

AVM2-PC



# AVM2-PC Test Stand

The AVM2-PC Test Stand is an advanced personal computer based diesel fuel pump test stand that is designed to save you time. In fact, it can save you as much as 50% of the time it takes to use another test bench.

The secret of the AVM2-PC is in its ease of use. Although it is a sophisticated piece of equipment, it allows the operator to use the test stand quickly, so you can potentially test more diesel pumps using the AVM2-PC than you could using another test stand system. Combined with the ability to test "All Makes" of fuel injection equipment, the AVM2-PC becomes the obvious choice.

The powerful computer at the heart of the stand has the well known, user friendly Windows™ operating system already installed. The AVM2-PC control software, Magmah, has been written with speed and ease of operation in mind. In addition it is possible to select semi automatic operation from an Auto Step test plan for a further saving of time.

## User Friendly and Adaptable Design

Ease of use was a prime consideration in the design of the AVM2-PC range. This results in an adaptable and user-friendly test stand, with the facility to handle virtually all automotive type in-line, rotary and common rail pumps up to 12 cylinders, as well as EUI, EUP and Common Rail injectors with minimum stress and strain on the operator.

## Advanced Video Metering

With the introduction of the PC based AVM2-PC, a development of the successful AVM test bench, **Hartridge™** is able to offer the diesel specialist the technology needed for the future. This stylish machine, incorporating uprated drive motors for improved torque at low rpm and improved test oil cooling capacity, complies with ISO4008, EEC & UL/CSA standards. It benefits from in excess of 20 years video metering experience in applications ranging from field service, research and development, to production.

With the ability to match the unrivalled speed of **Hartridge™** video metering, the AVM2-PC system has the capacity to handle pumps up to 12 cylinders. With its intelligent firing order learning, the AVM2-PC allows pumps to be connected to the test injectors in the most convenient way. Injector changeover is now as quick as any non-sealed system, using an innovative "plug-in" design; while the injector mount has vertical and 180° adjustment.

In addition to presenting full information on pump or injector output, the 15" TFT also has the facility to show test data simultaneously. The test stand is controlled using a standard keyboard and an optional printer is available to provide a colour hard copy record of pump or injector performance. This can be performed at any time during a test, for example results can be gathered before and after adjustments.

These and many other outstanding features, such as DC drive and a standard PC architecture (allowing connection to networks or a modem and future upgrades) make the AVM2-PC the ultimate test stand for future diesel fuel pump testing.

# Power and Inertia

The high torque direct drive DC motor fitted to the AVM2-PC completely eliminates a transmission system leading to greatly reduced cost and complexity of servicing. It also ensures that the full output torque of the drive motor is available at the drive coupling from 30 rpm. The 20hp (15kW) motor drives through a large 1.8kgm<sup>2</sup> (43lbf<sup>2</sup>) flywheel which is directly coupled to an integral anti-backlash flex coupling. For safety, both the flywheel and the coupling are enclosed. The drive system automatically compensates for load variations, to provide a constant, pre-selectable test speed within a range of 30 to 4000 rpm. In addition, the rate of acceleration and deceleration (ramp rate) can be set by the operator.

# Safety and Ergonomics

Safety has, of course, been of prime consideration when designing the AVM2-PC. The flywheel is fully enclosed and the electrical components are fully guarded within the electrical cabinet. The emergency stop switches are accessible from both sides of the machine and operate through a failsafe relay.

The control of drive starting is through an independent switch, so in the unlikely event of a PC malfunction, it cannot start unexpectedly. In addition, the drive cannot operate at less than 30 rpm for visible safety. The AVM2-PC complies with the European CE marking Directive and conforms to EMC standards. Hand in hand with safety, operator comfort has been designed into AVM2-PC for ease of use. The control console is pivoted to permit operation from either side of the test stand at all times. The keyboard height and angle is set to minimise strain and access to the floppy and CDROM drives is from the front of the machine. The use of a PC within the test bench offers the user the ability to utilise standard software to supplement the AVM2-PC operation. For example the testing results could be stored into a database for traceability. In addition, the PC could be connected to your office network for interaction with other systems.

# Pump and Injector Mounting

A system using special adaptors, permits test injector change over as quickly as any non-sealed system - with a simple, plug in action. So that the test injector mount can be repositioned without disturbing the pump mounting brackets, the articulated support arm is pivoted beneath the front of the table. The bed is long enough to accommodate all automotive pumps up to 12 cylinders enabling users to set a comfortable working height.

