

# ROVER MEMS DIAGNOSTICS

Martin Rubenstein discovers three diagnostic packages that deal with pre-EOBD Rover cars.

**A**fter waiting years for an affordable Rover MEMS diagnostic unit to appear on eBay, not one but three MEMS software packages have arrived. Necessity being the mother of invention, these came about because the developers wanted access to their

own pre-EOBD ECUs. Two of them run on the Windows operating system (OS) and the other is an app for Android devices. The results are displayed via graphical user interface, a far cry from the four-line Sykes-Pickavant ACR4 code readers with a Rover pod, which cost around £300 on eBay.

## MEMSGauge

The first package, a Windows programme, is called **MEMSGauge**, and was released in May 2014. The developer, Colin Bourassa, lives in New Hampshire, USA. A software engineer, he owns a left-hand drive Blue Star limited edition 1996 Mini SpI. MEMSGauge grew out of diagnostic software developed by Colin and his father and which eventually became RoverGauge for Land Rover and TVR vehicles [1]. Colin is an advocate of open-source software – anyone can inspect the code, use it or develop it – and has published the results of his research into the MEMS protocol [2]. Given that Rover vehicles are rare in America, MEMSGauge development was limited to MEMS 1.6, and there is also a Linux version [3].

## MEMS Diag

The second package is an Android app, **MEMS Diag**, developed by Pawel Wozniczka. It can be used for diagnosing

1.3, 1.6 and 1.9 versions of MEMS [4]. Pawel's work took him to Zurich, where he now lives, and he developed MEMS Diag so that he could access the ECU on his LPG-converted Freelander 1.8i via a small, portable device such as a tablet or smartphone.

The full app is available from the Google Play Store for less than £8, and there is a free 'lite' version available to check device compatibility. Pawel says the app should run on any Android system newer than 3.1, but there is no guarantee. It will not, for example, run on the LG Swift because that device does not permit USB host mode.

The greatest chances of success are with Samsung devices. Pawel uses a Samsung Galaxy Note 3 attached to his windscreen. We installed an emulator (Andyroid) on a Windows laptop, which allowed us to run MEMS Diag on the device; we also installed the Android OS directly into Virtualbox. However, unless the user is familiar with virtual machines or is willing to spend a lot of time troubleshooting, it is better to use

## Supported Operating Systems

- MEMS Diag – Android (Note 1).
- MEMSGauge – Windows, Linux.
- MEMSLogger/MEMSanalyser – Windows.

## Real-time display of ECU parameters

- MEMS Diag – Graphical display (up to 18 parameters) (Note 2).
- MEMSGauge – Simulated gauge display (4 parameters).

## Logging of ECU data

- MEMS Diag – Over 25 ECU parameters.
- MEMSGauge – 10 ECU parameters.
- MEMSLogger – Over 10 ECU parameters at high sample rate (Note 3).

## Replay logfile data for post-run analysis

- MEMSanalyser (ideally with high resolution MEMSLogger file from the same suite).

## Fault code display and clearing

- MEMSanalyser (Note 4).
- MEMS Diag.
- MEMSGauge.

## MEMS tuning

- MEMS Diag (Note 5).

## Sensor and actuator testing

- MEMSGauge.

- Note 1** Can also run on Windows inside a virtual machine running Android, but this is not recommended.
- Note 2** Graphical display (Graphview) and tabulated display (Gridview).
- Note 3** MEMSLogger logs 50 parameters; many remain to be identified.
- Note 4** Fault code display only.
- Note 5** Idle settings and ignition advance offset at high load (Tuneview).

an Android device as intended, all the more so given that the latest update makes use of GPS data.

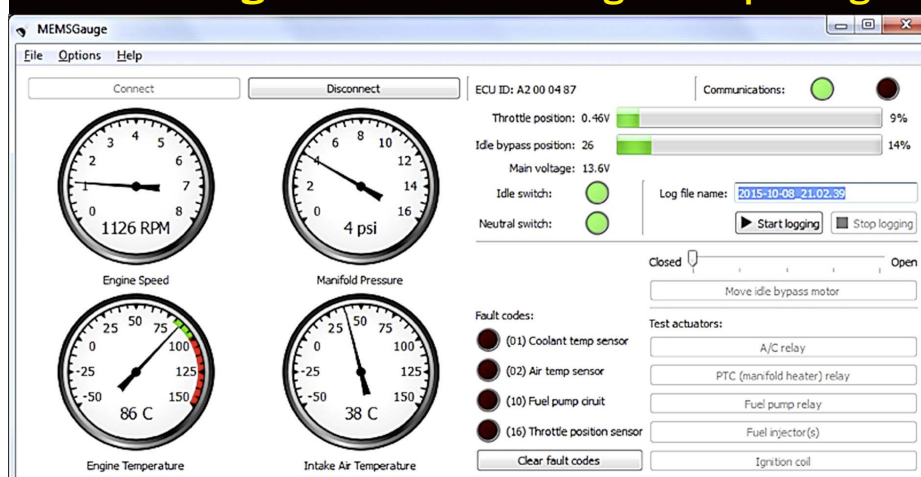
On the other hand, running MEMS Diag inside a virtual machine on a Windows laptop means you can switch effortlessly between all three packages. The latest update of MEMS Diag brings support for MEMS 1.3 together with a calculated fuel consumption, which takes GPS data to compute distance travelled. It assumes air-fuel ratios of 14.7:1 in closed loop and 13.5:1 in open loop and then calculates the mass airflow from the manifold absolute pressure, engine speed, inlet air temperature and volumetric efficiency. The graphic display allows any parameter to be displayed against time.

