NISTUNE MAF TECHNICAL NOTES

Overview:
Mass air flow meters (MAF) provide a reliable load signal based on mass airflow without the need to make separate measurements for barometric pressure and air temperature correction. Nistune provides the ability to upgrade to MAF sensors from other vehicles in order to measure increased load levels (where the existing sensor is unable to read further load).

Whilst MAFs provide a smooth accurate representation of load, they can become more subject to contamination or effects of reverse airflow. Correct plumbing and installation of the MAF will result in problem free operation. We often see on customer vehicles issues related to MAFs so have covered these problems in this guide.

Things to check

1. Reversion
When coming off boost, without a suitable blow off valve, the pressurised airflow will travel backwards through the turbo and back towards the MAF. The MAF will measure airflow in the reverse direction (it can't tell airflow direction) and will cause the ECU to see extra metered airflow. The ECU will subsequently inject the required amount of fuel for the airflow. This will result in exhaust popping unburnt fuel and sometimes a subsequent lean condition that may cause stalling.

2. Atmospheric venting blow off valve
These devices will vent metered air to atmosphere when the throttle is closed. This unexpected escape of the air is measured by the MAF sensor and the ECU (unaware of the airflow loss) injects a corresponding amount of fuel into the engine. Which has its throttle closed and so doesn't need the fuel. This results in a temporary rich condition on closed throttle which can cause stalling issues. Replace with a recirculating blow off valve.

3. Incorrectly plumbed recirculating blow off valve
The vented airflow from the recirculating BOV should be pointed towards the turbo - preferably at a shallow angle. Any vented airflow which reaches the MAF will cause it to report the measured airflow to the ECU, and subsequently the ECU will inject more fuel than required by the engine. Once again this can cause a very rich condition after boost and then a subsequent lean condition afterwards, causing stalling

4. Suitable plumbing and air filters
Air filters will cause a minor restriction to the airflow through the MAF. It has been noted during dyno sessions that removing of the air filter, or changing the type of filter can markedly affect the airflow through the MAF. Keep the setup with plumbing and filter consistent between runs and avoid changing inlet plumbing and/or filter after tuning is complete.

Factory piping between the turbo and air filter is worth checking as it may collapse at high airflow. It's usually best to replace this piping with hard pipe if possible. Don't forget to fit the fitting for the BOV – close to and facing the turbo inlet. Air filters themselves (read: cheap air filters) have been known to collapse and cause the same issues. These faults can be very frustrating and time consuming to find.

MAF plumbing ideally should place the MAF as far as possible from the turbo. Avoid sudden changes in diameter and tight bends if possible. Use an air filter with an inlet trumpet if you can – these help smooth the airflow into the MAF (you'll see them inside the air filter box of most standard cars). These little details will help eliminate reversion and help provide a reliable MAF signal.

5. Correct offset for slot style MAFs
When using slot style MAFs (R35 GTR, 350Z, HPX) ensure that the end of the sensor is in the centre of the tube. Using the correct size bung welded to the tube will ensure correct airflow measurement.

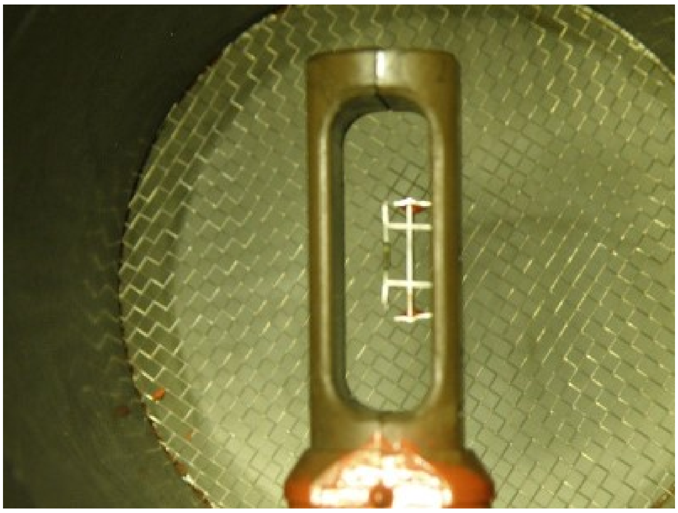
6. Genuine MAFs
Unfortunately with the automotive market there are cheaper copies of genuine products being put out on the market. This extends to the manufacture of inferior MAF units which were initially available on places like eBay but are now becoming common place even at legitimate parts retailers. Identification of MAF units is difficult because not all Nissan MAFs have the Nissan logo and copies use the exact same part numbering and look identical externally

