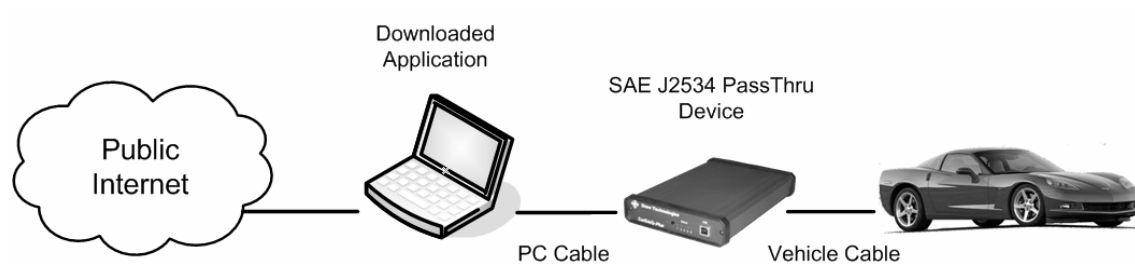# Introduction to J2534 and Flash Reprogramming

Provided by:

Drew Technologies

Background

The days of diagnosing and repairing automobiles without a laptop beside you are quickly fading. Newer vehicles include a large number of onboard computers that are each dedicated to performing specific tasks. Common onboard computers in newer vehicle include the Engine Control Module (ECM), Transmission Control Module (TCM), Fuel Injection Control Module (FICM), Anti-lock Brake System (ABS), Body Control Module (BCM) and numerous other control modules to manage every electronic system from power door locks to crash data.

Each onboard computer is programmed at the factory with software enabling it to perform certain tasks. Inside the ECM is software containing hundreds or even thousands of parameters to control spark, fuel, idle, cruising, emissions, economy, drivability, and performance. Likewise, a TCM will have software to control how the transmission and torque converter function. Sometimes, after the vehicle is shipped from the automaker, updates are released to improve emissions, fuel economy, drivability, performance, or specific bugs in the original software that have caused warranty issues. Updating this software can be a proactive fix because often it will resolve problems that a customer hasn't reported or noticed yet..

The practice of updating software in these modules is more commonly known as flash reprogramming. At new car dealerships, flash reprogramming is relatively straight forward because service technicians are connected to the automaker and have the expensive, specialized dealer service tools dedicated to reprogramming. The independent repair shops have faced a more difficult challenge because most shops typically service more than one make of automobiles. This increases the complexity, cost, and training required to operate dozens of different factory service tools.

J2534 – A Solution Arrives
In 2000, the Environmental Protection Agency had been watching this issue and decided to take action. The EPA requested a standard be developed within the SAE that led to

Show Desktop.scf J2534, a mandated specification to which automakers who sell vehicles in the United States must conform. The original J2534 specification was later updated to J2534-1 in order to support all automakers. The EPA mandate requires automakers to support aftermarket repair shops with J2534-1 flash reprogramming for any emissions related computer modules on a vehicle that can be reprogrammed by a new car dealership. This mandate took effect for all 2004 and newer vehicles, but many automakers have decided to offer J2534-1 support for vehicles older than 2004 and some vehicles as early as model year1996.

J2534-1 is a system devised of two independent parts: subscription software and a J2534-1 compliant PassThru vehicle interface. The subscription software comes directly from

the automaker, runs on your shop PC or laptop, and can either be web-based or CD-based. The subscription fees are charged differently for each automaker. Some automakers such as GM charge an annual fee for full access, while others have options for paying: per-vehicle, daily, weekly, monthly, or annually. Many of these services also include bonus features beyond flash reprogramming. FMP from Ford lets repair shops reprogram transponder keys, and other automakers are beginning to support diagnostic functionality. Figure 1 shows the website for each automaker's service and fees.

Hardware
The second part of the system is a J2534-1 compliant PassThru vehicle interface. This box or cable acts as a gateway between the vehicle's onboard computers and the technician's personal computer. It translates messages from the PC into the protocols used by the automobile and vice versa. A Drew Tech J2534 tool is pictured in Figure 2 to give you an idea of what a PassThru interface looks like.

