" technology

The Complete Kit Includes:

1. The Power Commander module with O.E.M. style connectors.
2. Standard serial cable for connecting to a Windows based computer.
3. Installation guide and everything required for mounting the Power Commander.
4. The Power Commander CD-ROM.



The CD-ROM has a user-friendly interface and includes:

The Power Commander Control Center Software

All of the maps available at the time the CD-ROM was produced. We are continually making maps and they are available for download on the Power Commander website.

Tutorials

Control Center Software User Manual



Why Do You Need a Power Commander?

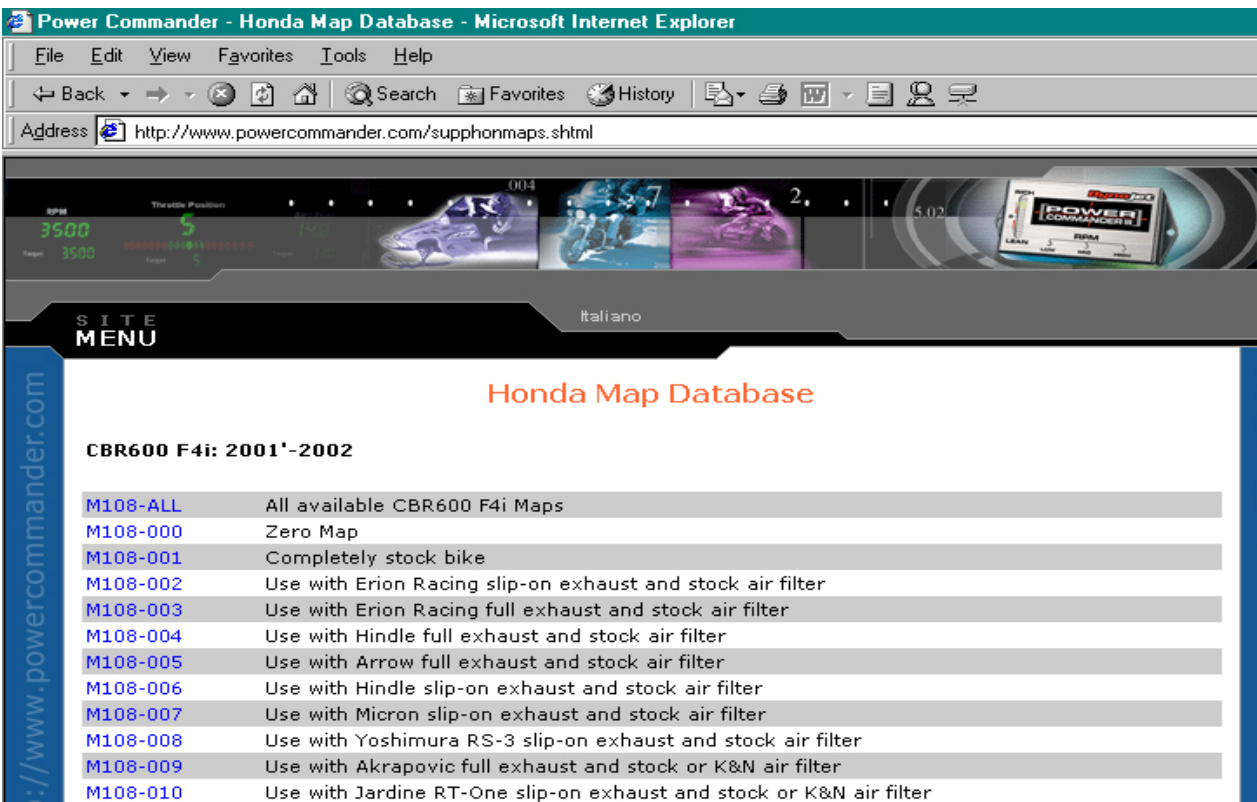
If you change the air flow of a carbureted bike for different pipes, air-box, cams, etc, you would need to change the jetting. With a fuel injected bike, you must adjust the fuel curve electronically, and that's where the Power Commander comes in. With a Power Commander equipped EFI bike you have more control over the fuel curve than with carburetion, i.e. you can improve deceleration popping without affecting idle; you can not do this with carburetion. With a Power Commander on your bike, it will run smoother, cooler and have better throttle response.