# Facilities

All AVM2-PC test benches incorporate features designed to provide ease of operation. These include vertical adjustment of the test injector mount - allowing the use of the shortest high pressure lines now being specified. All connections and associated valves are grouped together on the bulkhead, leaving a large unobstructed self-draining work area at the front of the table for tools and fittings.

The control of noise and vibration from the pump was also a major design consideration. This has been achieved by supporting the complete motor, pump mounting bed plate and injector arm assembly on rubber isolation mounts. In addition, careful design of the injector mounting has been made to reduce noise.

# Servicing

All test oil supply and lube system components are located on the left hand side of the test stand, with all electrical/electronic services on the right hand side. Full access is gained by removing two easily detachable panels from each side. Test and lube oil gravity drains are provided, together with easy access to tanks for refilling and filter changing. All electronic circuits use very reliable solid-state technology. However, should component failure occur, LED lights and error messages will indicate which board is malfunctioning and replacement is a simple plug-in operation.

# Operation Using the Computer

The AVM2-PC is operated using the onboard computer, keyboard and 15" TFT together with the pressure control valves and digital pressure gauges. The computer and keyboard allow the operator to either enter data e.g. speed, or to observe test results, such as pump output, on the metering display. Other displays available include pump advance and phasing angles, and test stand self diagnostic information. Operating data such as test plans can also be entered, stored and executed. This brings the ultimate in flexibility of use to the operator.

The AVM2-PC uses a powerful standard office PC running Microsoft™ operating system. This provides a user friendly environment with the familiar Windows user interface in which the AVM2-PC control application works. Limits can be set on other machine parameters, and the colour change also applies, giving instant recognition of an out of limits value. All functions are menu controlled, accessed by either the function keys or the mouse.

The main menu is displayed when first switching on the machine. The user can then set up the basic fuel pump parameters. The optional dynamic phasing display can be used to show all pump phasing angles simultaneously for rapid adjustment. The heart of the machine operation is the metering screen which presents all the information to the operator which is required at anyone time. The metering display changes automatically for Common Rail and EUI testing to ensure that test data displayed is relevant to the application.

A key feature is the on-screen "analogue" pressure gauges. The traditional gauge representation allows trends and relative measurements to be viewed, whilst the numerical value is also displayed for accurate setting. A limits band can be displayed on the gauges and an out of limits value is signaled by a change of the needle from yellow to red. Should a fault occur with the test stand it can be detected using self diagnostic routines displayed on the computer monitor. This will indicate for example motor over temperature, air supply failure, the need for filter change, stalled motor and low tank.

# Screen Display



Figure 1 AVM2-PC setup screen display



Figure 2 AVM2-PC metering screen display



Figure 3 AVM2-PC phasing screen display



Figure 4 AVM2-PC diagnostics screen display

# Main Features

- Flexible with Hartridge accessories – can test in-line, Rotary, Common Rail pumps and EUI, EUP and Common Rail Injectors
- PC with Windows™ operating system
- Pressure phasing to 80 bar
- Anti-Backlash Coupling
- Two variable DC supplies (0-24V @ 3 amp)
- Cooled metering unit
- Back leakage temperature measurement at pump outlet
- Auxiliary socket for external calibrator control and point of injection sensors
- Analogue speed trim for fine control of governors
- Digital pressure displays
- Drive "nudge" control
- Auto Step test plan editor and execution
- Compact dimensions compared with other machines
- 12 or 8 cylinder advanced video metering
- 20 hp (15 kW) DC high torque motor
- 1.8kgm<sup>2</sup> (43lbf<sup>2</sup>) flywheel
- Display of pump output and test stand operating data via 15" TFT
- Digital Dynamic phasing (optional)
- Digital Dynamic timing (optional)
- Digital Advance (optional)
- Digital Boost (optional)
- Digital Rack (optional)

# Benefits

- User friendly
- Industry standard PC allows expansion
- Connection possible to network or modem (e.g. for sharing test plan information or a results database between several machines)
- Approved and recommended by Delphi, Denso, Siemens and Stanadyne

