

# Auto Intelligence

Essential Information for the Modern Workshop | Issue 8 | Autumn 2009



**BOSCH**  
Invented for life

## Future engine technology

Which engine will be powering the cars of the future?

This issue was a hot topic at the recent International Automotive Press Briefing hosted by Bosch. With the vision of the electric car gradually becoming a reality, investment in this area will usher in completely new business model approaches, zero-emissions vehicles and current vehicles with significantly improved fuel efficiency. "At Bosch, we are investing heavily in making these visions a reality," said Dr. Bernd Bohr, chairman of the Bosch Automotive Group, at the start of the event.

While Bosch is working hard to get the electric drive of the future readied for large-scale series production, its engineers are continuing to further improve the internal-combustion engine for decades to come. "We will do the one thing without neglecting the other...our engineers are working to reduce the fuel consumption of gasoline and diesel engines by up to one third. This will make it possible to reduce the carbon dioxide emissions of diesel cars to under 99 grams per kilometre." said Bohr.

**Bosch hybrid technology is set to go into series production at the start of 2010.**

This year, some three billion euros are being invested in the sector's R&D activities. "Even in these economically difficult times, we are keeping our R&D investments on a high level, one that puts us at the very top of the automotive industry," said Bohr.

"The electric car will come, but in small numbers at first. It will occupy a niche and will not make a noticeable mark on the roads until after 2020," said Bohr. "We must first improve the performance of these vehicles considerably...above all, this means greater energy density for the battery, which acts as the electric vehicle's 'tank'."

As a systems supplier, Bosch believes it is well-prepared for the electric car. Bosch hybrid technology is set to go into series production at the start of 2010. The SB LiMotive joint venture with Samsung SDI



Bosch is working to develop the electric drive of the future and further improve the efficiency of the internal-combustion engine

aims to develop the heart of the electric drive of the future: the Lithium-Ion battery. The new battery technology is set to be ready for series production in 2011. However, according to Bohr, "regardless of how much Bosch is doing to develop alternative drive concepts, the internal combustion engine will remain the dominant technology over the next 20 years." Further development of gasoline and diesel engines is seen as the fastest way to effectively reduce fuel consumption and CO<sub>2</sub> emissions.

By 2016, the share of new vehicles equipped with fuel-saving gasoline direct injection systems will triple to 16% worldwide. This technology is gaining popularity, especially in Western Europe, North America, Japan, and Korea. One reason is that the combination of gasoline direct injection and turbocharging makes smaller, more efficient engines possible, with no loss in performance. "One thing is clear," said Bohr, "the trend toward the efficient internal-combustion engine is upon us."

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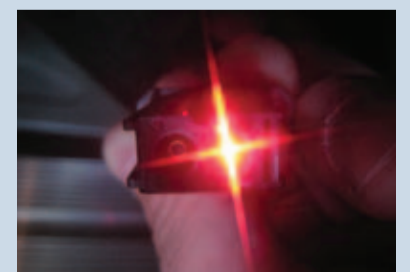
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## Welcome

Welcome to issue 8 of Auto Intelligence. Training has become a vital element in enabling workshops to service and repair modern vehicles. We have a report on the training offered by Bosch on page 3. In a change from our usual Star Car feature we're focusing on the ES[tronic] software (page 4-5), looking at the various diagnostic and service features.

With the Euro 5 legislation coming into effect, Auto Intelligence looks at what technical information vehicle manufacturers will have to make available and how independent workshops can access it (see page 6-7). And last but definitely not least, Bosch Training Manager, Grant Taylor-Smith explains Controller Area Network (CAN) and other vehicle network applications on page 8.



### Bosch Car Service lorry cover campaign goes live!

50 Tesco lorries displaying the Bosch Car Service brand are now on the road.

This campaign offers the opportunity to promote the Bosch Car Service brand on a national scale. The size and volume of the lorry branding is sure to make an impact, creating brand awareness for the Bosch Car Service network and encouraging new customers into the garages.

With the lorries delivering fresh food to almost 2,000 Tesco stores across the UK, marketing experts estimate that over a 12 month period the lorries will be seen up to 685.2 million times.

## New generation of ESP<sup>®</sup> sensors

**Bosch sensor now measures yaw rate and acceleration simultaneously.**

The Bosch SMI540 is the world's first micromechanical inertial measurement unit for vehicle dynamics control in low-cost SOIC16w housing. The unit opens up new development possibilities for the ESP<sup>®</sup> electronic stability program.

The 3-D sensor simultaneously monitors three of a vehicle's movement axes – two acceleration or inclination axes (ax, ay), and one axis of rotation (Ωz). Until now, at least two separate sensors were required for this.

Two of SMI540's three sensor signals provide information that is relevant for the ESP<sup>®</sup> system: the yaw rate and lateral acceleration. The remaining third sensor signal, not generally used by ESP<sup>®</sup>, measures a vehicle's



The 3-D sensor simultaneously monitors three of a vehicle's movement axes

acceleration or inclination in the direction of travel. Developers can use this information for other applications, such

as the hill hold function or for fuel-saving functions in cars with automatic transmissions (N control).

## KTS buyback offer

**The buyback offer from Bosch enables independent garages to be Euro 5 compatible.**

The Euro 5 standard, which came into force in September 2009, will allow independent repairers access to the software data to reprogramme vehicle control units using a PassThru device. The buyback offer from Bosch will enable workshops to upgrade their existing equipment to a KTS unit with PassThru capability.

