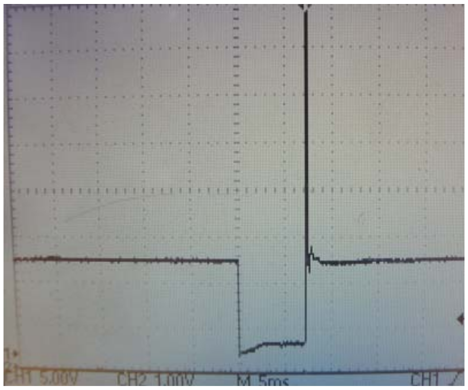
NISTUNE MAPPING GUIDE - DRAFT A

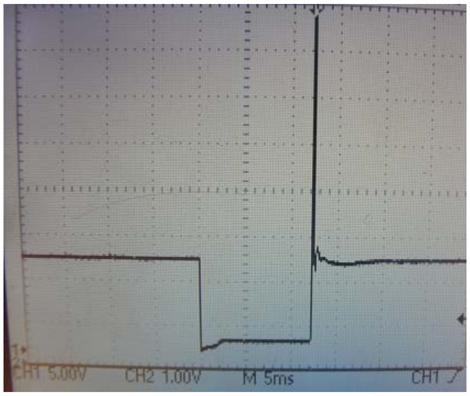
Determining Adjustments from Main fuel map

Your injection pulse width is the main thing which will determine what your final Air Fuel Ratios are going to be out of your tail pipe as measured by the wideband unit you are using

For ECUs which make this injection time available (not available on Z31, R31 and VL Turbo currently) you can monitor this consult gauge to monitor the changes you are making are working

Below is a comparison of the injection pulse width gauge and the output measurement of the injector. You can see the correlation in times (squares are in 5ms blocks) when going from 5.35ms to 12.20ms by adjusting the injection pulse width using fuel adjustments.





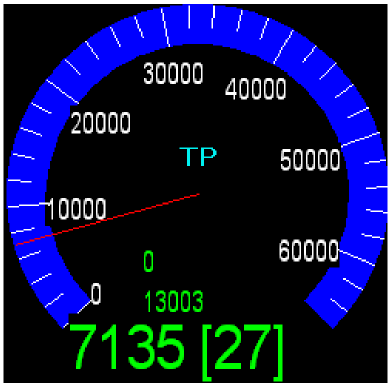
The main parameter for changing injector pulse width which will affect the vehicle regardless of current map(s) being accessed is the K constant (or injection multiplier)

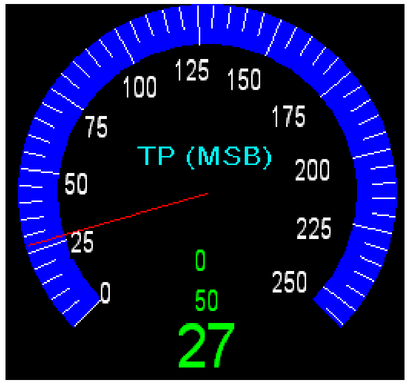
Understanding Theoretical Pulse Width

There are two types of injector pulse widths inside the ECU. There is **Theoretical Pulse width** which is an internal Nissan calculated pulse width used for accessing the columns on the fuel and timing maps, and then there is the final **Injector Pulse width** which is the physical opening time of the injector which we just looked at.

The two are closely related and understanding both is essential to knowing how to tune the Nissan ECU. Nissan patents available online go into great detail of how the ECU works and these pulses but we will focus on the practical side of things.

Theoretical Pulse width inside of Nistune is commonly referred to as 'TP', not to be confused with TPS (Throttle Position Sensor). The value is a largish number 0 - 65535 as seen in the gauge below:





The main number is the TP number and the second number in brackets is the TP / 256. This is known as TP (MSB) in later versions of Nistune (where MSB = Most Significant Byte). The TP is basically a load indication of the ECU. It is used to index fuel and timing maps inside the ECU and the amount of incoming air through the airflow meter will determine where things are indexed.

Important note: If you increase your boost and airflow makes the cursor hit the end of the fuel and timing maps, then it is time to rescale the TP load scales to allow for extra measured airflow

TKRMH: Mixture Coefficient Correction (Primary)

Load	12	16	20	24	28	32	36	40	48	52	56	64	72	80	88	104
6400	13.44	13.44	13.44	12.38	12.22	11.98	11.69	11.47	11.20	11.13	11.07	10.88	10.81	10.75	10.75	10.69
6000	13.63	13.63	13.63	13.44	13.16	12.54	12.22	12.06	11.69	11.33	11.27	11.13	10.94	10.75	10.75	10.69
5600	13.73	13.73	13.73	13.73	13.25	12.63	12.30	12.14	12.14	11.61	11.40	11.27	11.07	10.88	10.88	10.81
5200	13.94	13.94	13.94	13.94	13.73	13.25	12.80	12.80	12.46	12.22	11.69	11.69	11.47	11.20	11.13	11.13
4800	14.70	14.70	14.70	14.15	14.15	13.73	13.63	13.44	13.07	12.89	12.63	12.22	11.91	11.27	11.27	11.27
4400	14.59	14.59	14.93	14.93	14.93	14.93	14.70	14.25	13.84	13.16	12.63	12.38	11.91	11.76	11.61	11.61
4000	14.70	14.70	14.70	14.70	14.93	14.93	14.93	14.15	13.84	13.16	12.89	12.46	12.38	12.14	12.06	12.06
3600	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.25	13.84	13.54	13.34	13.07	12.54	12.38	12.38	12.38
3200	14.59	14.59	14.59	14.59	14.70	14.70	14.70	14.70	14.15	13.84	13.44	13.16	12.89	12.54	12.54	12.54
2800	14.59	14.59	14.59	14.59	14.59	14.59	14.59	14.59	14.70	14.04	13.25	12.98	12.80	12.63	12.63	12.63
2400	14.47	14.47	14.47	14.47	14.70	14.70	14.70	14.70	14.70	13.94	13.34	12.80	12.71	12.63	12.63	12.63
2000	14.47	14.47	14.47	14.70	14.82	14.93	14.93	14.82	14.82	13.94	13.25	12.89	12.89	12.89	12.89	12.89
1600	14.47	14.47	14.82	15.17	15.17	15.17	14.93	14.93	14.93	13.94	12.98	12.98	12.98	12.98	12.98	12.98
1200	14.59	14.59	14.82	14.82	15.17	15.17	14.93	14.93	13.94	12.98	12.98	12.98	12.98	12.98	12.98	12.98
800	14.25	14.36	14.70	14.93	14.93	14.93	14.82	14.70	13.94	12.98	12.98	12.98	12.98	12.98	12.98	12.98
400	17.59	17.59	16.36	16.36	16.36	16.36	16.36	15.55	15.55	15.55	15.55	15.55	15.55	15.55	15.55	15.55

In this example the RPM is at 1962rpm and the TP = 27. This sits between 24 - 28 on the load scaling. We have two trace cursors in the example. These are flickering around where the ECU is accessing the fuel table.

The pink cells are our hardware trace which will display 4 cells being used to derive the fuel injection from hardware accessing (available when using Moates Ostrich emulators)

The grey cells are the consult reported TP values. We highlight grey cells to indicate accessed cells and a darker grey cell (not pictured above) to indicate closest accessed cell.

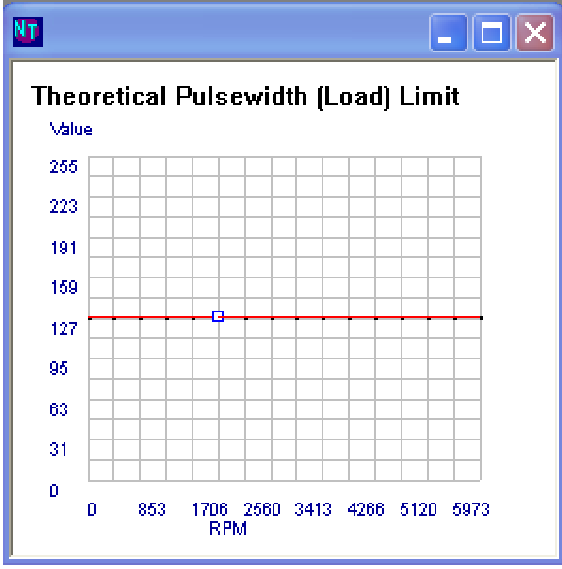
TP is used in other tables also. One of the common tables modified in Nissan ECUs is the TP Load Limit table. Some ECUs have two of these tables (second table TP Load Limit 2 is a conditional table which is checked under different circumstances still yet to be determined)

Theoretical Pulsewidth Limiting (aka Boost cut)

The TP Load limit tables look like the following for HCR32

Theoretical Pulsewidth (Load) Limit

RPM	0.00	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000
Value	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128	128



That guage that you saw the TP value earlier, if it goes above the TP values in the above table for the given RPM then the ECU will perform a fuel cut. This is a protection mechanism provided by the Nissan ECU for when the engine over boosts due to problem with controlling the waste gate actuator.

Note: It is recommend that when increasing boost and noticing that your TP reads higher values, that the values in this table be increased to higher but safe levels. Some tuners set to 255 which will allow for maximum TP to be reached but then takes out any over boost protection.

The basic works of the fuelling side of the ECU are:

Theoretical Pulse width (TP) = MAF Lookup * Injector multiplier + Injector Latency + Various enrichment

Injection Pulse width = Fuel table [RPM , TP/256] * TP

Total Injection Limits

Nissan ECUs have special injection limits in place. This stops injection when the injection pulse width is too small or too big. When adjusting for larger airflow meters and injectors, those limits will need to be changed to accommodate for these physical differences.

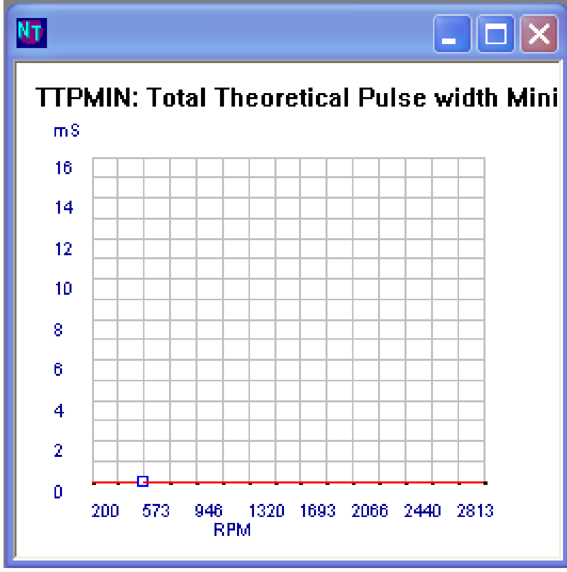
Larger injectors need a smaller pulse width to maintain the same amount of fuel at idle, but need a longer pulse width at full throttle than the ECU would typically provide with stock injectors.

There are two more tables to keep in mind. These are Total Theoretical Pulsewidth (TTP) minimum and maximum tables

TTP min is the smallest time that the injector will be allowed to open for. When using bigger injectors, this value will need to be reduced. When adjusting for injector size, enabling the tick box will allow Nistune to adjust this table to a ratio of small / big injector * TTP min

TTPMIN: Total Theoretical Pulse width Minimum

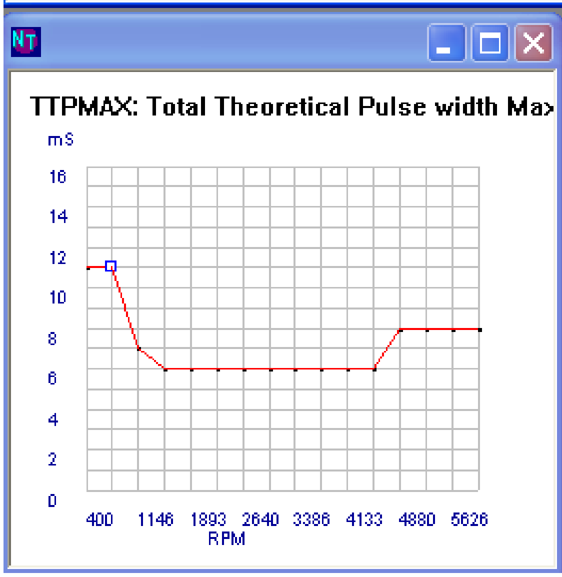
RPM	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000	3200
Value	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50	0.50
Value	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8



TTP max is the largest time for opening the injector. This is based on milliseconds opening time. Increasing this table to larger values will allow for greater opening time and avoid leaning out when on full throttle as some tuners have experienced when not altering this table.

TTPMAX: Total Theoretical Pulse width Maximum

RPM	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400
Value	11.5	11.5	7.00	6.50	6.50	6.50	6.50	6.63	6.50	6.50	6.50	6.75	8.00	8.00	8.00	8.00
Value	184	184	112	104	104	104	104	106	104	104	104	108	128	128	128	128

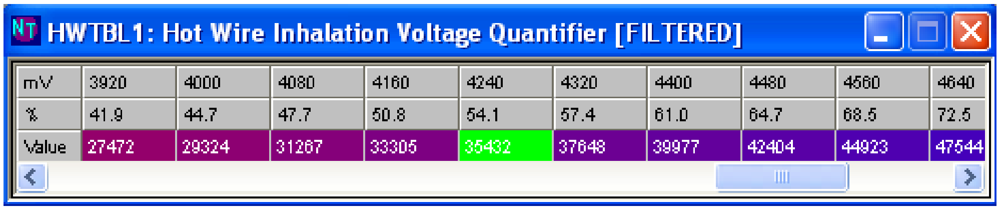


Mass Air Flow Meter

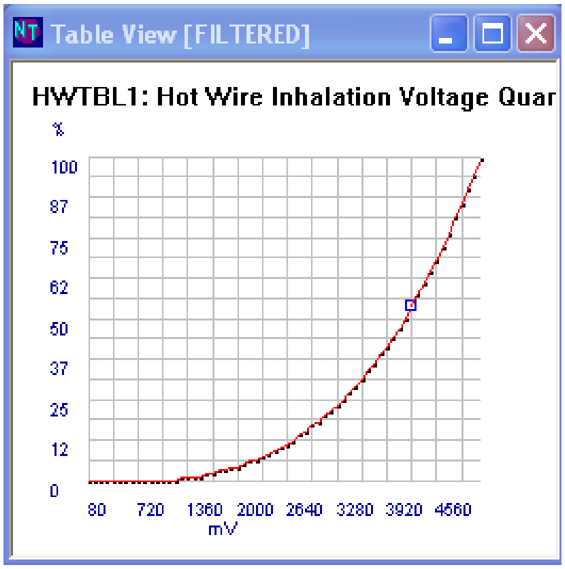
MAF (or Mass Air Flow Meter) is a sensor which uses a hot wire to measure the amount of air entering the engine. The MAF will attempt to keep the hot wire at a certain temperature, as the engine is running and air passes past the wire, the MAF will consume more current to keep the wire at that temperature.

The amount of extra current used is measured and output from the meter at a specified voltage typically 0 - 5 volts. This is then calculated by the ECU into a load reading percentage by the Voltage Quantifier (VQ) map.

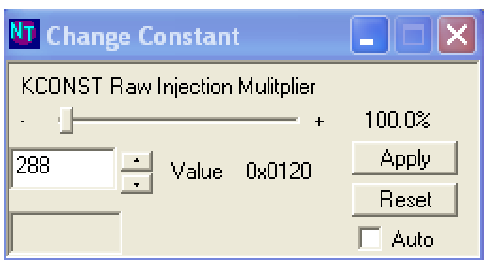
The lookup table takes the amount of volts from the airflow meter and converts it into a load percentage as below which can be seen inside of Nistune.


