



Document Number		DTN0001	
Title		Secondary Injection Notes	
Approved By			
Revision	Date	Prepared By	Change History
Draft	01/12/2004	JA	
Rev 1	9/2/05	AN	Added pulse width examples

Introduction

This document describes the process for setting up Secondary Injectors, also known as “Hi/Lo Injectors” on the MoTeC range of ECUs.

Scope

Hi/Lo injection is Standard on all ECUs in MoTeCs range, but ECUs are still restricted in Injector drivers. For example, an M4/M400 will only do 2 cylinder engines with hi low injectors and an M600 will only do three cylinders.

1. Establish the flow rates of the Primary and Secondary injectors in cc per minute.

Note: If 2 injectors are used on the primary or secondary then the flow rates must be added together.

2. General Set up - Secondary Injection Setup Parameters

Secondary Injection Ratio

This is the flow ratio between the Primary and Secondary Injectors

Expressed as a ratio of Secondary : Primary

Therefore if a secondary injector flows 300 cc per minute and a primary injector flows 150cc then the ratio would be:

- $300/150 = 2:1 = 2.$

If the primary and secondary injectors are the same size then the ratio would be:

- $150/150 = 1:1 = 1$

The Primary Injectors (Low injectors) are wired to the first injector drives, in the case of a 4 cylinder using an M48/M800, injector drives 1, 2, 3 & 4. Secondary injectors (High injectors) are wired to injector drives 5, 6, 7, 8, where number 5 is cylinder 1 high (see table).

Primary Inj	Cyl1	Cyl2	Cyl3	Cyl4
ECU Pinout	Inj1	Inj2	Inj3	Inj4
Secondary Inj	Cyl1	Cyl2	Cyl3	Cyl4
ECU Pinout	Inj5	Inj6	Inj7	Inj8

Secondary Injector Current (M800 only)

This is the same set up as in General Set up but refers to the injector current of the Secondary Injectors (M4/ M48/M8 all injectors must be the same resistance). The amount of current required by the injector is dependant on the Injector type. See the help screen (press F1) for a list of common injector examples.

Secondary Injector Battery Compensation (M800 only)

The battery voltage compensation value is dependant on the injector type. See the help screen (press F1) for a list of common injector examples.

Secondary Enrich

This is the extra fuel injected when the secondary injectors start operating.

Uses the decay characteristics from the main fuel enrichment.

Units: % IJPU

Secondary Enlean

This is the fuel gradually removed when secondary injectors stop operating.

Uses the decay characteristics from the main fuel enrichment.

Units: % IJPU

3. Secondary Balance Table

The Fuel - Secondary Balance Table determines the balance between the Primary and Secondary Injectors for various RPM and Efficiency Points.

The value is a percentage of the Primary Injector flow rate.

- **100%** All fuel is delivered by the Primary Injectors.
- **50%** 50% fuel is delivered by the Primary Injectors and 50% is delivered by the Secondary Injectors.
- **0%** All fuel is delivered by the Secondary Injectors.

If the Secondary Injection Ratio is set to 1 (equal flow injector high and low), the maximum amount of available fuel will be at a table number of 50.

Similarly if the Secondary Injector Flow Ratio is set to 2 (double flow high injector compared to low injector) the maximum amount of available fuel this time will be at table number 33.

The mixture readings stays the same at all balance table numbers, the pulse width is shared across the Hi/Lo injectors. This therefore lowers the effective duty cycle of the injectors.

The main fuel table is divided between the primary and secondary injectors according to the Secondary Balance Table. The secondary pulse width is then further modified according to the Secondary Injection Ratio.

ie: Primary pulse width = main fuel table * sec bal table * ijpu

Secondary pulse width = main fuel table * (100 - sec bal table) * ijpu / sec inj ratio

The idea of the Sec Inj Ratio is to tell the ECU the flow rate of the secondaries compared to the primaries in order to maintain fuelling/mixture at the level indicated by the main fuel table. eg: if the secondaries flow twice as much fuel as the primaries in a given time, the ratio is 2:1. The secondaries only need to be opened half as long to get the same amount of fuel.

Example 1:

main table = 60%, Sec Bal table = 25%, ijpu = 30ms and sec inj ratio = 2

primary = 60% x 25% x 30

= 4.5 ms

secondary = 60% x (100-25)% x 30 / 2

= 6.75 ms

Example 2:

main table = 80%, sec bal table = 33%, ijpu = 40ms and sec inj ratio = 1.5

primary = 80% x 33% x 40

= 10.56 ms

secondary = 80% x (100-33)% x 30 / 1.5

= 10.72 ms

4. Secondary Injection Timing

The Fuel - Secondary Injection Timing determines when the Secondary Injectors (if used) will stop (or start) injecting fuel for each injection pulse.

See the help (press F1) for the Main Injection Timing table for more detail.

Notes for 10 - 12cyl sequential with High/low injectors

If an M800 with the 10/12 cylinder sequential up grade is being used for a six cylinder engine with hi/lo injectors, the output assignment must be noted.

Primary Inj	Cyl1	Cyl2	Cyl3	Cyl4	Cyl5	Cyl6
ECU Pinout	Ign3	Ign4	Ign5	Ign6	Inj1	Inj2
Secondary Inj	Cyl1	Cyl2	Cyl3	Cyl4	Cyl5	Cyl6
ECU Pinout	Inj3	Inj4	Inj5	Inj6	Inj7	Inj8

It is important to note that any ignition out put being used as an injector out put can ONLY drive a 16ohm injectors, it CANNOT do current control for low ohm injectors.