### How does the buyback work?

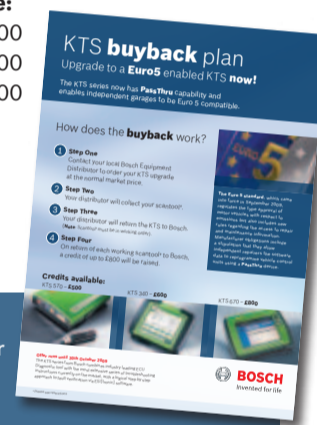
- ▶ **Step One** – Contact your local Bosch Equipment Distributor to order your KTS upgrade at the normal market price.
- ▶ **Step Two** – Your distributor will collect your Scantool\*.
- ▶ **Step Three** – Your distributor will return the scantool to Bosch. (Note: Scantool\* must be in working order).
- ▶ **Step Four** – On return of each working Scantool\* to Bosch, a credit of up to £800 will be raised.

### Credits available:

- ▶ KTS 570 – £500
- ▶ KTS 340 – £600
- ▶ KTS 670 – £800

\*Offer runs until 30th November 2009. Terms and conditions apply.

Contact your local distributor for more information



## New additions

**Bosch now has two versions of its new generation wheel aligners available.**

The basic model, FWA 4330, has six CCD (Charged Coupled Device) sensors and radio transmission while the top model, FWA 4430, features

eight CCD sensors and radio transmission. Thanks to the use of modern 20° digital CCD, caster measurement is simplified and a 360° measurement all around the vehicle is possible. The new wheel aligners also offer a rear axle measurement option while the system performs a self-check.

The vehicle database includes around

20,000 vehicles that can be extended at any time with individual vehicle target data. Windows based functions makes operation very easy. There is also the option of selecting either a guided routine, a fast measurement without caster deflection or an optional measurement for targeted testing of individual measured values.

## Case study: Bosch Super Pro rear brake set

**Mark Banks of Holmer Green Service Centre was asked to give his verdict on fitting the new Super Pro rear brake kit from Bosch.**

I chose a Vauxhall Astra G to try the Super Pro brake kit on. Built between 1997 and 2004, it's still a very popular model that we regularly see in our workshop.

The Super Pro kit comes well packaged and contains a pair of hydraulic wheel cylinders with the brake shoes. These are pre-assembled in handed pairs with all springs, handbrake linkages and adjuster bars in place. The set also includes the brake shoe retaining pins, springs and clips and a sachet of assembly grease. There are also detailed installation instructions if required. All of the

components have a high quality look and feel and were correct for this application.

Fitting of the Super Pro rear brake kit was trouble free, and most certainly quicker and easier than it would have been if fitting a set of brake shoes alone. An obvious benefit is the safety aspect of not having to swap over the springs etc. from the old shoes; I'm sure we have all had to dodge the odd spring or two pinging across the workshop!

There is an extensive range of Super Pro kits available and it is reassuring to know that when fitting the kit you will not encounter any unexpected delays or downtime to the job due to extra parts being needed, such as worn adjusters or broken springs. You can be confident

of an effective repair and your customer will have the peace of mind that all components are new and that the rear brakes have a long service life.

The cost of the Super Pro kit is very reasonable considering you get all the brake related components contained within the drum and the labour saving aspect of fitting the kit is an added advantage to your workshop.

The vehicle in question was also fitted with Bosch front brake pads and discs, which were also very high quality parts. The central hub and outer circumference of the discs are now coated in a tough corrosion resistant primer, which looks great.

On the road test the brakes performed smoothly and quietly, and instantly felt positive; so another happy customer!





**Paul Harding** Ross Motors



"I've completed most of the Systems Technician courses in the last few years with Bosch but vehicle systems are continually moving on and I find it's necessary to attend more courses to keep up-to-date."

**Paul Golden** Martin Pilley Services



"In the last few years I've probably done ten courses per year, you need the knowledge to deal with the cars we now see. You learn a lot on the course and from meeting and talking to the other guys"

**Richard Bloomfield** Alltrans



"I've done three or four courses with Bosch starting with the basic courses and moving on to the Master Technician ones, and with vehicles changing so quickly you really need to keep up to speed. That's why I'm here. I find these courses really good."

# Training for the future

Auto Intelligence attended a Master Technician course covering Gasoline Engine Management to find out more about Bosch training.

No matter how up-to-date your diagnostic equipment or technical information is, you need well trained technicians to get the very best from it. Attending training courses offers huge benefits. The more knowledge and understanding of vehicle systems that a technician has, the better they will be able to apply the equipment and information resources, making them much more efficient and confident.

Bosch offers two levels of training: the Diagnostic Technician courses, which cover the fundamentals of vehicle technology, and the much more in-depth Master Technician courses. We attended the three-day Bosch Master Technician course VSG 14, titled:

Gasoline Engine Management: Advanced Systems Controls, to see what technicians can get from training. It should be noted that the Master Technician courses are for experienced technicians. Prerequisites for this course are the completion of gasoline engine management courses VSG 2, VSG 5 and VSG 17. Attending technicians are expected to be proficient in the use of oscilloscopes, gas analysers and diagnostic test equipment.