HWTBL1: Hot Wire Inhalation Voltage Quantifier [FILTERED]

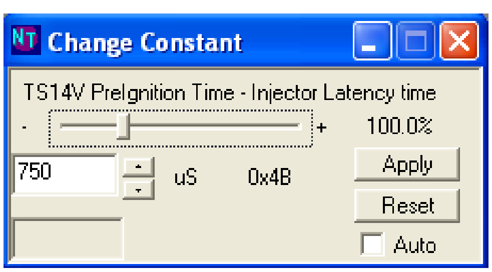
mV	3920	4000	4080	4160	4240	4320	4400	4480	4560	4640
%	41.9	44.7	47.7	50.8	54.1	57.4	61.0	64.7	68.5	72.5
Value	27472	29324	31267	33305	35432	37648	39977	42404	44923	47544



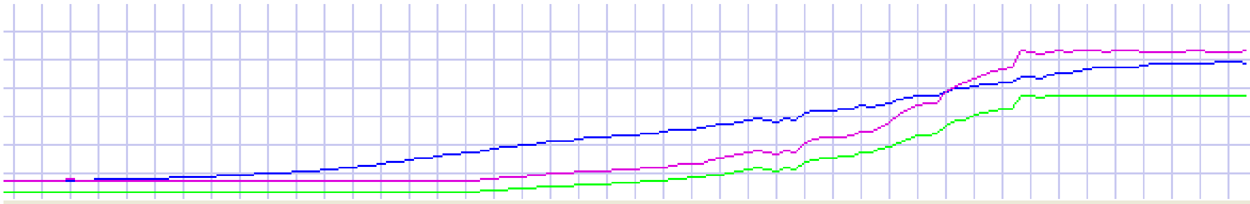
This is then multiplied by the Injection multiplier (K constant)



And then we add the Injection latency (sometimes known as pre ignition or void time). This is the opening / closing lag time of the injector. Bigger injectors need more latency to compensate for the increased opening / closing time. This will increase the Injector Time seen on the gauge by the amount entered in this box.



The following graph shows the relationship



Blue = MAF (volts)
Green = TP (ECU raw value)
Purple = Injector Pulsewidth (ms)

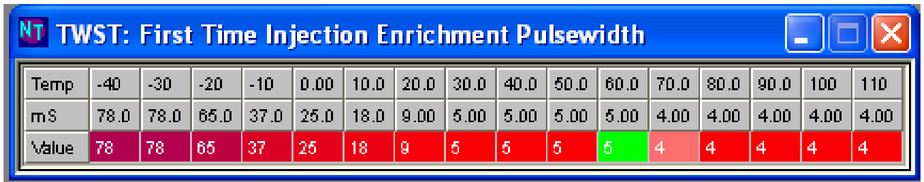
As the amount of airflow increases, so does TP increase and resulting in a larger injector pulse width.

Adjusting Fueling Maps and Tables

Fueling maps and tables make further adjustments on top of the Injection Multiplier and Latency. They are conditional on several things including

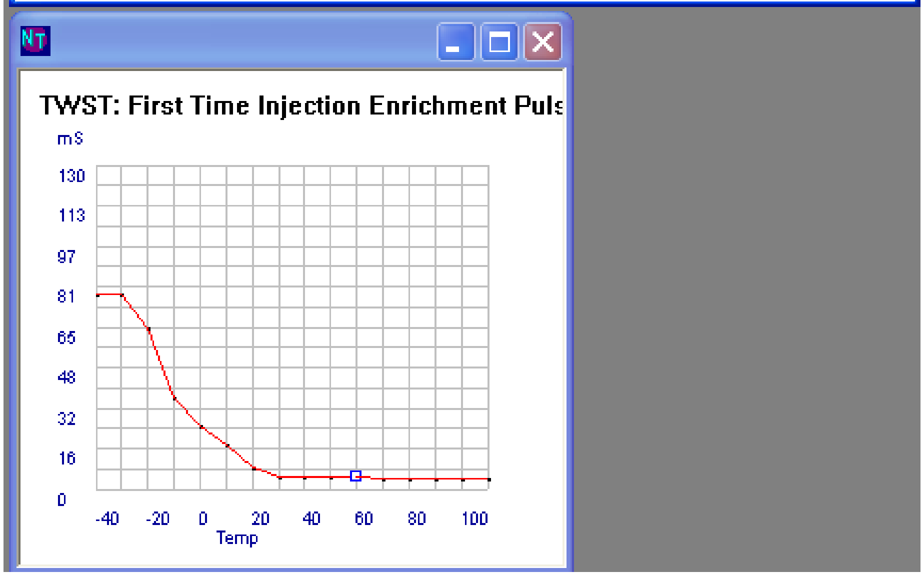
Engine Coolant Temperature
O2 feedback mode (closed loop)
Throttle Position Sensor input
Gearbox Neutral Switch

First Time Enrich

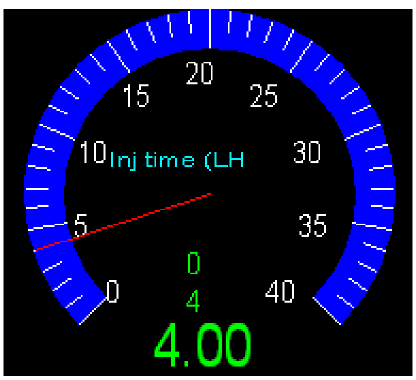


TWST: First Time Injection Enrichment Pulsewidth

Temp	-40	-30	-20	-10	0.00	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100	110
mS	78.0	78.0	65.0	37.0	25.0	18.0	9.00	5.00	5.00	5.00	5.00	4.00	4.00	4.00	4.00	4.00
Value	78	78	65	37	25	18	9	5	5	5	5	4	4	4	4	4



The first time enrichment map is accessed when the Start input  is used during cranking and subsequent starting of the engine.



This table is coolant temperature dependent. The map trace cursor will highlight the target milliseconds of pulse width which will match the consult gauge as reported. The above example uses 4 milliseconds for injection pulse width during starting. Adjusting this table will alter injection pulse width during starting.

After Start Enrich

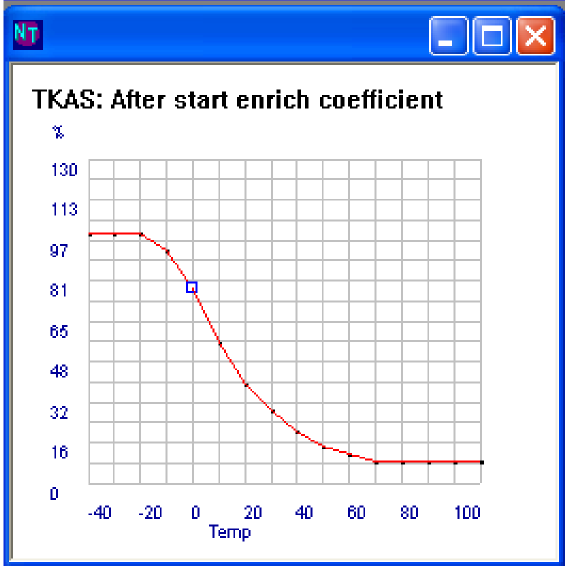
Similarly as for First Start Enrichment, when the starter is used on the engine, and the ECU detects this, it will use this table to determine the amount of extra enrichment based on temperature as a percentage value the engine will need.

This table can be viewed as an equivalent of a electronic choke. Colder temperatures will have more enrichment to get the engine started.

This table is only used during starting and once engine is running it is no longer accessed.

TKAS: After start enrich coefficient

Temp	-40	-30	-20	-10	0.00	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100	110
%	100	100	100	93.8	78.1	56.3	40.6	29.7	21.9	15.6	12.5	9.38	9.38	9.38	9.38	9.38
Value	64	64	64	60	50	36	26	19	14	10	8	6	6	6	6	6



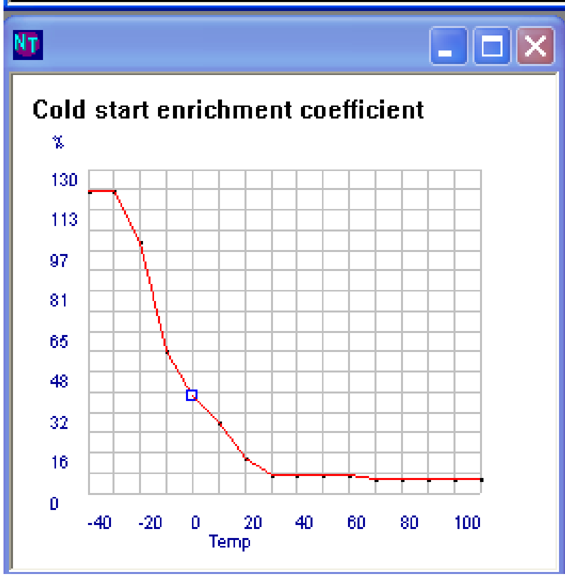
Cold Start Enrichment Coefficient

This table is accessed during cold starts after the Start sw is used during cranking and for about 5 seconds following starting of the engine. The temperature once again is coolant temperature based and injects more fuel when the engine is cold

The table is only used only for seconds after cranking and then not accessed afterwards.

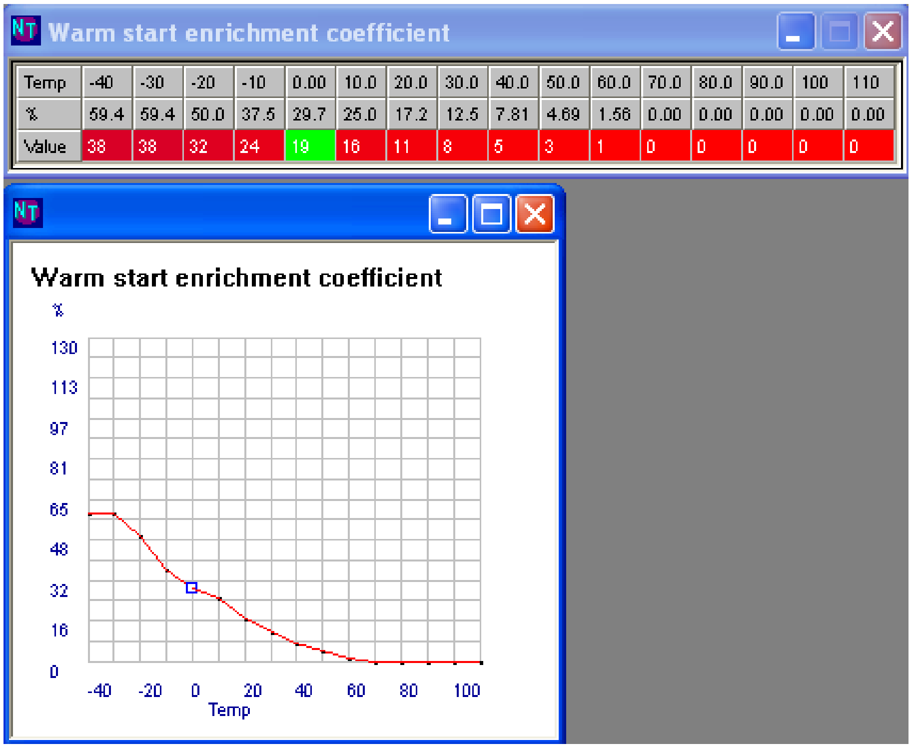
Cold start enrichment coefficient

Temp	-40	-30	-20	-10	0.00	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100	110
%	122	122	102	57.8	39.1	28.1	14.1	7.81	7.81	7.81	7.81	6.25	6.25	6.25	6.25	6.25
Value	78	78	65	37	25	18	9	5	5	5	5	4	4	4	4	4



Warm Start Enrichment Coefficient

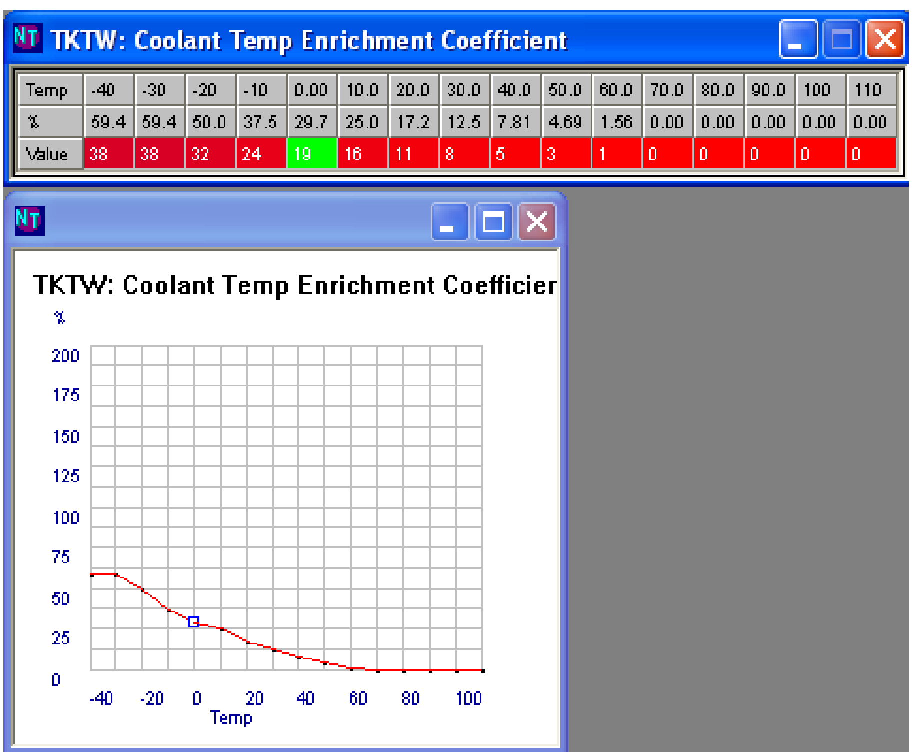
This table uses the coolant temperature to determine fuel injection coefficient for final pulsewidth adjustment during warm starts. It was noted during testing on HCR32 ECU that this table was not accessed on bench with any various starting, TPS or neutral switch positions. But assumed this table would be used after Start switch indication has been received



Warm start enrichment coefficient

Temp	-40	-30	-20	-10	0.00	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100	110
%	59.4	59.4	50.0	37.5	29.7	25.0	17.2	12.5	7.81	4.69	1.56	0.00	0.00	0.00	0.00	0.00
Value	38	38	32	24	19	16	11	8	5	3	1	0	0	0	0	0

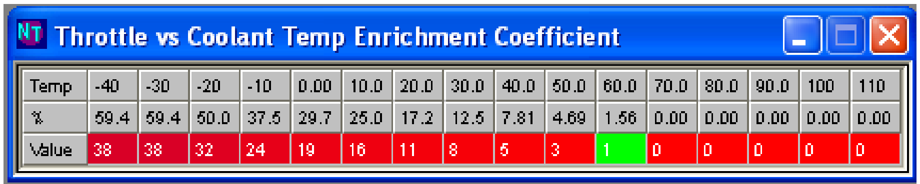
Coolant Temp Enrichment Coefficient
This table uses the coolant temperature to determine fuel injection coefficient for final pulsewidth adjustment. It was noted during testing on HCR32 ECU that this table was not accessed on bench with any various starting, TPS or neutral switch positions.



