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Method for programming an electronic control unit of a vehicle and corresponding electronic device

(57) The invention describes an electronic device (1) adapted to be applied onto an electronic control unit (2) of a vehicle and comprising first terminals (3), designed to be connected to the control unit (2), for sending pro-

gramming signals to the control unit, and second terminals (4), designed to be connected to a data network (5) of the vehicle, for receiving said programming signals.

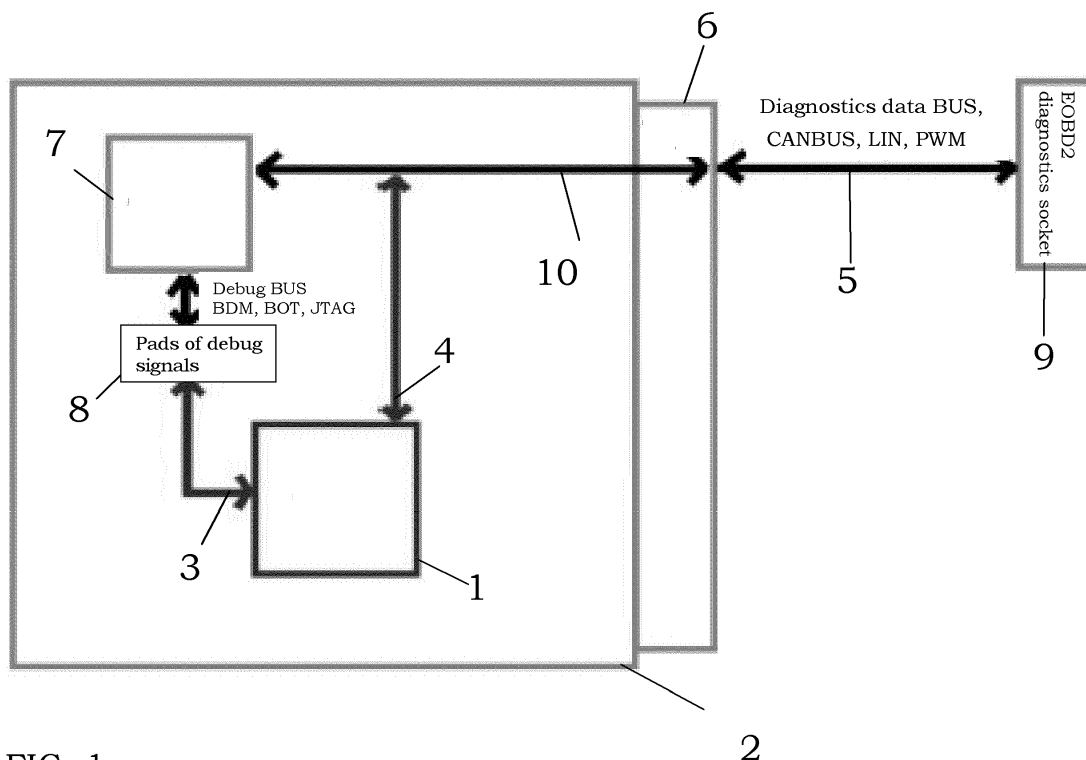


FIG. 1

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Description

Field of application

[0001] The present invention relates to a method for programming an electronic control unit of a vehicle and to a corresponding electronic device.

[0002] In particular, the invention relates to a method and a device of the abovementioned type for transmitting programming commands to a microprocessor of the electronic control unit of the vehicle, in order to perform tuning of the control unit, maintenance or debugging thereof.

Prior Art

[0003] Methods and devices for programming the electronic control unit of a vehicle, used for tuning, carrying out maintenance on or debugging the control unit, are known. These methods comprise reading or reprogramming the contents of a solid-state memory of the control unit, in particular the memory of a microprocessor mounted in the control unit.

[0004] According to a first known method, communication with the control unit is performed by connecting a programming device (programmer) to a diagnostics socket or EOBD2 socket of the vehicle, inside the passenger compartment, generally underneath the steering wheel, and electrically connected directly to the control unit via a data line, for example a CAN bus or a PWM or LIN bus.

[0005] Since the microprocessor of the electronic control unit and its memory are protected in reading and writing by means of a secure communication protocol, for example based on encryption keys predefined by the manufacturers of the control units or vehicles, communication with the programming device is protected.

