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Blip Systems Explained

Blipper = up-shifter in reverse, so clutch free downshifts become possible.

A 'blipper' system is designed to accelerate the engine for a very short duration to reverse the load direction of the gearbox, so engine braking changes to engine accelerating. Pretty much the inverse of an up-shifter which temporarily slows down the engine from accelerating to braking.

This change of gearbox direction (in either direction) gives a very small window of opportunity when the drive dogs of the gearbox and neither driving forwards nor backwards and all metal parts are free to move (change gear)

Are they necessary? quite simply none of the modern bike trickery is 100% necessary, not like wheels and brakes, but they do make the riding experience nicer and in the case of blippers they work alongside the engine braking strategy of the bike to make downshifts seamless, faster and safer due to the more consistent barking torque applied to the rear wheel, not to mention great fun and a lot less ache of the clutch arm.

From a racing perspective they provide far more stable corner entry and more freedom of gearing choice as the rider can make down-shifts far faster with a blipper, in fact a typical race setup would a allow a downshift every 280mSec , so pretty much 4 downshifts per second is possible if the rider could move his foot fast enough.

Any Blip system has to meet certain criteria in order to work.

1. It has to rapidly accelerate the engine to reverse the direction (see above)
2. But not so much or for so long that it then starts to push the back wheel
3. It has to match the revs for the next gear both to avoid the 'post shift' push, and to avoid the rear tyre skipping or any necessity for the slipper clutch to open.
4. Measure the foot pressure on the gear lever to know when you want the shift.
5. Measure specific engine data to understand how the bike is being used at the time of the shift.

To manage all of this the control strategy that is either built into the ECU or an external module like our Blip Box needs to consider all of these things:

1. What RPM is the engine at because lower RPMs need different 'blip height' (throttle opening) to higher RPMs
2. What gear is the bike in, because higher gears typically have a closer 'rev drop' to the next gear than the lower gears, so again the 'blip height' must be considered in order to match the revs.
3. The gear is also used to ensure that no additional blips can be made if the bike is already in first
4. Twist grip opening % is measured to ensure the rider is slowing down when making the downshift request.
5. Now there is engine temperature to consider as the engine doesn't respond so well when sluggish and cold, this is also the case if the engine mapping during braking is less than perfect.
6. Now we can add in wheel speed to ensure the blips don't happen when going too slowly, and other inhibit systems from the clutch sensor and even the engine power mode are all used to refine things.

Single and double blips, what are they? This is not a common strategy but is certainly built into our Blip Box system. It starts with a primary blip that is very short and typically quite large, this ensures that the gearbox accelerates, then there is a second blip that has a lower height and lasts a bit longer. This keeps the engine RPM high and if programmed correctly will allow perfect rev matching as you come down the gear box.

If you get it right, it looks like this. You can see the RPM in the middle graph with the RPM never over-shooting (pushing) and the upper graph being the throttle as it makes these primary and secondary blips to achieve this.

As a tuning parameter this secondary blip is quite useful as it can be tuned to match the deceleration rates found on a race track and also road riding where the braking is less extreme

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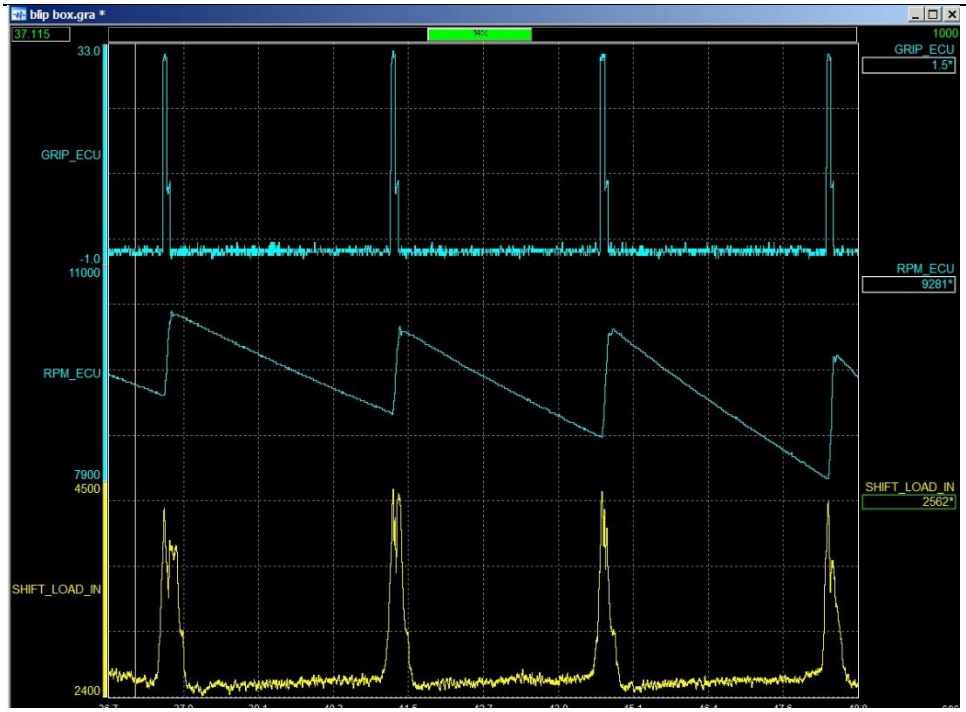

