Boost Control Guide

Overview

Nissan S14 and S15 series ECUs are equipped with factory boost control. Chris and Pete from the Nistune forums have been investigating their operation and enhancing the factory boost control system on the S15 200SX. Further investigation has allowed us to provide maps for end customers to adjust their boost controller through various means.

Standard ECU boost output:

The standard boost control setup is controlled from the ECU via the Waste Gate control valve:

S14 SR20DET
Pin 25 – WG Valve control

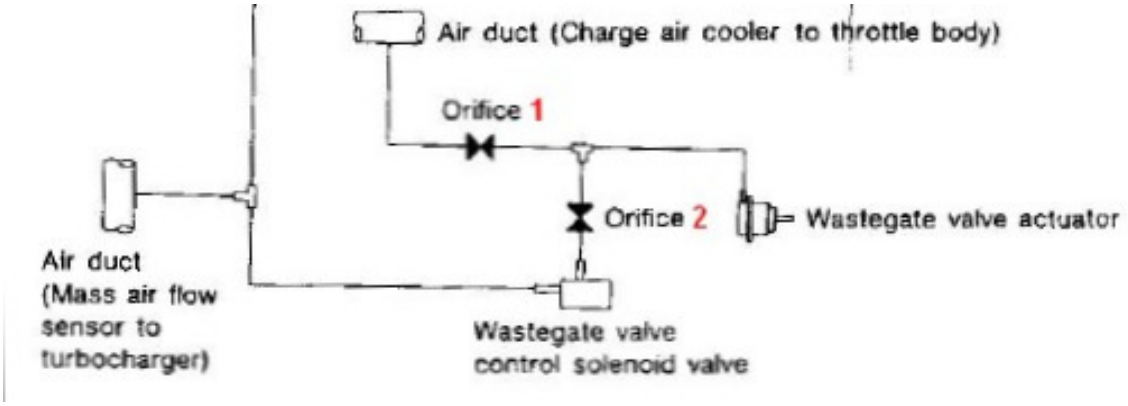
S14A SR20DET
Pin 102 – WG Valve control

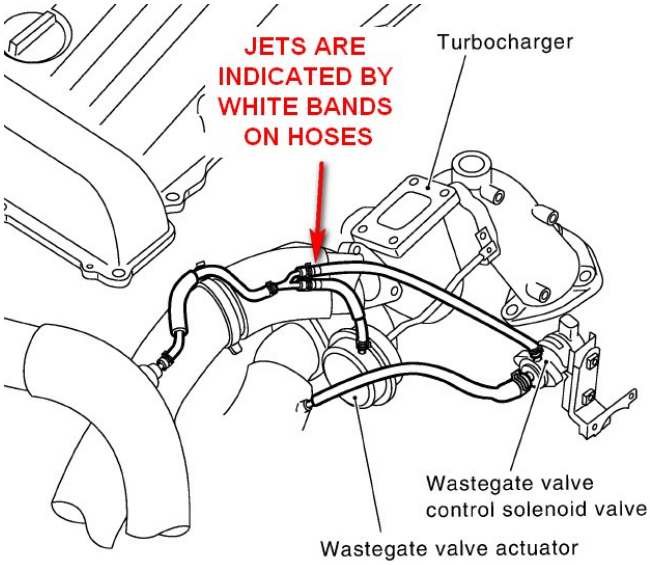
S15 SR20DET
Pin 115 – WG Valve control

Notes: Operating frequency of the boost solenoid is Frequency 20Hz. ER34 RB25DET / WC34 RB25DET and earlier SR20 vehicles have an output to control the solenoid. However the output is only used to limit boost under adverse/fault conditions, and cannot be used for variable boost control.

Stock Setup

Setup of standard boost restrictors and solenoid to waste gate:





Notes on standard setup:

1. Standard waste gate actuator spring is set to open at 0.5 bar with no other boost control measures in place.
2. Basic boost level is set by the ratio of the two jets sizes in the hoses – “orifice 1” and “orifice 2”. The more air that gets bled off, the higher the boost level.
3. The solenoid operates as a variable air bleed in addition to the two jets to allow ECU boost control around the basic level set by the two jets.
4. Standard restrictor jet “orifice 1” size is 1.6mm. This also restricts airflow to the wastegate actuator resulting in a slight delay in wastegate opening which can improve boost response but can also result in a boost spike if the jet is too small.
5. Increasing the length of the boost line (or its diameter) will tend to give less waste gate creep but may also increase the tendency to boost spike.
6. Standard solenoid port size is 3.5mm in to 2.6mm out (seat is 6mm).