[0006] This protection is restrictive since it prevents tuning, diagnosis or maintenance of the control unit in the absence of the hardware and/or software required to implement the secure communication protocol, for example in the absence of the encryption keys, thus preventing anyone who does not know the secure communication protocol from making use of the diagnostics socket and the data line.

[0007] Another method for programming the control unit is also known where there is the possibility of communicating therewith also in the absence of the secure communication protocol.

[0008] However, this method is complex and costly because it comprises removing the control unit from the vehicle, disassembling the control unit, performing a sort of reverse engineering operation, identifying certain circuit components which are involved by the signals sent to the microprocessor and intended for programming or debugging thereof, and then connecting a number of electrical wires to said circuit components.

[0009] The electrical wires have their opposite ends connected to a programming device (programmer). The

latter must be specifically selected in order to communicate with the microprocessor of the control unit, i.e. must implement a hardware communication protocol which can be understood by the microprocessor, and send unencrypted programming commands to the microprocessor. According to these methods, it is also necessary to use a stabilized power supplier for supplying the programmer, thus allowing the programmer to read correctly the contents of the solid-state memory, modify these contents and retransmit them to the memory, for reprogramming thereof.

[0010] It is evident that this second method has significant disadvantages, especially due to the fact that the control unit must be removed from the vehicle and disassembled whenever reprogramming or reading of the memory must be performed. Moreover, the electrical wires connected to the circuit components of the control unit must be removed after reprogramming, so as to allow reinsertion of the control unit in the vehicle, or connected again for subsequent reprogramming of the control unit. This operation may result in errors with regard to connection of the electrical wires, between one reprogramming operation and another, and result in a considerable amount of lost time.

[0011] In other words, this second method of reprogramming the electric control unit has the advantage that it may be applied without a secure communication protocol, but is subject to significant limitations associated with its implementation which requires technical experts and a step for testing correct connection between the programmer and the control unit, before proceeding with the actual reprogramming operation.

[0012] The problem at the basis of the present invention is that of devising a method for programming an electronic control unit for vehicles and a corresponding device which is able to perform reprogramming also in the absence of the hardware and/or software means needed to implement the security protocol predefined by the manufacturers of the control unit or the vehicles, but at the same time is also able to speed up and simplify the steps for electrical connection of the control unit to the programmer, overcoming the drawbacks which hitherto are associated with the known method and devices.

Summary of the invention

[0013] The idea at the basis of the present invention is to mount on the control unit an electrical device which is arranged between the microprocessor of the control unit and a programming device (programmer) connected to a diagnostics socket or EOBD2 socket of the vehicle, this electrical device being designed to receive unencrypted signals from the programmer and transfer the unencrypted signals as programming commands for the microprocessor, thus avoiding to remove the control unit from the vehicle and providing a permanent electrical connection between said socket and the microprocessor.

[0014] Advantageously, the device according to the

present invention is mounted only once on the control unit and remains permanently on it and inside the vehicle and is programmed to intercept the programming signals from the diagnostics socket of the vehicle and from the data network of the vehicle, i.e. intercept the signals of the programming device and transfer these signals to the microprocessor and to the associated solid-state memory.

[0015] In other words, the EOBD2 socket and the data network of the vehicle, for example the CAN bus or PWM or LIN bus, are used to transfer commands to the electrical device mounted on the control unit according to the present invention, without using a secure or proprietary communication protocol and this device is programmed to reprogram the memory of the specific microprocessor on the basis of the commands received from the vehicle data network.

[0016] On the basis of this proposed solution, the technical problem mentioned above is solved by an electronic device **characterized in that** it is adapted to be applied onto an electronic control unit of a vehicle and comprises first terminals, adapted to be connected to the control unit, for sending programming signals to the control unit, and second terminals, adapted to be connected to a data network of the vehicle, for receiving said programming signals.

[0017] According to a feature of the invention, the data network comprises a diagnostics socket or EOBD2 socket of the vehicle and the electronic device receives the programming signals via the diagnostics socket or EOBD2 socket of the vehicle. The data network comprises for example a CAN bus or PWM or LIN bus and the electronic device receives the programming signals via this bus.

[0018] According to another aspect of the present invention, the second terminals are adapted to be connected to a comb connector of the control unit.