There are two important factors in the effectiveness of any training course, the depth of information and how the trainer delivers the material. This was to be a very in-depth look at engine management

systems and components, and our trainer for this course, John Batten wasted no time in briefly running through the development of engine management systems, making sure all the delegates understood how they worked and could identify the various components and explain their function.

### Advanced diagnostics

One of the main themes of the course is to look in detail at key components and understand how they work and why they are needed. These explanations on the development and operation of a component go into some depth and are coupled with discussions on how to carry out advanced diagnostic procedures,

examining waveforms, wiring diagrams etc. then evaluating the data and relating this to the operation of the component. John gives clear and detailed explanations of each topic, encouraging the delegates to contribute to the theory sessions by asking questions and discussing model specific examples. Each day includes practical sessions in the Bosch training workshops. Here, the delegates get to put into practice what they have learnt by completing a series of tasks using a variety of test procedures and equipment on live vehicles. The final stage of the course is a written examination. Delegates achieving a pass mark of 70% or over receive a certificate of competence.

## The course content includes the following subject areas:

- ▶ Demand controlled fuel supply
- ▶ Injector testing and diagnosis
- ▶ Intake charge control and variable camshaft timing
- ▶ Air mass meter function, advanced testing and diagnosis
- ▶ Catalytic converter diagnosis
- ▶ Broadband lambda sensor function and testing
- ▶ Lambda adaptation and diagnostic terminologies

- ▶ Emissions control subsystems
- ▶ Misfire detection and advanced phase sensing methods

### On successful completion of VSG 14 delegates will be able to:

- ▶ Comprehensively identify and state the detailed operation of the sensors, components and actuators of advanced engine management systems

- ▶ Carry out advanced diagnostic test routines on systems and individual components, utilising all available data for the evaluation of vehicle faults
- ▶ They will be able to identify any components requiring replacement or repair and carry out comprehensive system tests to ensure functional serviceability



### Contact details

For further information on this course, you can contact the Bosch training team on **01895 878032**.

# Workshop solutions:

Modern cars can rightly be described as 'computers on wheels' and workshops now need access to in-depth, up-to-date information to carry out professional fault diagnosis, servicing and repairs.

## Software

ESI[tronic] software provides the technician with comprehensive vehicle information covering technical data, service information, vehicle diagnostics, repair instructions and parts catalogues, accessed through a simple interface. A standardised system for all makes, enables all the information to be accessed simply and quickly.

The software consists of modular information components, which you can immediately use on your PC and through different subscription packages, can be

adapted to the individual requirements of your workshop. This page highlights application contents available with ESI[tronic].

## Updates

With independent workshops now servicing newer and increasingly complex vehicles, having up-to-date technical information is vital. The annual subscription to ESI[tronic] allows technicians to access the latest technical data. Working with out of date information can have a limiting effect on the vehicles you can successfully service and repair.



## An overview of ESI[tronic]



- ▶ Automotive equipment
- ▶ Repair times
- ▶ Diagnostic Troubleshooting instructions
- ▶ Control unit diagnosis (in conjunction with Bosch test equipment)
- ▶ Identification of spare parts
- ▶ Vehicle mechanics with maintenance schedules
- ▶ Test specifications for diesel pumps
- ▶ Workshop system for vehicle service intervals and preparation of quotations
- ▶ Wiring diagrams for convenience electrical systems
- ▶ Technical service bulletins

## SIS: Diagnosis and repair on the vehicle

### What is SIS (Service Information Systems)?

SIS is the most extensive cross-manufacturer combination of technical information in Europe, including troubleshooting instructions for petrol and diesel engine management systems, car brake systems and many more (for Bosch and other manufacturers). The workshop-oriented troubleshooting instructions can be used on any PC (and for optimal vehicle diagnosis, with Bosch test equipment), with modular DVD software solution suitable for individual workshop requirements.

### Technical information covers system types including:

- ▶ Petrol engine management
- ▶ Diesel engine management
- ▶ Driving safety and braking systems
- ▶ Heating/AC systems
- ▶ Transmission control
- ▶ Airbags
- ▶ Lighting technology
- ▶ Service convenience systems
- ▶ Vehicle networking (CAN bus)

### And includes information on:

- ▶ System descriptions
- ▶ Troubleshooting procedures

- ▶ Fault code descriptions
- ▶ Wiring diagrams
- ▶ Removal and installation instructions
- ▶ Service information
- ▶ Testers and special tools required

### Technical service bulletins:

- ▶ Rapid access to common vehicle faults with information direct from the manufacturer
- ▶ Clear description of cause
- ▶ Symptomatic assignment under system group (ABS, airbag, engine, etc.)
- ▶ Tested repair tips

### Vehicle mechanics:

- ▶ Service schedules and illustrations
- ▶ Vehicle technical data
- ▶ Wheel alignment data
- ▶ Removal and installation instructions for timing belts
- ▶ Service light reset procedures

### Convenience vehicle wiring diagrams:

- ▶ Manufacturer spanning wiring diagrams for automotive electrical systems and convenience electronics in a standardised form
- ▶ 866,000 wiring diagram assignments and 24,000 complete wiring diagrams with zoom and printout functions

## Diagnosis and repair on the product

### Component repair instructions:



- ▶ Repair instructions, service information and bulletins for diesel pumps and rotating electric parts
- ▶ Direct interaction with the information of the ESI[tronic]-D and ESI[tronic]-E, e.g. spare parts and the ESI[tronic]-W Diesel test values