TKTW: Coolant Temp Enrichment Coefficient

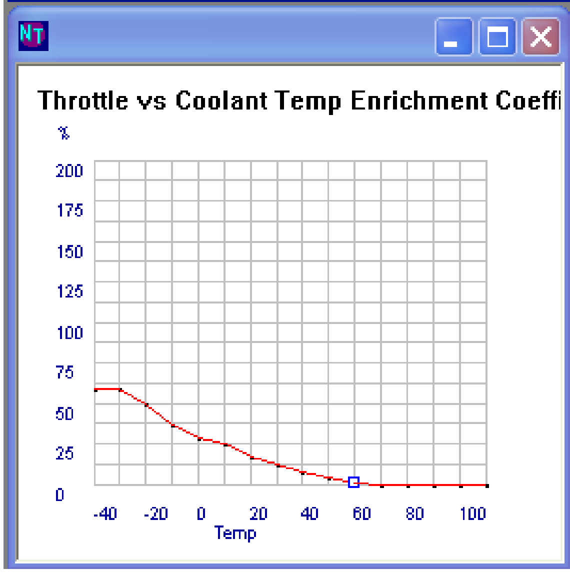
Temp	-40	-30	-20	-10	0.00	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100	110
%	59.4	59.4	50.0	37.5	29.7	25.0	17.2	12.5	7.81	4.69	1.56	0.00	0.00	0.00	0.00	0.00
Value	38	38	32	24	19	16	11	8	5	3	1	0	0	0	0	0

Throttle vs Coolant Temperature Enrichment Coefficient



Throttle vs Coolant Temp Enrichment Coefficient

Temp	-40	-30	-20	-10	0.00	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100	110
%	59.4	59.4	50.0	37.5	29.7	25.0	17.2	12.5	7.81	4.69	1.56	0.00	0.00	0.00	0.00	0.00
Value	38	38	32	24	19	16	11	8	5	3	1	0	0	0	0	0



This table is indexed by coolant temperature and adds an extra percentage of enrichment based from coolant temperature settings. It appears to be accessed during nomal ECU operation regardless of idle or neutral switch positions.

Throttle Enrichment tables

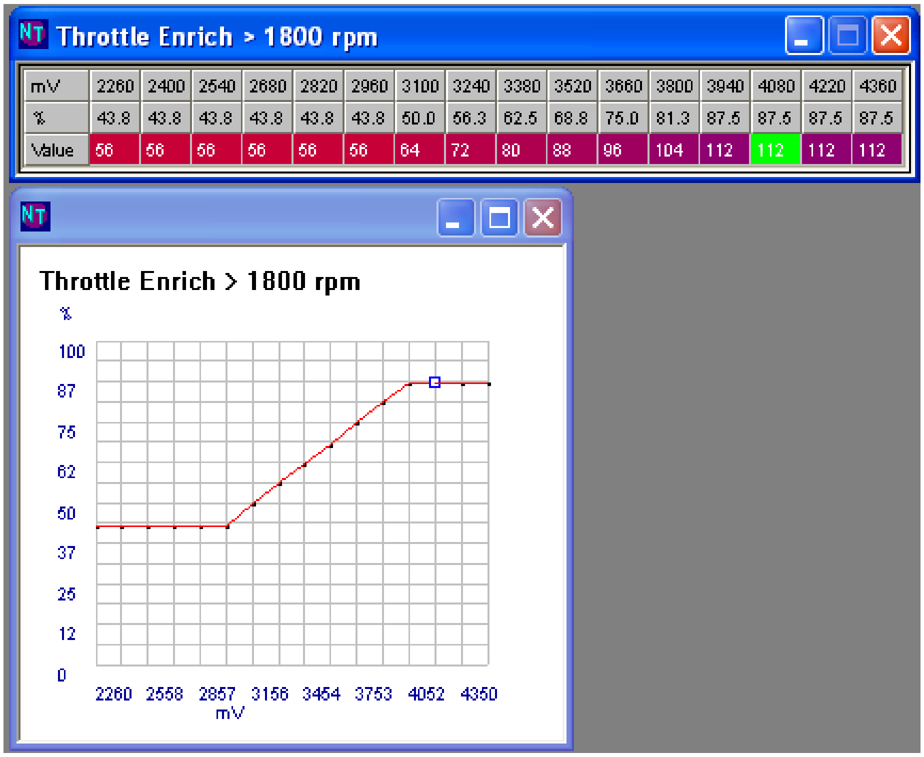
These have been found by Jeff from Speedlab for the HCR32 currently. We plan to hunt down these tables for further ECUs as information becomes available (as well as the necessity for having these tables)

Throttle Enrich 1
Throttle Enrich 2
Throttle Enrich 3
Throttle Enrich 4

There are four tables in the bands of

Throttle Enrich 1: 0 rpm - 600 rpm
Throttle Enrich 2: 600 rpm - 1200 rpm
Throttle Enrich 3: 1200 rpm - 1800 rpm
Throttle Enrich 4: > 1800 rpm

They are indexed by the TPS voltage (in millivolts) and alter the enrichment as a percentage based on the current RPM of the engine



mV	2260	2400	2540	2680	2820	2960	3100	3240	3380	3520	3660	3800	3940	4080	4220	4360
%	43.8	43.8	43.8	43.8	43.8	43.8	50.0	56.3	62.5	68.8	75.0	81.3	87.5	87.5	87.5	87.5
Value	56	56	56	56	56	56	64	72	80	88	96	104	112	112	112	112

Once the engine is running, if the TPS idle switch is OFF then TPS idle will be highlighted in consult guages and different tables are used. This is one of the tables used for enrichment coefficient based on vehicle RPM

Fuel Maps

Earlier model ECUs will only have single fuel and timing maps. They do not have knock maps unlike later types. Nistune is gradually implementing display of map type used via consult

Maps
Fuel Map
Knock Fuel Map
Timing Map
Knock Timing Map

Maps highlighted in pink colour indicate the current map being used by the ECU. As not all ECUs have knock reporting implemented at this time, use feedback from adjustments made to the fuel maps to determine which map you are currently using

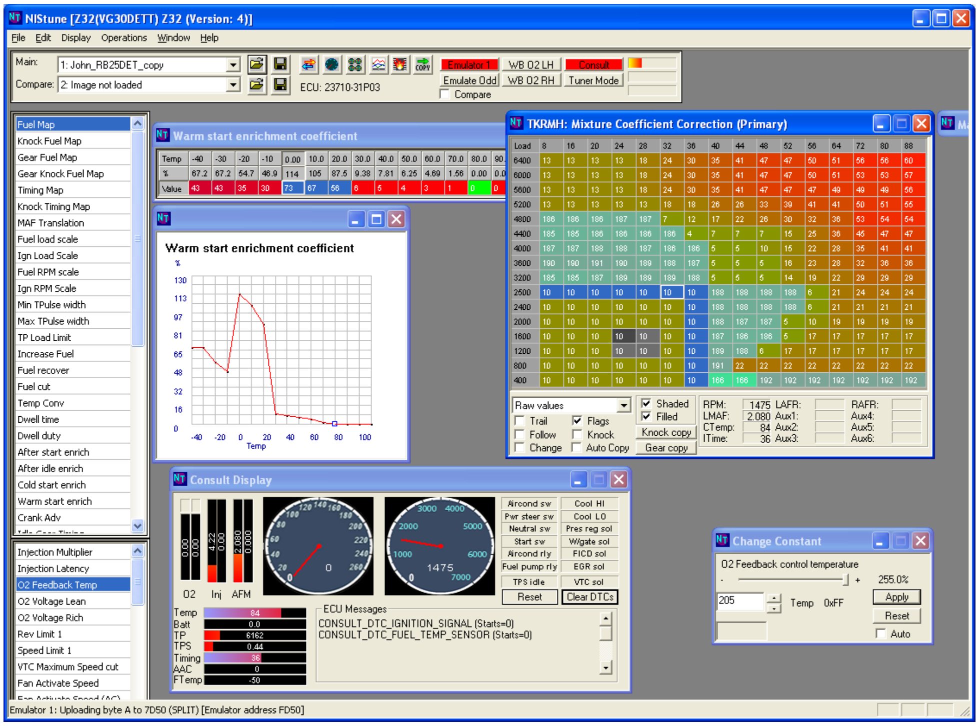
Fuel maps have an embedded O2 sensor flag within them (raw value + 128 indicates O2 flag used)

Fuel maps are always accessed regardless of TPS postiion or Neutral position (as noted for HCR32 ECU)

Fuel maps will use current RPM and TP for indexing the map.

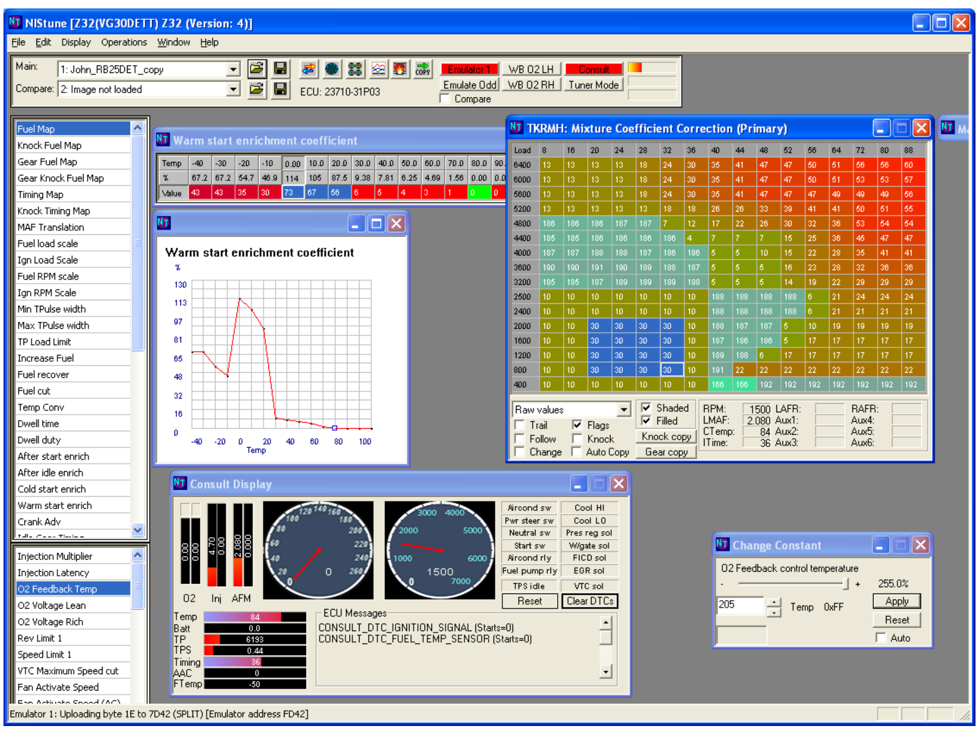
Diagnosing Fuel maps (example)

Temp = ~80degC
Set fuel table to 10s
Increase O2 feedback to 205 (Maximum) to doesnt use O2 sensor (or disable O2 in feedback switches if available)



Pulsewidth in example is 4.22

Example: Increase fuel table to 30 around maptrace block

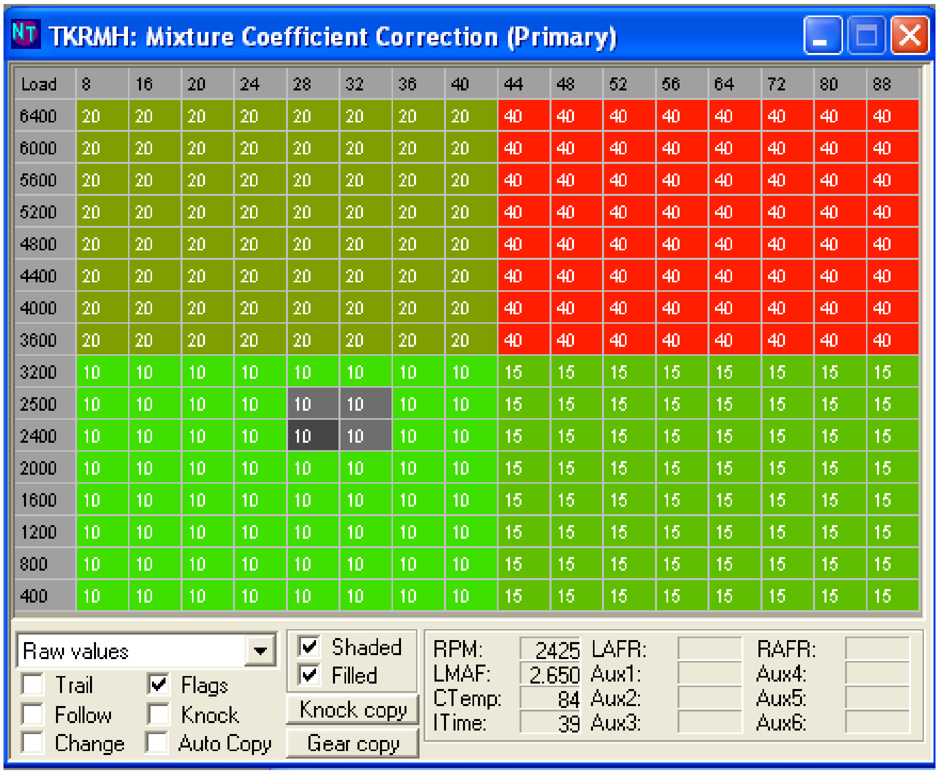


Check injection pulse width increases to 4.72ms (change due to alterations in fuel map)

If this doesn't work then try the Knock fuel map, Gear fuel map and Gear Knock Fuel map. Check your Knock sensor is connected (no knock DTC codes if connected should be raised). Check gear indication from A/T ECU or from 5th gear line (if available on manual ECU) is connected properly

Check knock sensor is not picking up engine noise. Replace with 570kohm resistor if suspect, or disconnect sensor from engine and short to sensor ground using clips

Further diagnosis then split the block into four areas with closed loop off



Load	8	16	20	24	28	32	36	40	44	48	52	56	64	72	80	88
6400	20	20	20	20	20	20	20	20	40	40	40	40	40	40	40	40
6000	20	20	20	20	20	20	20	20	40	40	40	40	40	40	40	40
5600	20	20	20	20	20	20	20	20	40	40	40	40	40	40	40	40
5200	20	20	20	20	20	20	20	20	40	40	40	40	40	40	40	40
4800	20	20	20	20	20	20	20	20	40	40	40	40	40	40	40	40
4400	20	20	20	20	20	20	20	20	40	40	40	40	40	40	40	40
4000	20	20	20	20	20	20	20	20	40	40	40	40	40	40	40	40
3600	20	20	20	20	20	20	20	20	40	40	40	40	40	40	40	40
3200	10	10	10	10	10	10	10	10	15	15	15	15	15	15	15	15
2500	10	10	10	10	10	10	10	10	15	15	15	15	15	15	15	15
2400	10	10	10	10	10	10	10	10	15	15	15	15	15	15	15	15
2000	10	10	10	10	10	10	10	10	15	15	15	15	15	15	15	15
1600	10	10	10	10	10	10	10	10	15	15	15	15	15	15	15	15
1200	10	10	10	10	10	10	10	10	15	15	15	15	15	15	15	15
800	10	10	10	10	10	10	10	10	15	15	15	15	15	15	15	15
400	10	10	10	10	10	10	10	10	15	15	15	15	15	15	15	15

Move around each block and + / - the block and monitor the injecton pulsewidth changes accordingly.

O2 Sensor Feedback

Nissan ECUs use an O2 narrowband sensor. It operates with stoichiometric air/fuel ratio being at 14.7:1 equating to an equivalent voltage of 0.5 volts

Whilst in closed loop operation the ECU will use the narrow band sensor to stay around 14.7:1 air fuel ratios. This ratio is chosen for pe[illegible]um because its the best burn ratio for the catalytic converter and for good fuel economy.

