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(54) Method, diagnostic system and configuration system for operating a device for requesting diagnostic data of a vehicle and a communication device

(57) In a method for operating a device for requesting diagnostic data of a vehicle and a communication device identification data is requested from the vehicle by the device. In response to receiving the identification data from the vehicle, the identification data is sent to a communication device. In response to receiving the identification data by the communication device configuration data for a vehicle or manufacture specific communication is requested from a configuration server depending on the identification data by the communication device. In response to receiving the configuration data by the communication device, the configuration data is sent to the device. In response to receiving the configuration data by the device, the configuration data is stored in the device for requesting diagnostic data of the vehicle by use of the configuration data for the vehicle or manufacture specific communication.

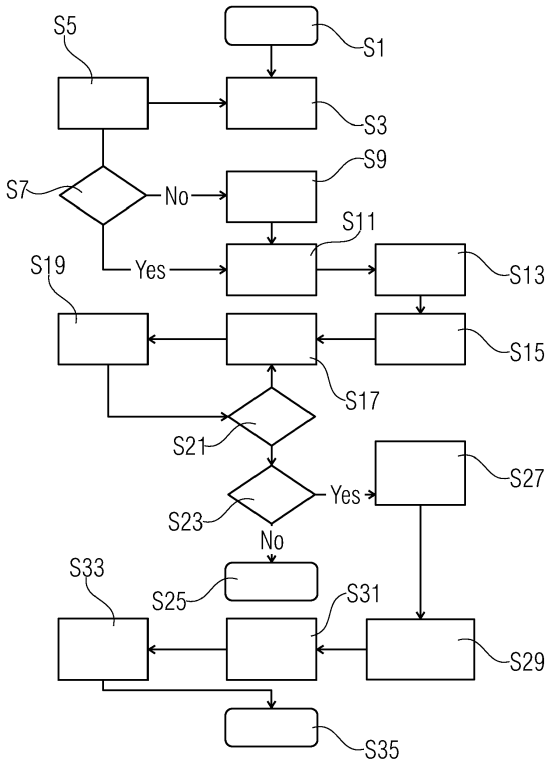


FIG 3

EP 2 988 278 A1

Description

[0001] The invention relates to a method for operating a device for requesting diagnostic data of a vehicle and a communication device. The invention further relates to a diagnostic system for operating a device for requesting diagnostic data of a vehicle and a communication device. The invention further relates to a configuration system for operating a device for requesting diagnostic data of a vehicle, a communication device and a communication server.

[0002] Today devices for requesting diagnostic data of a vehicle often communicate via a standardized connection with the vehicle, as, for example, defined by ISO15031. However, via such a standardized connection only little data can be requested, as, for example, emission related data.

[0003] The object of the invention is to provide a method and a system for operating versatilely a device for requesting diagnostic data of a vehicle and a communication device.

[0004] This object is achieved by the features of the independent claims. Advantageous embodiments of the invention are given in the sub-claims.

[0005] The invention is distinguished according to a first aspect by a method for operating a device for requesting diagnostic data of a vehicle and a communication device. Identification data is requested from the vehicle by the device. In response to receiving the identification data from the vehicle, the identification data is sent to a communication device. In response to receiving the identification data by the communication device configuration data for a vehicle or manufacture specific communication is requested from a configuration server depending on the identification data by the communication device. In response to receiving the configuration data by the communication device, the configuration data is sent to the device. In response to receiving the configuration data by the device, the configuration data is stored in the device for requesting diagnostic data of the vehicle by use of the configuration data for the vehicle or manufacture specific communication.

[0006] If the identification data which is requested from the vehicle is not sufficient, additional data for identification can be requested from a web server and/or from the communication device, wherein this additional request may be manually initiated.

[0007] By storing the configuration data not only a standardized connection with the vehicle, as, for example, defined by ISO15031, is possible, but also a non-standardized vehicle or manufacture specific communication. Thus, many different diagnostic data can be requested, as for example, information about a variable service and/or information about a given sensor of the vehicle.

[0008] According to one embodiment, the identification data comprises a vehicle identification number and the configuration data is requested from the configuration server depending on the vehicle identification number.

[0009] By use of the vehicle identification number a very easy determination of the configuration data is possible.

[0010] According to a further embodiment, the configuration data for the vehicle or manufacture specific communication is requested from the configuration server depending on a vehicle identification number by requesting control unit detection data from the configuration server depending on the vehicle identification number by the communication device. Further, in response to receiving the control unit detection data by the communication device the control unit detection data is sent to the device. In response to receiving the control unit detection data by the device at least one control unit of the vehicle is identified by use of the control unit detection data and an information about the at least one control unit is sent to the communication device. In response to receiving the information about the at least one control unit by the communication device the configuration data for the vehicle or manufacture specific communication is requested depending on the information about the at least one control unit.

[0011] By use of the control unit detection data it can be very exactly determined which diagnostic data can be requested from the vehicle.

