

# Buying an after-market ECU

## FAQ's

Q. Some ECU's use Military Spec. connectors, isn't this better?

A. *These connectors are very difficult to use and specialist tools are required that are very expensive. This means that the user can't remove or add wires at a later date. Also the wire gauge must be small. The down side of this is that they are not as strong physically even though they are capable of carrying the load. We supply colour coded, standard automotive cable, in larger diameters for strength. We don't have problems with these connectors and have proven to be very reliable.*

Q. Is a trigger wheel on the front of the engine better for accuracy?

A. *No. Factory triggering has proven very reliable (with minor exceptions). The only problems customers ever seen to have is with after-market triggering. Short answer - if factory triggering is available then use it.*

*Some systems advocate adding a trigger wheel on the front of the engine. This is because their systems can't "handle" the range of factory triggers on the market. Adding triggering can add a whole days work to an installation.*

Q. Some ECU's run at a higher Mhz rate, is this better?

A. *The LEM is an 8 MHz ECU (LinkPlus is 12 MHz). This is a measure of the time that it takes for an instruction inside the ECU to be completed. At 8 MHz the ECU is doing two million instructions per second. i.e. On an eight cylinder engine at 6,000 rpm it takes 100 Ms to fire all 8 cylinders. This means that ECU could have done on average of 67,000 instructions during one engine cycle.*

*An 8 cylinder firing a distributor ignition takes 12.5 milli seconds between sparks so the ECU could have done 8300 instructions between ignitions, ample time for other operations.*

*There are factors that determine an engines raw performance like turbo, inlet size, number of cylinders, stroke and compression. The ECU also has factors that effect how well it can control an engine. For an ECU one of the most important factors is how the ECU is programmed. This is done by writing code & instructions to tell the ECU what to do. Some code can be written so it takes up less room but takes up more time to process (slower). The latter is code that is large in size but takes less time to process (faster). This term is called stream lining. This is only one example of how an ECU can be programmed, effecting performance.*

*Factors which are particular to the CPU which effect performance are:*

- *Frequency of device (MHz)*
- *Amount the CPU divides the frequency by for instruction speed*
- *Bus speed (Time it takes to fetch data from memory like RAM / ROM)*
- *Pipe-lining (This gets the next instruction while the current instruction is being processed, which is faster)*
- *Instruction set (number of instructions RISC, CISC)*
- *ALU (Arithmetic Logic Unit) which does math functions. Some CPU's don't have this so maths functions take longer and require more code and the list goes on.....*

*Rating an ECU's performance by speed (MHz) is not good way to judge how well the ECU can control the engine. It's like saying that an engine that can rev to 7,000 has more power than one that can only rev to 6,500 while disregarding engine size and specification (e.g. turbo? multi valve etc.) Performance also depends on the method of programming (e.g. assembly or C), CPU architecture, number of features the ECU has to process including set-up i.e. An 8 cylinder engine using Sequential fuel (Sequential = fuel delivered 8 times per engine revolution) has a smaller time frame to calculate fuel delivery than an ECU running a 4 cylinder with group fuel (group = fuel delivered once per engine revolution)*

*Remember that all components are available to all ECU manufacturers. We have chosen this micro on its merit. If MHz rate was an important consideration we would choose a different micro. As the Mhz rate is not amongst the most important*

*considerations it is not a good basis for ECU comparison but highly relevant for games consoles.*

Q. Why bother with a Tuning module when you can have PC Tuning (PCLink)?

A. *For a quick adjustment e.g. rev limiter, plug in the Link Tuning Module, turn on the ignition make the adjustment and save. This takes less than one minute. With the tuning module you don't have to wait for it to "boot up", it never goes "flat", you can see it in bright sunlight, you can keep it with your other tools, it will stand vibration (to a point) and it is cheap. Downside, it doesn't log and you can only see one thing at a time.*

Q. Why buy an after-market ECU when I can "Chip" or "Reflash" the factory ECU?

A. *For chips and reflash adjustment is compromised and limited. It is a best guess for your application unless custom tuned. You have to revisit you "specialist" every time you need a change. Functions are limited to what the factory originally provided ie anti-lag, launch, water spray etc. is only available if originally supplied by the factory and major changes impossible. Owner changes are impossible and track side alterations are not possible.*