### Diesel injection pump test values:

- ▶ Complete test procedure from the

recording of measured values up to the printout of the log

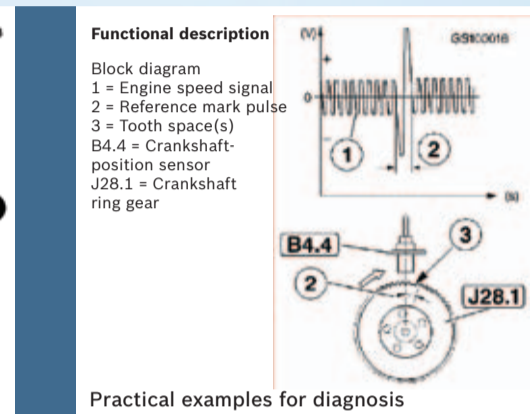
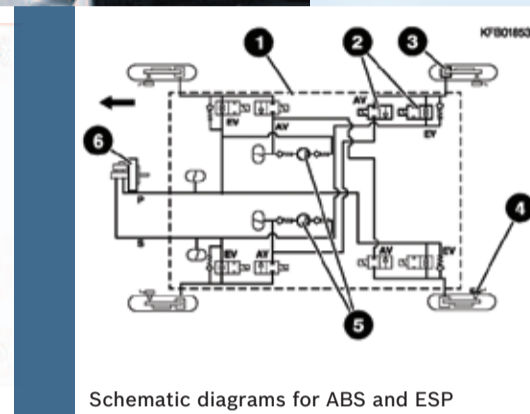
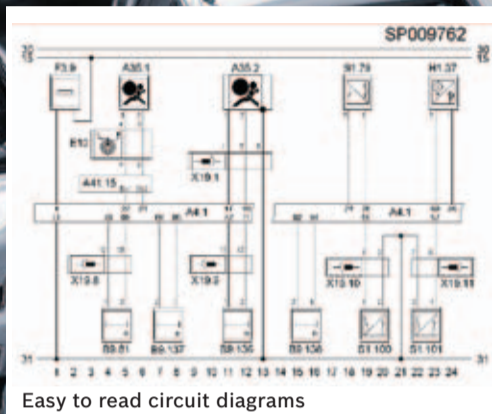
- ▶ Test values for a total of 14,000 pump assemblies
- ▶ All test steps are displayed in the optimum order and can be used in conjunction with the Bosch EPS 815 Diesel test bench

### Test values for Zexel diesel:

- ▶ Complete test procedure from the recording of measured values up to the printout of the log

25% discount for new ESI[tronic] subscribers †

# ESI[tronic]



ESI[tronic] contains extensive repair guides with diagrams and practical examples to guide you through the vehicle diagnosis



## Did you know?

- ▶ **ESI[tronic]** is the market leader for automotive technical information covering 230,000 models from 120 vehicle manufacturers. The highest market coverage in the world
- ▶ Bosch has 25 years experience creating vehicle service information and currently employs 300 engineers and technicians to create this superior software
- ▶ 1 in 3 independent workshops across Europe use **ESI[tronic]** with 60,000 customers worldwide
- ▶ **ESI[tronic]** gives you all the required automotive technical and parts information from a single source

## Ideal requirements

- Workshop PC:**
- ▶ Processor: 2 GHz 32-Bit
  - ▶ 1 GB RAM
  - ▶ Hard disk space: 40 GB
  - ▶ DVD drive Dual Layer
- Operating systems:**
- ▶ Windows Vista™ Home Premium/Windows Vista™ Business
  - ▶ MS-Windows XP

## Catalogue and parts information



- ▶ Over 51,000 parts lists with over 380,000 spare parts
- ▶ Featuring high quality exploded views with a stepless zoom function
- Electrical spare parts:**
  - ▶ The most extensive catalogue for Bosch rotating electric parts
  - ▶ Over 18,000 spare parts lists with over 383,000 spare parts
  - ▶ Detailed, high quality exploded views with a stepless zoom function
- Archive of electrical spare parts:**
  - ▶ 1,600 spare parts lists for older vehicles in the archive stock
  - ▶ Spare parts lists for electrical equipment, diesel and pneumatics
- Diesel spare parts:**
  - ▶ The most extensive catalogue for Bosch diesel products
- Diesel spare parts from Zexel:**
  - ▶ Catalogue for Zexel diesel products
  - ▶ Detailed exploded views and parts list

- Vehicle equipment:**
- ▶ Access to approximately 32,000 cars, 19,000 commercial vehicles, 6,000 motorcycles and 8,000 tractors and special vehicles
  - ▶ 95% market coverage for Bosch vehicle equipment in Western Europe
  - ▶ Identifying 73,000 vehicles and engines
- Diesel spare parts:**
- ▶ The most extensive catalogue for Bosch diesel products

## Order processing and cost estimating

- Repair times:**
- ▶ Over 10 million repair times for 16,000 of the most popular cars and vans
  - ▶ Clearly arranged, uniform display of repair times from various manufacturers in hours/minutes – choose your own hourly rates for electrical, mechanical or bodywork
- Vehicle service calculation:**
- ▶ Complete extents of service work and inspections, repairs of wearing parts
  - ▶ Precisely defined contents for standard service with number of components and working times
  - ▶ Fixed price calculation and transfer of all contents to existing workshop management system
- TecDoc equipment:**
- ▶ A joint software initiative between 294 parts manufacturers and suppliers
  - ▶ A preferred cross reference tool for Europe and North America. Used as an extension of the parts lists within ESI[tronic]

† Celebrating 25 years of Service Information Systems (SIS) 25% discount for new ESI[tronic] subscribers only. £375 + VAT for 15 months subscription. Terms and conditions apply. Offer ends 31st October 2009.