[0012] According to a further embodiment, in response to receiving a request for requesting diagnostic data by the device the diagnostic data of the vehicle is requested by the device by use of a given protocol for the vehicle or manufacture specific communication which is given by the configuration data. In response to receiving the diagnostic data by the device the diagnostic data is sent by the device by use of a given universal protocol to the communication device, wherein the given universal protocol is different from the protocol for the vehicle or manufacture specific communication.

[0013] The vehicle or manufacture specific communication is often not very efficient. By the given universal protocol a much more efficient communication between the device and the communication device is possible, especially for a wireless communication. For example, for the vehicle or manufacture specific communication above 200 bytes can be necessary to send given requested diagnostic data, wherein only about 40 bytes are necessary by use of the given universal protocol.

[0014] According to a further embodiment, a start of a cranking phase of the vehicle is determined by the device. A transient minimum voltage in the cranking phase is determined by the device. The determined transient minimum voltage is compared by the device with a given limit minimum voltage which is given by the configuration data.

[0015] Normally a determination of a battery status by use of control units is not possible because of the low sampling rate of the control units, but the device can be used for a determination of the battery status. For these measurements

the device is, for example, directly connected with a battery supply voltage pin of the vehicle.

[0016] According to a further embodiment, an initial voltage of a sustained cranking period of the cranking phase is determined by the device. An end voltage of the sustained cranking period of the cranking phase is determined by the device. The determined initial voltage and the determined end voltage are compared by the device with a given limit initial voltage and a given limit end voltage which are given by the configuration data.

[0017] Hereby a very exact determination of the battery status is possible.

[0018] According to a second aspect the invention is distinguished by a diagnostic system, wherein the diagnostic system comprises the device and the communication device being configured to execute the method according to the first aspect or an advantageous embodiment of the method according to the first aspect.

[0019] According to a third aspect the invention is distinguished by a Configuration system, wherein the Configuration system comprises the device, the communication device and the configuration server comprising the configuration data for vehicle or manufacture specific communication, being configured to execute the method according to the first aspect or an advantageous embodiment of the method according to the first aspect.

[0020] Exemplary embodiments of the invention are explained in the following with the aid of schematic drawings.

[0021] These are as follows:

Figure 1 a network comprising a diagnostic system;

Figure 2 a diagram of a battery voltage;

Figure 3 a first flowchart for operating the diagnostic system;

Figure 4 a second flowchart for operating the diagnostic system;

Figure 5 a third flowchart for operating the diagnostic system; and

Figure 6 a fourth flowchart for operating the diagnostic system.

[0022] Figure 1 shows a network. The network comprises a diagnostic system 1. The diagnostic system 1 comprises a device 3 for requesting diagnostic data of a vehicle 10 and a communication device 5. The device 3 is, for example, built in a dongle. The communication device 5 is, for example, built in a smartphone, laptop, PC and/or telematics device.

[0023] The device 3 can, for example, be plugged into an on-board diagnostic, OBD, plug of the vehicle 10 to communicate with control units of the vehicle 10.

[0024] The device 3 is further configured to communicate with the communication device 5, for example via a wireless communication as, for example, Bluetooth.

[0025] The communication device 5 is configured to communicate with the device 3, for example, via a wireless communication as, for example, Bluetooth. The communication device 5 is configured to communicate with a configuration server 30 and/or with a customer server 40, for example, via internet 20.

[0026] The configuration server 30 is configured to communicate with the communication device 5, for example, via internet 20. The configuration server 30 is further configured to communicate with a diagnostic database 35.

[0027] Figure 2 shows a diagram of a measured battery voltage, which can be measured by the device 3. For this, the device 3 is configured to determine a start of a cranking phase of the vehicle 10. The device 3 is, for example, further configured to determine a transient minimum voltage V1 in the cranking phase. The device 3 is, for example, further configured to compare the determined transient minimum voltage V1 with a given limit minimum voltage which is given by a configuration data, which will be later described. Dependent on the comparison a battery status to predict pending failure or insufficient capacity to start the vehicle 10 can be determined, for example, by the device 3 and/or the communication device 5.

[0028] Additionally or alternatively the device 3 is configured to determine an initial voltage V2 of a sustained cranking period of the cranking phase. The device 3 is, for example, further configured to determine an end voltage V3 of the sustained cranking period of the cranking phase. The device 3 is, for example, further configured to compare the determined initial voltage V2 and the determined end voltage V3 with a given limit initial voltage and a given limit end voltage which are given by the configuration data. Dependent on the comparisons a battery status to predict pending failure or insufficient capacity to start the vehicle 10 can be determined, for example, by the device 3 and/or the communication device 5.

[0029] Figure 3 shows a first flowchart of a first program for operating the diagnostic system 1 for receiving the configuration data. The configuration data can, for example, be used for a vehicle or manufacture specific communication of the device 3 with the vehicle 10. The configuration data can, for example, additionally be used for the above explained determination of the battery status.

[0030] The first program can be executed distributed on the device 3, the communication device 5 and the configuration server 30.

[0031] In a step S1 the program is started and, for example, variables are initialized.

[0032] In a step S3 identification data is requested from the device 3 by the communication device 5. The identification data comprises for example a vehicle identification number.

[0033] In a step S5 the identification data is requested from the vehicle 10 by the device 3.