## TECHNICAL SPECIFICATION

<b>Drive System</b>	
<b>Motor</b>	D C Thyristor controlled, 20hp (15kW)
<b>Speed Range</b>	30 - 4000 rpm
<b>Power</b>	20hp (15kW) motor
<b>Speed (rpm)</b>	0          590          1500          2500          4000
<b>Torque (Nm)</b>	165      165      95      54      22
	*All torque ratings are for continuous operation.
<b>Speed Control</b>	Closed loop speed control system giving zero steady state droop. Digital speed selection from the computer application, with analogue trim adjustment of: $\pm 10\%$ . Acceleration rate of 400 RPM per second. However, the rate of drive acceleration and deceleration (ramp rate) can be varied from 10 rpm per second to 400 rpm per second in 1 rpm increments. Ability to store/select commonly used speeds. "Nudge" function to orientate drive to aid pump mounting.
<b>Flywheel</b>	Inertia 1.8 kgm <sup>2</sup> (43 lbft <sup>2</sup> ). Incorporating air operated friction brake for emergency stop.
<b>Stiffness</b>	Antibacklash coupling 600mm <sup>2</sup> /stroke ISO rating. Suitable for 75, 90 and 120mm drive couplings. Adaptors are available for different pump drives.
<b>Calibration System</b>	8 or 12 line video display metering using a 15 inch colour display screen, Capacity 5 - 500mm <sup>3</sup> /stroke with 3 measuring modes, calibrate, overcheck and average. Selectable units (mm <sup>3</sup> /st, cc/50, cc/100, cc/125, cc/200, cc/250, cc/300, cc/500) and adjustable scale via upper/lower limits entry. Back leakage flowmeter display of 50-1500cc/min 3-90 l/hr. Units selectable cc/min, l/hr and cc/1000 st. Water cooled metering system to enable testing of high pressure / temperature pumps.
<b>Computer System</b>	<ul style="list-style-type: none"> <li>• Quality PC (subject to change) preloaded with Windows™ operating system and AVM2-PC application (Magmah).</li> <li>• Floppy disk drive</li> <li>• CDROM drive</li> <li>• Mouse</li> <li>• Two serial ports, one parallel port.</li> <li>• Expansion by standard ISA or PCI card interface (e.g. network card or internal modem)</li> <li>• 15" TFT</li> <li>• 102 key keyboard with protection membrane cover.</li> <li>• USB</li> </ul>
<b>Instrumentation</b>	
<b>Tachometer</b>	Numerical display on screen, resolution to 1 rpm, stability +/-1 rpm.
<b>Fuel Supply</b>	Range - 1 bar to 4 bar. Displayed on screen as numerical value and analogue representation (10 bar option). Units selectable between bar, MPa, psi, mmHg, mbar, hPa, kPa
<b>Auxiliary A</b>	Range 0 bar to 7 bar. Displayed on screen as numerical value and analogue representation. Units selectable between bar, MPa, psi, mmHg, mbar, hPa, kPa
<b>Auxiliary B</b>	Range 0 bar to 16 bar. Displayed on screen as numerical value and analogue representation. Units selectable between bar, MPa, psi, mmHg, mbar, hPa, kPa
<b>Boost Pressure (optional)</b>	Range 0 bar to 3 bar. Displayed on screen as numerical value and analogue representation. Units selectable between bar, MPa, psi, mmHg, mbar, hPa, kPa
<b>Pressure Phasing</b>	80 bar. Displayed on screen as numerical value. Units selectable between bar, MPa, psi, mmHg, mbar, hPa, kPa
<b>Lube Oil (optional)</b>	7 bar. Displayed on screen as numerical value. Units selectable between bar, MPa, psi, mmHg, mbar, hPa, kPa
<b>Advance (optional)</b>	Range +/-10mm. Resolution 0.1mm. Units selectable between mm, DPA°, DPC°, DP200°, Stanadyne°, Bosch°
<b>Rack (optional)</b>	Range 30mm. Resolution 0.1 mm. Displayed on screen as numerical value (mm).
<b>Fuel Supply Temperature</b>	Range 0 to 65°C. Displayed on screen as numerical value, Units °C, °F
<b>Back Leakage</b>	Both temperature and flow numerical values are displayed on screen. Range 0 to 80°C. Flow units cc/min, l/hr, cc/1000str.
<b>Static phasing</b>	Range 0 to 360° resolution 0.1°
<b>12 line Dynamic Phasing</b>	Range 0 to 360°, resolution 0.1°
<b>Injector Mount</b>	Quick release injector mount to accommodate ISO 4010 orifice plate and T size injectors as well as other common types. Caters for very short high pressure pipes and can be moved from one side of the bench to the other without unplugging any pipes or cables.
<b>Phasing</b>	Pressure phasing as standard, digital dynamic phasing optional, angle of rotation shown (0.1° resolution display).
<b>Hydraulic Systems</b>	
<b>Test Oil supply and controls</b>	Electric motor directly driving a pump providing 550 l/hr, 50Hz machines and 660 l/hr, 60Hz machines. Maximum pressure of 0-7 bar.
<b>Pressure Phase Supply</b>	0 to 80 bar.
<b>Test Oil Tank</b>	45 litres capacity/10 imperial gallons.
<b>Test Oil Temperature Control</b>	Temperature controlling to $\pm 2^{\circ}\text{C}$ . The default setting is 40°C but 25-65°C can also be set as an alternative.
<b>Lube Oil Supply (optional)</b>	250 l/hr at 50Hz and 300 l/hr at 60Hz, pressure 0-4 bar. Tank 14litres capacity/3 imperial gallons.
<b>Hours Counters</b>	<ul style="list-style-type: none"> <li>• Fuel pump</li> <li>• Fuel filter with "change filter" message every 500 hours</li> <li>• Drive</li> <li>• Machine</li> </ul>
<b>Auxiliaries</b>	Two D.C supply outputs of 0-24V at 3 amps, which can be parallel, connected to give 6 amps. Multipin 110V connector (for external single cylinder calibrator and point of injection transducers) Real time clock display. Socket for advance and rack kit transducer.