Common PassThru devices connect your PC to the vehicle using USB, serial, Ethernet, or wireless. The easiest to configure is probably USB, but Ethernet has the longest range and highest performance. You can double the distances on USB connections by adding a hub between your PC and PassThru tool. Wireless has also become popular with both Bluetooth and 802.11 options being offered by different tool vendors. The 802.11 technology offers a higher bandwidth and distance range, but typically costs more than a Bluetooth option. Figure 3 illustrates the benefits of each connection type and highlights the option best for each characteristic. The CarDAQ-Plus from Drew Technologies (www.drewtech.com) and the E-Flash from ATS (www.automotivetestsolutions.com) are currently the only PassThru tools offer Ethernet, USB, and an upgrade path to 802.11 wireless all from one device.

There are a number of PassThru tools for sale in the market, all at different prices with different features, performance, and customer support. The primary function of a PassThru device is to support the automaker's subscription service for reprogramming. Picking a device that is fully compliant to J2534-1 is important, but many bonus features may make certain brands more attractive. Some offer additional features such as generic scan tool software, enhanced diagnostics software, and analog scope inputs.

Performing J2534 reprogramming requires computer knowledge and experience. The technician will need to operate a laptop or desktop, the PassThru device, and the reprogramming software. Operation will also require a good high-speed connection to the Internet such as DSL, Cable, or T1.

Non-compliant Devices
Because J2534-1 is an SAE standard, all PassThru tools should be the same; but in reality not all devices are fully compliant to J2534-1 or work with all vehicles. You should shop carefully when picking a device, and look at functionality and compliance before shopping on price alone. Be sure to get one that is guaranteed by the manufacturer to be fully compliant and that has been validated by the automakers you plan to service. None

of the automakers sell their own PassThru tool, but many recommend products that they have validated internally.

The SAE is planning to publish a conformance test. The conformance test has been named J2534-3, and will be applied to J2534-1 devices. The numbering is confusing, but remember that J2534-1 is the standard for reprogramming, and J2534-3 tests for conformance to J2534-1. There is even a J2534-2 published spec, but that doesn't apply to EPA reprogramming requirements. Once the J2534-3 test has been published, a tool manufacturer should be able to certify that their products pass the J2534-3 test. The J2534-3 conformance test has not been published yet, so for now you should look for devices that have been validated by the automakers. Many of the automaker websites in Figure 1 have a list of recommended devices. Of all vendors offering J2534 tools, at the writing of this article, Drew Technologies has been validated by more automakers than any other.

ROI
The initial purchase price for getting acquainted with J2534 will pay back over time and generate revenue. Although each price is different, the average software charge from each automaker is approximately $25 per flash over time. The average revenue for shop service tickets that include a reflash is $150. At four tickets per month, the shop would pay $100 in software fees and make back $600 in gross revenue. That equals $6000 per year in revenue. You will spend around $2000 on J2534 equipment up-front. If you use the tools you purchase and offer these services, the cost will pay itself back in a very short time.

Onboard VS Offboard
Onboard programming means that you are reprogramming the vehicle's computer while it is installed in the vehicle and offboard reprogramming means you are removing the computer from the vehicle and reprogramming it from a bench top with a special cable and power supply. Figure 4 shows what an offboard reprogramming bench may look like. There are some pre-made offboard cables available for certain vehicles, but there are literally dozens of different types of onboard computers, connectors, and pin diagrams.

Unless you have a specific reason to remove the onboard computer from the vehicle and reprogram it from an offboard bench, or unless you have advanced experience with J2534, you should leave the onboard computer installed in the vehicle when reprogramming. Many of the J2534-1 applications may try to reprogram more than one module when you select a reprogramming operation, and the only way you can guarantee all necessary modules are reprogrammed and the software matches is by reprogramming the computer while it is installed in the car. This is the way the automakers intend you to use their software, and for that reason onboard programming is preferred. There are some special cases where offboard reprogramming becomes more advantageous, but you must first have knowledge of that specific processor and configuration to understand the possible risks of reprogramming a module outside its normal environment.