There are several conditions which must be adhered to in order to stay in closed loop. The vehicle must be travelling above a certain speed, the O2 sensor must be heated to the correct temperature and the fuel map must be in the closed loop area

As per the Z32 screen shot below this is indicated by the aqua cells when the 'Flags' tickbox is enabled

Load	8	16	20	24	28	32	36	40	44	48	52	56	64	72	80	88
6400	13	13	13	13	18	24	30	35	41	47	47	50	51	56	56	60
6000	13	13	13	13	18	24	30	35	41	47	47	50	51	53	53	57
5600	13	13	13	13	18	24	30	35	41	47	47	47	49	49	49	56
5200	13	13	13	13	13	18	18	26	26	33	39	41	41	50	51	55
4800	186	186	186	187	187	7	12	17	22	26	30	32	36	53	54	54
4400	185	185	186	186	186	186	4	7	7	7	15	25	36	45	47	47
4000	187	187	188	188	187	186	186	5	5	10	15	22	28	35	41	41
3600	190	190	191	190	189	188	187	5	5	5	16	23	28	32	36	36
3200	185	185	187	189	189	189	188	5	5	5	14	19	22	26	29	29
2800	184	184	187	188	188	188	188	188	188	188	188	12	22	27	27	27
2300	186	186	187	187	188	188	188	188	188	188	188	7	21	21	21	21
2200	186	186	188	188	188	188	188	188	188	188	192	8	21	21	21	21
1600	188	188	189	189	189	189	188	187	186	186	5	10	15	15	15	15
1200	190	190	191	191	191	191	190	189	188	6	15	17	17	17	17	17
800	190	190	191	192	192	191	191	191	8	15	20	22	22	22	22	22
400	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192	192

This is a raw view of the fuel map. All areas above 128 in this table are highlighted, and indicate that the ECU is running in closed loop in this area.

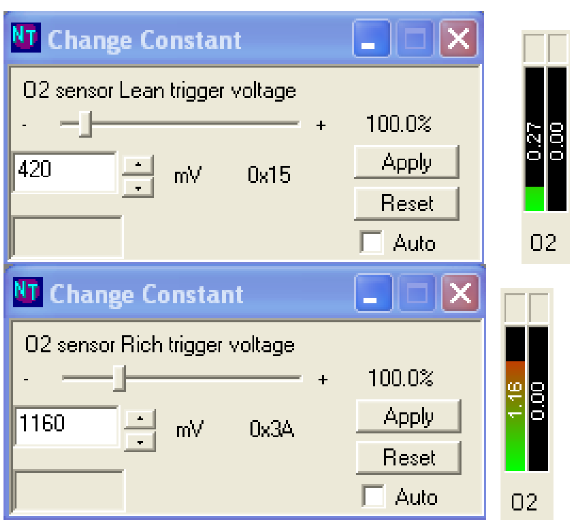
You can also view this in the target AFR view and it maintains the flags high lights

Load	8	16	20	24	28	32	36	40	44	48	52	56	64	72	80	88
6400	13.34	13.34	13.34	13.34	12.89	12.38	11.91	11.54	11.13	10.75	10.75	10.57	10.51	10.23	10.23	10.01
6000	13.34	13.34	13.34	13.34	12.89	12.38	11.91	11.54	11.13	10.75	10.75	10.57	10.51	10.40	10.40	10.17
5600	13.34	13.34	13.34	13.34	12.89	12.38	11.91	11.54	11.13	10.75	10.75	10.75	10.63	10.63	10.63	10.23
5200	13.34	13.34	13.34	13.34	13.34	12.89	12.89	12.22	12.22	11.69	11.27	11.13	11.13	10.57	10.51	10.28
4800	15.42	15.42	15.42	15.30	15.30	13.94	13.44	12.98	12.54	12.22	11.91	11.76	11.47	10.40	10.34	10.34
4400	15.55	15.55	15.42	15.42	15.42	15.42	14.25	13.94	13.94	13.94	13.16	12.30	11.47	10.88	10.75	10.75
4000	15.30	15.30	15.17	15.17	15.30	15.42	15.42	14.15	14.15	13.63	13.16	12.54	12.06	11.54	11.13	11.13
3600	14.93	14.93	14.82	14.93	15.05	15.17	15.30	14.15	14.15	14.15	13.07	12.46	12.06	11.76	11.47	11.47
3200	15.55	15.55	15.30	15.05	15.05	15.05	15.17	14.15	14.15	14.15	13.25	12.80	12.54	12.22	11.98	11.98
2800	15.68	15.68	15.30	15.17	15.17	15.17	15.17	15.17	15.17	15.17	15.17	13.44	12.54	12.14	12.14	12.14
2300	15.42	15.42	15.30	15.30	15.17	15.17	15.17	15.17	15.17	15.17	15.17	13.94	12.63	12.63	12.63	12.63
2200	15.42	15.42	15.17	15.17	15.17	15.17	15.17	15.17	15.17	15.17	14.70	13.84	12.63	12.63	12.63	12.63
1600	15.17	15.17	15.05	15.05	15.05	15.05	15.17	15.30	15.42	15.42	14.15	13.63	13.16	13.16	13.16	13.16
1200	14.93	14.93	14.82	14.82	14.82	14.82	14.93	15.05	15.17	14.04	13.16	12.98	12.98	12.98	12.98	12.98
800	14.93	14.93	14.82	14.70	14.70	14.82	14.82	14.82	13.84	13.16	12.71	12.54	12.54	12.54	12.54	12.54
400	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70	14.70

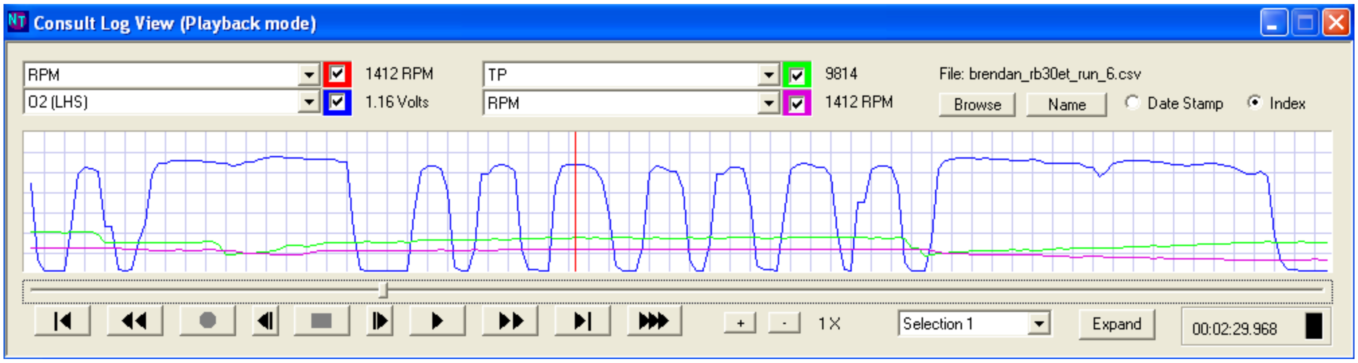
So in those areas, the ECU can enter closed loop operation mode. This can be observed by watching the O2 Guage on the display

Given that the narrow band only really has the ability to report whether it is above or below stoichiometric point, the ECU uses an upper and lower voltage limit to determine whether the ECU is running leaner or richer than 14.7:1

Some ECUs will have this as adjustable parameters which you can see control when the ECU adds or reduces injection to maintain closed loop

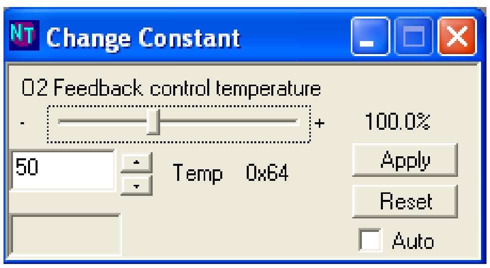


The best way to observe your O2 sensor feedback is using the log player window

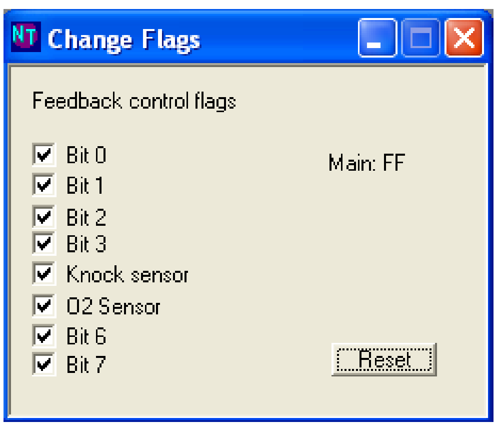


You will see from the run below that the O2 (LHS) on this RB30ET bounces above/below trigger voltages. We have the red line on 1.16 volts just as the ECU picks this up, it will lean the mixture.

Several things to be mindful of when tuning is to keep the ECU out of closed loop mode at the start. This can be done by increasing O2 Feedback temp to maximum



Or turning O2 sensor off in the feedback control flags



You can also use the 'O' key to turn off O2 feedback in the fuel map but only where the AFR is richer than 14.7:1. Nissan ECUs cannot turn off O2 feedback in this map for leaner than 14.7:1 because the map does not have the required numeric resolution to do so

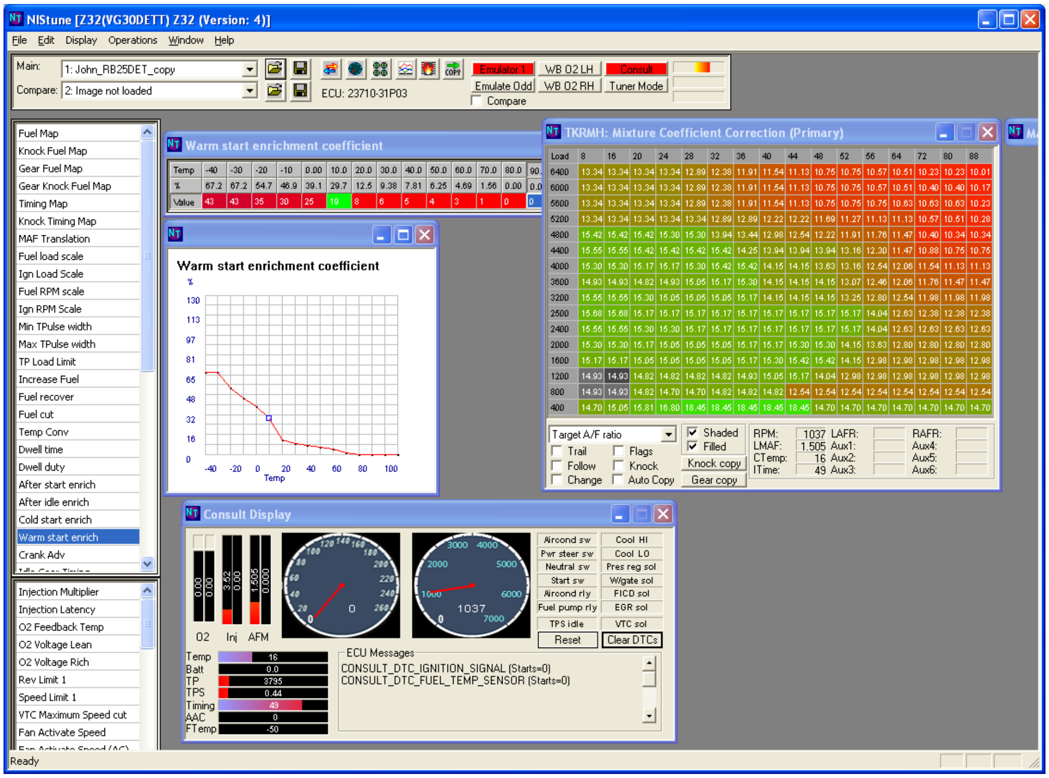
Nissan ECUs have the following mapping for O2 feedback:

Raw Value	**Target AFR**	**O2 Feedback**
0 .. 127	14.7:1 ... 7.38:1	OFF
128 .. 255	29.4:1 ... 9.85:1	ON

Note that these are theoretical AFRs. We have noticed on some vehicles they follow closely to what is displayed, whilst on other vehicles they may not be as rich or sometimes richer as the display

This gets changed significantly when the injection multiplier and latency are altered

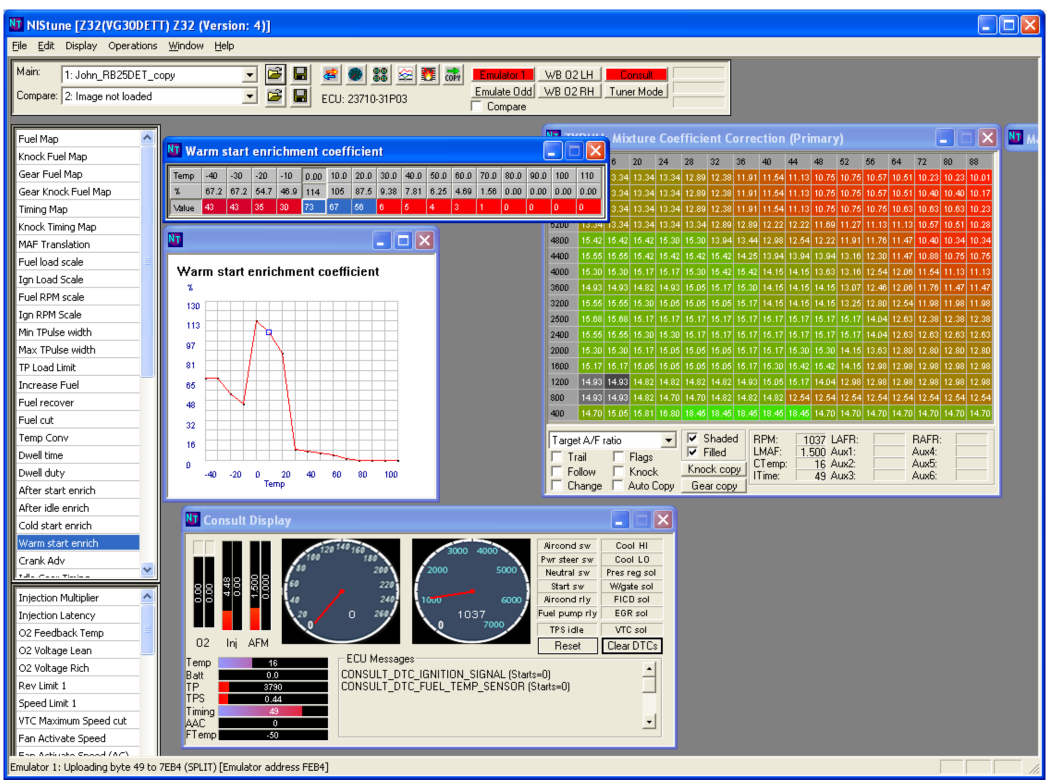
Example Cold / Warm Start Enrichment



Temp = 10 degC

Before injection pulsewidth time = 3.52ms

Increased from 30% up to 105% in 'Warm start enrich' table

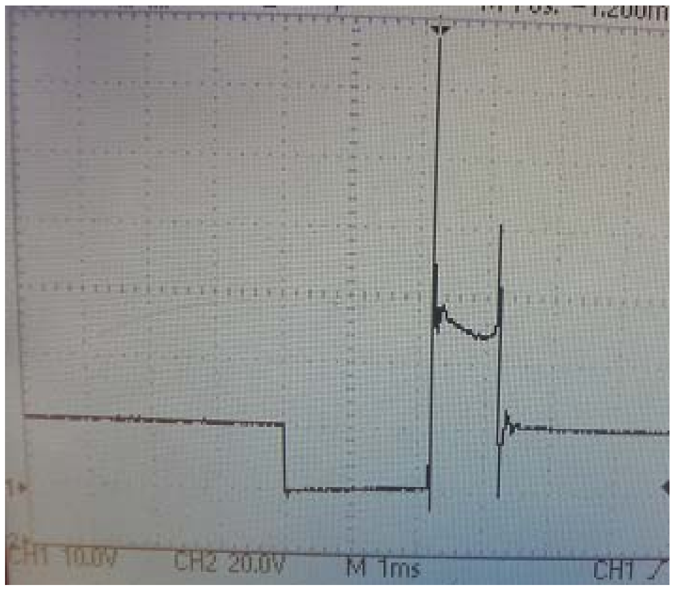


Changed injection now = 4.50ms

Timing Changes

Ignition timing is the point at which the spark plug ignites the fuel in the cylinder relative to position Before Top Dead Centre (BDTC). Generally the sooner that the fuel is ignited, the more pressure that is put on the piston and usually the more power you can obtain. That is usually for Nautrally Aspirated engines one method of obtaining more power through 'chipping'. Timing maps are increased, but generally there is a trade off and higher quality fuel must be used to avoid detonation.