# Installation Recommendations

Electrical Supply 20hp: 380-480V 50Hz 3 phase (54 amp maximum) 200-240V 60Hz 3 phase (108 amps maximum) via autotransformer 93-264V 50/60Hz single phase supply for PC Compressed Air: 6 bar/90 psi Min 8 bar/120 psi max Water: 8 l/min/0.6 Imp Gall 20 ° C max temperatures at 1-5 bar pressure.

## Additional Accessories

- Lube oil supply (Kit No. HB352)
- Dynamic phasing (Kit No. HB372W)
- Digital rack (Kit No. HB351)
- Turbo boost (Kit No. HB350)
- Digital advance (Kit No. HB346)
- DP210 Timing (Delphi agents only)

### Common Rail

- Common Rail Base Kit (Kit No. HB378)
- Common Rail Pump test controller (Kit No. HF1130)
- Common Rail Pump test application kits
- Common Rail Injector Base Kit (Kit No. HK900)
- Common Rail Injector application kits

### EUI and EUP

- EUI Base Kit (Kit No. HK870)
- EUI and EUP application kits

### Traditional Pump Kits

- Rotary pump accessories (Kit No. HF126)
- In Line pump accessories (Kit No. HF125)
- Combined rotary and in line pump accessories (Kit No. HF137)

### Test Injectors (sold individually)

- ISO4010 Injector (AI29)
- 0.4mm O.P Injector (AI33)
- 0.5mm O.P Injector (AI43)
- 0.6mm O.P Injector (AI44)
- 0.7mm O.P Injector (AI45)
- 0.8mm O.P Injector (AI46)
- Dynamic timing (Kit No. HB373W)

### Test Injector Adaptors

- A129/1 **Hartridge™** A129, ISO4010 Test Injector
- A133/1 All **Hartridge™** orifice plate test injectors
- HB287 All Bosch test injectors (except 'T' size, set of 8)
- HB288 All Bosch test injectors (except 'T' size, set of 12)



**Figure 5** Common Rail Base Kit HB378



**Figure 6** EUI Base Kit HK870

## Ordering

AVM2-PC Test Stands are ordered using one of two basic order numbers. These define the number of cylinders you require. All machines supplied comply with the specification and include all the standard features listed below.

<b>AVM208A</b>	(15kW)	8Cyl	3 Phase 380/440V 50Hz
<b>AVM2012A</b>	(15kW)	12Cyl	3 Phase 380/440V 50Hz
<b>AVM208C</b>	(15kW)	8Cyl	3 Phase 200/220V 60Hz
<b>AVM2012C</b>	(15kW)	12Cyl	3 Phase 200/220V 60Hz

Please note that the following languages already installed on the AVM2-PC:

- English
- German
- Italian
- Dutch
- French
- Spanish
- Turkish
- Portuguese

## Shipping

**Gross Weight:** 1170 kgs

**Nett Weight:** 970 kgs

**Case size:** 191 x 114 x 209 cms

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Contact your local **Hartridge™** distributor  
for more detailed information or visit  
**[www.hartridge.com](http://www.hartridge.com)**



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