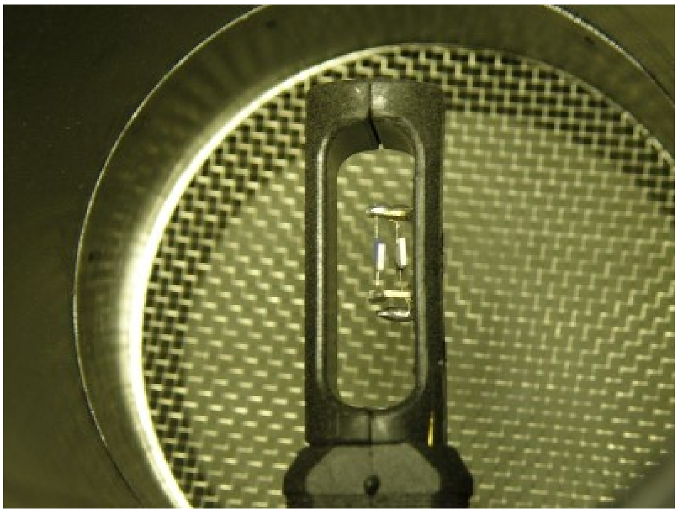
Using a counterfeit or used/dirty MAF is fraught with danger and often results in higher cost than that of buying a brand new genuine sensor.

The guide below (originally on the Nistune forums) shows the differences between both sensors:

1. Externally part numbers and the housing are the same

2. Both original and copied items may or may not have the Nissan identification logo





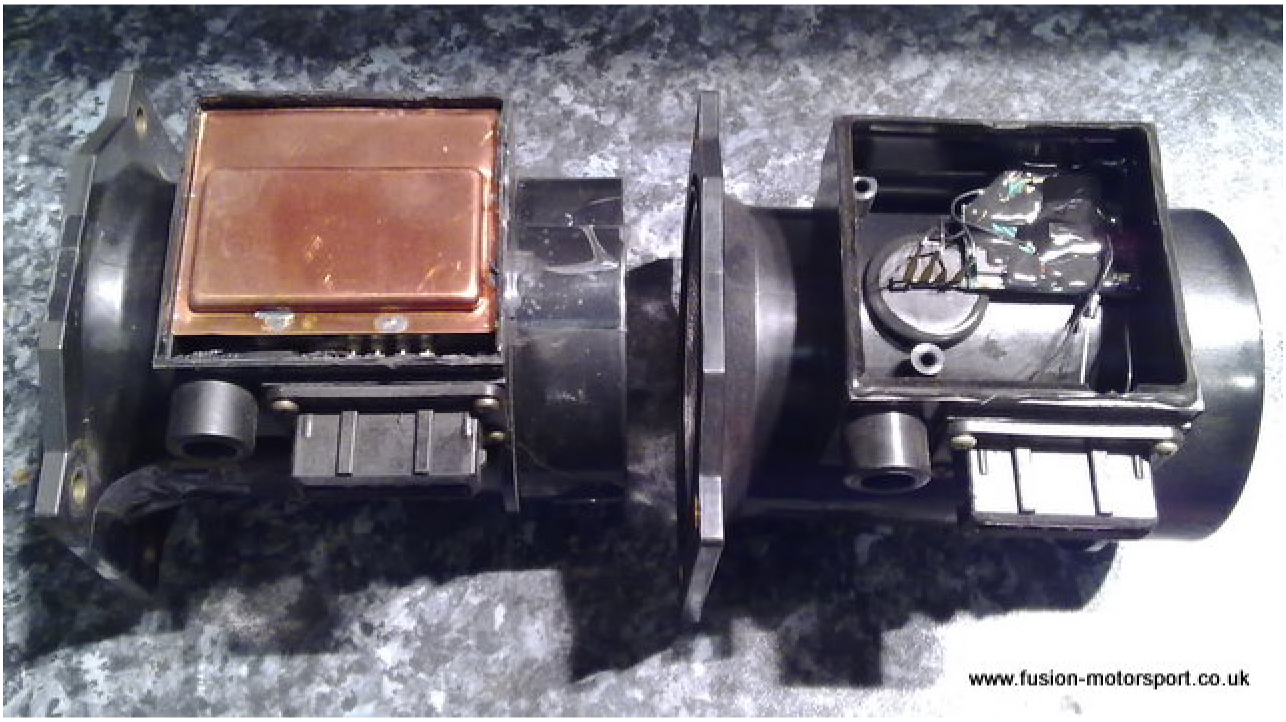
3. The genuine unit (left) has orange coating at the base of the MAF and a single dark coloured bead in the centre with a second ceramic strip sensor. The fake unit has white components and black plastic sensor mount.