It is all relative to combustion static compression and engine temperature. On turbo charged engines when there is extra pressure in the cylinder due to forced induction, temperatures will increase greatly and may result in pre ignition (due to too much heat) or detonation (due to fuel not burning properly due to a bad mix of factors including temperature, amount of fuel and air, quality of fuel, and pressure inside the cylinder)



Picture above: Output to primary coil from power transistor (trigged from ECU). Secondary coil output is what causes the massive spike and creates the spark

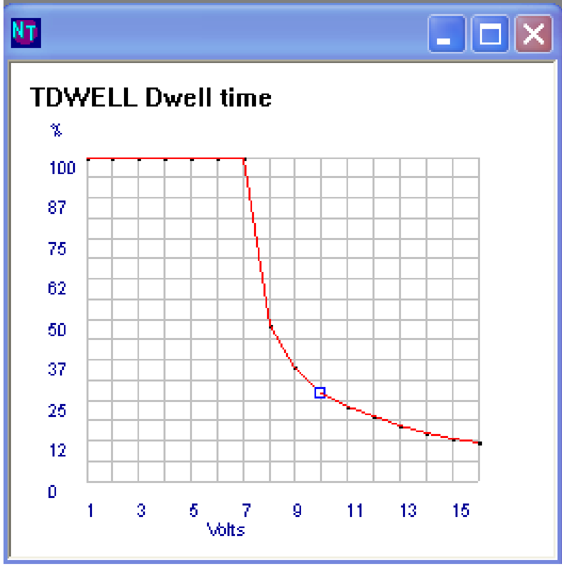
The ECU will use the Crank Angle Sensor (CAS) as an input to determine the cylinder position. It will then use coil dwell and duty tables to determine for the available battery voltage and current RPMs of the engine the duration to charge the coil for prior to spark. These tables are available for most ECUs supported by Nistune

Dwell Time table

Dwell time is the charge time against battery voltage. You will notice as the voltage becomes lower the dwell time is increased to 100% to charge the coil with all available current. This table generally doesnt need to be adjusted by the end user.

TDWELL Dwell time

Volts	1.00	2.00	3.00	4.00	5.00	6.00	7.00	8.00	9.00	10.0	11.0	12.0	13.0	14.0	15.0	16.0
%	100	100	100	100	100	100	100	48.6	35.3	27.8	23.1	20.0	17.3	15.3	13.7	12.5
Value	255	255	255	255	255	255	255	124	90	71	59	51	44	39	35	32

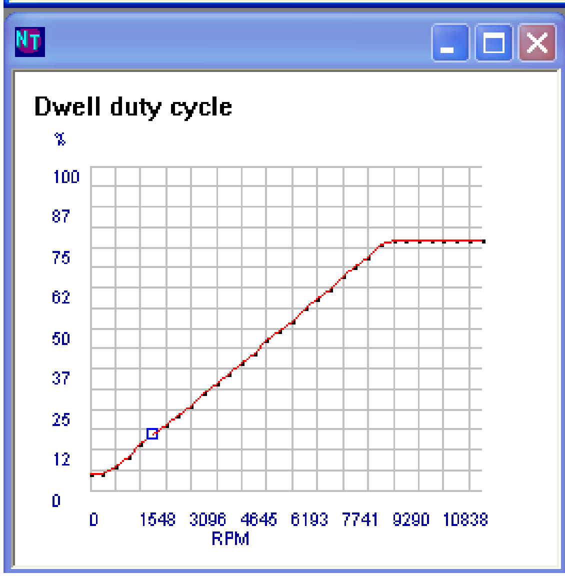


Dwell Duty Cycle

Dwell duty cycle is the percentage of time to charge the coil based against the current RPM. This table may be changed in some cases to adjust for more spark, but the operator must be aware that changing coil tables can adversely affect coil life.

Dwell duty cycle

RPM	0.00	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000	6400	680
%	5.00	5.00	7.33	10.7	14.0	17.3	20.0	23.3	26.7	30.0	33.3	36.7	39.0	42.3	46.0	49.3	52.7	56.0
Value	15	15	22	32	42	52	60	70	80	90	100	110	117	127	138	148	158	168



The remaining timing tables are used to determine when to fire the spark, relative to position of the cylinder. This is measured in BDTC. The engine must be at factory BDTC settings on the CAS for Nistune to accurately display the timing. The timing is what the ECU 'thinks' the engine is set to. If the CAS timing settings are wrong, then so will the Nistune displayed settings.

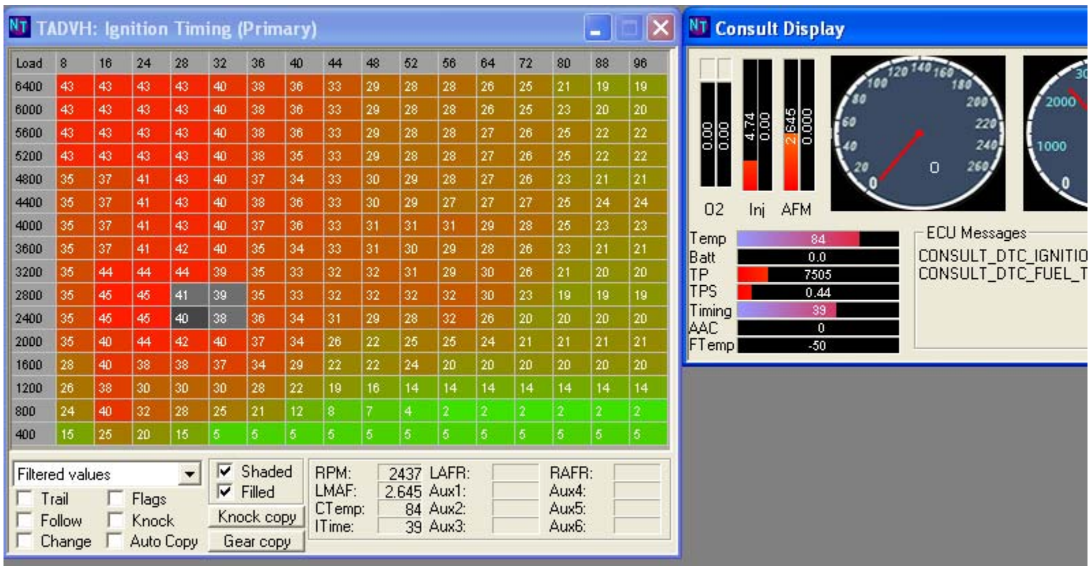
Timing maps vary between various Nissan ECUs. Some of the tables we cover here may not be used in your particular ECU. This can make the ECU easier to tune as there are less settings to adjust under various conditions.

Several of the main things affecting timing are

Coolant Temperature Sensor
Knock Sensor
Throttle Position Switch input
Neutral switch input

As with the fuel map you may have multiple timing maps. Make sure you aren't getting into the knock map by accident. Otherwise you changes may not be changed.

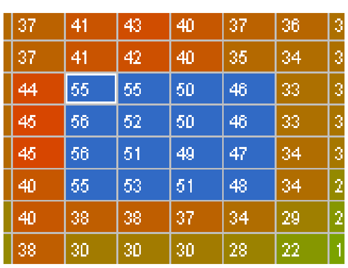
Using knock copy can update the knock map, and will upload the changes to both maps on the ECU



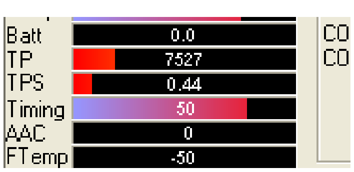
Load	8	16	24	28	32	36	40	44	48	52	56	64	72	80	88	96
6400	43	43	43	43	40	38	36	33	29	28	28	26	25	21	19	19
6000	43	43	43	43	40	38	36	33	29	28	28	26	25	23	20	20
5600	43	43	43	43	40	38	36	33	29	28	28	27	26	25	22	22
5200	43	43	43	43	40	38	35	33	29	28	28	27	26	25	22	22
4800	35	37	41	43	40	37	34	33	30	29	28	27	26	23	21	21
4400	35	37	41	43	40	38	36	33	30	29	27	27	27	25	24	24
4000	35	37	41	43	40	37	36	33	31	31	31	29	28	25	23	23
3600	35	37	41	42	40	35	34	33	31	30	29	28	26	23	21	21
3200	35	44	44	44	39	35	33	32	32	31	29	30	26	21	20	20
2800	35	45	45	41	39	35	33	32	32	32	32	30	23	19	19	19
2400	35	45	45	40	38	36	34	31	29	28	32	26	20	20	20	20
2000	35	40	44	42	40	37	34	26	22	25	25	24	21	21	21	21
1600	28	40	38	38	37	34	29	22	22	24	20	20	20	20	20	20
1200	26	38	30	30	30	28	22	19	16	14	14	14	14	14	14	14
800	24	40	32	28	25	21	12	8	7	4	2	2	2	2	2	2
400	15	25	20	15	5	5	5	5	5	5	5	5	5	5	5	5

Example of correctly synced maps above. Where the timing value on the map is around 39 degrees (surrounding cells are 41, 39, 40, 38) and the interpolated value on the guages is 39.

Adjusting around this timing block should change the timing also



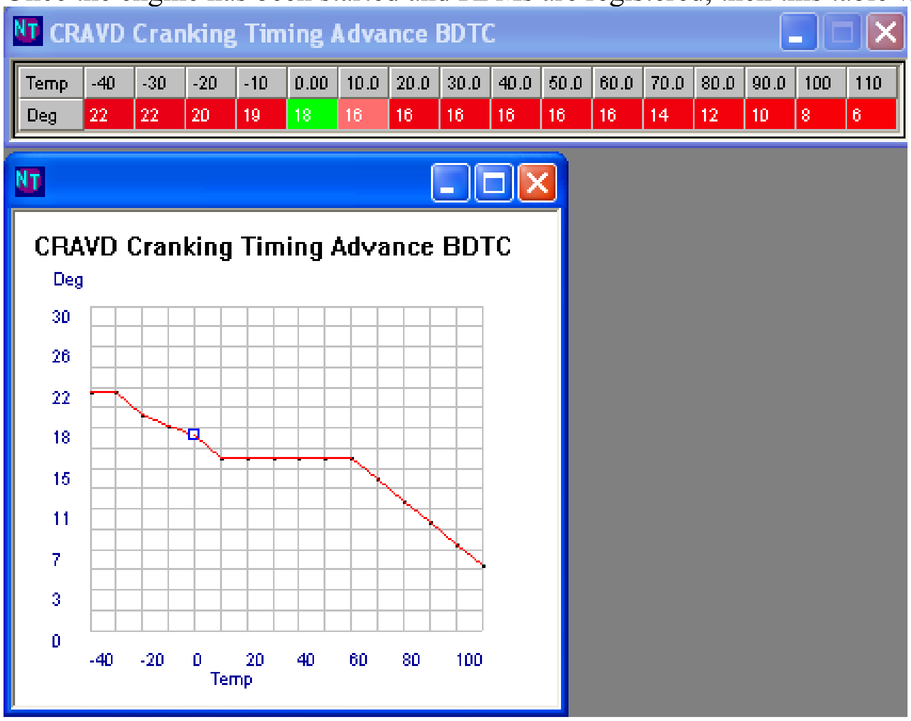
37	41	43	40	37	36	3
37	41	42	40	35	34	3
44	55	55	50	46	33	3
45	56	52	50	46	33	3
45	56	51	49	47	34	3
40	55	53	51	48	34	2
40	38	38	37	34	29	2
38	30	30	30	28	22	1



Cranking Timing Table

The cranking timing table sets the timing value whilst cranking the engine attempting to start it. The ECU will monitor the Start sw start indicator and use this table accordingly. Other timing tables are not used when this table is being accessed.

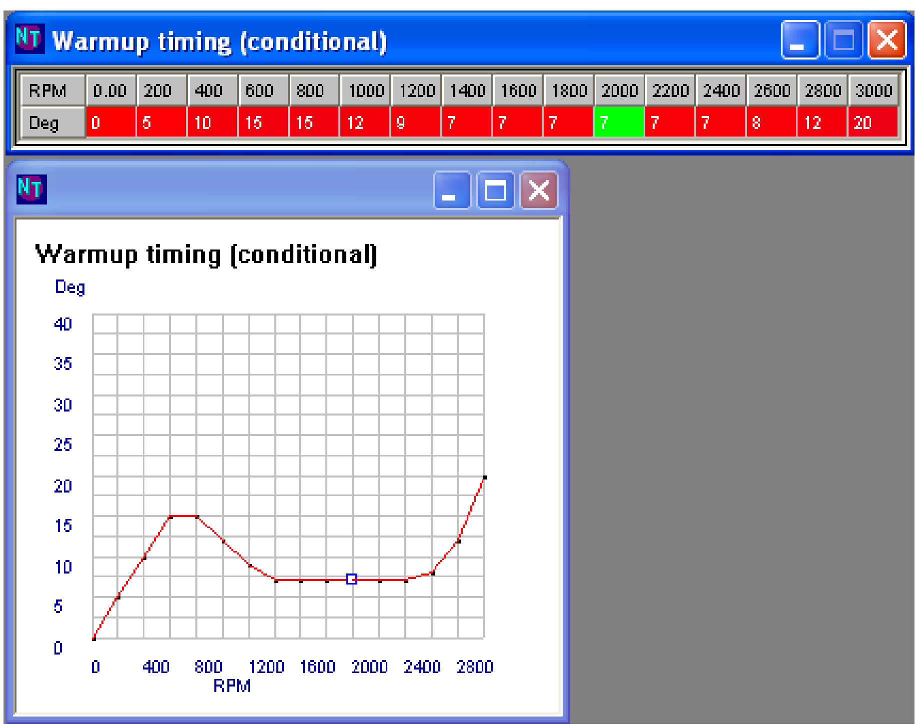
Once the engine has been started and RPMs are registered, then this table will no longer be accessed.

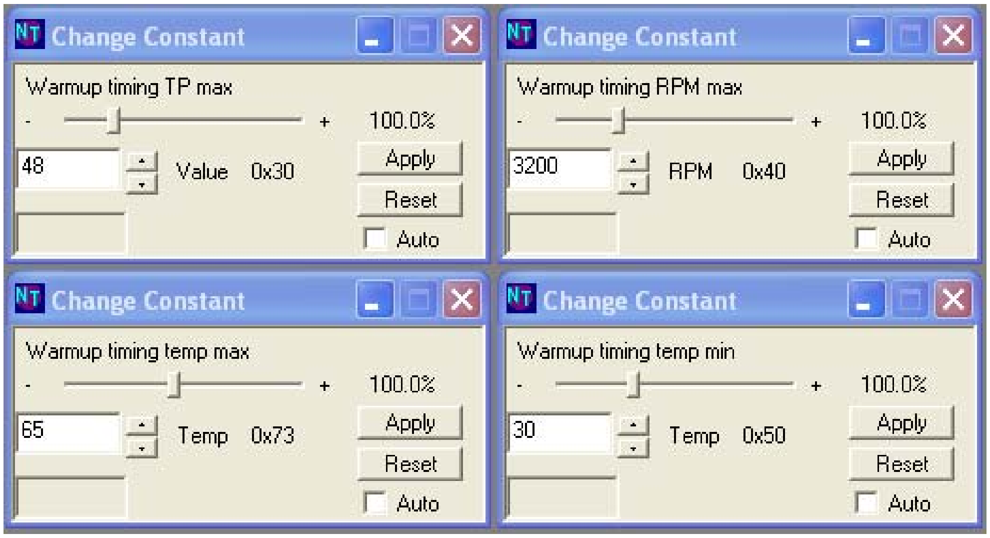


Warmup Timing Table

This is a fairly recently discovered table for vehicles such as the HCR32 skyline. This table is a conditional table which means that its accessed then certain conditions are met.