Standard restrictors will only allow tuning up to around 14psi on the factory T28 turbo (using stock wastegate actuator). Adjustment to the stock solenoid or restrictors must be performed to change this.

Methods of adjustment:

1. Chris changed the solenoid ports from 4mm in to 3mm out (dependent on system) to increase flow of the standard solenoid.
2. PL increased the size of ‘Orifice 2’ pictured above which will allow the solenoid to bleed off more air and increase boost. Number drills were used to gradually increase the jet sizes. The base boost is set by the jets and the tuning of the solenoid maps is used to adjust around this boost level.

Two sets of drills 0.3 – 1.6mm and 1.0 – 2.0mm should cover required sizes. The sizes themselves depend on the vehicle and what turbo and actuator is fitted.

Example:

Graham’s S15 SR20DET fitted with GT2871R (and supporting mods) achieved 14-15psi with factory solenoid fitted. Removing jet at ‘Orifice 2’ (going towards the solenoid) got a controllable 20psi and then boost maps were tuned to give 18psi. Boost control maps were made into a simple linear slope with 0% throttle = 10% solenoid duty in first column up to 100% solenoid duty (= 20psi) in last column. Values in the last three columns were then decreased to give 18psi (= desired max boost) up to about 5000rpm.

Aftermarket Boost Solenoids:

Using a 3-port valve is faster responding and has a wider range than the stock units. The Nissan ECU is able to output up to 2 amps continuous (3 amps pulsed) from its standard driver circuitry to the solenoid.

S14 Nissan EDM solenoid: 39 ohms / S15 Nissan ADM solenoid: 32 Ohms

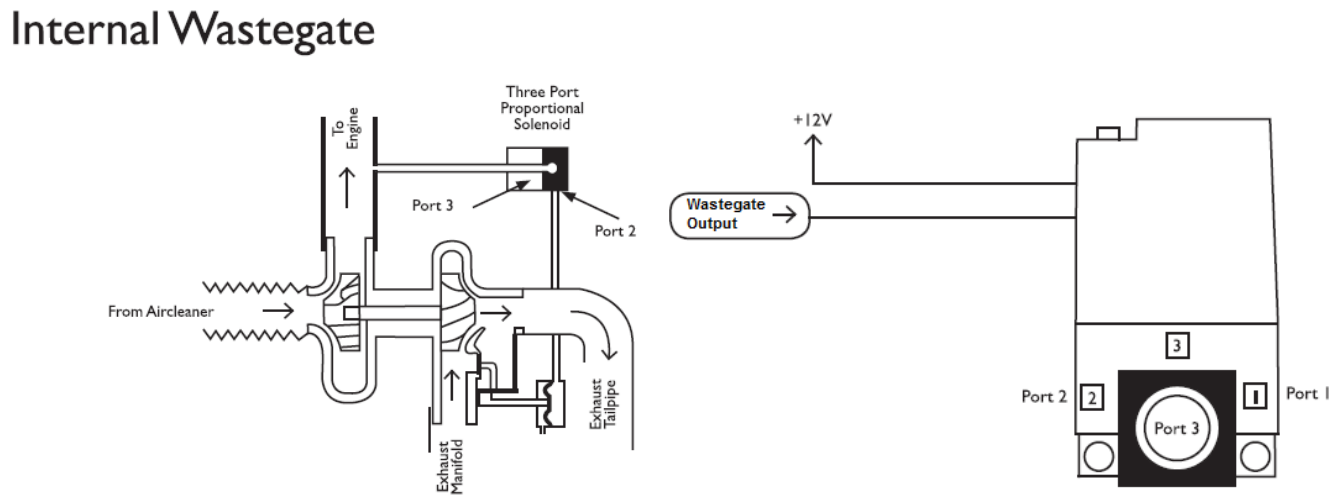
Suitable replacement solenoids:

MAC 35A Valve: 35A-AAA-DDBA-1BA / 35A-ACA-DXXA-1BA : 25 ohm – Current 1.2 amps
Apexi AVC-R Valve : 35 ohm
GM 3 Port BCS Valve: AC Delco 214-474

MAC valves will have a lower latency than standard solenoids, measured MAC at 4.5ms, GM at 6ms compared to stock solenoid responses of around 10ms.