Benefits:

1. Improves Horsepower, throttle response, and rideability.
2. Reduces running temperatures, pinging, and can help prevent pipe bluing.
3. You can continue to add performance accessories of any type and simply install a new map to tune the Motorcycle.

How to Tune a Power Commander:

The best way to tune a bike is by selecting the proper map. A large number of maps have been developed for popular performance modifications. New Maps are continuously being developed and these are available for download at www.powercommander.com



Power Commander - Honda Map Database - Microsoft Internet Explorer

Address: <http://www.powercommander.com/supphonmaps.shtml>

3500 RPM Throttle Position 004 7 2 5.02

Italliano

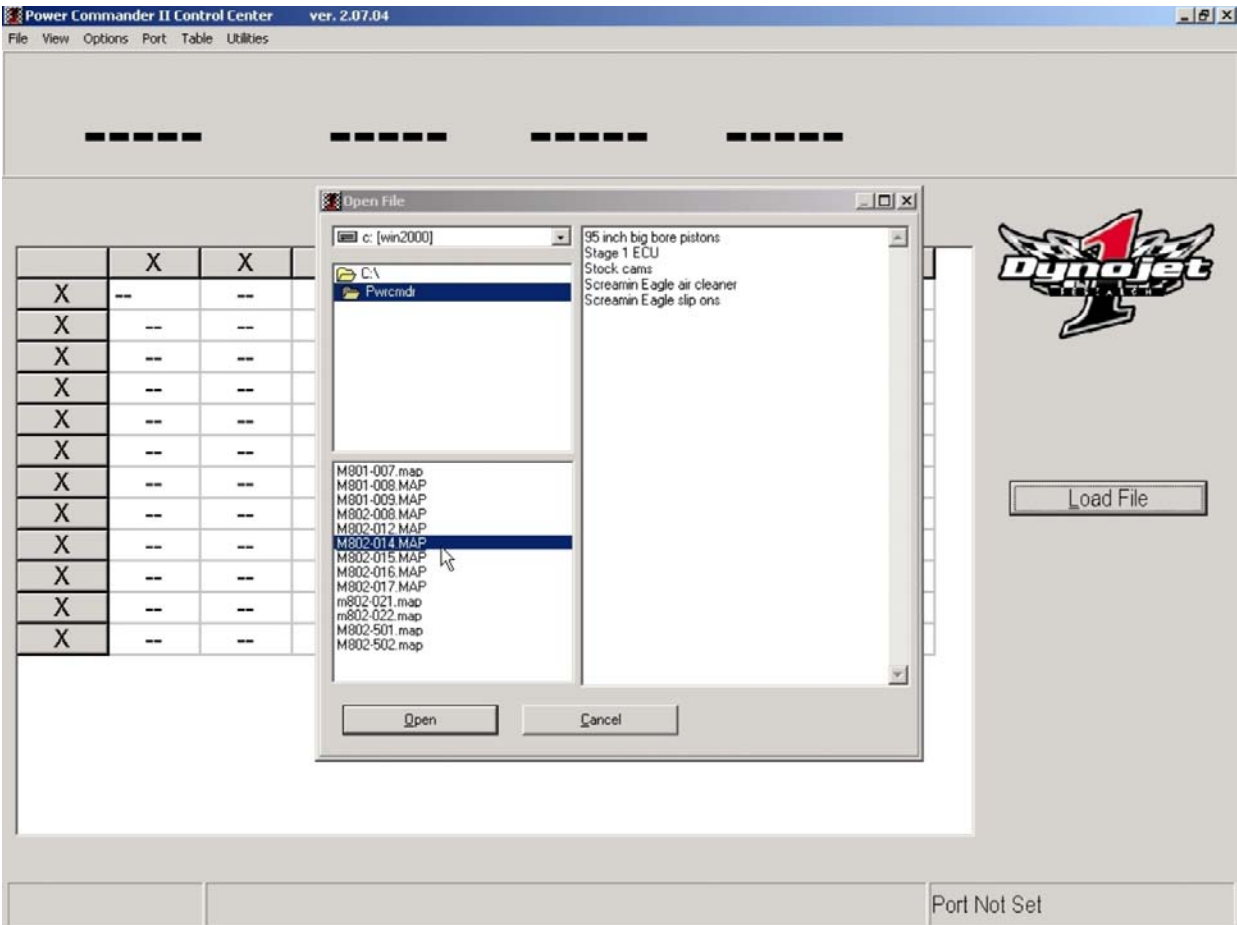
Honda Map Database

CBR600 F4i: 2001'-2002

M108-ALL	All available CBR600 F4i Maps
M108-000	Zero Map
M108-001	Completely stock bike
M108-002	Use with Erion Racing slip-on exhaust and stock air filter
M108-003	Use with Erion Racing full exhaust and stock air filter
M108-004	Use with Hindle full exhaust and stock air filter
M108-005	Use with Arrow full exhaust and stock air filter
M108-006	Use with Hindle slip-on exhaust and stock air filter
M108-007	Use with Micron slip-on exhaust and stock air filter
M108-008	Use with Yoshimura RS-3 slip-on exhaust and stock air filter
M108-009	Use with Akrapovic full exhaust and stock or K&N air filter
M108-010	Use with Jardine RT-One slip-on exhaust and stock or K&N air filter

If you can operate a Windows Computer, you can easily install a map

- a. Open the Control Center Software
- b. Select a map
- c. Upload it to the Power Commander



The Power Commander can easily be fine tuned with the buttons.

Lean out the low and mid buttons for better economy while traveling on the interstate, then richen them for riding in stop and go traffic for cooler running. If you get a tank of bad gas you can richen the curve to help prevent pinging.

If you have a Palm Pilot, you can load a map with it.



Button Adjustment Feature

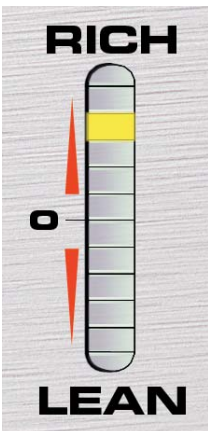
Button adjustment is designed for fine-tuning a motorcycle that has a Power Commander installed with the proper map to match your modifications.

Please note: there is a video on the Power Commander CD-ROM that demonstrates button adjustment.

