Timmy’s Y-Block Ford V8 Web Page http://m571.com/yblock/loadomatic.htm

The Y-Block engine was available in Ford, Edsel, and Mercury cars from 1954 until 1962, and in Ford trucks from 1954 to 1964. Aside from its racing success in many motorsport contests around the world, including NASCAR (a Y-Block powered Ford was NASCAR’s champion in 1957) and Pike’s Peak Hill Climb, the Y-Block was known as a power plant as durable as any made.

How does a Ford Load O Matic Distributor Work?

Part One of Two

First, I will give an overview of how the Load O Matic works, and then I will describe how the heart of the system, the Spark Control Valve, works.

The Holley Load O Matic distributor was standard equipment on 1954 to 1956 Y-Blocks, 1949 to 1953 flatheads, and many Ford 6s offered into the 60s. Given that, from the outside, they appear like a conventional distributor and from the inside, their principles are a little obscure, here is an explanation of how the Load O Matic works.

To sense speed, or rpm, conventional distributors, such as the 1957 and up Y-Block distributors, use centrifugal weights that are controlled by spring counterbalances. The faster the engine runs, the further the weights fly out and the more advance that is provided.

To sense the load of the engine, the manifold vacuum signal is used. When an engine has a light load, the vacuum is high. At the highest load, the vacuum will approach almost zero, especially if the carburetor is large enough for the engine. The vacuum canister on the distributor senses the manifold vacuum, which is directly related to engine load, and controls the advance accordingly: more advance when cruising, and less to none when you have the "pedal to the metal".

Both the mechanical and the vacuum advance work together to provide the right advance for any combination of engine load and speed.

On the Holley Load O Matic unit, the difference is the way the distributor senses the engine speed. Engine load is still measured by manifold vacuum. But the engine speed is measured by the amount of air that is passing thru the carburetor venturi. Look at the carburetor that is made for any engine with a Load O Matic, and you will see a small pinhole orifice at the narrowest part of the venturi. The principle that is used here is that the more air that is passing through the venturi, the faster the engine must be going.

(At this point, remember that when I say the AMOUNT of air, I am not talking about the DENSITY of the air. It's important to remember that these two values are not the same thing!)

The Load O Matic system “knows” that rpm is high when large volumes of air are being ingested into the engine, and it measures the airflow by the carb venturi vacuum signal. That's why you have a steel tube from the middle of the carb to the vacuum can on the distributor.

At the carburetor, the SPARK CONTROL VALVE (that thing that looks like a Holley power valve sitting on the outside of the carb), uses a diaphragm and springs to mix the venturi signal and the manifold vacuum signal, so that the right instructions are sent to the Load O Matic advance canister.

In a conventional distributor, the weights and the vacuum canister work together to give the right amount of advance for any engine speed and load situation. In the Load O Matic, the Spark Control Valve decides the right amount of vacuum to send to the distributor, by means of its spring/diaphragm working with the two signals: manifold vacuum (sensing load) and venturi vacuum (sensing rpm).

The amount of vacuum that the Load O Matic works with is very low, compared to a conventional distributor's vacuum signal. Since this signal is used to provide both the load and rpm of the engine, you can see that when you swap a regular carburetor on a Load O Matic equipped Y Block, the manifold vacuum signal will NOT provide the right information to the Load O Matic. Or, if you use a Y Block carburetor, like a Holley 94, on an engine with a conventional distributor, the vacuum port on the carburetor will not give the right signal to a conventional distributor's vacuum advance canister. If you use a Load O Matic carburetor on an engine equipped with a conventional distributor, plug the distributor port so that you don't have a vacuum leak into one of the carburetor's venturis.

In the Load O Matic distributor, the vacuum canister is counterbalanced by two springs sitting at angles to each other, visible when the distributor cap is removed. The posts these springs attach to are able to be turned with a special tool and they are eccentric. If you had the proper test bench with which the Load O Matic is tested, these spring posts would be turned to provide the correct spring tension, which provides the correct advance curve.

Actually, some advance in the Load O Matic is provided by the friction of the points on the point cam, also. That is why point spring tension is a very important value on a Load O Matic equipped vehicle.

So, why don't Load O Matics provide good performance, compared to conventional distributors? I believe that they are very slow to provide advance when the engine is accelerated under load. Where the centrifugal weights of a conventional distributor immediately swing out as the rpm is increased, the vacuum diaphragm in the Load O Matic reacts slowly to the weak signal that is applied to it from the carburetor's spark control valve.

All you have to do is exchange the Load O Matic for a conventional distributor to see a marked performance difference. This is something that not only Y Block owners have known for years, but also Volkswagen hot rodders. (VWs used a distributor like the Load O Matic in cars, but the Micro Bus used a full centrifugal distributor, which was a cheap hop up trick.)

Incidentally, if you are running 2 Holley "Teapot" 4v carbs, you can tie the spark ports together. This will ensure that the secondaries of both carbs open at the same rate. Note that Holley vacuum secondary carbs use the same venturi signal to open the secondaries that the Load O Matic spark control valve uses. On Teapots, the passages to the secondary diaphragm and the spark control valve are tied together, as can be easily seen by disassembling the Teapot and using a flashlight.

Part Two of Two

In this second part of a Load O Matic discussion explains the Spark Control Valve's operation. It really is pretty straightforward and the somewhat tricky part is thinking about the signal passages in the carb and how the various restrictions make the system work.