Q. Sure the Link is cheap but you get what you pay for, don't you?

A. *In 1974 a 26" CTV cost the equivalent of six week pay from the "average wage". Today a superior CTV of the same size costs one weeks average pay. The same technology shift applies to the ECU market. ECU's have improved dramatically but many suppliers have kept the old pricing levels. After market ECU's are now volume manufactured and we are passing on the savings. Even to Link the component cost is a minor consideration when designing.*

*If you require a recording studio VCR to make your professional documentary then purchase a suitable VCR. For recording at home how much benefit is a VCR costing fifteen weeks pay? The same goes for ECU's. Link systems run better than factory systems and win races when the driver and car are up to it. Remember all good, adjustable ECU's make the similar power when tuned correctly. Link systems typically out perform rival systems due to their ease of set up, information feed back and features available within our standard systems.*

Q. How much horsepower will I gain using a Link?

A. *At any given load there is an optimum level of fuel, boost and ignition advance. If this requirement is met then the engine will deliver optimum power. All engine management systems should make the same power if properly tuned. The difference is how easy is the system to tune and how good is the information that you are getting back.*

Q. How much boost can I run?

A. *On a LEM 1.5 Bar of boost (22 lb.). On a LinkPlus use the appropriate MAP sensor. Boost is limited by what the engine will stand and the turbo / supercharger will develop.*

Q. Isn't it more accurate to tune in milliseconds?

A. *No. Link systems as are many leading systems are tuned in V.E. Refer to the start of the instruction manuals under "speed density".*

*When tuning in milliseconds each zone must be different from the next as the load grows. This requires a lot of tuning and more zones are better when tuning in milliseconds.*

*When tuning in Speed Density (V.E.) you are only tuning for the change in volumetric efficiency ie. how much extra air is drawn in to the engine per induction. This makes tuning very simple. Adjust MASTER to get the best idle and most engines are drivable.*

Q. Some computers offer more zones, isn't that better?

A. *Refer to the above question. Unless something radical (e.g. cams or VTEC etc.) "come in" the zones are usually the same regardless of rpm (left to right) and increase*

*gradually with the increase in load. When we are sent fuel and ignition maps for evaluation we look for consistency between zones. If we see large variances we often suggest that a problem exists elsewhere and they are trying to tune it out e.g. inadequate fuel pumps, manifold leaks, ignition interference.*

**Q.** *Isn't sequential fuel injection better than group fire?*

**A.** *Sometimes. It may be better for emission tests, large "cam overlap" and idle smoothness. As often as not it makes little difference. Often when the sequence is wrong people don't even notice!*

**Q.** *The link is only 8 bit.*

**A.** *Yes the LEM and LinkPlus are 8 bit but programmed in assembly language (low level compiler). This means the instruction code to control the ECU can be written efficiently (compactly). Also the electronics are much faster than what the engine is mechanically and recalculations can be done many more times than engine events occur. When purchasing an ECU the user should be aware of the following points:*

- 1. Method of programming; assembly (low level compiler) or C (high level compiler) A low level compiler (assembly) doesn't require a faster processor due to efficient instructions (a bit like DOS vs. Windows). High level compilers require a fast processor. An advantage of writing code in a high level compiler means that a software engineer can write code quickly but can result in less efficient code and a loss in absolute control requiring a faster processor to achieve the same performance.*
- 2. Number of features the ECU has to process i.e. Triggers, fuel, ignition, boost, idle control etc. More features generally means the more the ECU as to process. As a rule no one application uses every feature although the ECU is designed to handle all functions simultaneously.*
- 3. Accuracy of inputs like map sensor and fuel delivery. An 8 bit ECU gives more resolution than most of the sensors can supply.*
- 4. The cost of ECU is one of the most important factor in purchasing an ECU. You gain more benefits in spending money on pistons, turbo's etc. than you do on an ECU alone. This is because almost all ECU manufactures allow the user to control / tune an engine for maximum horse power regardless of processor speed and number of features. But as a user you need to weigh the cost versus what you actually require. The ECU is a tool to adjust, it doesn't "make" power.*

**Q.** *Some systems have complete wiring harnesses, Links harnesses are open.*

**A.** *A pre-loomed harness seems appealing and is not difficult for us to build. The trouble is the following:*

- it requires a large hole in the fire wall to pass the connectors through*
- if a wire is too short it is difficult to extend*
- if a wire is too long it is untidy*
- it is very hard to tidily install it*
- our customers don't want it*
- if the plug is not identical to the one on the engine it must be changed*
- installation is usually slower, therefore more expensive*