Put the Power Commander in button programming mode by firmly holding down all 3 buttons while switching on the ignition key. Note; the buttons may feel stiff.



When the Power Commander is in button programming mode, pressing the Low, Mid, or High buttons will select that RPM range, and the L.E.D will indicate what the setting is.



"Zero" is indicated by two L.E.D's lit in the middle, indicating that the buttons are not affecting the fuel being delivered by the map.

A movement of one led represents a 4% change on a Power Commander II and a 2% change on a Power Commander III.

(Except for the Power Commander III on the Kawasaki Drifter and the Ducati models which are 4%)

Tapping a button will richen *that* RPM range, which is shown by the L.E.D climbing closer to the rich end of the L.E.D scale. Holding down a button will lean *that* RPM range, which is shown by the L.E.D dropping closer to the lean end of the L.E.D. scale.

When you are through with the button-programming mode, leave the bike on without touching the buttons for 20-30 seconds.

The Power Commander will save the button settings, and go out of button programming mode, then the L.E.D will drop to the lowest position.

You can verify this by twisting the throttle. The L.E.D will move up and down (not the full range) as you open and close the throttle. This indicates the Power Commander is not in button programming mode

Note: If while adjusting the buttons you wait 10-20 seconds between adjustments the Power Commander will go out of button programming mode

Note: If you turn your ignition switch off before the Power Commander goes out of button programming mode the changes will not be saved.

Frequently Asked Questions

What is a map?

A map consists of tables which tell the Power Commander how much fuel/ignition timing to add or remove from each throttle position at each RPM.

How do I load a map?

A complete description is provided in the user manual.

1. Open the Power Commander Control Center Software
2. Click load file
3. Select a map
4. Click open
5. With the Power Commander powered up, click upload

Can the Power Commander damage my ECM/ECU?

The Power Commander is designed so that it can not send current to the processor in the ECU, which makes it incapable of damaging the ECU

Will the Power Commander void my warranty?