In this case the Coolant Temperature, RPM and TP values are monitored by the ECU prior to using this table. It has been noted that when logs of timing is pulled that sometimes this map can be the culprit





This indicates that quite a substantial part of the timing table uses this window as can be seen below in blue:

Load	12	16	20	24	28	32	36	40	48	52
6400	29	29	29	28	28	28	27	26	24	22
6000	29	29	29	28	28	28	27	26	24	22
5600	29	29	29	28	28	28	27	26	24	22
5200	29	29	29	28	28	28	28	27	26	25
4800	29	29	29	28	28	28	28	27	27	27
4400	36	36	36	35	35	33	31	30	28	28
4000	43	43	41	39	36	35	33	32	29	29
3600	43	43	42	40	38	36	33	31	30	29
3200	41	41	40	38	36	34	32	31	29	28
2800	41	41	39	37	35	33	32	31	27	26
2400	40	40	38	36	34	32	30	28	26	25
2000	38	38	37	35	33	31	29	27	24	22
1600	34	34	33	32	29	27	25	23	22	21
1200	32	32	31	29	27	25	23	22	18	17
800	28	28	25	22	19	17	16	15	13	12
400	5	5	5	5	5	5	4	3	1	0

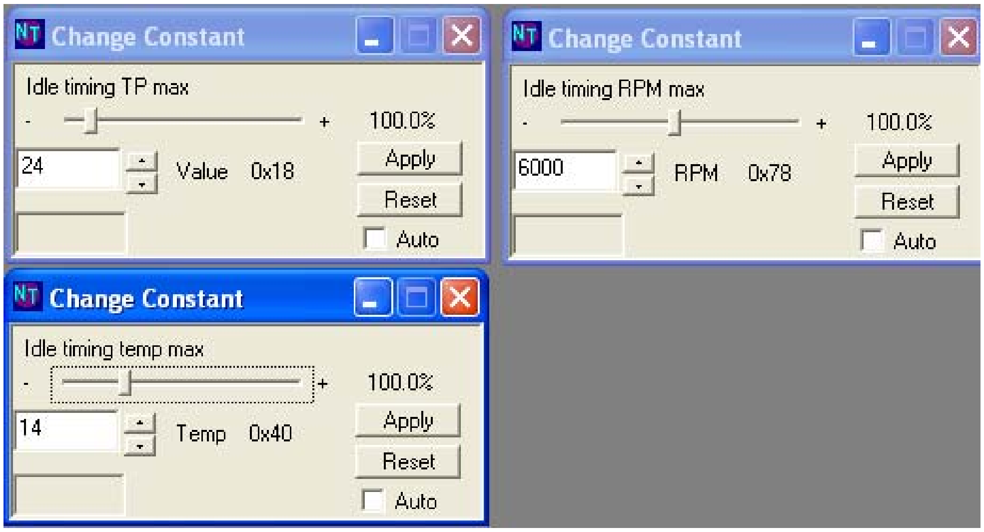
As you change the TP scaling for more airflow, this scaling may also need to be changed in the above constant windows and the warm up timing values may also need to be changed to avoid 'bogging' down when the engine is still warming up (in this case between 48 deg C to 65 deg C)

Idle Timing Changes

When idle timing comes into effect timing will get pulled back from what is on the main timing maps to what is in the individual tables. This is dependent on engine temperature

Typically say for the Z32 300ZX the tables are used upto 60 degreesC. It is possible to configure this limit in the future to determine when the tables are used.

Below are the constants available for HCR32 to determine when the idle timing tables are used.



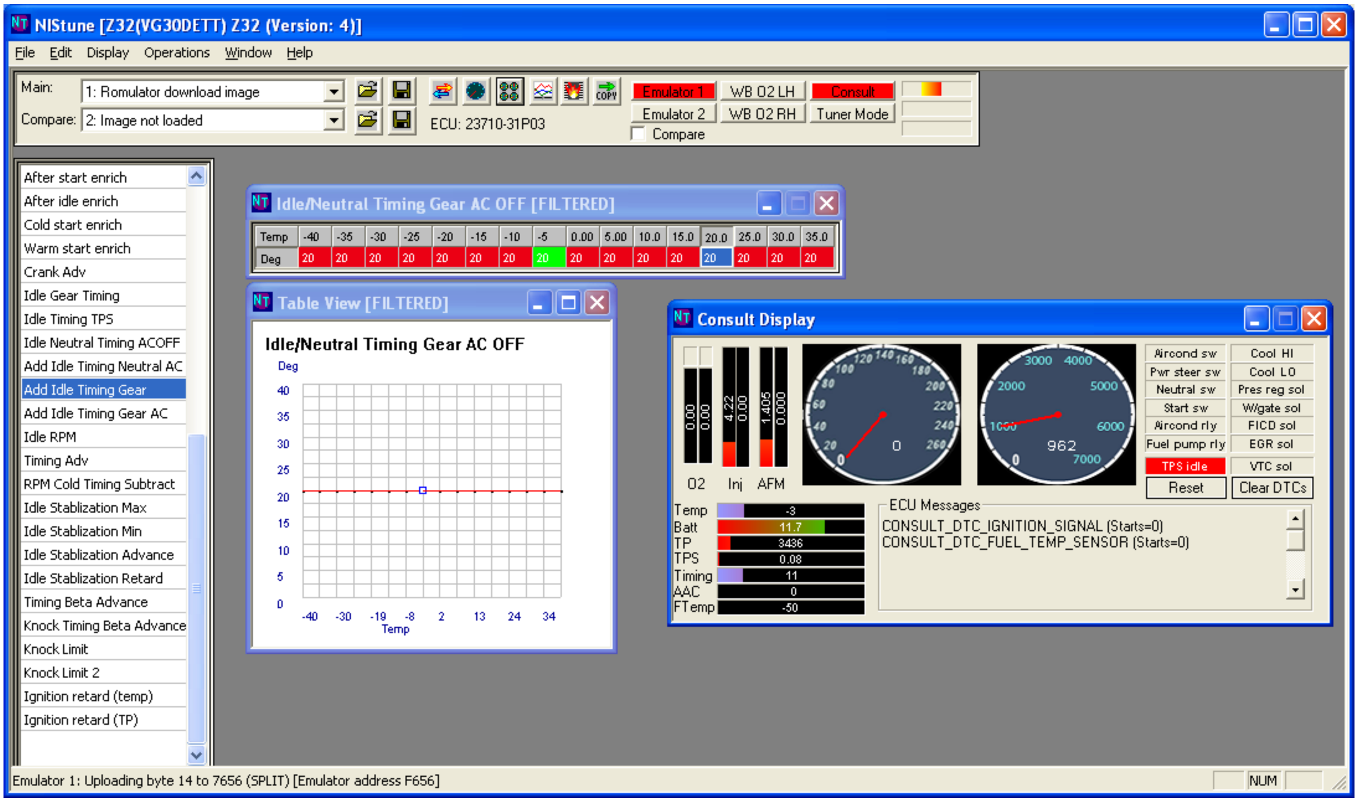
For the Z32 300ZX. There are basically four different tables and determines if you are in gear and if the Air Conditioning is on/off

Cold Idle Neutral Timing AC OFF
Cold Idle Neutral Timing AC ON
Cold Idle Gear Timing AC OFF
Cold Idle Gear Timing AC ON

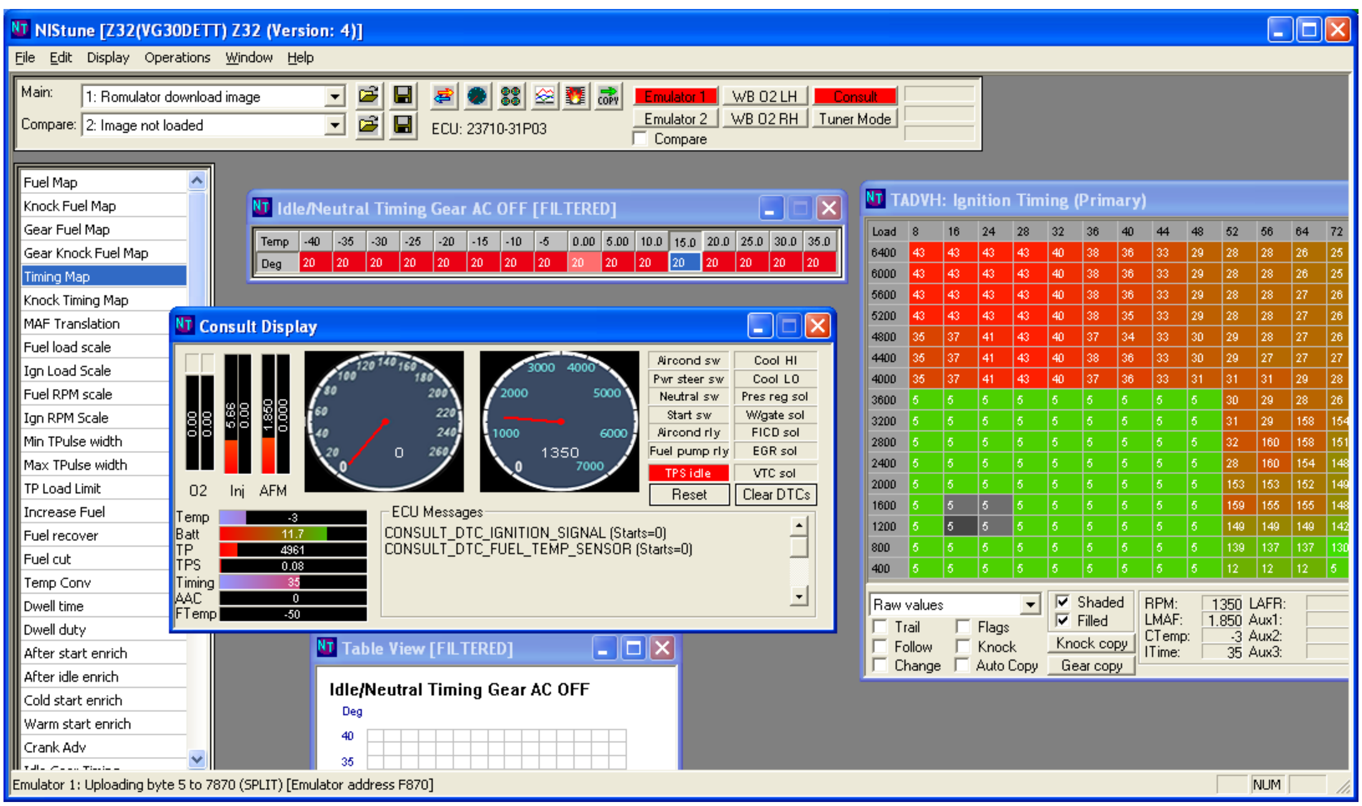
Looking at the example below, you see that TPS is 'TPS Idle' and that the cable is based on engine temperature.

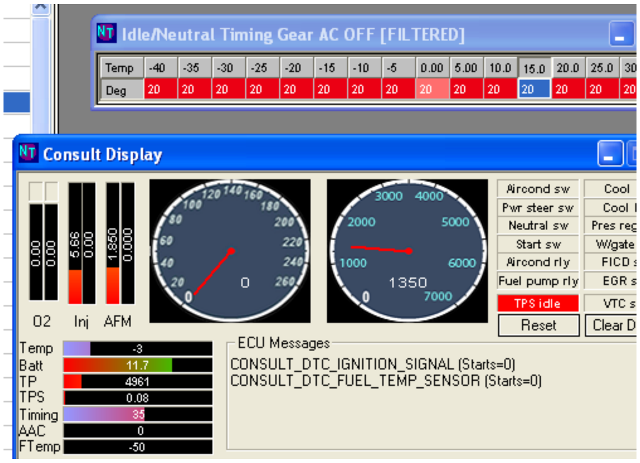
Based on the particular engine temperature, the degrees of timing in the selected table are added to a 'base timing' calculated by the ECU.

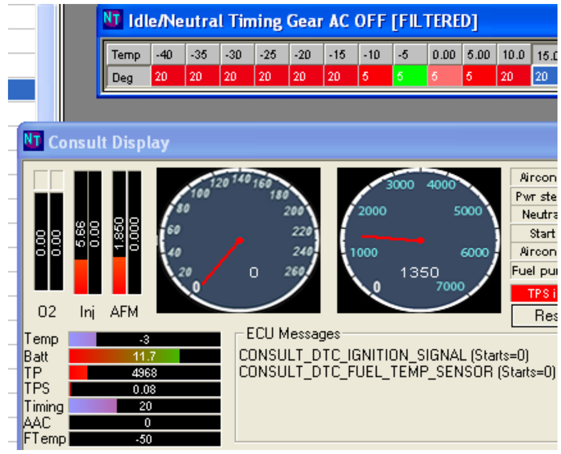
Adjusting this table will adjust the base timing. It may use this timing in addition to timing from the ignition timing maps, depending on load and RPM. The ECU makes decisions what load and RPM before deciding if to use this table



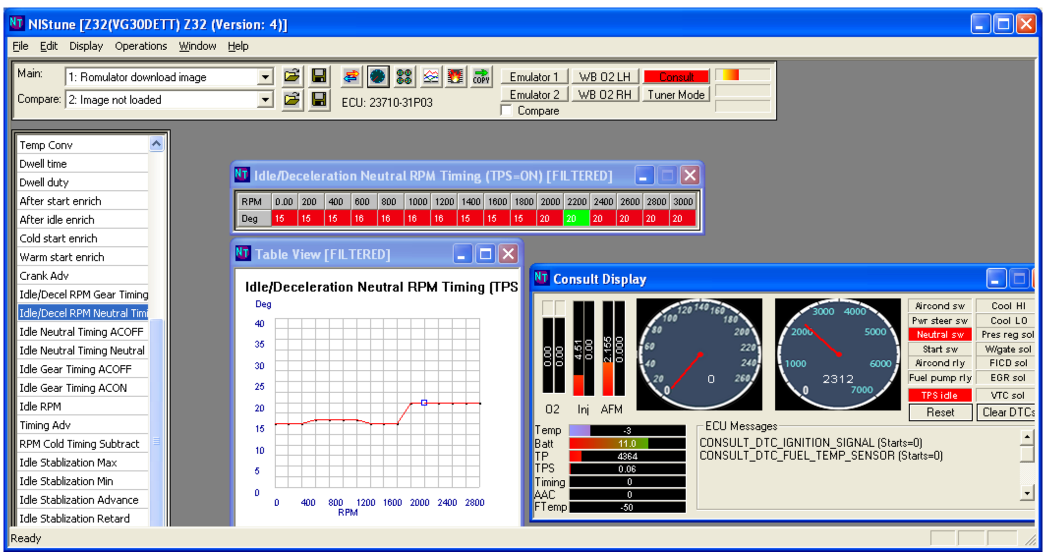
In the example below, altering the timing from 20 to 5 changes the timing from 35BDTC to 20BDTC







The timing is used as a combination of the various timing maps in the ECU and is pulled in depending on the temperature, TPS switch, neutral switch, TP and RPM conditions met in the ECU



Idle / Deceleration RPM appear to be trigger points where for a particular RPM reached, if the timing is below the value in the chart then timing is cut to 0 until it recovers. Used to cut timing during deceleration.