[0034] In a step S7 the identification data is checked by the device 3. If the identification data is not correct the program is continued in a step S9. If the identification data is correct the program is continued in a step S11.

[0035] In the step S9 the identification data is requested from the vehicle 10 by use of a user input.

[0036] In the step S11 the identification data is sent from the communication device 5 to the configuration server 30.

[0037] In the step S13 the identification data is decoded by the configuration server 30.

[0038] In the step S15 a control unit detection data package is created by the configuration server 30 depending on the identification data by use of the diagnostic database 35 and the control unit detection data package is sent to the communication device 5. The control unit detection data package can comprise control unit detection data for one control unit or for more than one control unit. The control unit detection data package is, for example, encrypted, for example, by use of AES256.

[0039] In the step S17 in response to receiving the control unit detection data package by the communication device 5 control unit detection data is send to the device 3 for identifying at least one control unit of the vehicle 10 by use of the control unit detection data.

[0040] In the step S19 in response to receiving the control unit detection data by the device 3 at least one control unit of the vehicle 10 by use of the control unit detection data is identified and an information about the at least one control unit is sent to the communication device 5.

[0041] In the step S21 it is checked by the communication device 5 control unit detection data package comprises further control unit detection data. If the control unit detection data package comprises further control unit detection data the program is continued in the step S19 and further control unit detection data is sent to the device 3, if not the program is continued in a step S23.

[0042] In the step S23 it is checked by the communication device 5 if at least one control unit was identified. If at least one control unit was identified the information about the at least one control unit is sent to the configuration server 30 and the program is continued in a step S27, if no control unit was identified the program is continued in a step S25.

[0043] In the step S25 the program is stopped and can, for example, be restarted in the step S1.

[0044] In the step S27 configuration data for a vehicle or manufacture specific communication is requested by the communication device 5 from the configuration server 30 depending on the information about the at least one control unit, for example, by use of a web server. The web server, for example, comprises a token-system for security.

[0045] In a step S29 the configuration data is built by the configuration server 30, in particular by the web server and the configuration data is sent to the communication device 5.

[0046] In a step S31 in response to receiving the configuration data by the communication device 5, the configuration data is sent to the device 3.

[0047] In a step S33 the configuration data is stored and/or loaded into the device 3 for requesting diagnostic data of the vehicle 10 by use of the configuration data for the vehicle or manufacture specific communication.

[0048] In the step S35 the program is stopped and can, for example, be restarted in the step S1.

[0049] Figure 4 shows a second flowchart of a second program for determining a list of diagnostic data which can be requested from the vehicle 10. The second program is, for example, started at vehicle logon.

[0050] The second program can be executed distributed on the device 3, the communication device 5 and the configuration server 30.

[0051] In a step S40 the program is started, for example, after the first program was stopped and, for example, variables are initialized.

[0052] In an optional step S41 a security authentication is done by the communication device 5.

[0053] In an optional step S43 a security authentication is done by the device 3.

[0054] In a step S44 a request is sent from the communication device 5 to the device 3 for getting a list of supported diagnostic data which also can be called supported live readings.

[0055] In a step S45 a vehicle or manufacture specific communication is started by the device 3 with control units for which the configuration data was stored. Optionally a standardized communication with other and/or the same control units is started by the device 3.

[0056] In a step S47 a list of all supported live readings is built by the device 3, for example, by interrogating all control units and attempting all live data commands which are given to the device 3 by a diagnostic package. The list is, for example, separated in a part for diagnostic data which can be requested by a vehicle or manufacture specific communication and diagnostic data which can be requested by a standardized communication, as, for example, defined by ISO15031. The diagnostic data which can be requested by a standardized communication can also be called Level 1

diagnostics. The diagnostic data which can be requested by a vehicle or manufacture specific communication can also be called Level 2 diagnostics.

[0057] In a step S49 the list is sent to the communication device 5.

[0058] In a step S51 the list is, for example, displayed and or logged by the communication device 5 and the program is stopped. An example list is shown in the table 1.

Table 1: list of all supported live readings

Live reading	**Level 2 supported**	**Level 1 supported**
Engine Speed	YES control unit 1	YES
Vehicle Speed	YES control unit 1	YES
Coolant Temp	YES control unit 1	YES
Intake Air Temperature	YES control unit 1	YES
Mass Air Flow	NO	NO
Absolute Throttle Position	NO	NO
Odometer	YES control unit 3	N/A
Brake Pedal	YES control unit 2	N/A
Fuel Level	NO	NO
Distance till service	YES control unit 3	N/A

[0059] Figure 5 shows a simplified flowchart of the second program.

[0060] In a step S60 the request is sent from the communication device 5 to the device 3 for getting the list of supported live readings.

[0061] In a step S61 the list of all supported live readings is built by the device 3, for example, by interrogating all control units and attempting all live data commands which are given to the device 3 by a diagnostic package.

[0062] In a step S63 the list is sent to the communication device 5.

[0063] In a step S65 the list is stored in the communication device 5 and the program is stopped.

[0064] Figure 6 shows a flowchart of a third program to get diagnostic data.

