“Flatshift” Quick Setup guide (Load cell)

These instructions must be followed exactly!

1. Connect the red wire from the shift ECU harness to an ignition 12v supply.
2. Connect the Black wire from the shift ECU harness to the power ground.
3. Connect the 3-pin female Sureseal connector to the gear position sensor.
4. Connect the Green wire from the shift ECU harness to the engine ECU “gear cut” input. If the engine ECU does not support gear cut then connect flatshift ECU coil cut pins (red & white wires) in accordance with the wiring schematic.
5. Where applicable, the ECU gear cut MUST be configured so that the cut is applied while ever the green wire is switched to ground – not for a fixed duration. If in doubt, consult your engine tuner.
6. If possible, the gear cut should be set to a torque reduction mode instead of a total cut. The torque reduction should be initially set at 90-95%, but the final value should be determined by track testing.
7. Install the Geartronics control panel application on your laptop.
8. Connect the laptop to the shift ECU using either the serial cable provided or a USB to serial converter cable.
9. Start the software and at the top of the screen, click *“settings”* then *“communications*” and select your serial port from the pull-down list. *Note: USB to serial converters create a ‘virtual’ COM port, and if the USB drivers have been installed correctly then the virtual COM port will appear in the list.*
10. When the PC connects to the ECU, the connection status in the bottom left corner should change to “ECU Connected” and the ECU version should be reported as 3.1.9 (as of July 2014). A dialogue box will also appear, asking if you wish to upload the current ECU values. You should always answer “YES”. This will read the current calibration and display on screen.
11. The first part of the setup is to teach the ECU the positions of each gear. To do this, set the number of forward gears and then click the box entitled *“Sample Gear Positions”*. You will then be prompted to select each gear in turn and confirm the position by clicking “OK”.

    Note: If your gearbox does not have a unique barrel position for reverse gear then you must select neutral when the software asks you to confirm the reverse position.

    When all gears have been sampled, the ECU will calculate the gear positions and display them as coloured ‘windows’ around the barrel position dial at the top right of the software. There should be an equal distance between each of the gears. Also, the zero degree position should not fall between adjacent gears – it must be between the lowest & highest gears. When you are satisfied that the gear positions are calibrated correctly, press F8 to save the changes to the ECU. The software gear indicator in the centre of the dial will now display the correct gear.
12. The *“Gear Position Tolerance”* sets the window size for the system to recognise the selected gear. When the needle of the barrel position dial first enters the gear window, this is the point at which the engine power is resumed. If the tolerance is reduced (larger value) the engine power will resumed earlier. Increasing the window size can help to make the shift appear faster and smoother, but if the window is too big, there is a risk of causing dog damage by resuming power before the dogs have engaged. Typical values are between 5 and 10 degrees.
13. Next, the gear lever trigger must be configured. The gear lever trigger method should be set to *“Load Cell (Analogue)”*.

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14. At the right hand side of the screen you will see the value *"Analogue input"*. This value should be approximately 127 when there is no load on the gear lever. When you pull the lever to make an upshift, the value will increase or decrease depending upon the direction of the applied force. If the value decreases when you pull the gear lever then you must check the box "Invert Trigger Polarity". The *"Upshift Trigger Threshold"* should be adjusted so that the ECU correctly recognises the point at which a shift is initiated. If the Analogue input value increases when you make an upshift then the ignition cut is initiated when the value exceeds the trigger threshold. Conversely, if the Analogue Input reduces when you make an upshift then the ignition cut is initiated when the value falls below the trigger threshold. Each time you make an adjustment, you must press F8 to save the changes to the ECU. To check the sensitivity, observe the status indicators at the bottom right of the screen. The *"Trigger Active"* indicator should illuminate just after the point where any free-play has been taken up. If the sensitivity is set to high, the system will cut the engine unintentionally when going over bumps. If the sensitivity is too low, it will be difficult or impossible to change gear.
15. At the top centre of the screen there is a setting for *"Trigger Filter".* For the system to validate the shift, the trigger threshold must be exceeded for this time, otherwise it is rejected. You should aim to set this value as low as possible without the system false triggering.
16. The *"Trigger Mask"* is the minimum time between two successive triggers. This should typically be set to about 500mS.
17. The upshift cut strategy has two modes: *"Open-Loop"* and *"Closed-Loop"*. In closed-loop mode, the ECU determines the point at which it is safe to resume engine power based on the gear position sensor feedback. Unless you suspect a problem with the gear position sensor, you should always use closed-loop mode, as this will give the smoothest shifts and reduce dog wear. In open-loop mode, you can specify the cut duration for each gear, but this will remain constant regardless of whether the next gear has been selected within the given time. Open-loop mode should only be used if there is a problem with the gear position sensor. However, this mode is not recommended and you must fully understand the consequences of doing so.
18. In closed-loop mode, the *"Maximum Cut Duration"* specifies the maximum time that the engine will remain cut, even if the next gear has not been successfully engaged. In most instances, this can be set to about 500mS.

To perform the initial test of the system, set the maximum cut duration to 50mS - remember to press F8 to save the change. Select 1st gear and hold the engine at approximately 3000rpm with the clutch depressed. Pull the gear lever with sufficient force to cause a trigger, but not so hard as to select 2nd.

Please note that a cut will not be allowed until 2 seconds have elapsed after you shift from neutral to 1st – this is to prevent the engine stalling on the start line.

Each time you pull the lever, you should hear a slight engine cut (50mS). Next, set the maximum cut duration to 250mS and repeat. This time you should hear a long cut and the engine will possibly stall. This procedure verifies that the engine ECU is cutting for the time specified by the shift ECU. After you have verified the cut operation, set the maximum cut duration back to 500mS. Next, put the car securely on stands (or preferably a 2-post ramp) so that you can run through the gears with the wheels turning. Hold the engine at about 3000rpm and shift up through the gears without using the clutch or lifting off the accelerator. When shifting, make fast and positive movements with the gear lever. Remember that with dog gearboxes, the faster the shift, the less likelihood there is of dog damage! Each upshift should be accompanied by a slight engine cut. However, with no load on the gearbox, the shift will be so fast that the cut might not always be apparent. When you have reached top gear, allow the engine speed to reduce to idle and then shift down the box.

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If the static tests are OK you can then road test the car. The initial test should be conducted at low engine speed and small (no more than 30%) throttle angles. Only when you are satisfied that the engine cut is consistent and that the shifts are smooth can you test at full speed & power. If there is any doubt whatsoever, you should immediately stop the test to investigate the problem. To continue testing could result in serious gearbox damage!

At the start of each meeting, we strongly recommend that you check the gear position calibration and the gear lever trigger thresholds. Remember that the system is only as good as the feedback it receives from the sensors…