Constant Power

Whether you are reprogramming onboard or off board, you must be sure that the power supplied to the module does not drop below 11.5 - 12 volts. Some reprogramming operations with the key-on will turn on cooling fans, fuel pumps, and other components that will cause the battery to drain faster than normal. Instead of pulling fuses to prevent the battery drain, it is easier and more practical to have the vehicle connected to a charger or jump pack. During reprogramming there is a risk of having the operation fail if voltage falls below the proper operating voltage. Sometimes a failed operation can be recovered, but there is a chance that failed reprogramming could ruin the control module. To mitigate this risk, put a high quality battery charger on the vehicle if you are reprogramming onboard or use a good bench top power supply if you are reprogramming offboard.

Updated Calibrations
One important step in the service process is determining of a vehicle needs a calibration update. The J2534 subscription software will usually tell you if an update is needed, but sometimes only after you pay the subscription fee. That makes it tough to check for updates without encountering some type of fee. If you want to find out before you purchase the subscription, you can usually find a table, PDF, or matrix on the manufacturer's website telling you if there are updated calibrations. For example, Chrysler has a flash matrix available at http://techauthority.com under the J2534 Flash availability section. For GM vehicles, you can visit http://calid.gm.com and type in the VIN or part number to learn if updates are available. Figure 5 shows GM's CalID site. At www.motorcraftservice.com, there is a link in the reprogramming section called Latest Calibration Information. That link will open an Excel sheet that lists all of the PCM tag codes, and shows what updates are available. You should note that a calibration update may be available even if there is not a specific TSB calling for it.

Using J2534-1
Because each automaker has different software, you should become comfortable with one automaker's service before you start on the next. Start by reprogramming a vehicle you have regular access to before accepting vehicles from walk-in customers. Take your time and follow the steps at the automaker's website. If you have questions, call the automaker's customer support number or your PassThru tool vendor. J2534 reprogramming requires a PC and Internet, and the technician reflashing cars should be computer savvy. If you are uncomfortable using a PC and the Internet, you may want to seek out an independent trainer in your area and attend a J2534 class.

When you provide reprogramming service to a customer there are several things you should consider. First, reprogramming is a service that cannot be reversed. If you update the calibration in the customer's car, there is no method to put the old calibration back in. There is a chance the new calibration will change noticeable characteristics in the way the customer's car drives. It may raise or lower the idle, change the shifts or idle speed control, or other settings meant to solve a warranty issue, economy issue, or emissions issue. There is no way to revert back if the customer doesn't like one of the new settings.

This is not something that happens often, but you should always disclaim this to the customer beforehand and ask the customer to waive any liability to you.

The duration of a reprogramming operation will vary between manufacturers and models. The shortest time may be less than a minute, with some of the abnormally long reprogramming operations exceeding an hour. The average is just under 15 minutes for the entire process. Before you start, remember you should be certain that you have a good battery in the vehicle or an external charger

Although unlikely, there is also a chance that the reprogramming operation on the vehicle could fail. It could fail due to faulty wiring/modules, low battery, or for some other reason. Some older vehicles, especially Class2 GM vehicles, may not be recoverable if you lose power to the module and the process fails. If the reprogramming does fail, it will take more time to update the vehicle. In the worst case scenario a new module may need to be ordered for the vehicle.

If a reprogramming event fails, immediately retry the operation without disconnecting the J2534 tool. If a battery charger or jump pack was not used the first time, connect one and turn it on before you retry. Usually a failed attempt will complete successfully the second time. If you cannot get the reprogramming operation to succeed after repeated attempts, call the automaker's support number to find out if there is any other way to recover the module. If all else fails, the module might be reprogrammable offboard.