# Euro 5: FAQs

Euro 5 is currently a hot topic and with the legislation now coming into force, Bosch looks at how this will affect independent vehicle repair workshops.

## What is Euro 5?

The Euro 5 standard regulates the type-approval of motor vehicles with respect to emissions, but it also includes new rules regarding the access to vehicle repair and maintenance information. As of September 2009, any vehicle manufacturer (VM) applying for EC type-approval for a new vehicle must provide proof of compliance with the Euro 5 regulations.

The main areas covered in the regulations are:

- ▶ Tighter emissions limits for diesel and petrol engine vehicles
- ▶ Access to manufacturer information for vehicle repair
- ▶ Flash programming of control units

For the independent repairer it's the proposed access to vehicle repair and maintenance information, to be made available via the manufacturer websites that is probably most important. This includes a stipulation that the VMs must allow independent repairers access to the software data that is used to reprogramme vehicle control units by use of a J2534 PassThru device.

Here are some answers to frequently asked questions regarding Euro 5:

## What is a PassThru device?

A PassThru device is an item of hardware that allows a PC type computer to communicate with a vehicle's computer systems for the purpose of reprogramming and software updates.

## What is J2534?

J2534 is a common programming interface standard designed by SAE (Society of Automotive Engineers) that enables the transfer of the software data. This standard must be adopted by all of the vehicle manufacturers and will allow the Independent Aftermarket (IAM) the ability to reprogramme (flash programme) ECUs without the need for a special dealer-only tool.

## To enable my workshop to carry out J2534 ECU reprogramming, where do I obtain a PassThru device?

A Euro 5 compatible hardware device is required and most of the Bosch KTS diagnostic range has this capability already built-in. This includes the KTS 340,

KTS 515, KTS 530, KTS 540, KTS 570 and KTS 670. The earlier KTS 520, 550 and 650 models are compatible when used in conjunction with UBox2.

## What vehicles are applicable and when does the legislation take effect?

Euro 5 mandates that within 6 months of any new vehicle type approval made after September 2009, the VM must make all of the repair and maintenance information (including ECU calibrations) for that vehicle available. This means, however, that the earliest issue date may not be until 01.03.2010.

## Where do I get the ECU software updates from?

Each VM is required to make their ECU calibrations available on their own websites. It is the responsibility of each VM to maintain and update their own sites, and keep current calibrations available for download.

## Will vehicle information and software downloads be free?

No. The VMs must make vehicle repair and maintenance information available via their websites on a daily, monthly, and yearly basis, but with fees for access to such information varying in accordance with the respective periods of time for which access is granted.

## Are ECU software updates necessary for normal vehicle servicing?

It is envisaged that some VMs will require their vehicles to have any necessary software updates carried out during servicing in order to retain the vehicle's warranty status. With some vehicles, the installation of the latest software updates may be required before the service lamp can be extinguished.

## Will I be able to reprogramme all of the ECUs in a vehicle?

No, it depends on the vehicle manufacturer, and not all ECUs are reprogrammable.

## Will I be able to "initialise" and code new or replacement ECUs?

If the VM makes the software data available it will be possible to code new control units but certain programming procedures may fall outside the scope of the legislation. For example, security and safety system data may not be accessible.

## Does a PassThru interface allow ECU diagnosis?

Not always. A PassThru interface is a stand-alone hardware device requiring only a windows-based PC with a USB or RS-232



The system voltage must remain constant (as specified by the VM) during the reprogramming process. Electronic chargers such as the BAT 415 can ensure that system voltage remains stable throughout.



serial port, and an internet connection (to access the calibration files). Some VMs may allow ECU diagnosis with a PassThru interface and internet connection but only a few manufacturers propose this function. Euro 5 does not oblige vehicle manufacturers to provide online diagnosis.

**How long does a J2534 ECU reprogramming process take?**

The programming period depends on the actual vehicle, the calibration file size, and

It is envisaged that some VMs will require their vehicles to have any necessary software updates carried out during servicing.

the total number of calibration files. Expect a range between 2 minutes and 75 minutes per control unit, however, in some cases it may take longer. Multiple control units on a vehicle may also require updating simultaneously.

**Is high-speed internet access required?**

No, but it is highly recommended. As you will be required to download the calibration file directly from the VM website, shorter downloads equate to quicker reprogramme times. Also, in some cases the VM will require a direct connection between the vehicle, the shop PC and the VM server.

**Can I use wireless internet connections?**

These are not recommended. A connection

failure could result in the permanent loss of data and leave the vehicle in an inoperable condition.

**Is it possible to damage a vehicle ECU during the reprogramming process?**

If all the VM instructions are followed correctly, this is not likely. However, it is important to understand that once started, the reprogramming process must not be interrupted or any reprogramming device disconnected. PCs must not be allowed to go into hibernation or similar power management modes and the vehicle's voltage must be maintained. It may also be worth explaining to the customer that the reprogramming is recommended by the vehicle manufacturer, and that your workshop does not control the content of the calibration files.