4. If in doubt, remove the sealed plastic lid from the MAF and check the inside.

The below images from Fusion Motorsport show:

LHS genuine Nissan MAF (Metal, heat shield, underneath is a ceramic circuit board inside a jelly compound).

RHS shows the counterfeit MAF, which in this case has a small board with components and coated in epoxy.



7. Used MAFs
Second hand units may be contaminated or otherwise damaged. Check the wire of the MAF is clean using a magnifying glass. Remove the mesh from one side of the MAF and with a cue tip/cotton bud carefully clean the hot wire using electrical contact cleaner or isopropyl alcohol.

8. Post turbo MAF installation
Installing MAFs post turbo can eliminate some issues with reversion but the sensor itself is then pressurised under boost. Depending on boost levels this may cause damage to the MAF housing or result in leaks if boost is too high.

8.1 Contamination issues
Other issues seen have been post turbo contamination (water or oil) on the sensor. Take note of this if installing the MAF this way as a dirty MAF may adversely affect the tune.

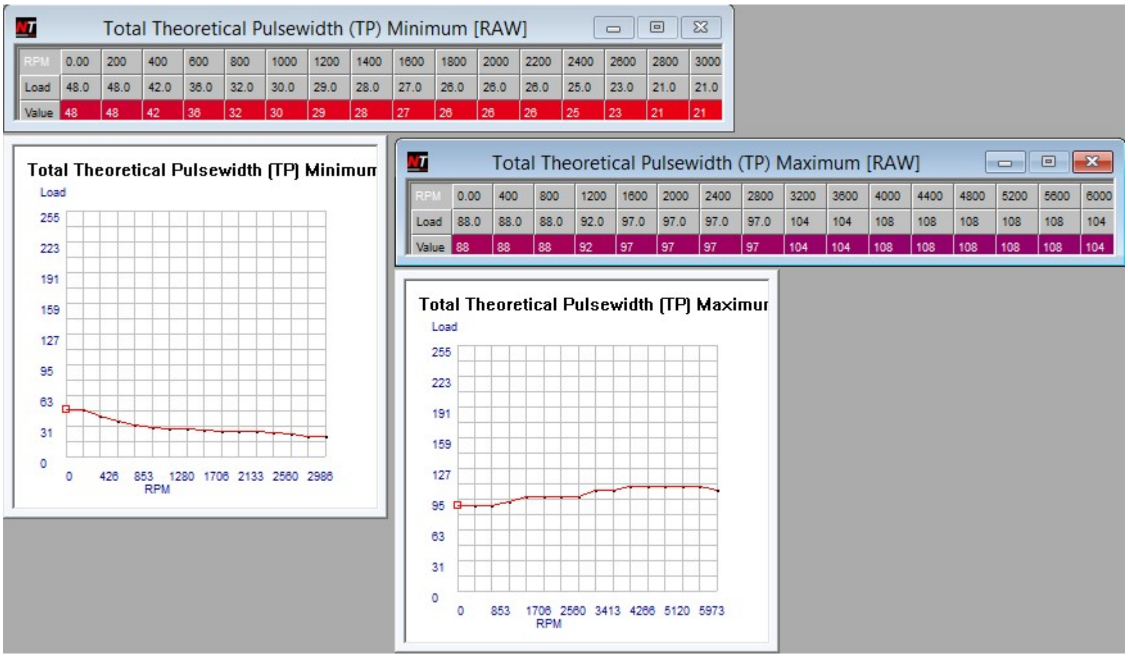
8.2 Heat soak issues
If installing the MAF post turbo, ensure that it is not subject to heat soak. Customer reports show that if the MAF is subject to heat soak, it can result in reporting richer than the actual mixture.