[0019] In particular, the electronic device is configured to receive the programming signals in unencrypted form on the data network and receive said unencrypted signals from a programming device connected to the data socket or EOBD2 socket of the vehicle.

[0020] Even more particularly, the electronic device is arranged between the control unit and the programming device and comprises a programming software for encoding the programming signals in the form of commands which can be interpreted by a microprocessor mounted in the control unit.

[0021] According to a preferred embodiment, the electronic device is applied in an irremovable manner onto the control unit. Preferably the device is adapted to be applied to the microprocessor of the control unit. For example, the electronic device comprises an adhesive substrate for quick fixing to the control unit, the adhesive substrate being heat-resistant.

[0022] According to another aspect of the present invention, connection of the first terminals to the control unit is configured to send the programming signals to the

microprocessor of the control unit as programming commands. Connection of the first terminals to the control unit is performed via pads associated with the debug signals of the microprocessor.

[0023] The technical problem described above is also solved by an electronic control unit which comprises or incorporates an electronic device of the type described above.

[0024] The technical problem is also solved by a method for programming an electronic control unit of a vehicle comprising the steps of:

- applying an electronic device onto an electronic control unit of a motor vehicle, said electronic device application step comprising:
- connecting first terminals to the control unit, for sending programming signals to the control unit, and
- connecting second terminals to a data network of the vehicle, for receiving the programming signals.

Brief technical description of the accompanying drawings

[0025]

Figure 1 shows schematically the electric device according to the present invention, mounted on a control unit of a vehicle.

Detailed description

[0026] With reference to Figure 1, an electronic device according to the present invention is schematically represented and indicated with numeral reference 1, mounted on an electronic control unit 2 of a vehicle engine.

[0027] The control unit 2 is provided with a microprocessor 7 and a respective solid-state memory, which is programmed to control and operate electrically the components of the vehicle. The control unit 2 is also provided with a comb connector 6 and a data line 10 which extends from the microprocessor 7 to the comb connector 6.

[0028] Figure 1 also represents a diagnostics socket 9 or EOBD2 socket of the vehicle, for example installed inside a compartment or in a box underneath the steering wheel. A data line 5, for example a CAN bus or a PWM or LIN bus extends from the diagnostics socket 9 to the comb connector 6 of the control unit 2 and forms a data network together with the data line 10 between the comb connector 6 and the microprocessor 7. The data network allow signals to be sent from the diagnostics port directly to the microprocessor, using a secure communication protocol, which is known to the manufacturers of the control unit or the vehicles which are fitted with it.

[0029] According to the present invention, the electronic device 1 is installed on the control unit 2, for example on a surface of the control unit 2 directed upwards, when the control unit is installed in the vehicle, or on a surface

of the microprocessor 7, preferably in an irremovable manner, for example via adhesive means which are resistant to the heat which is generated inside the engine compartment (bonnet) of the vehicle, during use.

[0030] The electrical device 1 is electrically connected to the data network and in particular to the data line 10 which connects the comb connector 6 to the microprocessor 7 and is also connected to the microprocessor 7, via connection points or pads 8 through which the debug signals of the microprocessor 1 pass. The electrical device 1 is then connected inside the control unit.

[0031] More particularly, the electronic device 1 has first terminals 3 for connection to the microprocessor 7, connected via the pads 8, and second terminals 4 for connection to the data network. The pads 8 in turn communicate with the microprocessor 7 via a debug bus or a JTAG, BOOT or BDM port.

[0032] The device 1 forms a communication node between the microprocessor and a programmer or programming device, not shown in the figures, adapted to be connected to the diagnostics port or EOBD2 port of the vehicle, for sending programming signals to the control unit 2. The communication signals sent from the programmer to the microprocessor 7, although passing over the data network, do not directly reach the microprocessor 7, but are intercepted by the electronic device 1 which encodes them in the form of programming commands to be interpreted by the microprocessor 7. The electronic device therefore acts as a bypass. The commands allow rewriting or updating of the solid-state memory of the microprocessor and therefore reprogramming of the control unit.

[0033] Advantageously the programmer sends unencrypted signals on the data network and the unencrypted signals are transferred from the electronic device 1 to the microprocessor as memory programming commands, therefore allowing reprogramming of the control unit without knowing the secure protocol provided by the manufacturers of the control unit or the vehicle for communication via the EOBD2 port or diagnostics port of the vehicle.