One important point to note with MEMS Diag is that you must set the version of MEMS in the app's preferences before attempting to connect to the ECU.

## MEMSanalyser

The third package, **MEMSanalyser**, is a new development using some of Colin's MEMSGauge work and is still in its infancy. The developer, Alan Richey, lives near Grantham in Lincolnshire and

## MEMSGauge The Windows diagnostic package



served in the RAF for nearly 40 years. He runs a Robin Hood Superspec kit car with a Rover T-Series 2000cc engine [5]. Alan's MEMS diagnostic package runs on Windows [6] and has two basic components: the first is a data logging program, MEMSLogger, which calls on one of Colin's open-source programs to read MEMS; the other component, MEMSAnalyser, not only reads and displays the output of MEMSLogger, but can also display the log files from MEMSGauge and MEMS Diag. However, the native sampling rate of Alan's MEMSLogger is over three times that of the other two packages, producing, for example, an O<sub>2</sub> sensor output which is as detailed as one from an oscilloscope.

Like the other two packages, MEMSAnalyser also shows fault codes, but it does not clear them – it is, after all, simply a logfile analyser. Switching between parameters to compare sensor data at any point in time is simple, and a cursor with variable step size allows exact measurement of Y-axis parameters at any point.

## Cabling requirements

All three diagnostic packages require a USB-to-MEMS cable, which is a 5V USB to TTL serial converter with a MEMS-style connector attached, depending on the MEMS version (3-pin for MEMS 1.6 and OBD-II for MEMS 1.9). All the necessary parts are available from Mouser UK [7] [8] [9] and the developers' websites give clear assembly instructions [2] [4].

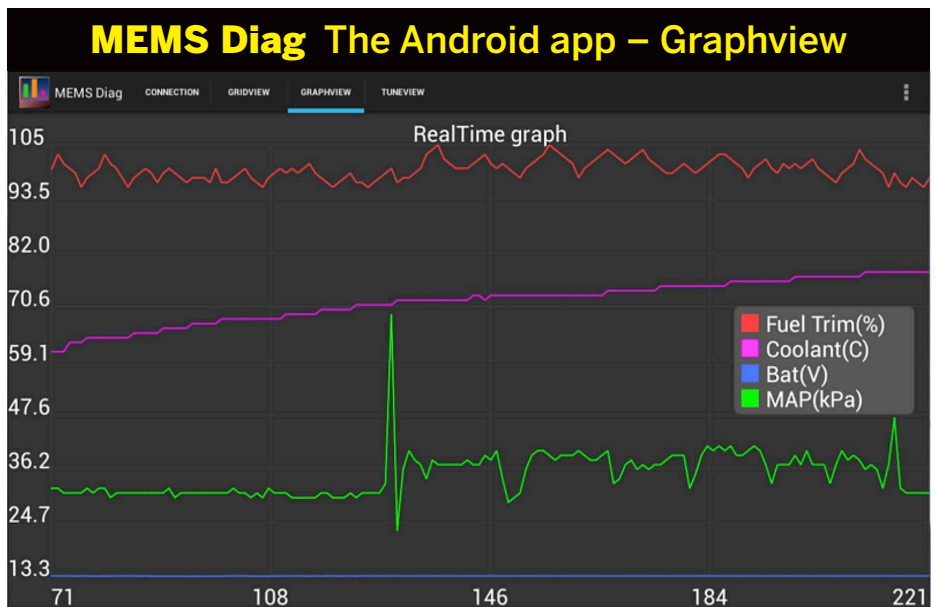
Running MEMS Diag on an Android device also requires a USB On-The-Go (OTG) lead. The TTL lead comes with information about the necessary Windows drivers.

The three packages differ in the ways they present the ECU data, as the screenshots show. They also offer a number of different features.

## Clearing fault codes

An oscilloscope shows the output from the various MEMS sensors, but it does not show what MEMS does with the data. Thanks to this suite of powerful programmes, fault codes can now be cleared, various systems tested and a great deal of diagnostic information is visible. All credit goes to the gifted developers who have reverse-engineered MEMS by taking the raw output data, applying a lot of detective work and producing these three outstanding diagnostic tools.

The three developers are very generous with their time, patiently answering users' queries, and there's an active forum for MEMSGauge, the Windows package [10].



Parameter	Value
RPM	0
MAP(kPa)	100
TPS(V)	0.78
Coolant(C)	11
Inlet(C)	14
Bat(V)	11.80
IgnAdv	6.5
Lambda(mV)	435
FuelTrim(%)	100
CLoop	0
IdlePos	136

[1] <http://bit.ly/1SsRzW9>

[3] <http://bit.ly/1RCQKKo>

[5] <http://bit.ly/1Vh1sei>

[7] <http://bit.ly/1X3zfxp>

[9] <http://bit.ly/1oqm4Uy>

[2] <http://bit.ly/1SsRrWz>

[4] <http://bit.ly/21XnRxs>

[6] <http://bit.ly/1UZ9HnH>

[8] <http://bit.ly/1ToSLyD>

[10] <http://bit.ly/1N1v9cH>