**What is critical for successful reprogramming?**

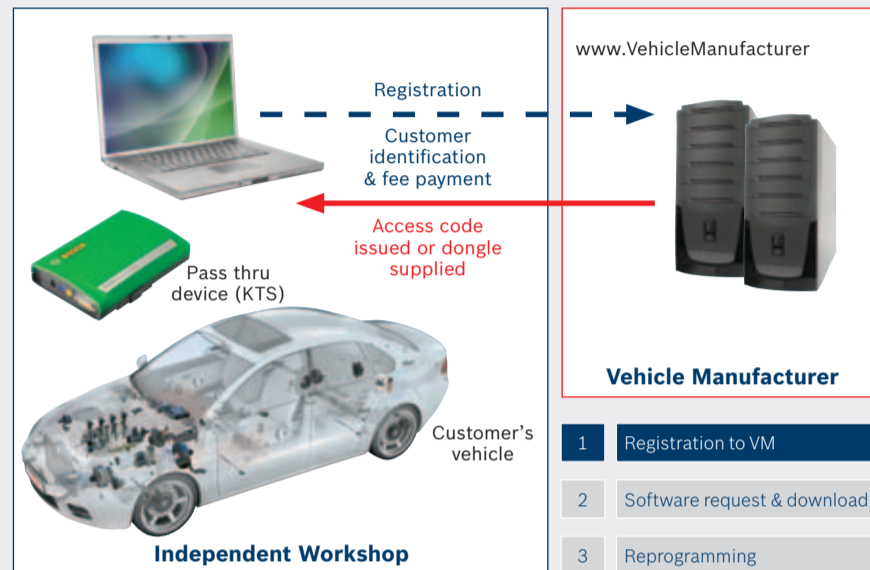
- There are 4 key-points that need to be followed for successful reprogramming:
1. The vehicle's system voltage must remain constant (as specified by the VM) during the reprogramming process. Note: Electronic chargers such as the Bosch BAT 415 can ensure that system voltage remains stable throughout.
  2. The vehicle's electrical system also needs to be functioning properly and in a good state of health (e.g. battery condition and cable connections).
  3. Ensure that the reprogramming process is not interrupted and that all devices such as PCs remain fully active throughout the process.
  4. Follow the manufacturer's reprogramming instructions to the letter.



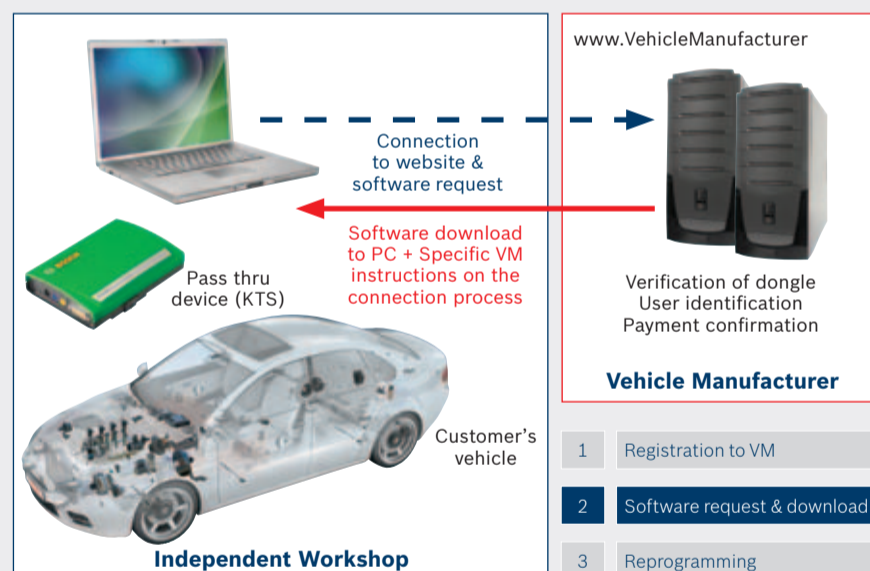
Bosch offers several diagnostic tools with Euro 5 PassThru capability. This includes the KTS 340, KTS 515, KTS 530, KTS 540, KTS 570 and KTS 670. The earlier KTS 520, 550 and 650 models are compatible when used in conjunction with UBox2

# Step-by-step: The typical ECU reprogramming sequence:

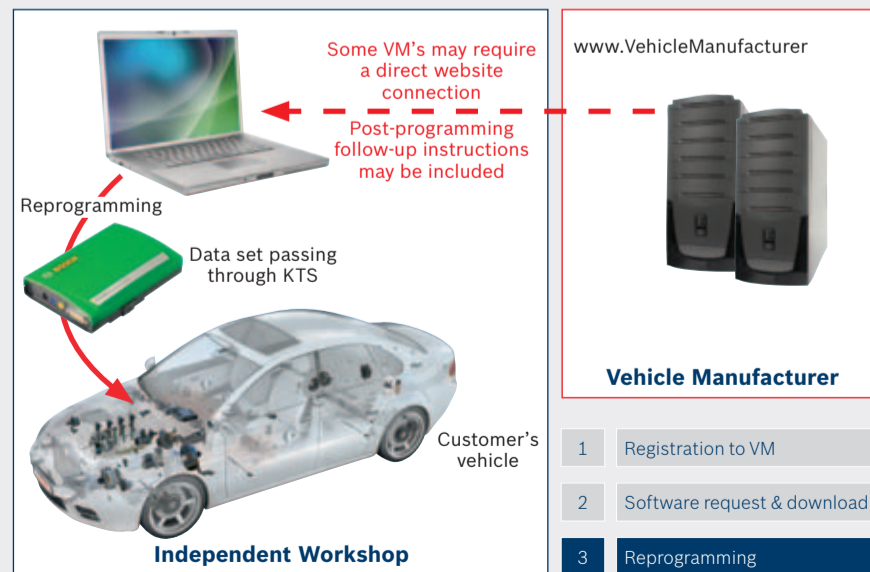
## An example of the typical ECU reprogramming sequence: Step 1