[0034] Advantageously, once the device 1 has been installed on the control unit, it is no longer necessary to disassemble the control unit or remove it from the vehicle in order to perform reprogramming or tuning, thereby simplifying and speeding up all the control unit maintenance, debugging or upgrading operations.

Claims

1. Electronic device (1), **characterized in that** it is adapted to be applied onto an electronic control unit (2) of a vehicle and comprises first terminals (3), adapted to be connected to the control unit (2), for sending programming signals to the control unit, and second terminals (4), adapted to be connected to a data network (5) of the vehicle, for receiving said

programming signals.

2. Electronic device (1) according to claim 1, **characterized in that** said second terminals (4) are adapted to be connected to a comb connector (6) of the control unit (2).
3. Electronic device (1) according to claim 1, **characterized in that** said data network (5) comprises a diagnostics socket or EOBD2 socket (9) of said vehicle and the electronic device (1) is adapted to receive said programming signals via the diagnostics socket or EOBD2 socket of the vehicle.
4. Electronic device (1) according to claim 3, **characterized in that** it is configured to receive the programming signals in unencrypted form on the data network and to receive said unencrypted signals from a programming device connected to the data socket of the vehicle.
5. Electronic device (1) according to claim 3, **characterized in that** it is adapted to be arranged between the control unit (2) and the programming device and comprises a software for encoding the programming signals in the form of commands to be interpreted in a microprocessor (7) of the control unit.
6. Electronic device (1) according to claim 1, **characterized in that** it is adapted to be applied irremovably onto the control unit (2).
7. Electronic device (1) according to claim 1, **characterized in that** it is adapted to be applied to a microprocessor (7) of the control unit.
8. Electronic device (1) according to claim 1, **characterized in that** it comprises an adhesive substrate for quick fixing to the control unit (2), said adhesive being heat-resistant.
9. Electronic device (1) according to claim 1, **characterized in that** the connection of said first terminals (3) to said control unit (2) is configured to send the programming signals to a microprocessor (7) of the control unit (2).
10. Electronic device (1) according to claim 9, **characterized in that** the connection of said first terminals (3) to said control unit (2) is performed via pads (8) associated with the debug signals of the microprocessor.
11. Electronic device (1) according to claim 1, **characterized in that** said data network comprises a CAN bus or a PWM or LIN bus and the electronic device (1) is adapted to receive the programming signals on the CAN bus or on the PWM or LIN bus.

12. Electronic control unit comprising an electronic device according to one of the preceding claims.
13. Method for programming an electronic control unit of a vehicle, comprising the steps of applying an electronic device (1) onto an electronic control unit (2) of a vehicle, said electronic device application step comprising connecting first terminals (3) to the control unit (2), for sending programming signals to the control unit, and connecting second terminals (4) to a data network (5) of the vehicle, for receiving said programming signals.
14. Method for programming an electronic control unit according to claim 13, **characterized in that** said data network comprises a diagnostic socket or EOBD2 socket of the vehicle.