Ford
The FMP (Ford Module Programming) application is a user-friendly J2534 service. Visit www.motorcraftservice.com and download the reprogramming software. You'll need to be connected to the Internet during the entire reprogramming operation. The cost to use FMP is $24.95 for a 72 hour period or $59.95 per month, so it is a very inexpensive way to start learning J2534-1. For this price you gain access to the latest calibrations, can perform module initialization (PATS), and can adjust certain parameters on Ford, Lincoln and Mercury vehicles. The Ford application works on almost all OBD2 Ford vehicles that are 1996 or newer, . Ford modules typically reprogram quickly, and recover easily if you have a reprogramming failure. Figure 6 shows the J2534 configuration screen in FMP, and Figure 7 shows the J2534 programming screen.

GM
Currently, General Motors vehicles can be reprogrammed using the TIS/SPS subscription service. This service is DVD-based, and DVD updates are mailed frequently through the year when you purchase the service. The DVD-based kit, part number OTC-3625-17, can be purchased for just under $1000 and includes one year of updates. Instructions for configuring TIS for a J2534 PassThru device should be available from your J2534 tool vendor.

You can reprogram as many vehicles as you want for the subscription cost. GM's new service called TIS2WEB, already in use by GM dealerships, will be released to the aftermarket at the end of 2006. With TIS2WEB the aftermarket repair shop can get instant access to updates without buying a TIS DVD-based subscription. The GM

software works on almost all OBD2 GM vehicles, covering most 1996 and newer models. When reprogramming older GM vehicles, be very careful not to interrupt the operation. Some of the older modules may not be easily recoverable if reprogramming fails. Newer CAN vehicles do not seem to have this problem, and overall the risk is small as long as you are careful (i.e. don't unplug the equipment in the middle of a reprogramming operation.)

Chrysler
The Chrysler J2534 service works similarly to Ford's FMP. Visit www.techauthority.com to subscribe and download the reprogramming software. You'll need an Internet connection initially, to download the calibration file, but it's not required during actual reprogramming. The service fee is $20 per day, or $200 per month. For this price, you get access to not only the calibrations, but also the service information on the website. Once downloaded, you will be prompted to enter the vehicle information so you have access to the latest calibrations. Chrysler's application works on most OBD2 vehicles, again 1996 and newer. Figure 8 shows the J2534 programming with Chrysler.

Honda
Honda and Acura require a base ServiceExpress membership plus a subscription to their CD-based J2534 reprogramming service. Visit techinfo.honda.com to see a matrix of reprogrammable vehicles, subscribe, and download the reprogramming software. The basic membership costs $20 for a 3-day subscription, $50 per month, or $250 per year. The reprogramming CDs are an additional fee of $300 per year. The ServiceExpress membership includes access to TSB's and online service information. Honda mails updates through the year, and you won't need an Internet connection during reprogramming. Although the 1996 Acura RL and 1997 Prelude can be flashed, neither Honda nor Acura have widespread reprogramming support until model year 2002.

Toyota
Toyota's J2534 software is CD-based like many others, and can be purchased from techinfo.toyota.com. From the CD you can pick the calibration and update the vehicle. A screenshot from Toyota's Calibration Update Wizard is shown in Figure 9.

Many other manufacturers offer J2534 subscription services, as listed in Table 1. Although each one has a unique user interface, they all follow the same basic principles. They are designed to allow you to perform updates to the calibration software inside newer vehicles. After using a few different versions, you will become comfortable with the reprogramming process.

Closing
Reprogramming and J2535 is relatively new, but it's here to stay. There are an estimated 75-100 million programmable modules on the road today, with factory updates available for over half of them. Automakers are manufacturing vehicles with more and more of these modules, so the numbers will only increase.

This article is just the beginning of your journey. The next step is purchasing equipment and starting the learning process. Soon you will be ready to offer reprogramming to your customers. It will require some cost and effort upfront, but will pay off in the long term as reprogramming becomes an essential part of your customer service.