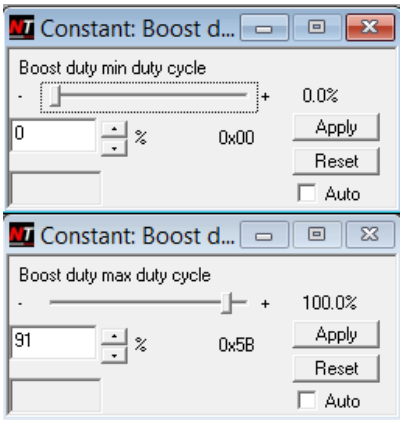
Example : At 17psi of boost using a MAC valve (Port 2 to port 1) the Nissan ECU range starts at 5% duty cycle venting 16.3psi towards the actuator, and ceases at 96% duty cycle with 2-2.5 PSI towards the actuator.

Connect the output to the factory solenoid wiring:



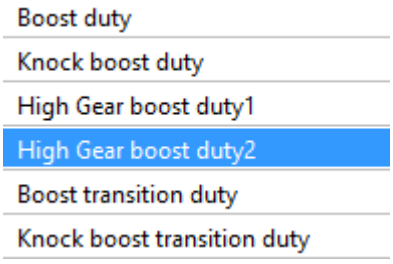
Nissan ECU boost control output range measurement:

Some Nissan ECUs will have a restricted range on boost duty cycle which needs to be expanded. Nistune provides these parameters for adjustment.

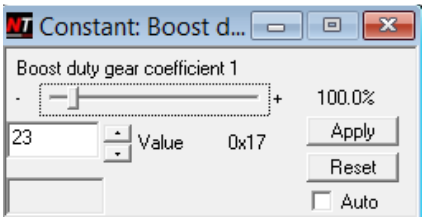


Nissan Mapping Notes:

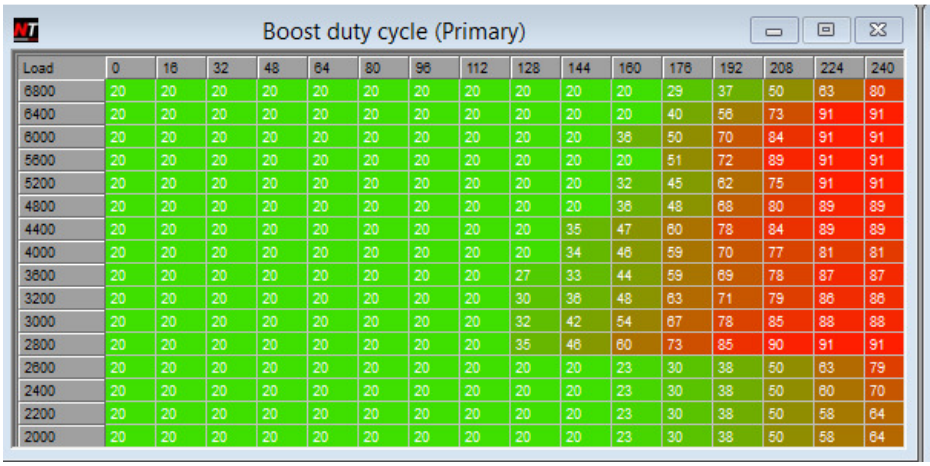
Nissan uses multiple boost control maps which are indexed load vs TPS voltage. Current boost map is indicated in Nistune by map title highlighted in green and is dependent on the current gear (coefficient) and whether the ECU has sensed knock.



Nissan sense gear position by comparing RPM to vehicle speed (there is no switch on the gearbox to indicate gear position to the ECU). Use the boost coefficient parameters to adjust the speed/RPM ratio where necessary. There are differences in calculations of low/high gear between auto and manual vehicles.



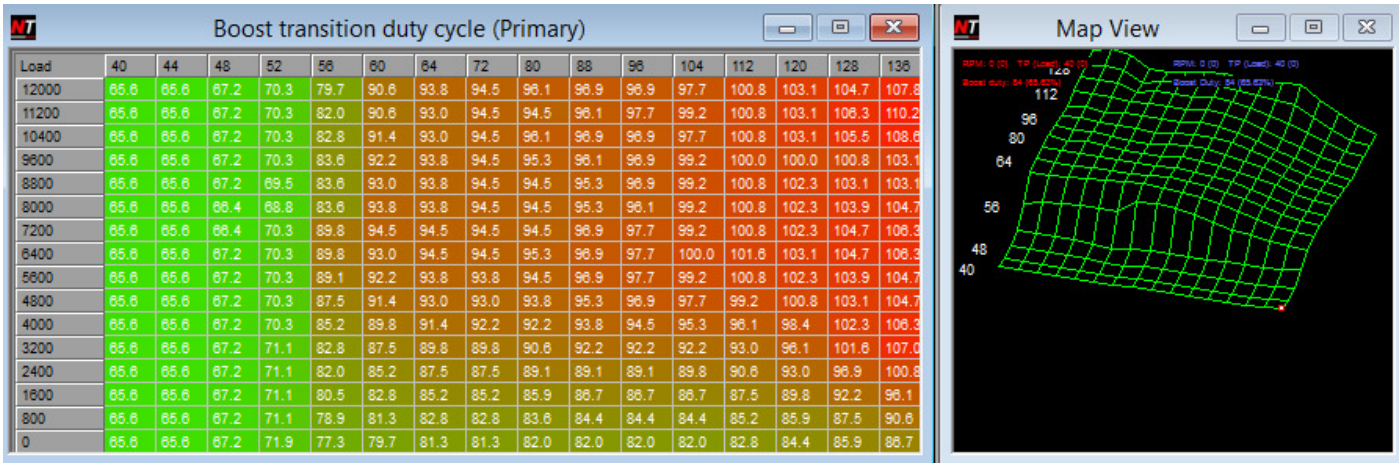
The boost tables themselves in 'raw view' represent the boost duty cycle to the solenoid:



The output from these tables, plus any adjustments is available for display in the gauges and knock warning panel:

This shows the exact duty cycle used to control the connected solenoid.

There are additional boost duty transition tables which are used to make trim adjustments to the base boost duty cycle table whilst on boost. View these in 'duty cycle' view to see the percentage of adjustment:



Boost transition duty cycle (Primary)

Load	40	44	48	52	56	60	64	72	80	88	96	104	112	120	128	136
12000	65.6	65.6	67.2	70.3	79.7	90.6	93.8	94.5	96.1	96.9	96.9	97.7	100.8	103.1	104.7	107.8
11200	65.6	65.6	67.2	70.3	82.0	90.6	93.0	94.5	94.5	96.1	97.7	99.2	100.8	103.1	106.3	110.2
10400	65.6	65.6	67.2	70.3	82.8	91.4	93.0	94.5	96.1	96.9	96.9	97.7	100.8	103.1	105.5	108.6
9600	65.6	65.6	67.2	70.3	83.6	92.2	93.8	94.5	95.3	96.1	96.9	99.2	100.0	100.0	100.8	103.1
8800	65.6	65.6	67.2	69.5	83.6	93.0	93.8	94.5	94.5	95.3	96.9	99.2	100.8	102.3	103.1	103.1
8000	65.6	65.6	66.4	68.8	83.6	93.8	93.8	94.5	94.5	95.3	96.1	99.2	100.8	102.3	103.9	104.7
7200	65.6	65.6	66.4	70.3	89.8	94.5	94.5	94.5	94.5	96.9	97.7	99.2	100.8	102.3	104.7	106.3
6400	65.6	65.6	67.2	70.3	89.8	93.0	94.5	94.5	95.3	96.9	97.7	100.0	101.6	103.1	104.7	106.3
5600	65.6	65.6	67.2	70.3	89.1	92.2	93.8	93.8	94.5	96.9	97.7	99.2	100.8	102.3	103.9	104.7
4800	65.6	65.6	67.2	70.3	87.5	91.4	93.0	93.0	93.8	95.3	96.9	97.7	99.2	100.8	103.1	104.7
4000	65.6	65.6	67.2	70.3	85.2	89.8	91.4	92.2	92.2	93.8	94.5	95.3	96.1	98.4	102.3	106.3
3200	65.6	65.6	67.2	71.1	82.8	87.5	89.8	89.8	90.6	92.2	92.2	92.2	93.0	96.1	101.6	107.0
2400	65.6	65.6	67.2	71.1	82.0	85.2	87.5	87.5	89.1	89.1	89.1	89.8	90.6	93.0	96.9	100.8
1600	65.6	65.6	67.2	71.1	80.5	82.8	85.2	85.2	85.9	86.7	86.7	86.7	87.5	89.8	92.2	96.1
800	65.6	65.6	67.2	71.1	78.9	81.3	82.8	82.8	83.6	84.4	84.4	84.4	85.2	85.9	87.5	90.6
0	65.6	65.6	67.2	71.9	77.3	79.7	81.3	81.3	82.0	82.0	82.0	82.0	82.8	84.4	85.9	88.7

These tables are governed by upper and lower bound parameters available in the ‘boost parameters’ section in Nistune. These ECU internal parameters, whilst available to the tuner, do not normally require adjustment.

Boost control forum references:

http://forum.nistune.com/viewtopic.php?f=11&t=2554

http://forum.nistune.com/viewtopic.php?f=12&t=811