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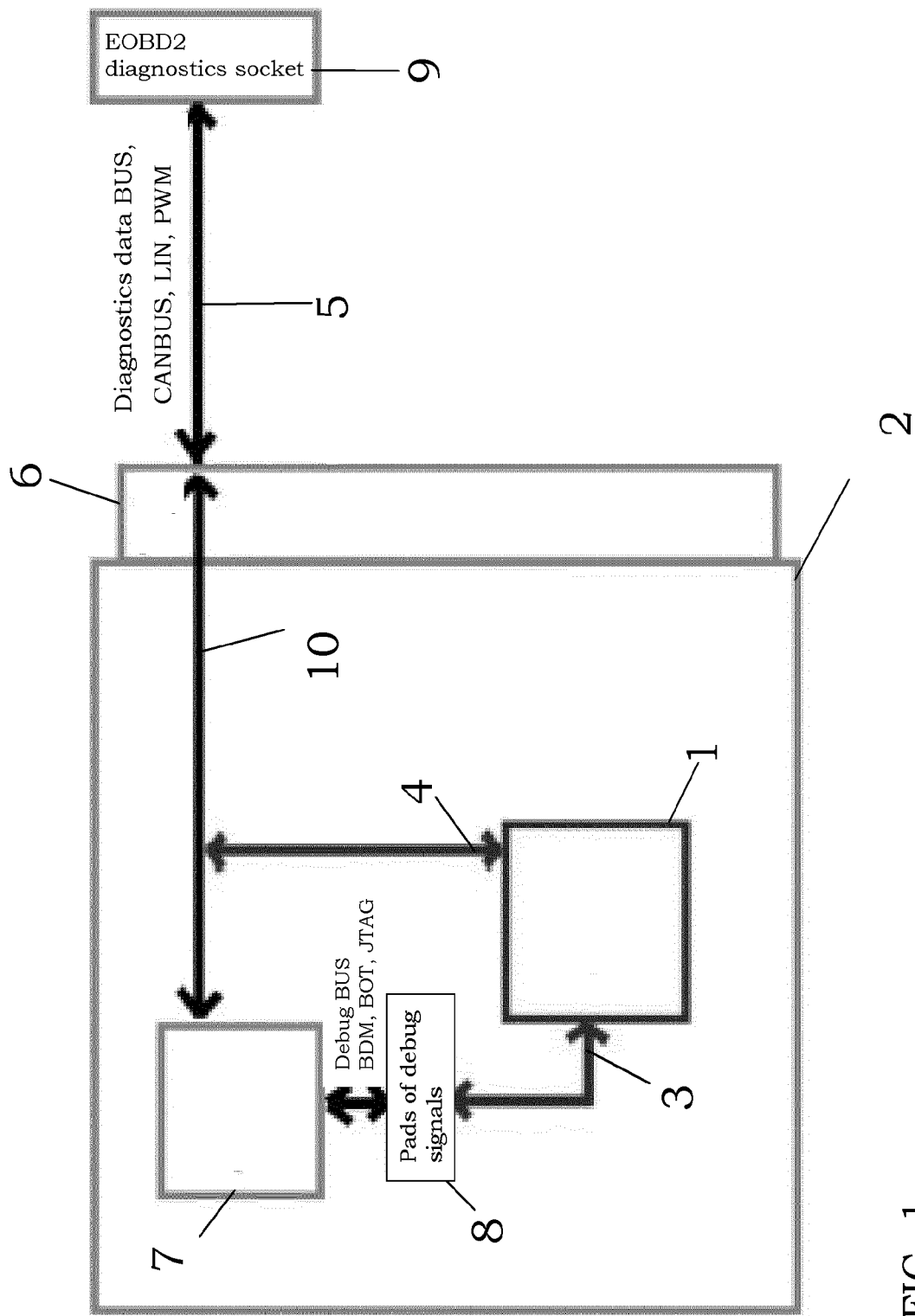


FIG. 1



EUROPEAN SEARCH REPORT

 Application Number
 EP 13 17 9545

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 2003/100980 A1 (GRUENEWALD MARTIN [DE] ET AL) 29 May 2003 (2003-05-29) * paragraph [0002] * * paragraph [0009] - paragraph [0018] * * paragraph [0021] - paragraph [0031] * * figure 1 *	1-14	INV. G07C5/00
X	US 5 922 037 A (POTTS KENNETH M [US]) 13 July 1999 (1999-07-13) * column 2, line 58 - column 4, line 65 * * figure 1 *	1,6-9, 12,13	
X	US 2002/156560 A1 (BACHLE DIETER [DE] BAECHLE DIETER [DE]) 24 October 2002 (2002-10-24) * paragraph [0022] - paragraph [0029] * * page 1 *	1,6-9,13	
			TECHNICAL FIELDS SEARCHED (IPC)
			G07C
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 30 January 2014	Examiner Miltgen, Eric
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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 EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 13 17 9545

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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30-01-2014

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2003100980 A1	29-05-2003	DE 10153085 A1	15-05-2003
		JP 4643114 B2	02-03-2011
		JP 2003162303 A	06-06-2003
		US 2003100980 A1	29-05-2003

US 5922037 A	13-07-1999	NONE	

US 2002156560 A1	24-10-2002	CZ 20020596 A3	16-10-2002
		DE 10108392 A1	19-09-2002
		JP 2002304212 A	18-10-2002
		US 2002156560 A1	24-10-2002
