Vehicle Installations

Document Number	VIAU0007	
Title	BMW M5 E39 S62B50	
Revision Date	**Prepared By**	**Change**
27 September 2002 – Draft 2 Oct 2003	Andrew Dennison Andrew Naumann	Initial version Updated for v2.0 software Added info on solenoid diodes

Introduction

This document contains some details on Vanos control for the S62B50 engine fitted to the E39 series of the BMW M5. This information was collected with the assistance of Kempower www.kempower.be.

REF/SYNC

M800 REF/SYNC Mode 30 (BMW)
Suits: S62B50 (quad vanos), S52B32 (double vanos), etc
Ref : 60-2, MAG, FALL : 60 evenly spaced teeth with two missing (per rev)
Sync: 8-1, HALL, FALL : eight evenly spaced teeth with one missing (per cycle)
CRIP: 445

Vanos Control

Introduction

The Vanos system allows the timing of the intake and exhaust camshafts to be adjusted. This has benefits in both reducing engine emissions and while also generating a broader spread of torque. At idle the intake cam is fully retarded, and can be advanced up to 60 degrees (crank).
Exhaust CAMs have eight teeth with one missing (used for sync)
Inlet CAMs have six teeth

Camshaft Position Measurement

The exhaust CAM has a missing tooth for SYNC that moves relative to REF for measurement of the exhaust CAM position. Digital inputs are used to measure the remaining camshaft positions, any 3 of Dig inputs 1 – 4 can be used.

Sensor Setup – Ref/Sync Sensor Setup – Sync CAM Position
Right Exhaust CAM (bank 1, cyl 1-4)

Channel	6
Offset	60.0
Filter	3

Digital 2 – Right Inlet CAM (bank 1, cyl 1-4)

Function	19
Edge	0
Offset	706.0
Channel	5
Teeth	6
Filter	3

Digital 3 – Left Exhaust CAM (bank 2, cyl 5-8)

Function	19
Edge	0
Offset	60.0
Channel	4
Teeth	8
Filter	3

Digital 4 – Left Inlet CAM (bank 2, cyl 5-8)

Function	19
Edge	0
Offset	706.0
Channel	3
Teeth	6
Filter	3

Camshaft Position Control

The position of the camshaft is adjusted with two solenoids per CAM. Pulsing the advance solenoid advances the CAM, while pulsing the retard solenoid retards the cam. Thus eight auxiliary outputs are required to control the four camshafts.

The Vanos CAM Control solenoids have a resistance of around 5-10ohms. The factory ECU connects one side of the solenoid to GND and drives the other side to 12V. However, the M800 requires that one side is connected to 12V and the other side is driven by the ECU.

The pinout below suits the M800:

Pin	Description
1	Inlet Retard
2	Inlet common to ECU 12V
3	Inlet Advance
4	Exhaust Retard
5	Exhaust common to ECU 12V
6	Exhaust Advance

Note: if using the factory wiring, the loom will need to be modified so that pins 2&5 are connected to 12V instead of ground. There may be internal diodes on the valve solenoid block that need to be removed – see below.

AUX5 – Right exhaust cam advance (bank 1, cyl 1-4)

Function	123
Source Channel	6
Proportional Gain	4.00
Integral Gain	0.0
Derivative Gain	0.000
Dead Band	1.0
Y Axis	1
Offset	1.900
Polarity	0
Lo Limit	0.00
Hi Limit	0.00

Note: AUX6 is automatically assigned to right exhaust cam retard

Below is a table of a starting point for the exhaust CAM position table. Points marked '*' were logged with an M800 monitoring the factory ECU - other points were interpolated.

AUX7 – Right inlet cam advance (bank 1, cyl 1-4)

Function	123
Source Channel	4
Proportional Gain	4.00
Integral Gain	0.0
Derivative Gain	0.000
Dead Band	1.0
Y Axis	1
Offset	1.900
Polarity	0
Lo Limit	0.00
Hi Limit	0.00

Note: AUX8 is automatically assigned to right exhaust cam retard

Below is a table of a starting point for the inlet CAM position table. Points marked '*' were logged with an M800 monitoring the factory ECU - other points were interpolated.

IGN3 – Left exhaust cam advance (bank 2, cyl 5-8)

Function	123
Source Channel	4
Proportional Gain	4.00
Integral Gain	0.0
Derivative Gain	0.000
Dead Band	1.0
Y Axis	-6*
Offset	1.900
Polarity	0
Lo Limit	0.00
Hi Limit	0.00

Note: IGN4 is automatically assigned to left exhaust cam retard

* -6 as the Y-axis makes the Left exhaust CAM track the right exhaust cam

IGN5 – Left inlet cam advance (bank 2, cyl 5-8))

Function	123
Source Channel	3
Proportional Gain	4.00
Integral Gain	0.0
Derivative Gain	0.000
Dead Band	1.0
Y Axis	-5
Offset	1.900
Polarity	0
Lo Limit	0.00
Hi Limit	0.00

Note: IGN6 is automatically assigned to left exhaust cam retard

* -5 as the Y-axis makes the Left exhaust CAM track the right exhaust cam

Solenoid Diodes

Each side of the OEM VANOS control includes a high current diode, ie: 2 per CAM. These diodes are reversed compared to what is needed for the M800 to drive the solenoids. See note above about connecting the solenoids to 12V instead of Ground.

Aux outputs 5 - 8 (and any spare Ignition outputs) have internal diodes that obviate the need for external diodes. Consequently, the existing ones must be removed.

On this particular engine (the S62) the VANOS control solenoids are in a 'block' on the front of each head. Each 'block' must be removed from the engine and disassembled to gain access to the diodes. Clearly visible on the PCB are round, high current, SMT diodes which must be removed for the application of MoTeC control.

On other VANOS engines (eg; the S50B32) the diodes may be moulded into connectors attached to the solenoids. The connectors can simply be cut off and replaced with 'normal' connectors.

The S54 inline 6-cylinder 3.2L motor has a VANOS block on the front of the head which is semi-potted and not easy to open. Ie: it may be required to drill holes through the top of the VANOS housing to expose the diodes on the PCD for removal. So far no elegant solution has been found for these.