[0065] In a step S100 the program is started and, for example, variables are initialized.

[0066] In a step S101 a request for requesting diagnostic data is sent by the communication device 5 to the device 3.

[0067] In a step S103 the list of all supported live readings is provided by the device 3 which was built for example in the step S61 and/or S47.

[0068] In a step S105 it is checked by the device 3 if the requested diagnostic data is supported by use of the list. If the requested diagnostic data is not supported the program is continued in a step S160. If the requested diagnostic data is supported the program is continued in a step S107.

[0069] In a step S107 it is checked by the device 3 if the configuration data is needed or if the requested diagnostic data can be requested by use of a given standardized protocol. If the configuration data is needed the program is continued in a step S120. If the configuration data is not needed the program is continued in a step S109.

[0070] In a step S109 the diagnostic data is requested by the device 3 from the vehicle 10 by use of a given standardized protocol.

[0071] In a step S111 the request for diagnostic data is received by the vehicle 10.

[0072] In a step S113 the diagnostic data is sent back to the device 3 from the vehicle 10.

[0073] In a step S115 the diagnostic data is received by the device 3 and the diagnostic data is decoded and the program is continued in a step S150.

[0074] In the step S120 the required configuration data is loaded for a vehicle or manufacture specific communication, in particular, for the use of a given protocol for the vehicle or manufacture specific communication which is given by the configuration data.

[0075] In a step S123 a wakeup/start command is sent by the device 3 to the control unit from which the diagnostic data is requested.

[0076] In a step S125 a wakeup sequence is started in the control unit.

[0077] In a step S127 the wakeup sequence is finished in the control unit.

[0078] In a step S129 a diagnostic data request for the requested diagnostic data is loaded by the device 3 by use of the configuration data.

[0079] In a step S131 the diagnostic data request is sent by the device 3 to the control unit.

[0080] In a step S133 the control unit receives the diagnostic data request.

[0081] In a step S135 the requested diagnostic data is sent by the control unit to the device 3.

[0082] In a step S137 a request is sent by the device 3 for stopping the communication with the control unit to the control unit.

[0083] In a step S139 the communication is stopped by the control unit.

[0084] In a step S141 a stop acknowledgment is sent by the control unit to the device 3 and the program is continued in the step S150.

[0085] In the step S150 the diagnostic data is stored by the device 3.

[0086] In a step S160 it is checked by the device 3 if further diagnostic data is requested. If further diagnostic data is requested the program is continued in the step S103. If no further diagnostic data is requested the program is continued in a step S161.

[0087] In the step S161 the diagnostic data is sent by the device 3 to the communication device 5, in particular by use of a given universal protocol, wherein the given universal protocol is different from the protocol for the vehicle or manufacture specific communication.

[0088] In a step S163 the diagnostic data is displayed by the communication device 5 and/or stored in the communication device 5.

[0089] In a step S170 it is checked by the device 3 if the diagnostic data is to be requested again, for example, in a given interval. If the diagnostic data is to be requested again, the program is continued in the step S103. If the diagnostic data is not to be requested again, the program is continued in a step S173.

[0090] In the step S173 the program is stopped and can, for example, be restarted in the step S1.

[0091] By storing the configuration data not only a standardized connection with the vehicle 10, as, for example, defined by ISO15031, is possible, but also a non-standardized vehicle or manufacture specific communication. Thus, many different diagnostic data can be requested, as, for example, information about a variable service and/or information about a given sensor of the vehicle 10. Further, the battery status can be determined.

Claims

1. Method for operating a device (3) for requesting diagnostic data of a vehicle (10) and a communication device (5), wherein

   - identification data is requested from the vehicle (10) by the device (3),
   - in response to receiving the identification data from the vehicle (10), the identification data is sent to a communication device (5),
   - in response to receiving the identification data by the communication device (5) configuration data for a vehicle or manufacture specific communication is requested from a configuration server (30) depending on the identification data by the communication device (5),
   - in response to receiving the configuration data by the communication device (5), the configuration data is sent to the device (3),
   - in response to receiving the configuration data by the device (3), the configuration data is stored in the device (3) for requesting diagnostic data of the vehicle (10) by use of the configuration data for the vehicle or manufacture specific communication.

2. Method according to claim 1, wherein the identification data comprises a vehicle identification number and the configuration data is requested from the configuration server (30) depending on the vehicle identification number.

3. Method according to claim 2, wherein the configuration data for the vehicle or manufacture specific communication is requested from the configuration server (30) depending on a vehicle identification number by

   - requesting control unit detection data from the configuration server (30) depending on the vehicle identification number by the communication device (5),
   - in response to receiving the control unit detection data by the communication device (5) sending the control unit detection data to the device (3),
   - in response to receiving the control unit detection data by the device (3) identifying at least one control unit of the vehicle (10) by use of the control unit detection data and sending an information about the at least one

control unit to the communication device (5),
- in response to receiving the information about the at least one control unit by the communication device (5) requesting the configuration data for the vehicle or manufacture specific communication depending on the information about the at least one control unit.