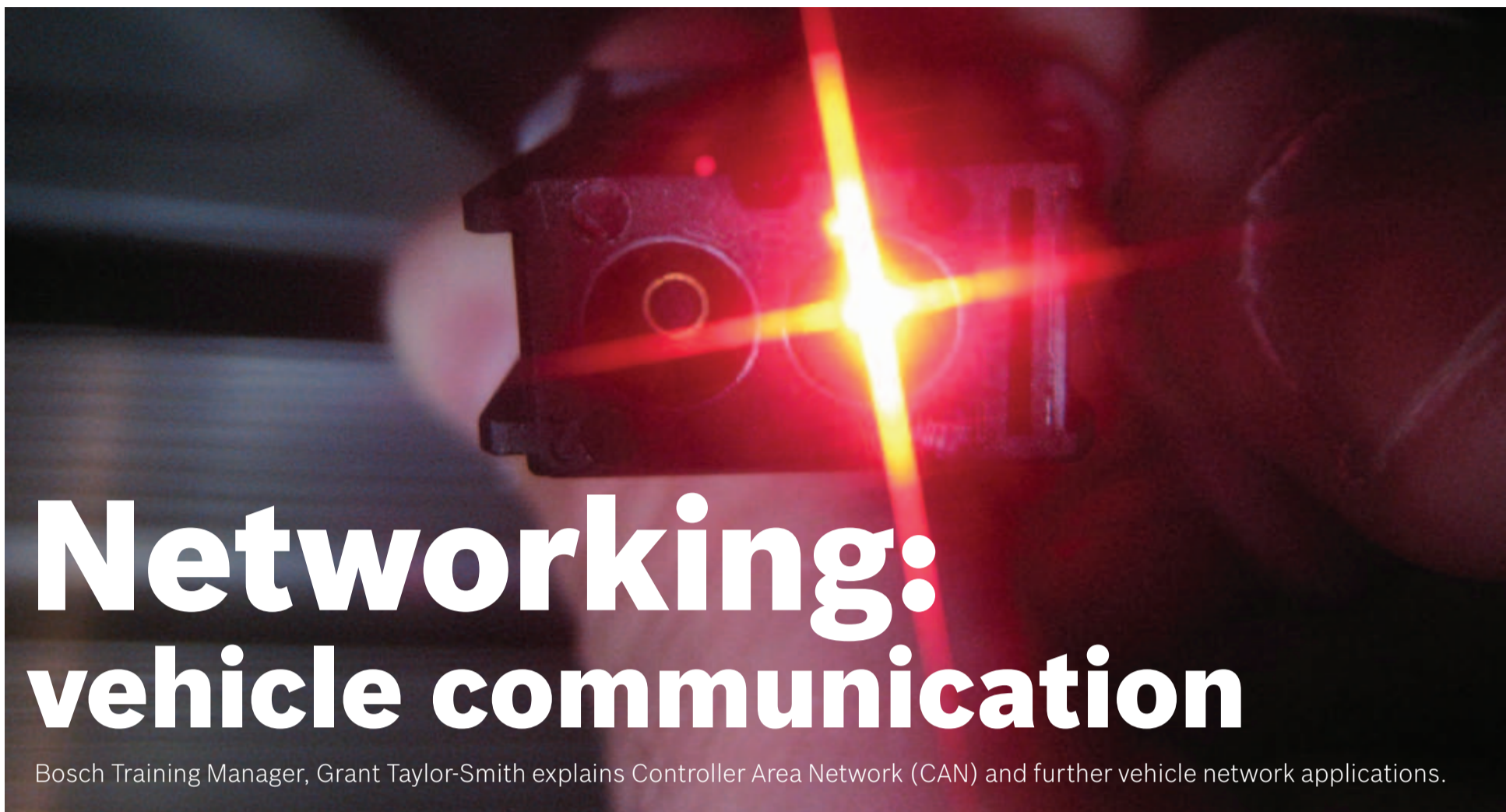


## An example of the typical ECU reprogramming sequence: Step 2



## An example of the typical ECU reprogramming sequence: Step 3





# Networking: vehicle communication

Bosch Training Manager, Grant Taylor-Smith explains Controller Area Network (CAN) and further vehicle network applications.



Every car owner these days takes it for granted that at the push of a button or flick of a switch, a realm of vehicle functions is made available. However, does he realise the actual

extent of the technology behind the basic operation say of just an electric window? Probably not, considering that some of the latest systems employ digital signals and computers to initiate such operations.

This proliferation in electronic technology within the vehicle over recent decades has made it necessary for the car manufacturer to employ simpler and more reliable cabling technologies and this is where the idea of computer “networking” within the vehicle first came in.