Foot pressure sensors – Load cell or 'spring and switch' type. This is an interesting one as every road bike manufacturer uses the 'spring and switch' type, whereas every race bike uses a load cell, so what's the difference and why this difference of opinion.

Spring and switch type – This is a mechanical component that is either stretched or compressed against a spring and after a pre-determined movement a switch is triggered and the signal sent to the control box (ECU).

Load cell – This has no moving parts and is purely a strain gauge sensor which outputs a voltage signal to ECU to measure both compressive and extension forces

To understand why road bike manufacturers prefer the 'spring and switch' type you have to visualise what is happening with your foot and more importantly the speed at which your foot is moving (up or down)

Lets presume you have a standard pattern gearbox and you pressing down on the lever to make a downshift on your 'load cell' equipped bike, you may well be unsure how all of this is going to work so are moving your foot slowly to see how it feels, the load cell measures this increase in force and when the trigger threshold is reached the Blip occurs, the engine briefly accelerates and that very short window of opportunity is available. But your foot is moving slowly and although the shift is initiated the mechanical movement of the gearbox has not fully engaged the next gear and at best you have a false neutral. The bottom line is ' your foot was not moving quick enough' to complete the shift.

Compare this identical scenario with a 'spring and switch' sensor on a stock bike. Your slow moving foot compresses the spring and when the switch is activated the engine blips and the spring unloads to complete the shift for you at a pre-determined speed relative to the spring rate.

This may seem like a firm case for the 'spring and switch' device, so why does every race team and our Blip Box use a load cell. It all comes down to adjustability and foot feeling, where the rider has a solid link between his boot and the gearbox which is turn gives less foot travel without the moving springy parts. Add to this the team can set the foot pressure when they want to make the shift and they only need a rider who can make shifts at a consistent foot speed and they are problem free. Not to mention 'no moving parts' to wear out, and they are typically smaller and lighter.

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Slipper clutches and Blippers, These 2 systems can argue amongst themselves sometimes but thankfully a good engine braking strategy coupled to a well tuned blipper means the slipper clutch rarely opens. It is however important to consider what happens to the Blip system if the clutch is 'open' (slipping), is this scenario the engine crankshaft is not rigidly connected to the gearbox input shaft so when the engine is accelerated by Blipping, the first job is to close the clutch before it can accelerate the gearbox and this all takes a little more time on the primary blip.

Things you need to know:

1. Blippers will only work on bikes with Ride By Wire where there is an electronic control on the throttle opening, this is essential in order to make the Blip.
2. Don't try and use a 'blipper' like you would the paddle shift on your car, so trying to drop a gear to overtake while already accelerating simply wont work. Up-shifters work to change UP while accelerating, Blippers work to change DOWN, while braking, and nothing else.
3. When learning to use a blipper, practice getting your foot speed consistent if you find you are missing gears.
4. Get the bike up to temperature before using any Blip system as the engine responds differently to throttle opening (blipping) when cold.
5. Be careful when making very high RPM downshifts to avoid mechanically over-revving the engine. Manufacturer systems often inhibit this from happening but at the same time block the downshift which is un-nerving, so our Blip Box has an option to remove this inhibit for more enthusiastic riding.
6. Avoid using blippers around town at low speed and RPM, in these scenarios your blip systems are close to being de-activated and even the best systems are not smooth when used like this.
7. If your clutch is 'super slippy' tune your blipper accordingly.

Load cell shifter and Blip Box

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Tuning tips – Blip Box

The Blip Box works by modifying the throttle twist grip signal when shifting so the ECU thinks that the rider is making these perfectly timed 'blips' . For this reason every tuning value you see in the WinBlip edit page is in % of twist grip, not % of engine throttle.

Example of 959 Blip Map are below.