In most cases, in order for the manufacturer to deny warranty for a failed component, they must prove that the aftermarket part caused the component to fail. As the Power Commander cannot send current to the stock ECU, it is highly unlikely that it could damage the stock system in any way.

My dealer says my warranty is void because I installed aftermarket parts on my bike, what can I do?

Consumers have specific rights, on any product they purchase. SEMA (Specialty Equipment Market Association) helps protect these rights, and has a web page with a list of what to do if your warranty is denied. For more information please visit <http://www.sema.org/warranty>

I cannot find a map for my combination, what should I do?

If you have minor modifications (exhaust, air-box, mild cams), use a map for a similar set-up. If you have major modifications (ported heads, aggressive cams, Stroker), then it may be best to have a custom map built by a Power Commander Tuning Center.

My Harley has a stage burn with all of the recommended Screamin Eagle components. Why would I need a Power Commander?

A stage burn is a recalibration for specific Screamin Eagle components. When used with these components, the cruise air/fuel ratio is about 15:1. However at 15:1, they can run hot, surge, ping and are more likely to blue pipes.

With the Power Commander installed with the proper map, the air/fuel ratio at cruise will be about 13.8:1, the bike will run smoother, cooler, accelerate better, and be less likely to ping or blue the pipes.

My Harley dealer modified my Harley ECM with a stage burn, will I still benefit from the Power Commander?

Yes.

The Stage burns are calibrations for specific Screamin Eagle components. If you run any other parts that can change the air flow through the engine (pipes, cams), you will not have the proper fuel curve.

My dealer says that I can run any pipes I want to on my EFI Softail and the ECM will correct for it.

The Delphi System is very good at masking low speed rideability problems, however it cannot reshape the fuel curve for any modifications you may do. It may appear to run ok with different pipes and air-box, but when checking air/fuel ratios, you find that they are not optimum and in some cases dangerously lean. With the Power Commander and a proper map installed, the Softail's run noticeably better, smoother, and cooler, with improved throttle response.

My Suzuki dealer adjusted my ECU with a YFMS "clicker box". What is the advantage of a Power Commander over this?

A clicker box only has 3 adjustments, which is not nearly enough to build a proper fuel map; the Power Commander can have up to 260 different adjustments.

A clicker box can change the fuel curve up to 10%; the Power Commander can change the fuel up to 100%.

A clicker type box flashes the EPROM on the ECU which can make it difficult to return to stock; the Power Commander makes no permanent changes to the ECU and unplugging it, returns the fuel curve back to stock.

Does the Power Commander interfere with the bikes ability to compensate for atmospheric conditions?