Figure 1 OEM table

J2534 Subscription Services

Information about services available from automakers

	J2534 reprogramming costs			Website
	one use	1-3 day	monthly	yearly	
BMW		30	250	2500	http://www.bmwtechinfo.com/
Mini					http://www.minitechinfo.com/
Porsche	100				http://techinfo.porsche.com/
Chrysler, Jeep, Dodge		20	200	1500	http://www.techauthority.com/
Ford, Lincoln, Mercury		24.95	59.95	599.95	http://www.motorcraft.com/
Land Rover					http://www.landrovertechinfo.com/
Volvo****		84			http://www.volvotechinfo.com/
General Motors Brands*				995	http://www.gmtechinfo.com/
Acura, Honda**				300	http://www.serviceexpress.honda.com/
Isuzu				1968	http://www.isuzutechinfo.com/
Kia / Hyundai					http://www.kiatechinfo.com
Mazda		24.95	59.95	599.95	http://www.mazdatechinfo.com/
Mercedes				925	http://www.startekinfo.com/
Mitsubishi		19.95	249.95	1449.95	http://www.mitsubishitechinfo.com/
Nissan	19.95				http://www.nissan-techinfo.com
Subaru***				75	http://techinfo.subaru.com
Toyota, Lexus, Scion				55	http://techinfo.toyota.com/
Volkswagen		50	200	1000	www.ebahn.com/vw
Audi		50	200	1000	www.ebahn.com/audi

* GM is moving to Web based TIS2WEB system at the end of 2006 with different purchase options available
** Honda requires that you have a Service Express Membership to gain access to reprogramming instructions and TSBs. Service express is $20 for a 3-day subscription, $50 per month, or $250 per year
*** Subaru charges $75 per CD that contains all calibrations. There could be up to 4 updates per year
**** Volvo charges $84 per 3-day period, plus around $30 per calibration

Figure 2 CarDAQ-Plus

Figure 3

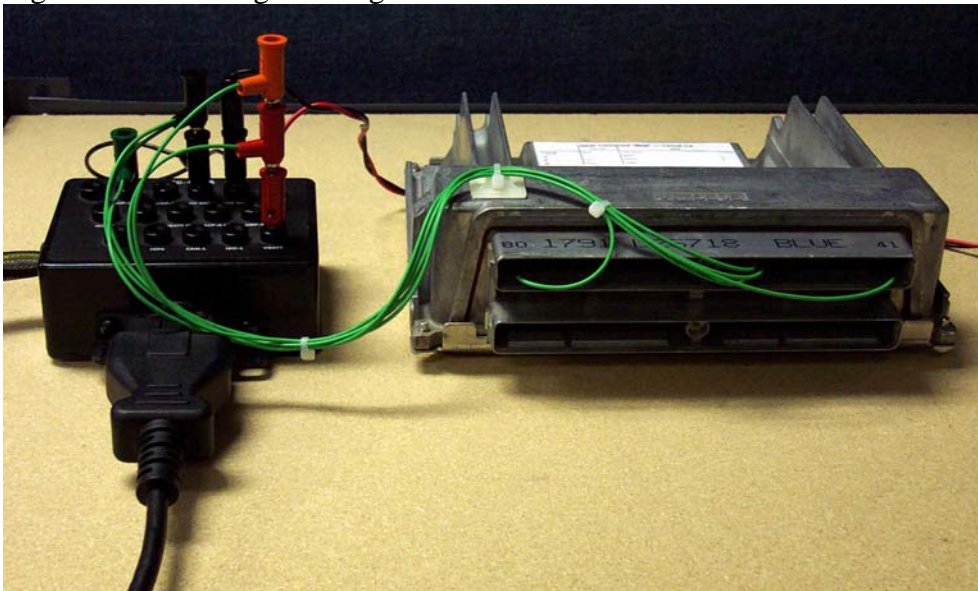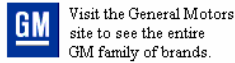| characteristic	USB	Serial	Ethernet	Bluetooth	802.11
Plug and Play	Yes	No	No	No	No
Protected from ground loops, static, and surges	No	Yes	Yes	Yes	Yes
Distance Limitation	15 feet	45 feet	300 feet	32 Feet*	300 feet*
Max Speed	11Mbps	0.125Mbps*	100Mbps	1Mbps	54Mbps
Available on most new laptops	Yes	No	Yes	No	Yes