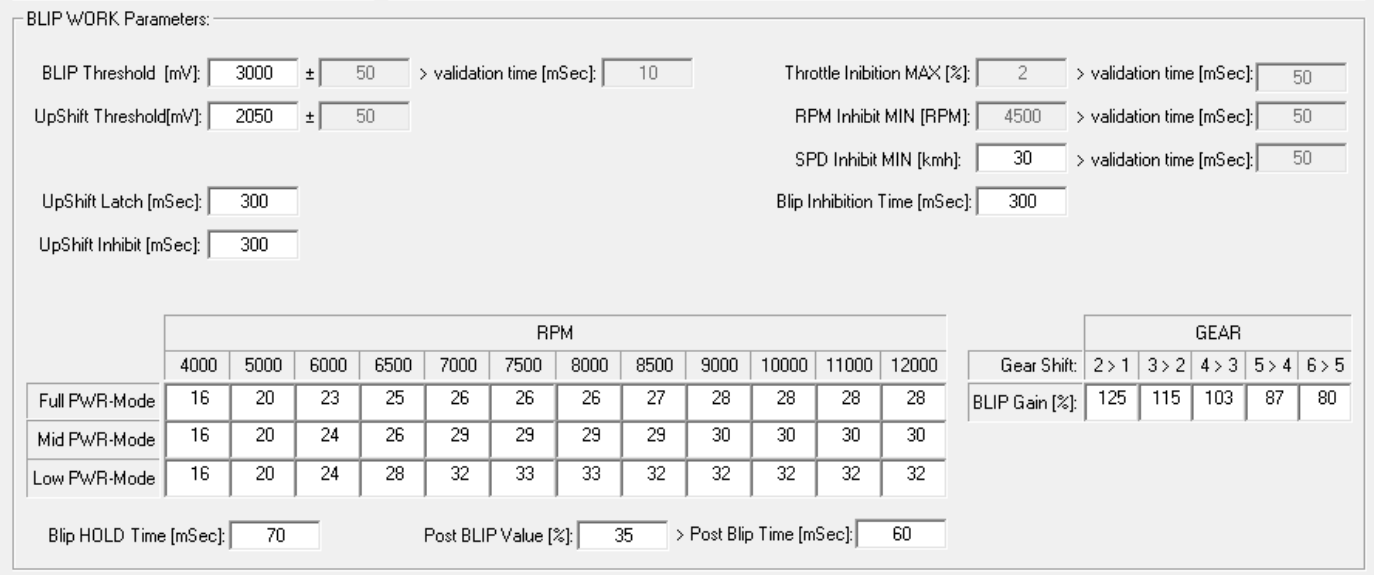
The numbers in the main table show the amount of twist grip % that will be applied in each of the power modes and at each RPM, the higher the RPM the higher the value simply because you need more throttle to reach the higher revs.

This 'blip' is held for 70 (milliseconds) , 0.070 of a second to momentarily accelerate the engine from braking to accelerating which removes the gearbox backlash and allows a free movement of the lever.

The post blip value and post blip time are there simply to try and rev-match the next gear.

On the right side you see some GEAR shift blip gains, these are used to modify the main table values for each gear. In this example at 7500rpm in full power mode the blip is 26% of twist grip, but from 2nd to 1st gear a multiplier of 115 is applied (1.15%) so the actual blip value would be 30%.

This is done because the lower the gear, the higher the rpm step as you downshift.


BLIP WORK Parameters:

BLIP Threshold [mV]: 3000 ± 50 > validation time [mSec]: 10
UpShift Threshold[mV]: 2050 ± 50
UpShift Latch [mSec]: 300
UpShift Inhibit [mSec]: 300
Throttle Inibition MAX [%]: 2 > validation time [mSec]: 50
RPM Inhibit MIN [RPM]: 4500 > validation time [mSec]: 50
SPD Inhibit MIN [kmh]: 30 > validation time [mSec]: 50
Blip Inhibition Time [mSec]: 300

	RPM											
	4000	5000	6000	6500	7000	7500	8000	8500	9000	10000	11000	12000
Full PWR-Mode	16	20	23	25	26	26	26	27	28	28	28	28
Mid PWR-Mode	16	20	24	26	29	29	29	29	30	30	30	30
Low PWR-Mode	16	20	24	28	32	33	33	32	32	32	32	32

	GEAR				
Gear Shift:	2 > 1	3 > 2	4 > 3	5 > 4	6 > 5
BLIP Gain [%]:	125	115	103	87	80

Blip HOLD Time [mSec]: 70
Post BLIP Value [%]: 35 > Post Blip Time [mSec]: 60

Quick and dirty tuning tips:

1. If the bike pushed after the shift this means the blip is being held too long, so make the blip time shorter or make the blip value lower.
    a. If it only happens in one gear or RPM range, then just tune that part of the map.
    b. I suggest big changes first so you can clearly see the affect.
    c. Typical min/max values for blip % are 15 > 45
2. Blip hold time typical values, the lowest we have ever used is 65 and the highest is 110mSec
3. If the lever pressure is high and the engine is not blipping, this does not mean the system is not working, it can simply be that the engine is poorly tuned and running either rich or lean during braking so a short blip of the throttle is not enough time to clear the cylinders and accelerate the engine, try a longer blip time until a clear blip is felt and heard.