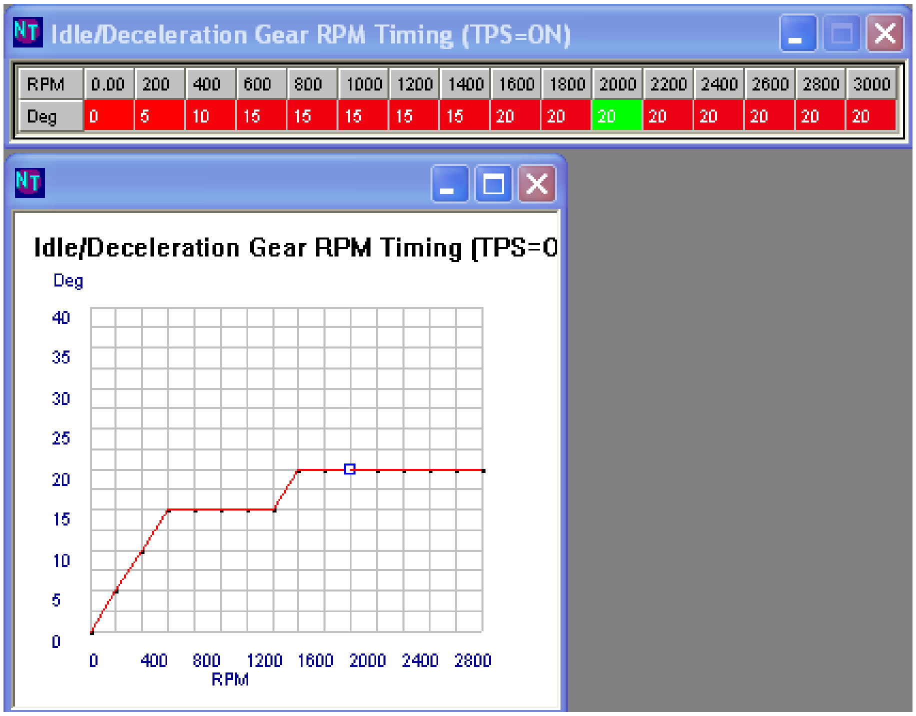
Other ECUs such as HCR32 use different tables. They are not temperature dependent but TPS and gear position dependent

Idle/Deceleration Gear RPM timing

This table currently being accessed is in gear (neutral is off) 

and TPS is on 

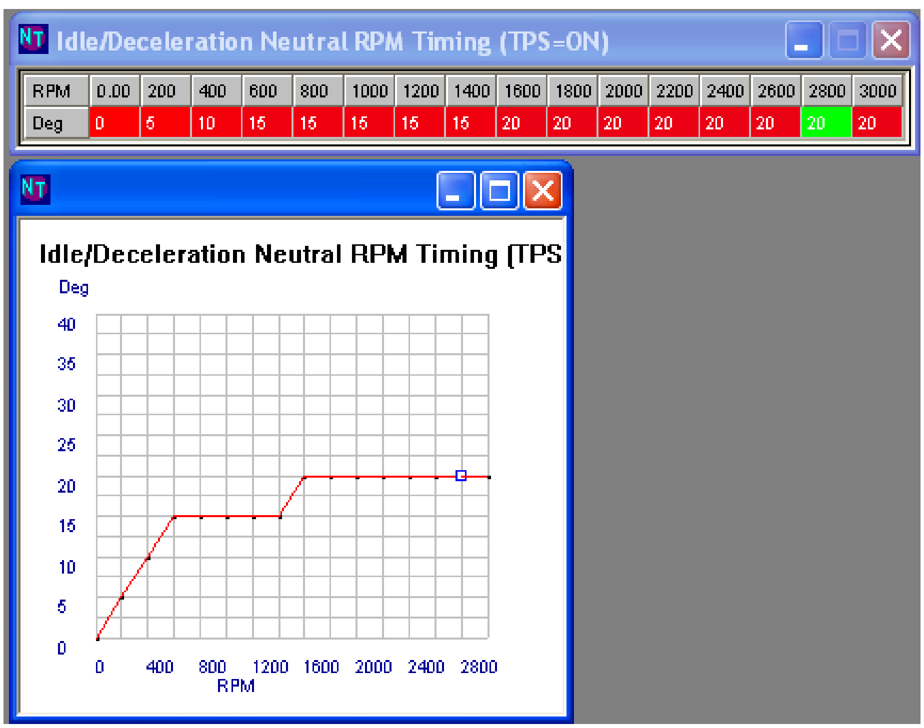
. The main timing map is not accessed and the consult timing is based from this map.



RPM	0.00	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000
Deg	0	5	10	15	15	15	15	15	20	20	20	20	20	20	20	20

Idle/Deceleration Neutral Timing

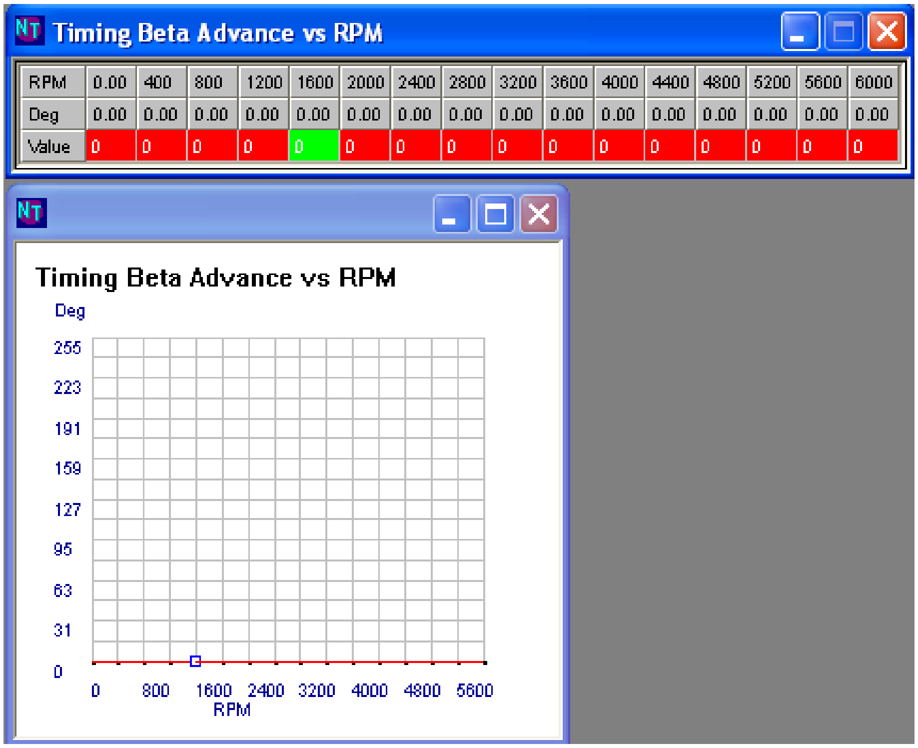
This table currently being accessed is in gear (neutral is off) Neutral sw and TPS is on TPS idle . The main timing map is not accessed and the consult timing is based from this map.



RPM	0.00	200	400	600	800	1000	1200	1400	1600	1800	2000	2200	2400	2600	2800	3000
Deg	0	5	10	15	15	15	15	15	20	20	20	20	20	20	20	20

Timing Beta Advance

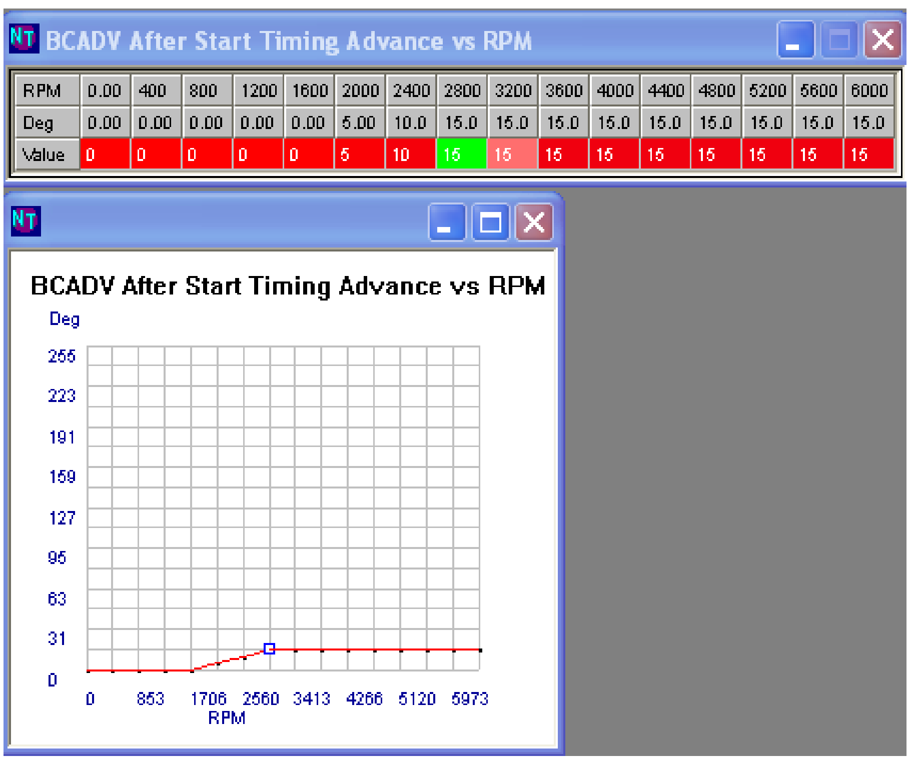
Table advances timing further based on RPMs. Notably on HCR32 below this is zeros and hardware map tracing indicates that this table is not regularly accessed during normal conditions.



RPM	0.00	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000
Deg	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Value	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

After Start Timing Advance

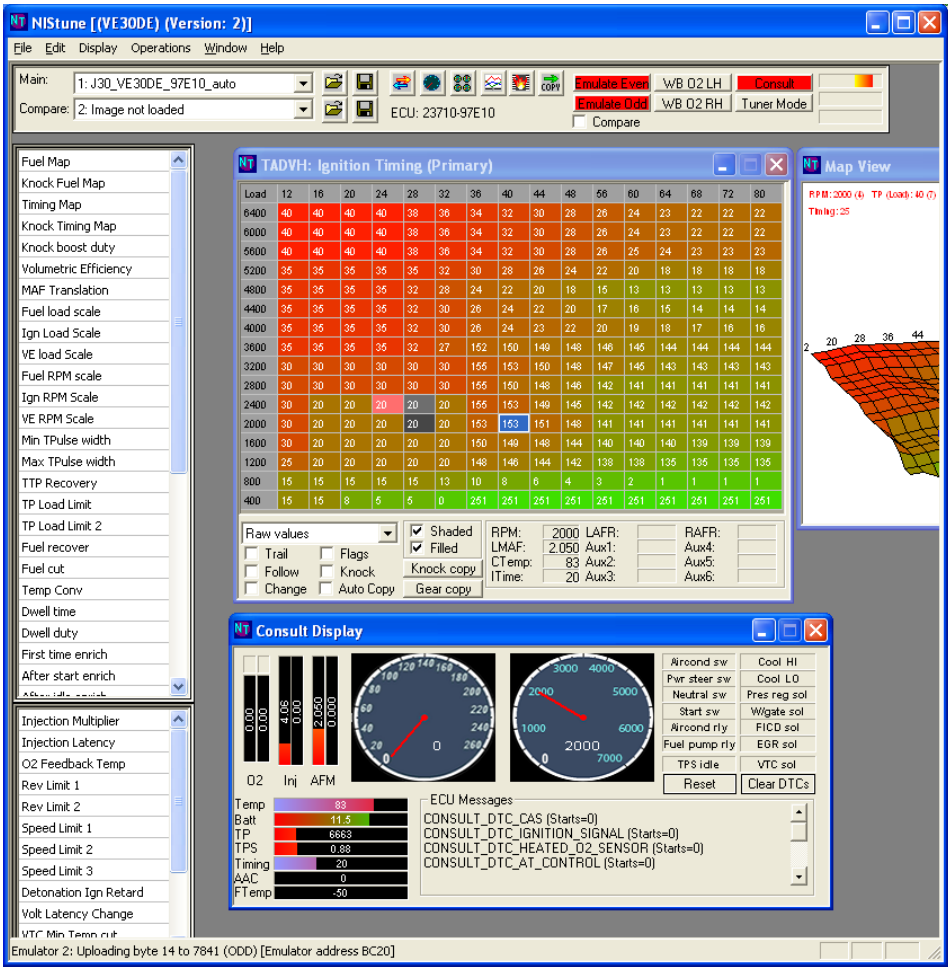
This table is used for timing advance after starting the engine. It is only accessed when TPS TPS idle is not idle. However if the main map is being accessed instead then this table is notably not used.



RPM	0.00	400	800	1200	1600	2000	2400	2800	3200	3600	4000	4400	4800	5200	5600	6000
Deg	0.00	0.00	0.00	0.00	0.00	5.00	10.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
Value	0	0	0	0	0	5	10	15	15	15	15	15	15	15	15	15

Example: Determining if timing map used (J30 VE30DE)

Check timing works at 80 degrees Celcius or over when TPS is not idle 



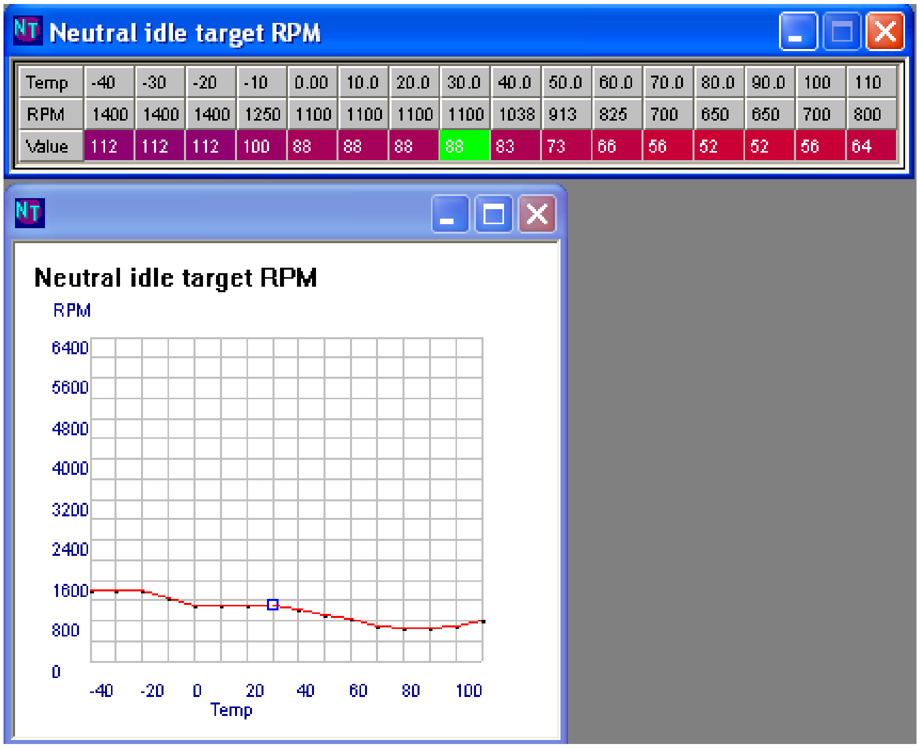
Filled area with 20 degrees and then adjust and monitor timing