Make sure the MAF sensor is installed after the intercooler, if installed post turbo (in case of slot sensors like HPX for example)

9. Nistune MAF to load stabilisation
Nissan added MAF to TP (load) limit stabilisation tables which may require adjustment:

TP minimum: Minimum load limit where MAF voltage dips below the specified load point for the given RPM. This avoids the cases where on deceleration there is no measured load. Increase this table to increase the minimum load (if too lean at idle for example. Preferably fuel map should be adjusted first and latency must be correct for the injectors)

TP maximum: Maximum load limit where on acceleration the table prevents overshoot load (reading too rich). This table needs to be increased when boost levels are increased (normally done on injector resize). Lower the levels of this table in cases where on deceleration there are spikes in MAF voltage through reversion which cannot be physically resolved. Care must be taken to no lower these too much where acceleration load on boost would be limited


Total Theoretical Pulsewidth (TP) Minimum [RAW]

RPM	0.00	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000
Load	48.0	48.0	42.0	36.0	32.0	30.0	29.0	28.0	27.0	26.0	26.0	26.0	25.0	23.0	21.0	21.0
Value	48	48	42	36	32	30	29	28	27	26	26	26	25	23	21	21

Total Theoretical Pulsewidth (TP) Maximum [RAW]

RPM	0.00	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000
Load	88.0	88.0	88.0	92.0	97.0	97.0	97.0	97.0	104	104	108	108	108	108	108	104
Value	88	88	88	92	97	97	97	97	104	104	108	108	108	108	108	104

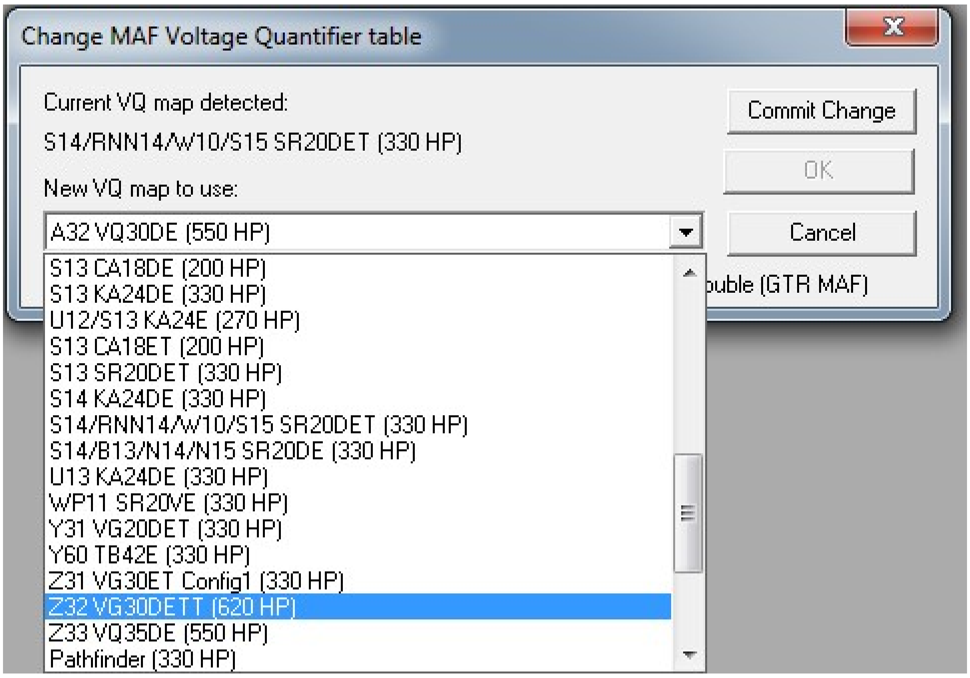
Notes:
TP minimum not available on some VE map equipped later model ECUs (1995 onwards) including NEO ECUs

Upgrading your MAF

The voltage quantifier table ("VQ map") in Nissan ECUs converts the MAF voltage into a value used for determining load.