4. Method according to anyone of the claims 1-3, wherein

- in response to receiving a request for requesting diagnostic data by the device (3) the diagnostic data of the vehicle (10) is requested by the device (3) by use of a given protocol for the vehicle or manufacture specific communication which is given by the configuration data and
- in response to receiving the diagnostic data by the device (3) the diagnostic data is sent by the device (3) by use of a given universal protocol to the communication device (5), wherein the given universal protocol is different from the protocol for the vehicle or manufacture specific communication.

5. Method according to anyone of the claims 1-4, wherein

- a start of a cranking phase of the vehicle (10) is determined by the device (3),
- a transient minimum voltage (V1) in the cranking phase is determined by the device (3),
- the determined transient minimum voltage (V1) is compared by the device (3) with a given limit minimum voltage which is given by the configuration data.

6. Method according to claim 5, wherein

- an initial voltage (V2) of a sustained cranking period of the cranking phase is determined by the device (3),
- an end voltage (V3) of the sustained cranking period of the cranking phase is determined by the device (3),
- the determined initial voltage (V2) and the determined end voltage (V3) are compared by the device (3) with a given limit initial voltage and a given limit end voltage which are given by the configuration data.

7. Diagnostic system (1), wherein the diagnostic system (1) comprises a device (3) and a communication device (5) being configured to execute the method according to anyone of the claims 1 - 6, wherein

8. Configuration system, wherein the configuration system comprises a device (3), a communication device (5) and a configuration server (30) comprising the configuration data for vehicle or manufacture specific communication, being configured to execute the method according to anyone of the claims 1 - 6.