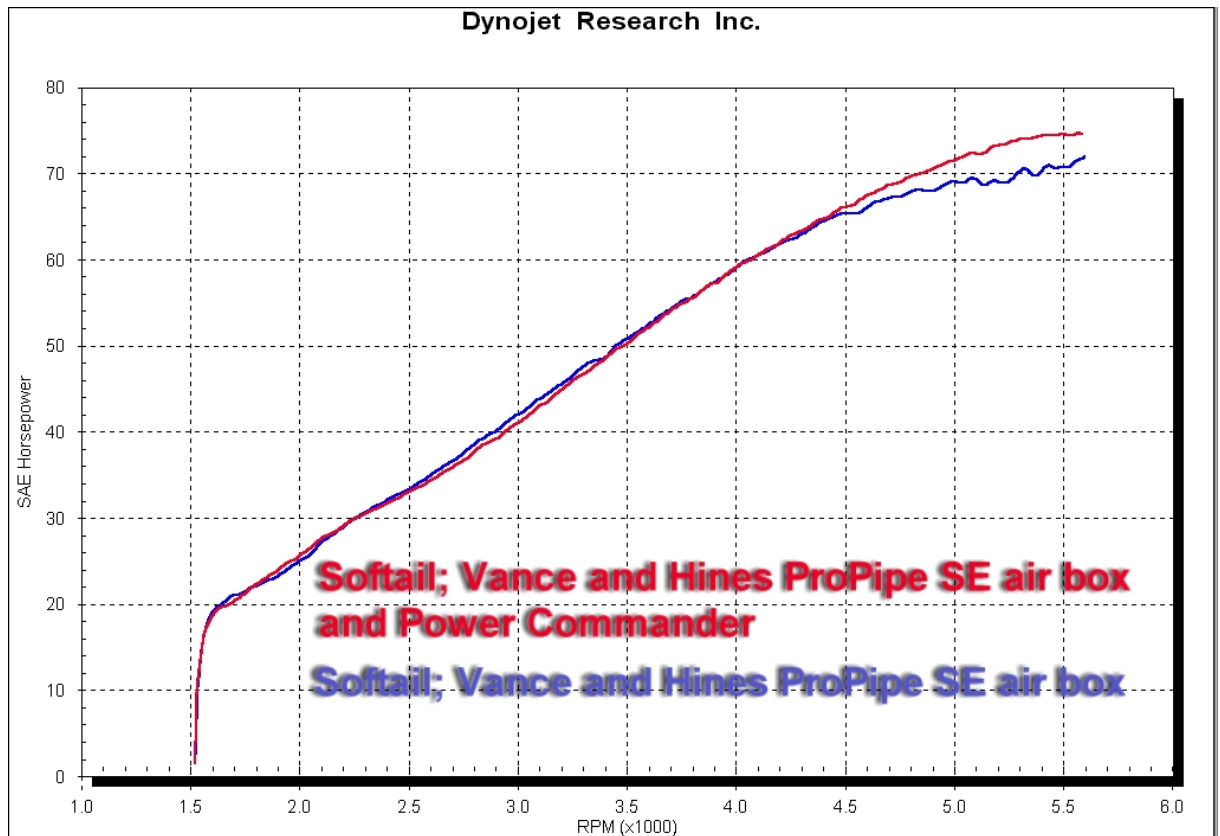
No.

The Fuel Injection Systems found on today's bikes do a good job of adjusting fuel for atmospheric conditions (air temperature, altitude, etc). The Power Commander does not interfere with this and the automatic compensation remains in effect.

How much power will the Power Commander give me?

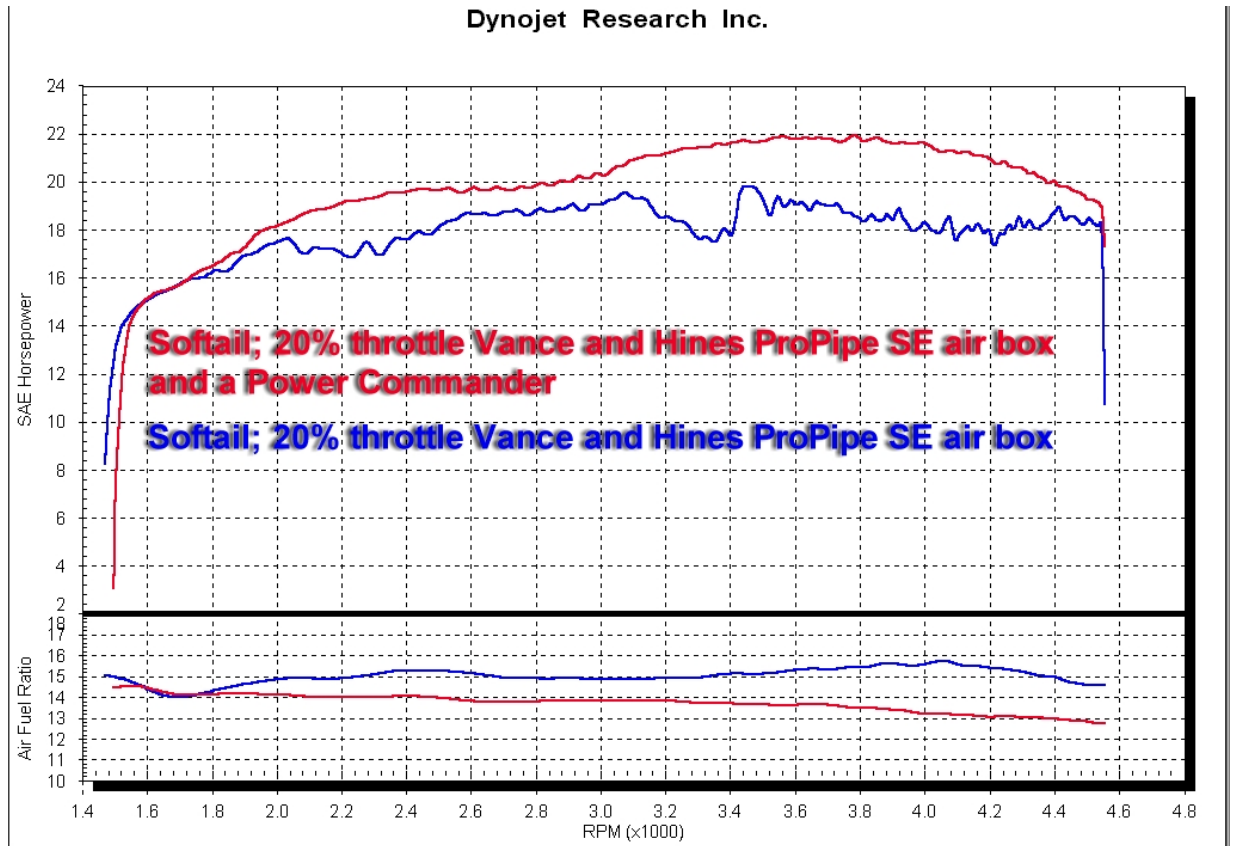
Horsepower is a product of how much air you can pump through your engine. The Power Commander cannot cause your engine to pump more air, however, the modifications you would make to your engine to pump more air (exhaust, air-box, cams, heads, etc) are limited, if you are unable to adjust the fuel curve to match the air curve.