Recall that from the Load O Matic discussion, above, that you can look through the spark port on the carburetor and see down the passage to the port in the narrowest part of one of the carburetor's venturis. (This is easier to do if you have a flashlight shining down the carburetor's throat.) The important thing to note here is that the passage going into the carburetor is a lot larger than the orifice into the venturi. This is an intentional restriction and is an important factor in the way the Load O Matic system works.

Also, recall that the spark control valve looks a lot like a Holley power valve. It works similarly to a power valve, but instead of passing fuel, it passes air.

Looking at the part of the spark control valve that is exposed ot the atmosphere, you will see a stamped cover that has some holes in it. The outside of the diaphragm is exposed to atmospheric pressure by these holes.

On the other side of the diaphragm, the stem of the valve goes down the middle of the cast zinc alloy body of the spark control valve. There are a few features about the part of the spark control valve that I'll describe now, and then put all of the features together to describe how the spark control valve works.

The portion of the spark control valve that's inside the carburetor houses the rod that is attached to the diaphragm. This rod has two springs on it. The one that is inside the cast zinc alloy housing is the one that is important, as it is the key part of the spark control valve's function in concert with the diaphragm. The second spring is the one you can see, and its function is to provide a method for finely calibrating when the spark control valve opens and closes. So, we'll ignore the calibration spring for the rest of this discussion.

Also inside the spark control valve is a tapered valve, which is part of the diaphragm rod. It is a tapered, conical shape around the rod. It has a seat in the cast body of the spark control valve.

Around the body of the spark control valve, there are some holes that will allow the back side of the diaphragm to be exposed to manifold vacuum (almost -- more on this later, but just follow me on this part for now). The spark control valve is then set up so that there is the atmosphere on one side of the diaphragm and manifold vacuum on the other side. Manifold vacuum will make the diaphragm want to move toward the carburetor body, but this movement is resisted by the spring that is inside the spark control valve body. In many applications, the spark control valve diaphragm will move toward the carburetor body when the manifold vacuum is around 6" to 7", depending on the specific engine.

The vacuum that is on the carburetor side of the diaphragm is also around the rod attached to the diaphragm, but it cannot get to the very innermost part of the chamber the spark control valve is screwed into, because the conical valve on the rod is seated in the spark control valve body to close off this passage inside the carb body. When the manifold vacuum becomes sufficient to move the diaphragm, the conical valve moves off of the seat, and the vacuum can get inside the spark control valve's inner chamber inside the carb body.

So, let's recap this so far: When the manifold vacuum is around 6" or 7", the spark control valve diaphragm will move in, toward the carb body, allowing the manifold vacuum to be exposed to the innermost part of the chamber that the spark control valve is screwed into.

Now, to connect the manifold vacuum to the venturi vacuum!

Remember the passage from the outside of the carburetor (where the distributor is connected to) that bores thru the carb, ending at the narrowest part of the venturi? Actually, this passage is connected to the inner part of the chamber that the spark control valve screws into. Think of the hole that the spark control valve screws into, and 'way inside, in the back, there is a system of passages that look like a capital letter "T". The stem of the "T" connects to the spark control valve chamber. The horizontal part of the "T", at the top, is the passage from the outside of the carburetor to the venturi. The stem of the "T" connects the back of the spark control valve chamber with the venturi vacuum passage that attaches to the distributor.

Now, we can start putting all of this together.

As the engine rpm increases, the vacuum signal of the venturi will be passed across the top of the "T" channel to the distributor. Generally, this vacuum signal will be from 0 to about 6" of vacuum, and this will provide from 11* to 17* of advance AT THE DISTRIBUTOR. (Remember, you have to double distributor degrees for crank degrees.) The exact amounts of vacuum and advance degrees will vary between engine applications, but this will get you in the ballpark.

When the manifold vacuum rises above 6" or 7", the spark control valve will open. At this point, the vacuum that is in the manifold will be applied to the top "T" channel from the spark control valve chamber. It MUST be at or above the vacuum level that is needed to open the spark control valve, so it is more than will be coming from the venturi signal at any RPM.

Therefore, at the opening point of the spark control valve, the signal that is applied to the distributor to control the advance will pass from the venturi signal to the manifold signal.

Putting this in terms of the engine, when the engine revs up, the advance is increased because the venturi vacuum is increased. So, advance increases as the speed of the engine increases.

But, if the engine load is light, the engine needs even more advance for better fuel economy (read the first part of the Load O Matic description to understand why). When the manifold vacuum gets high enough, the spark control valve opens and control of distributor advance passes to the stronger manifold vacuum signal, for even more advance.

If you've followed my attempt at explaining the Load O Matic to this point, you are probably thinking to yourself: "This can't be right, because the manifold vacuum will bleed out thru the orifice going to the venturi, instead of operating the distributor advance canister. This doesn't happen, but if you have thought this, you have come upon the reason that the Load O Matic gives lousy performance:

The reason that manifold vacuum doesn't bleed off into the venturi is because the venturi orifice is very small. This restriction keeps the greatest part of the vacuum signal applied to the distributor advance unit, even though a slight amount of bleed off does occur.

But, in order to limit the bleed off, the venturi orifice is too small to allow enough air to move in the "T" cross passage quickly. So, an abrupt change in rpm will increase the vacuum in the venturi, but the orifice restriction in the distributor passage (needed to keep the manifold vacuum signal from bleeding off) will not pass very much air from the distributor vacuum canister, which keeps the Load O Matic from giving advance to the engine as quickly as it needs it.

The result is that soggy acceleration that Load O Matics are noted (notorious?) for.