Vehicle Installations

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Introduction

This document contains some details on Vanos control for the S50B32 engine fitted to the E36 series of the BMW M3.
This document is a starting point for collating information on this vehicle. The information is incomplete and certain elements may not be totally accurate.

REF/SYNC

M800 REF/SYNC Mode 31 (BMW)
Suits:S50B32 (double vanos)
Ref : 60-2, MAG, FALL : 60 evenly spaced teeth with two missing (per rev)
Sync: 6+1, HALL??, FALL?? : six evenly spaced teeth with one additional (per cycle)
Exhaust CAM: 8, HALL??, FALL?? : eight evenly spaced teeth (per cycle)
CRIP: unknown, try 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 CAM has eight teeth
Inlet CAM has six teeth with one additional (used for sync)

Camshaft Position Measurement

The input CAM has an additional tooth for SYNC and moves relative to REF for measurement of the inlet CAM position. The exhaust CAM signal should be connected to digital input 1 (inputs 1-4 are suitable). The digital input and sync input are used to measure the camshaft positions, and must be setup is as follows:

Digital 1 – Exhaust CAM

Function	19
Edge	0
Offset	Unknown
Channel	2
Teeth	8
Filter	3

Sensor Setup – Ref/Sync Sensor setup – Sync CAM position

Channel	1
Offset	Unknown
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 four auxiliary outputs are required to control the two 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 –exhaust cam advance

Function	123
Source Channel	2
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 exhaust cam retard

AUX7 –inlet cam advance

Function	123
Source Channel	1
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 inlet cam retard

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. On this particular engine the diodes are moulded into the LK/3 connectors which are attached to the solenoids on flying leads. It is simply necessary to cut off the connectors and replace them with 'normal' connectors.

On other Vanos style engines (eg: the S54 in line 6 cylinder), the diodes may be located in a 'block' on the front of each head. It is necessary to gain access to the diodes and remove them for control by an M800 ECU. See also document VIAU0007.