To make more Horsepower by adjusting the fuel curve, the fuel curve must be too lean or too rich, and then when optimized, you can see a Horsepower increase.



Peak horsepower occurs at 100% throttle, most fuel curves aren't too bad at 100% throttle.

However, most part throttle openings are lean from the factory, so adjusting the fuel curve here can make additional Horsepower, as seen in the next graph. Since most riders spend a good deal of time in the part throttle areas, Horsepower made here is more noticeable and useful than peak power at 100% throttle.



My local shop has a Dyno; can they tune my Power Commander correctly?

Yes, if they are an Authorized Power Commander Tuning Center. The basic Inertia Dyno that most shops have are great for dialing in carburetion, however to build a complete fuel injection map, you need a load control dyno with real time air/fuel ratio monitor, and special training.

What is a Power Commander Tuning Center? And how does a dealer apply to be one?

A Power Commander Tuning Center is an established Bike Shop with a Dynojet Model 250 Load Control Dyno equipped with a Real Time Air/Fuel Ratio monitor, and has successfully completed the Power Commander training course.

To become a Power Commander Tuning Center, the shop must:

- Own or purchase a Model 250 Dyno.

- Sign the Power Commander Tuning Center agreement with Dynojet.

- Successfully complete a two-day training course at Dynojet's head office in Las Vegas.

How can I keep myself updated on new Power Commander Maps?

You can join the mailing list on www.powercommander.com for either one model of bike or every model. When new maps or new information is available, you will automatically receive an e mail with the new information.

What kind of technical support is available for the Power Commander?

Dynojet employs several experienced technicians who provide Toll-Free support Monday through Friday 8 AM – 5 PM Pacific time.

1-800-992-4993

The Power Commander web site is constantly updated with new information. This is a vast resource for support including installation guides, user manuals, new maps, frequently asked questions, etc.

Technical and Sales support are available by e mail

tech@powercommander.com

sales@powercommander.com

Company Information

Dynojet Research, Inc. is a world leader in the development and manufacturing of performance enhancement products and tools. Our fuel management and diagnostic products, coupled with our personalized services, give you the resources to maximize performance and increase efficiency.

With over a decade of experience, Dynojet has relied on state-of-the-art technology to provide you with the best products available. Our philosophy stands behind the belief that our customers are number one. Individualized attention is given so that you can take full advantage of the products we offer. Because of this philosophy, we guarantee high credibility, consistency, and customer satisfaction. Here at Dynojet, we invite you to put our products to the test.