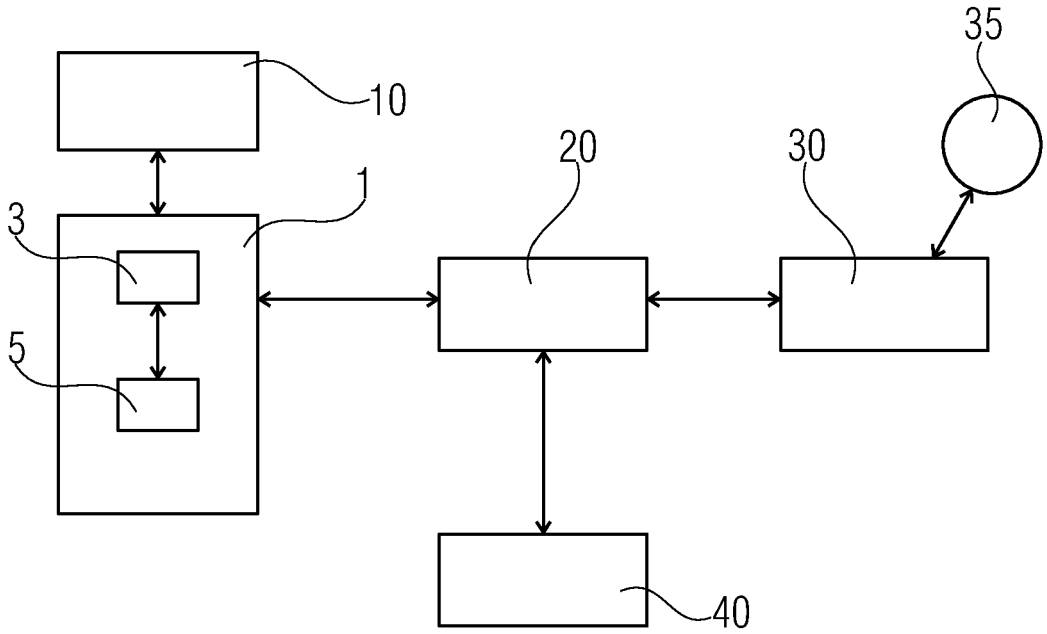


FIG 1

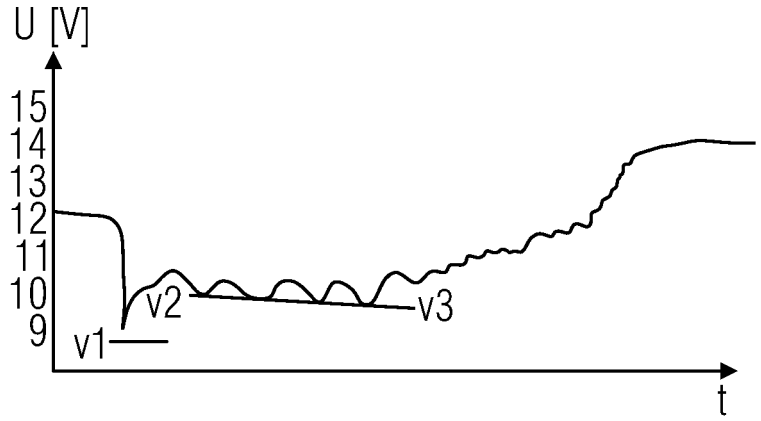


FIG 2

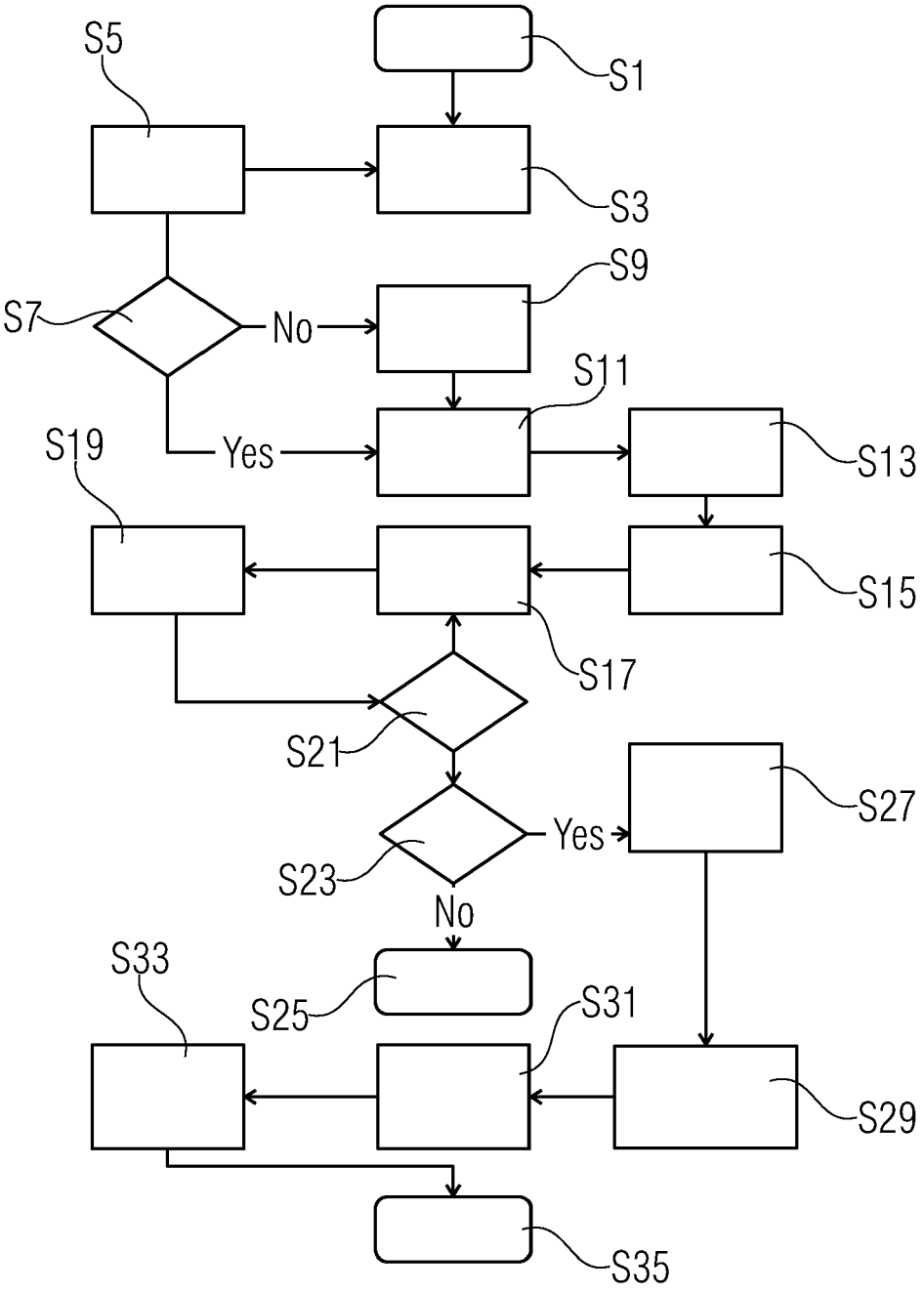

S1
S3
S5
S7
No
S9
Yes
S11
S13
S15
S17
S19
S21
S23
Yes
S27
No
S25
S29
S31
S33
S35

FIG 3

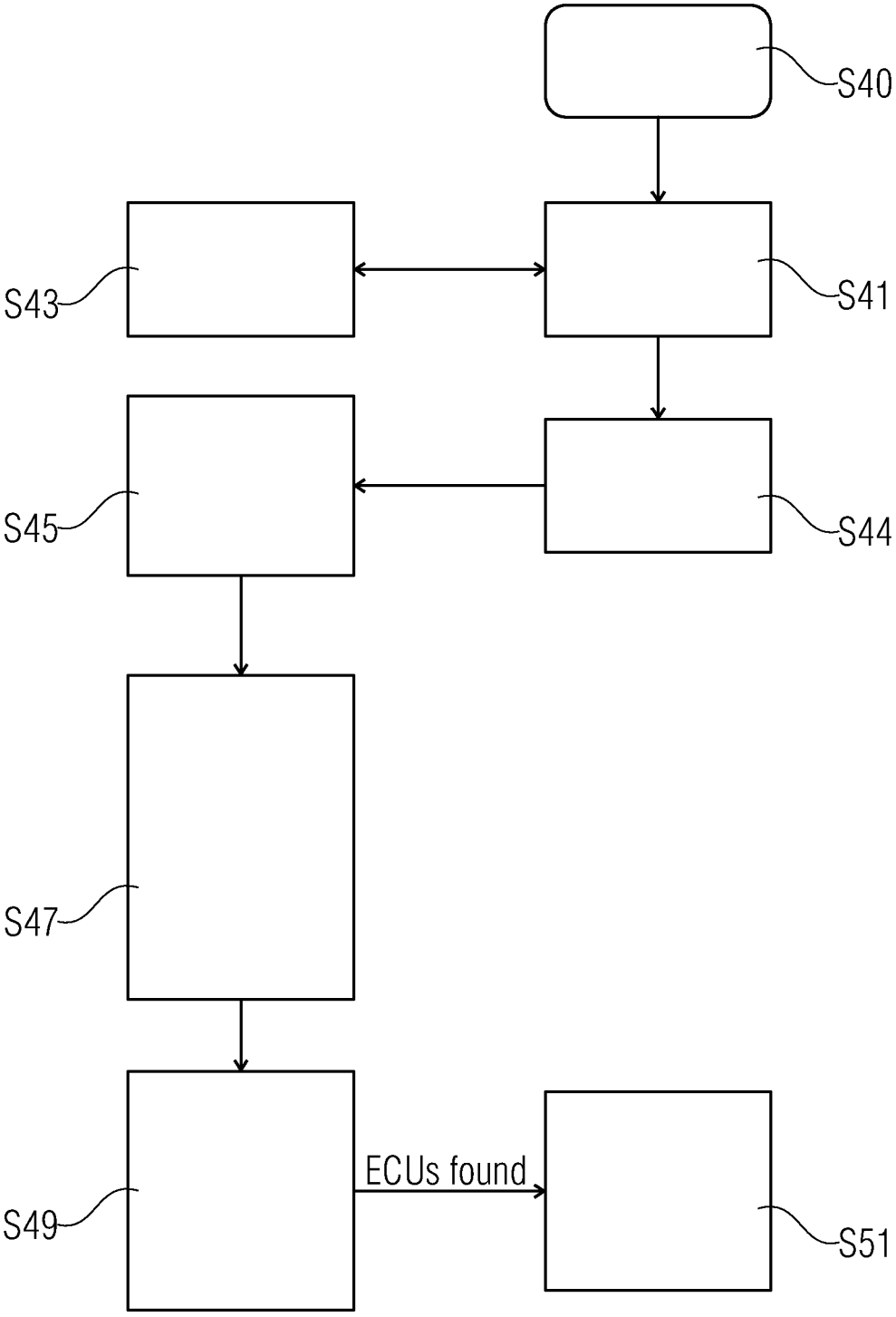


FIG 4

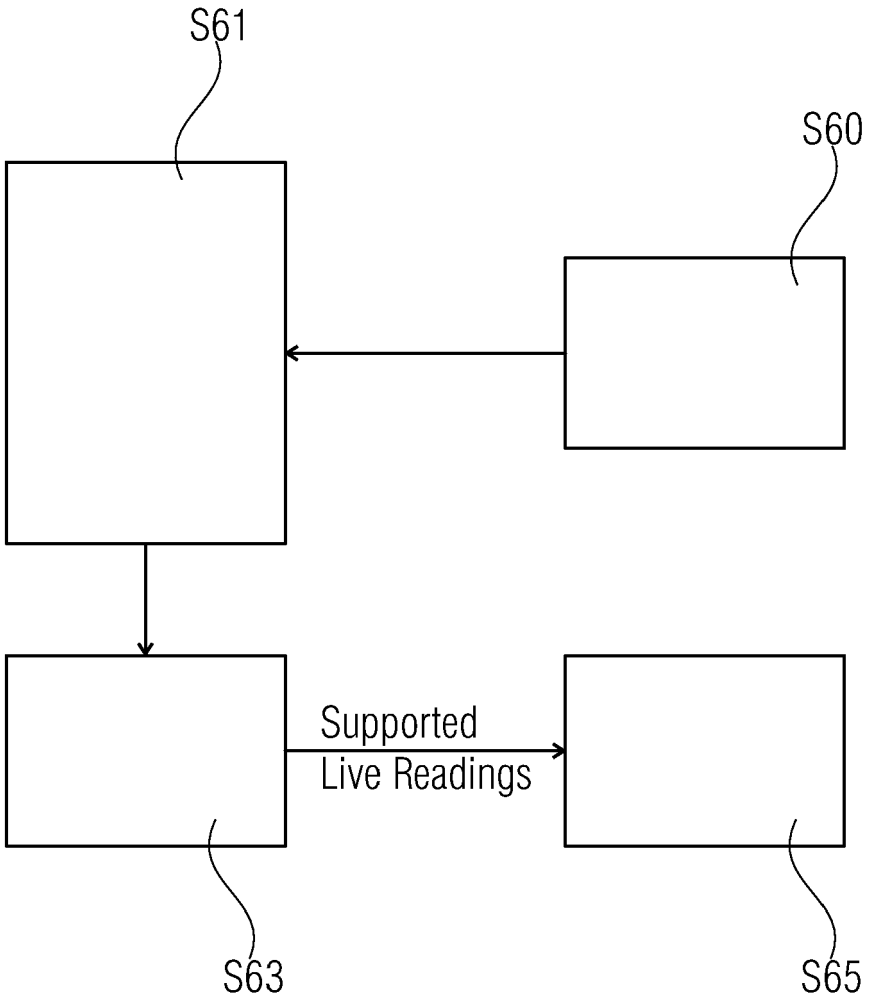


FIG 5

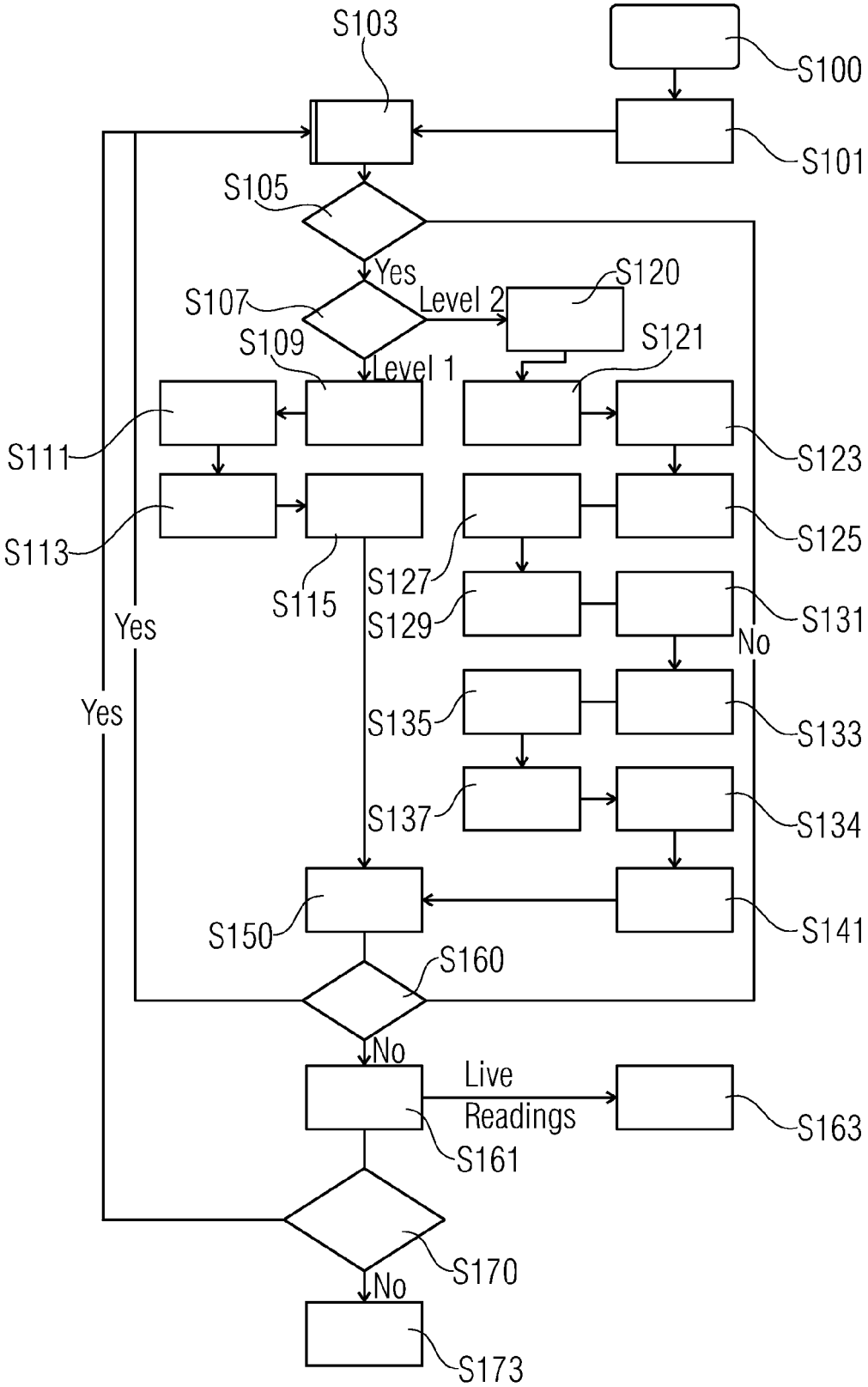

S103
S100
S101
S105
Yes
S120
S107
Level 2
S109
S121
Level 1
S111
S123
S113
S125
S115
S127
S129
S131
No
Yes
Yes
S135
S133
S137
S134
S150
S141
S160
No
Live
Readings
S163
S161
S170
No
S173

FIG 6

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EUROPEAN SEARCH REPORT

Application Number
EP 14 18 1862

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 2009/276115 A1 (CHEN IEON C [US]) 5 November 2009 (2009-11-05) * abstract * * * paragraph [0004] - paragraph [0043] * * paragraph [0047] - paragraph [0099] * * claims 1-21 * * figures 3-8 *	1-4,7,8	INV. G07C5/00 G07C5/08
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	9 February 2015	Pañeda Fernández, J

CATEGORY OF CITED DOCUMENTS

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