Hang on, simpler? You might be forgiven for questioning this, but in fact as the need for more electronic functions across the vehicle arose, so did the amount of cabling. A method to reduce the number of cables carrying the multitude of different signals between systems and on-board computers was needed and in 1986 Bosch came up

with a communication system called CAN: Controller Area Network.

### What is CAN?

Originally put into use for communication between powertrain (engine management, transmission and chassis) control units, CAN was a way to pass information between the systems using a two-wire data link (the bus). Information on vehicle speed for example, would be configured into a digital message by the ABS control unit and sent on to the engine management ECU in a similar way as to a message is sent down a telephone line. An example of what a CAN signal looks like on an oscilloscope is shown below.

By referring to the timebase used here for the capture of this signal, the bit rate or transmission speed of this signal can be calculated to be 500 Kbits per sec. This speed is generally used for powertrain systems but lower speed CAN signals of around 125 Kbit/s can be found on many body network systems.

### But what about the other types of network system that are now popping up on cars and commercials? LIN, MOST

### and FlexRay just to name a few. Why and where are these used?

The basic reason is that some systems are requiring increasingly higher speeds and communication reliability, whilst at the other end of the scale these high transmission speeds are not required. For example, the signal between our body control ECU and the door ECU to operate the electric window doesn't need to be of lightning fast speed. A delay of a few milliseconds to operate the window is imperceptible to a human but on the other hand, a delay of a few milliseconds to

### In-depth training on the diagnosis of such systems is something that Bosch can help with.

deploy the airbag is unacceptable. So it is ‘horses for courses’ and along with the territory comes the associated cost. The LIN protocol is mainly intended to support the control of the “mechatronic” componentry in the vehicle e.g. on-off devices such as car seats, door locks, sunroofs, rain sensors, and door mirrors.

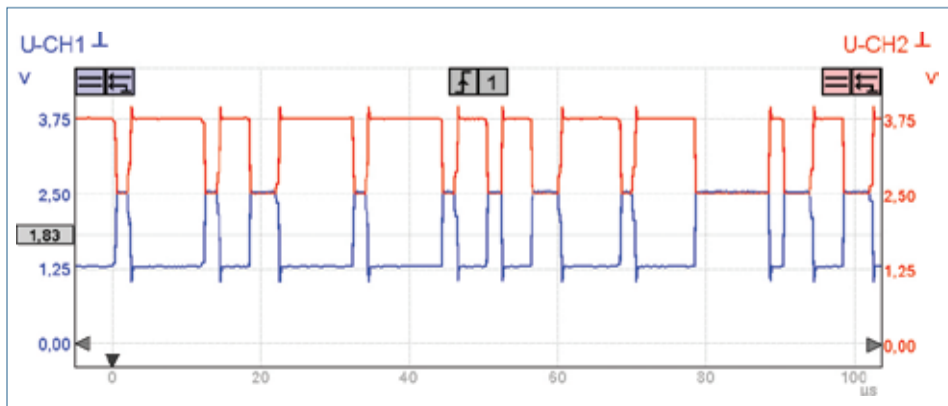
Cheaper and simpler than CAN, it provides a sub-bus for areas in the vehicle that don't need the performance, speed and complexity of CAN. The maximum transmission rate is 20 Kbit/s.

MOST is a fibre-optic network protocol with the capacity for high-volume streaming on automotive multimedia networks. With MOST, the data transfer rate is 21.2 Mbit/s.

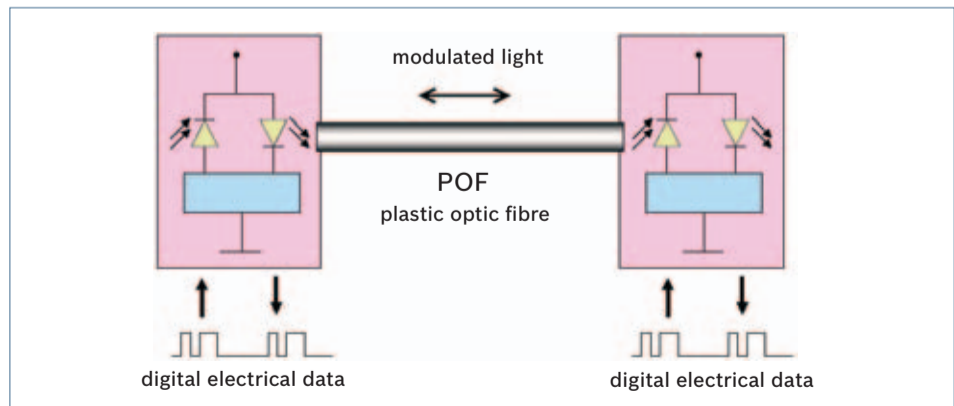
FlexRay is a protocol designed for high data rate, advanced-control applications, such as steer-by-wire systems. It's also used to replace CAN in some vehicles (e.g. BMW X5), and using a two-wire databus, the data transmission rates are up to 10 Mbit/s.

### So where does all this technology leave you, the vehicle technician?

Well vehicle networks are not without their problems and in-depth training on the diagnosis of such systems is something that Bosch can help with. Bosch run a two-day course titled: Body Control Systems, CAN and Multiplexed Networks (course code VSB 10). For further information on this course, you can contact the Bosch training team on **01895 878032**.



CAN is a two-wire communication network to carry digital messages between vehicle control units



MOST fibre-optic network allows high volume streaming of data for multimedia applications