* Approximation, may vary

Figure 4 Bench Programming

Figure 5

Figure 6 FMP Webflash J2534 Configurations
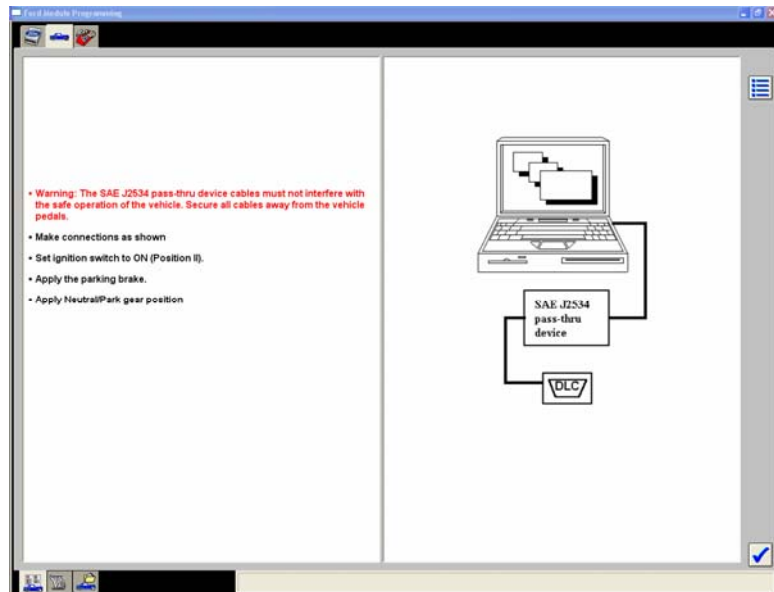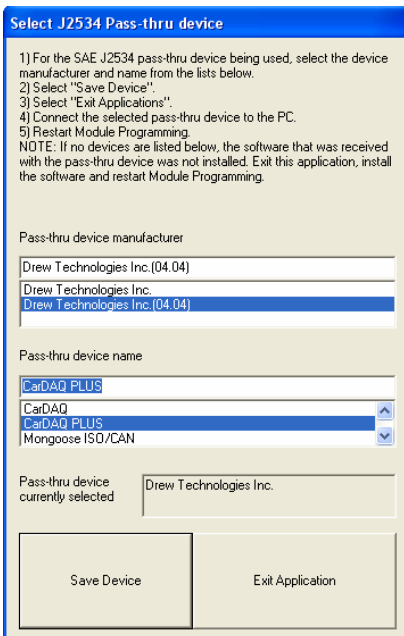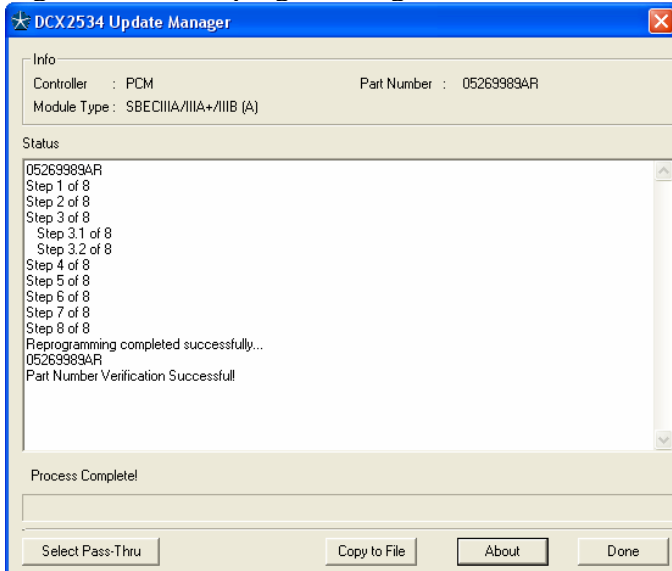
Figure 7 FMP reprogramming screen

Figure 8 DCX Reprogramming

Figure 9 Toyota Reprogramming Screen