Now adjust TPS so that 'TPS idle' is lit

Notes: Timing map hardware trace (pink) indicates Timing map no longer used. Timing guage indication reads 28 degrees BDTC

Idle Control

Nissan ECUs control idle to maintain RPMs as per the Idle Speed RPM table below:


Neutral idle target RPM

Temp	-40	-30	-20	-10	0.00	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100	110
RPM	1400	1400	1400	1250	1100	1100	1100	1100	1038	913	825	700	650	650	700	800
Value	112	112	112	100	88	88	88	88	83	73	66	56	52	52	56	64

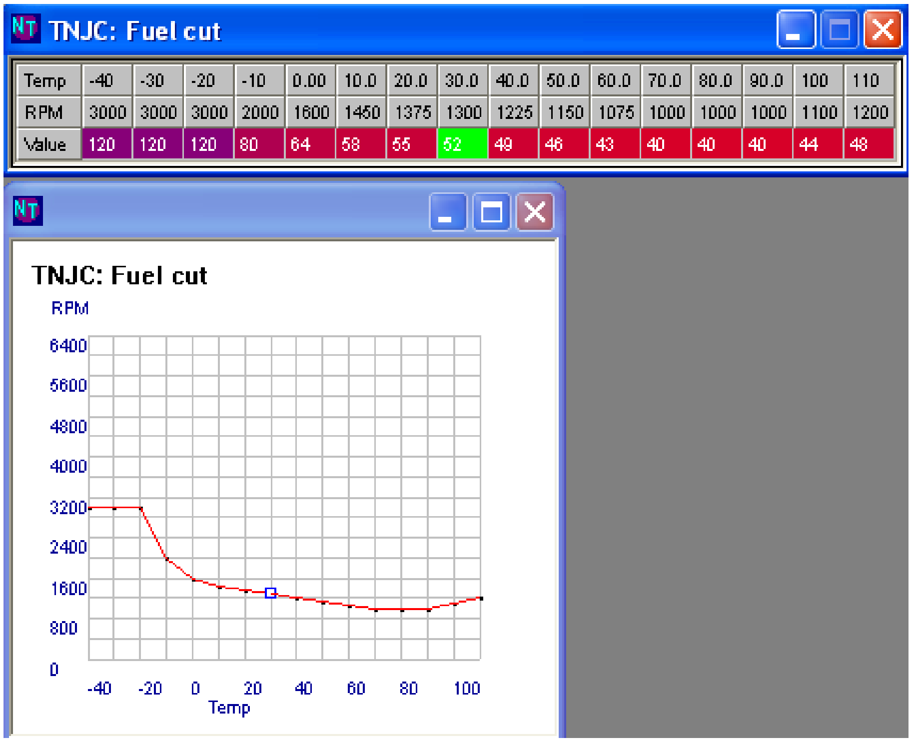
The ECU will then adjust the timing to attempt to reach the desired RPM. This is the main thing which stops the car from stalling, and timing will be increased when RPMs start dropping below the values in this table. Noticeably as the engine is colder, the target idle RPM is higher.

On this HCR32 the target RPM is about 650 when the engine is at operating temperature (about 85 degC)

Idle Stabilisation tables for timing advance and retard are used to control the target idle RPM. Typically these should be left as is unless some extra advance or changes to limits is required to maintain idle.

Fuel Cut and Recovery

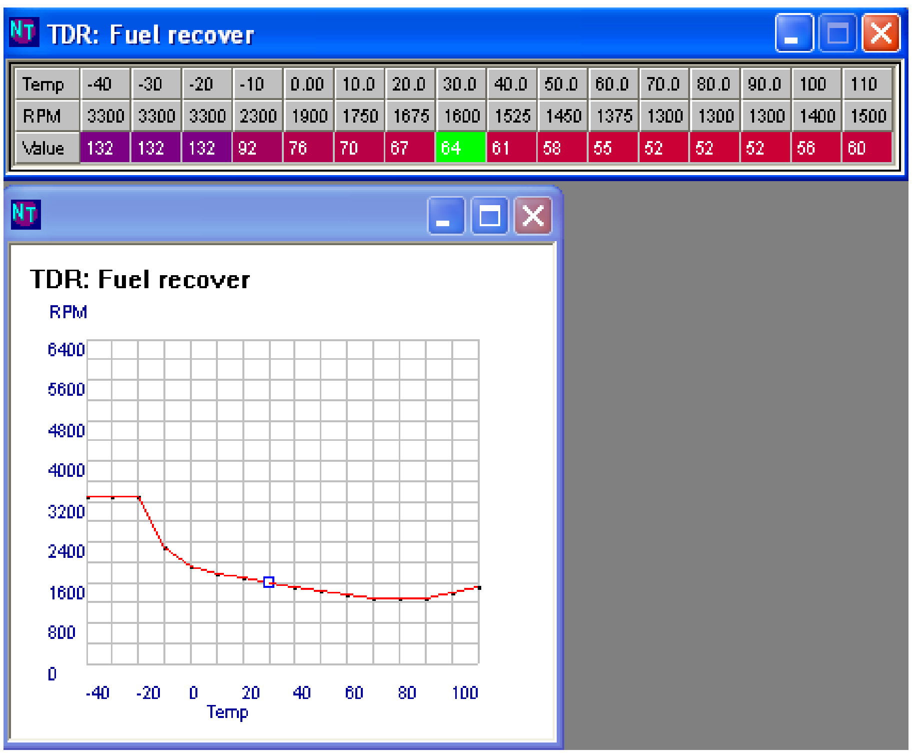
Nissan ECUs will cut fuel under certain conditions, for example when releasing the accelerator then fuel will be cut for a short amount of time so there is not excess fuel being injected under those conditons. Typically the fuel cut and recovery points are different for manual and automatic transmission vehicles.



TNJC: Fuel cut

Temp	-40	-30	-20	-10	0.00	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100	110
RPM	3000	3000	3000	2000	1600	1450	1375	1300	1225	1150	1075	1000	1000	1000	1100	1200
Value	120	120	120	80	64	58	55	52	49	46	43	40	40	40	44	48

Here the fuel cut at normal operating temperature (85degC) will occur at 1000rpm



TDR: Fuel recover

Temp	-40	-30	-20	-10	0.00	10.0	20.0	30.0	40.0	50.0	60.0	70.0	80.0	90.0	100	110
RPM	3300	3300	3300	2300	1900	1750	1675	1600	1525	1450	1375	1300	1300	1300	1400	1500
Value	132	132	132	92	76	70	67	64	61	58	55	52	52	52	56	60

The fuel recovery will resume injection when the ECU has reached the desired RPM in this table (85degC will occur at 1300 rpm)

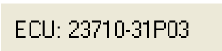
Diagnosis and Reporting Tuning Issues

Determine if problem is
- Related to engine temperature
- Related to knock sensor input switching maps

- Related to misreported TPS idle (check idle status on Consult display) or misreported Neutral switch (check Neutral switch status on consult display)

Let us know your address file you are using

Make sure you let us know the ECU part number you are using:

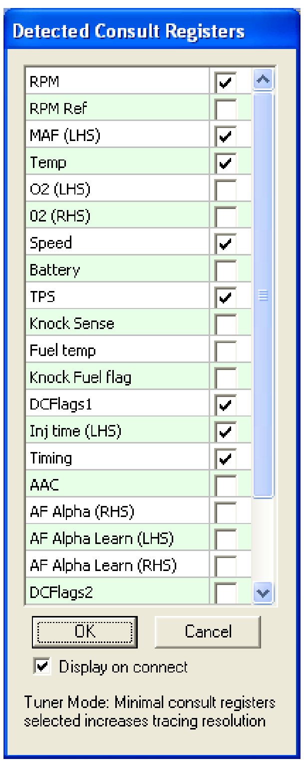


If you are using a Nistune board you will also see 'REV: [number' next to the ECU part number. If you are using a Nistune board and not seeing this, your ECU has not been jumpered to use the board. Recheck your installation in this case.

TUNING ISSUES

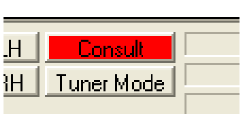
Email us a log of the problem, and your BIN file which you are using so that we can replay it back here for further diagnosis

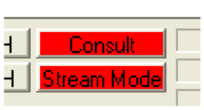
Click the items you want us to see



We require at least RPM, MAF, Temp, O2, Speed, TPS, DCFlags1, Injection Time and Timing to be recorded. If you are able to connect up a wideband unit, then you can also capture that in parallel with the log

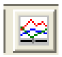
For logging only (no changes) then click on 'Tuner mode' to change to 'Stream mode'





This will make the button red and greatly increases the sampling rate of sensor data from the ECU. But you wont be able to make any changes if using a Nistune board whilst doing this (change back to 'Tuner Mode' to make changes)

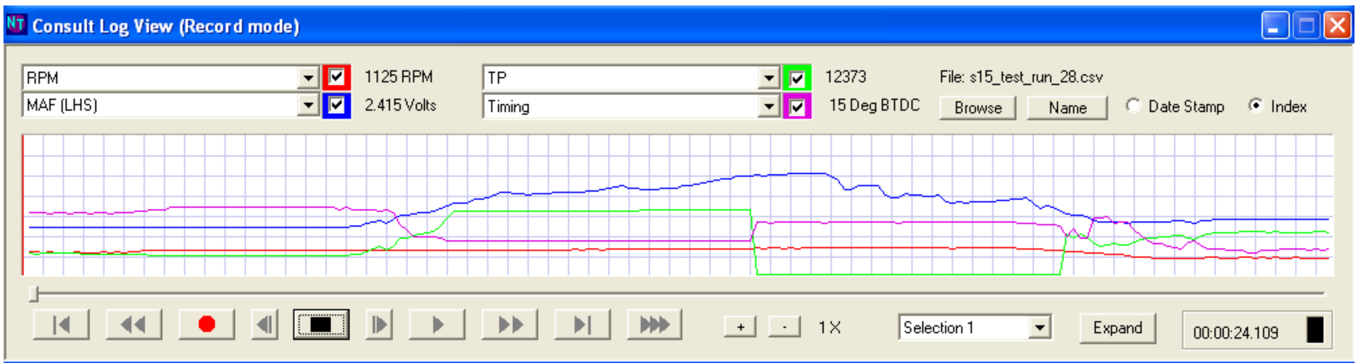
Logging (Recording)

This button  is your log button and will bring up the log player / recorder

There are two modes of operation

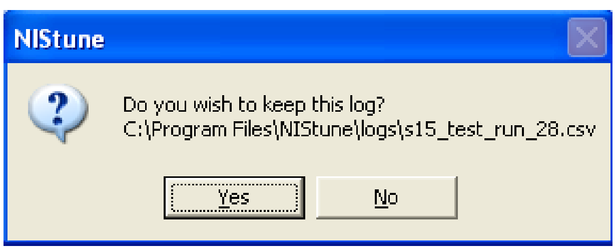
When you have input data (whether from consult or wideband devices) you will be put in Record Mode

Record mode will get the log once you press the RED record button until you press the STOP button



You can continue to record in record mode, even after stop. All parameters are recorded (even the ones you cannot see on the display).

If you wish to save your log file, or record another log file then press STOP again

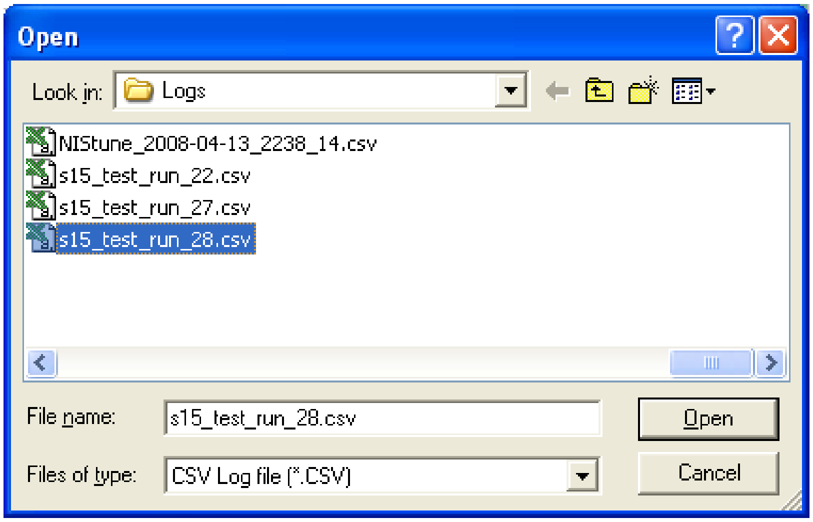


You will be prompted to save your log and where it is going to

After this you will be put back to record mode again with a blank screen to record more logs.

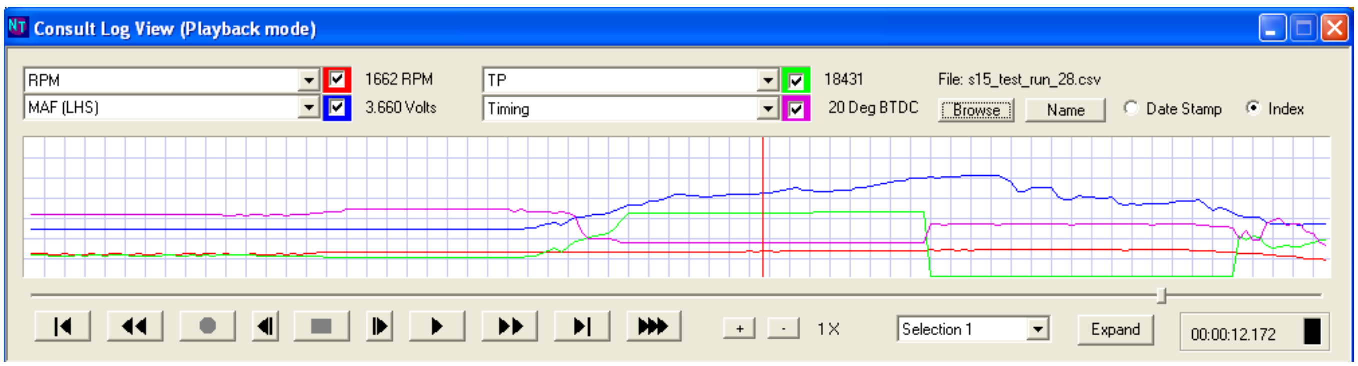
Logging Playback

To enter playback mode, either Browse for the log file using  then select your file to playback



Or stop your input data by stopping Consult and Wideband

Now in playback mode you can analyse or playback data



It will show 'Playback Mode' in the title bar to indicate this mode

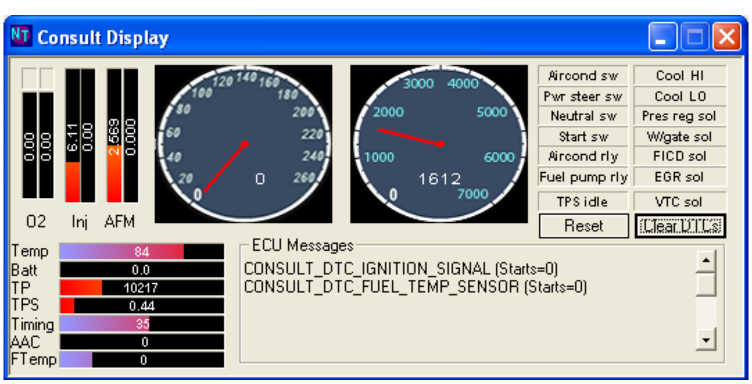
You can click on the graph to display current values and use CTRL LEFT / RIGHT to move the line

Pressing play will run through the log until the end

Clicking on the scrollbar will navigate around the log file

You can select different parameters to display on the screen here also

Nistune will show all the current parameters on the various display, maptracing and guages (even AFR tracing can be used here)



Note that DTC codes will NOT be played back.