Formula for calculating load:
*TP (load) = VQMap [MAF voltage] / RPM * K Constant*

Nistune provides a selection of predefined VQ maps which are sourced from other ECUs. These may be used for upgrading from stock MAF under *Operations > Resize MAF*



This list includes the addition of slot style MAF sensors including those from 350Z, R35 GTR and HPX when installed in 3" tubing.

MAF VQ Function Generator (Advanced Users)

Slot style sensors may be used in larger tube sizes to increase maximum MAF range. When this is done (or the load measuring range of the sensor is more than required for the vehicle), then custom VQ maps are required. They are also more resistant to reversion having out flow vents on the sides of the sensor.

Important notes for ordering

The MAF sensors we use and recommend are from PMAS MAF sensors. We use the PMAS HPX-N1 sensor which is capable of:

3” housing 640 rwhp (477 rwkw)
3.5” housing 748 rwhp (557 rwkw)
4” housing 830 rwhp (618 rwkw)

These provide a low more range than using the R35 GTR MAF sensor (approx 415rwhp or 310rwkw).

The sensors use the Ford style MAF connector which are normally provided with the sensor (when ordering through Nistune). You can also order the sensor direct from PMAS, especially if you are in the USA or Canada

http://www.pmas-maf.com/hpx/

MAF sensors are fitted using weld on aluminium bungs available from MRP Machine Shop (via ebay or contact directly)

http://mrpmachineshop.com/

Nistune provides 3”, 3.5” and 4” bungs which we have used for pre-turbo setup and testing in our vehicle. MRP also offer tubes with honeycomb air straighteners which are riveted into the tube which you can purchase direct from them

Important notes for installation

Nistune has tested HPX sensors before the turbo on two different vehicles pre-turbo with 3”, 3.5” and 4” housings.

PMAS claims these MAFs can be used post turbo, but you should take into consideration:

1. Ensure that you use an air filter prior to the turbo in all MAF setups to ensure straight airflow.

2. Use of a honey comb straightener is recommended to improve air stability, especially on larger tube setups

3. The sensor should correctly match the tube size (correct bung sizing for the application)

4. The tube size used in Nistune should match the diameter of the tubing that the sensor is installed

5. The sensor should be located in a straight piece of tubing. The airflow measured by the sensor takes a sample of the total airflow passing through the surface area where the tube is fitted. If the sensor is installed in a position (ie on or immediately after a bend) then this will affect the sample of the airflow.

6. In the case where airflow is coming after a bend in piping, the airflow would be similar to water on a slide where the majority is on the outside edge of the corner. The MAF sensor should not be positioned too closely to the corner otherwise it may measure less than the actual airflow (resulting in a leaner mixture, particularly at lower load levels).

7. MPS engineering to manufacture airflow honey comb straighteners to assist with larger tube diameters and straight airflow. Note that these must be riveted in, as I’ve so far heard of one case of spot welding the straightener, resulted in dislodgement after boost and it going through the turbo!

8. Ensure the MAF is not fitted to the hot side post turbo where it may be subject to heat soat. Ideally post intercooler or before throttle body.

Tuning Information

Nistune has now added a VQ translation function generator. It creates custom VQ maps based from these sensor types.

Example:

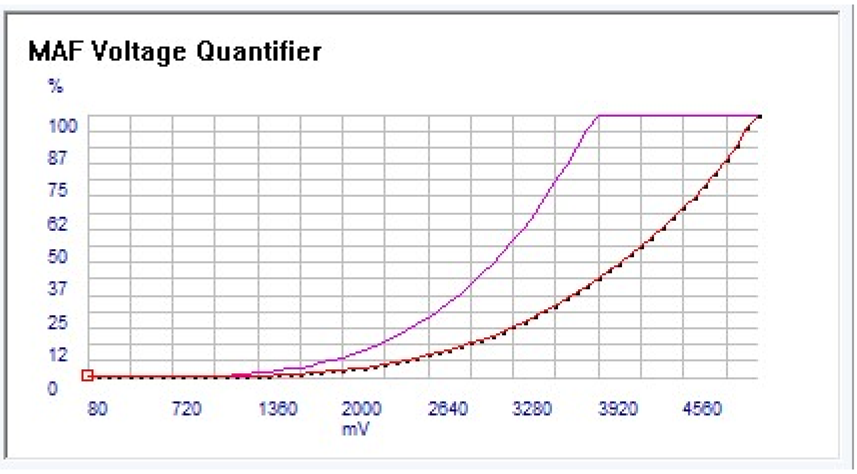
S14 SR20 when resizing to a HPXN1 MAF, the airflow measurement of the MAF (from S14 MAF 330hp flow to HPXN1 MAF 1460hp flow) results in an increase of 4.4x the original load of the S14 MAF

Normally during a MAF resize, K constant would then be multiplied by 4x4:

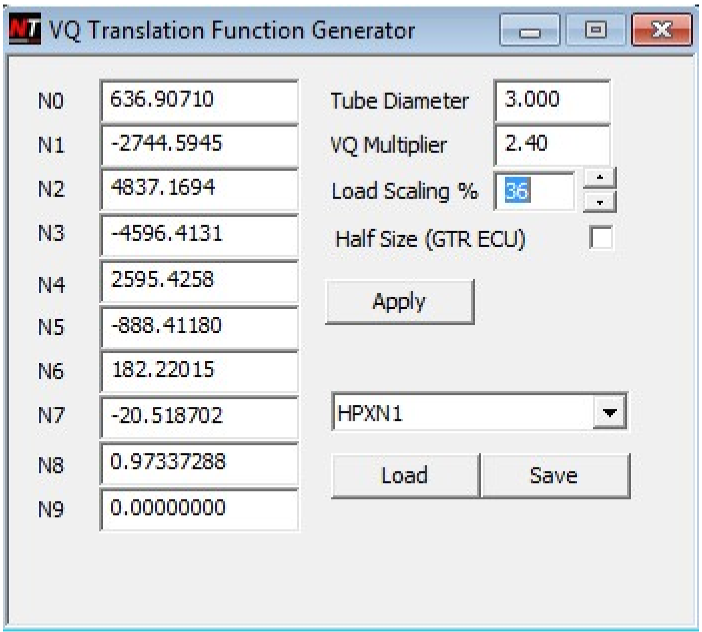
K constant of 33,000 x 4.4 = 146,000

This is outside the range of the Nissan ECU and also affects the load scaling of every item in the ECU making the HPXN1 unusable for most Nissans

Using the transfer function generator we can shorten the load measurement required by the ECU and reduce the total load multiplier:



RED = normal VQ map for 3" HPXN1 sensor
PURPLE = normalised VQ map for S14 SR20DET running 200rwkw with 3" HPXN1 sensor



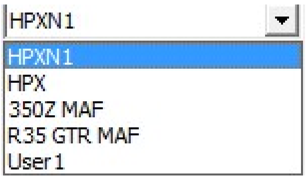
This was a result of 36% of the maximum airflow which can be read from the HPX in a 3" tube. The adjustment to K constant would now be from 33000 to 52250 to use this MAF.

Using the Transfer Function Generator

Only use this if your MAF is not available in the dropdown list in the software.

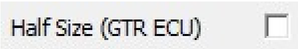
The definitions for the transfer functions are located in Documents\Nistune\transfer_functions.txt. There are five selections available, including a custom selection which can be changed by the user.

1. Select from the drop list the MAF you wish to use



2. Enter the tube diameter that the slot MAF is installed in.

3. If using a R32 GTR ECU then the VQ map needs to be halved (each MAF uses the VQ map)



4. Start with about 50% of the initial load scaling on HPX (or 100% using 350Z/R35 MAF)

5. Adjust your K constant accordingly to get AFRs back to normal with the MAF

6. Perform several runs and watch your TP load tracing on the fuel map. If more load / less load reading is required then adjust the load scaling accordingly. Adjustments to load scaling automatically apply to the VQ map. Open and watch the VQ map adjustments in the window: