

A system for controlling the current supply of a motor vehicle

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FIELD OF THE INVENTION AND PRIOR ART

The present invention relates to a system according to the preamble of claim 1 and a method according to the preamble of claim 7 for controlling the current supply of a motor vehicle. The invention also related to a computer program comprising computer program code for implementing such a method, a computer program product comprising a data storage medium readable by an electronic control unit and having such a computer program stored thereon, and an electronic control unit.

A motor vehicle is provided with a current source in the form of one or several electric batteries responsible for the current supply of the vehicle. The motor vehicle is often provided with a manually manoeuvrable operating member in the form of a main switch that has to activated manually by the vehicle driver in order to provide supply of current to different vehicle components, such as for instance different control units of the vehicle, before the ignition of the vehicle can be activated. The main switch controls a disconnecter, a so-called battery disconnecter, which consists of a relay and which is manoeuvrable by means of the main switch to and fro between a switched-off position, in which the disconnecter keeps the current source of the vehicle electrically disconnected from said vehicle components, and a switched-on position, in which the disconnecter keeps the current source of the vehicle electrically connected to said vehicle components for supplying electric current to them.

In order to avoid that vital vehicle functions will get lost during driving due to an unintentional or erroneous switching off of the main switch of the vehicle, it is common to lock the battery dis-

connector in switched-on position as long as the driving engine of the vehicle is in operation. According to a conventional solution, this is accomplished by having the battery disconnector connected to an outlet of a generator driven by the driving engine, this outlet being alive as long as the generator is active so that electric current then is supplied to the battery disconnector and retains the battery disconnector in switched-on position irrespective of the position of the main switch. When the driving engine stops and the generator thereby becomes inactive, the supply of electric current from the generator to the battery disconnector ceases, whereupon the battery disconnector can be manoeuvred to switched-off position by switching off the main switch.

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OBJECT OF THE INVENTION

The object of the present invention is to achieve an alternative to the solution described above for retaining a battery disconnector in switched-on position.

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SUMMARY OF THE INVENTION

According to the invention, said object is achieved by means of a system having the features defined in claim 1 and a method having the features defined in claim 7.

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According to the invention, an electronic control unit that is adapted to activate a retention function under predetermined conditions is used, the control unit being adapted, when the retention function is activated, to retain the disconnector in switched-on position and thereby prevent the disconnector from being manoeuvred from switched-on position to switched-off position under the effect of the operating member. By making an electronic control unit take care of the desired retention of the

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disconnecter in switched-on position, very good possibilities to adapt the retention function in question to the specific security requirements of the motor vehicle in question are obtained. Furthermore, the inventive solution is implementable in an easy
5 manner by relatively simple modifications of existing vehicle systems.

The invention also relates to a computer program having the features defined in claim 12, a computer program product having
10 the features defined in claim 16 and an electronic control unit having the features defined in claim 17.

BRIEF DESCRIPTION OF THE DRAWINGS

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The invention will in the following be more closely described by means of embodiment examples, with reference to the appended drawings, where:

20 Fig 1 is an outline diagram of a system according to the present invention, and

Fig 2 is an outline diagram of an electronic control unit for implementing a method according to the invention.

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DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

A system 1 according to the invention for controlling the current supply of a motor vehicle is schematically illustrated in Fig 1. The system is intended to be used in a vehicle that is provided with a current source 2 for supplying electric current to different vehicle components, which are schematically and jointly indicated by the block 3 in Fig 1. These vehicle components comprise different control units, lighting devices, refrigerators and
30 various other components of the vehicle that are driven by
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means of electric current from the current source 2. The current source consists of one or several electric batteries, which are charged by means of one or several generators driven by the driving engine when the driving engine of the vehicle is in operation. A heavier motor vehicle, such as a bus, a lorry or a towing vehicle, is usually provided with two such generators, schematically indicated at 4a and 4b in Fig 1.

The inventive system 1 comprises a disconnecter 5, also denominated battery disconnecter, which is manoeuvrable between a switched-off position, in which the disconnecter 5 is arranged to keep the current source 2 of the vehicle electrically disconnected from said components 3, and a switched-on position, in which the disconnecter 5 is arranged to keep the current source of the vehicle electrically connected to said components 3 for supplying electric current to these components from the current source. The disconnecter 5 is preferably a relay, which in a conventional manner comprises a breaker 5a and an electromagnet 5b, where the breaker 5a under the effect of the electromagnet 5b is closed when electric current is supplied through the electromagnet and returns to open position when the current supply through the electromagnet ceases.

The system 1 further comprises a manually manoeuvrable operating member 6, by means of which the disconnecter 5 is manoeuvrable to and fro between switched-off position and switched-on position. The operating member 6 is preferably a breaker that is manoeuvrable to and fro between closed position, denominated ON position below, and open position, denominated OFF position below. In the ON position, the breaker 6 is arranged to conduct electric current from the current source 2 to the disconnecter 5, to its electromagnet 5b to be precise. When the breaker 6 is in the OFF position, electric current is not conducted to the disconnecter 5 via the breaker 6. The disconnecter 5 is manoeuvred from switched-off position to switched-on position when the breaker 6 is closed and remains in

switched-on position as long as the breaker 6 is kept closed. This breaker 6 constitutes the so-called main switch of the vehicle.

5 The system 1 further comprises an electronic control unit 7, which is adapted to activate a retention function under predetermined conditions, the control unit 7 being adapted, as long as the retention function is activated, to retain the disconnecter 5 in
10 switched-on position and thereby prevent the disconnecter from being manoeuvred from switched-on position to switched-off position under the effect of the operating member 6. In the illustrated example, the control unit 7 is adapted, when the retention function is activated, to supply electric current via one of its outlets 7a to the disconnecter 5, to its electromagnet 5b to be
15 precise, so as to thereby retain the disconnecter in switched-on position. In the illustrated example, the disconnecter 5 is retained in switched-on position as long as at least either of the control unit 7 and the operating member 6 allows electric current to be conducted to the disconnecter 5. As long
20 as the control unit 7 keeps the disconnecter 5 energized, the disconnecter will remain in switched-on position no matter whether the operating member 6 is in the ON position or the OFF position. When the vehicle is started up, the control unit 7 is energized together with the other vehicle components 3 when
25 the operating member 6 by manual influence is made to manoeuvre the disconnecter 5 from switched-off position to switched-on position. When the control unit 7 then registers that the predetermined conditions are fulfilled, it will activate the above-mentioned retention function and will thereby secure that
30 the vehicle components 3 remain energized by the current source as long as this retention function is activated. When the retention function then, under predetermined conditions, is deactivated, the current supply to the disconnecter 5 via the outlet 7a of the control unit ceases, whereupon the disconnecter 5 in
35 conventional manner can be manoeuvred from

switched-on position to switched-off position under the effect of the operating member 6.

5 In this description and the subsequent claims, deactivation of the retention function implies that the retention function activated by the control unit is interrupted, i.e. that the retention function is brought from active state to inactive state.

10 The different conditions for activation and deactivation can easily be adapted to the vehicle type and the specific requirements of the vehicle type in question by reprogramming the control unit 7. In a vehicle that is not provided with any emergency stop function, the control unit 7 is suitably adapted to activate the retention function as soon as the driving engine of the vehicle is
15 started and to maintain the retention function active as long as the driving engine is in operation. If the vehicle is provided with an emergency stop function, the retention function is to be deactivated when the emergency stop function is activated so as to not interfere with the emergency stop function.

20 That the driving engine of the vehicle is in operation can be detected and established in several different ways. A particularly advantageous way is to detect this via the generators 4a, 4b driven by the driving engine. A motor vehicle is often provided
25 with two such generators, which are active and generate electric current when the driving engine is in operation. That at least one of these generators 4a, 4b is active will consequently indicate that the driving engine is in operation. By sensing the activity of both generators, redundant information as to whether
30 the driving engine is in operation or not is obtained. The control unit 7 may be adapted to receive such information directly from the generators 4a, 4b or via a control unit 8 connected to the generators, such as the engine control unit of the vehicle.

35 In order to increase the security level of the system, the control unit 7 may also use information regarding the velocity of the

vehicle as a parameter for controlling the activation and deactivation of the retention function, the retention function being activated if the velocity of the vehicle exceeds a predetermined threshold value, for instance in the magnitude of 1 km/h, and deactivation of the retention function only being allowed if the velocity does not exceed the threshold value. The velocity of the vehicle can be measured or established in several different ways. The control unit 7 is suitably adapted to receive information regarding the velocity of the vehicle from the speedometer control unit 9 of the vehicle but could also receive such information directly from a velocity sensor 10.

According to an embodiment of the invention, the control unit 7 is adapted to activate the retention function when the following conditions, optionally in combination with one or several further conditions, are simultaneously fulfilled:

- the control unit 7 receives information indicating that the driving engine of the vehicle is in operation or receives information indicating that the velocity of the vehicle exceeds a predetermined threshold value, and
- the control unit 7 receives, in case the vehicle is provided with an emergency stop function, information indicating that the emergency stop function is not activated.

If the inventive solution is used in a vehicle provided with an emergency stop function, which is common in buses, the control unit 7 is adapted to establish whether the emergency stop function is activated or receive information about that. The control unit 7 may be adapted to receive information regarding the activation state of the emergency stop function directly from an operating member 11 that is manually manoeuvrable for activation of the emergency stop function or from a control unit 12 of the vehicle connected to such an operating member, such as a brake control unit.

The control unit 7 is suitably adapted to deactivate the retention function when the following conditions, optionally in combination with one or several further conditions, are simultaneously fulfilled:

- 5 - the control unit 7 receives information indicating that the driving engine of the vehicle is not in operation,
- the control unit 7 receives information indicating that the velocity of the vehicle does not exceed the predetermined threshold value,
- 10 - the control unit 7 receives, in case the vehicle is provided with an emergency stop function, information indicating that the emergency stop function is not activated,
- the control unit 7 receives information indicating that the parking brake of the vehicle is set, and
- 15 - the control unit 7 receives information indicating that the ignition of the vehicle has been switched off.

When the above-mentioned conditions for deactivation of the retention function are applied, the control unit 7 is consequently
20 adapted to establish whether the parking brake of the vehicle is set and whether the ignition of the vehicle has been switched off or receive information about that.

The control unit 7 may be adapted to receive information re-
25 garding the setting state of the parking brake directly from a sensor 13 arranged to sense setting and release of the parking brake or from a control unit 12 of the vehicle connected to such a sensor, such as a brake control unit. Setting and release of the parking brake is suitably sensed by means of a pressure
30 sensor 13 arranged to sense the pressure in the air conduit to the parking brake cylinder. If the sensed pressure is below a predetermined threshold value, for instance in the magnitude of 0,8 bar, this will indicate that the parking brake is set. As an alternative, the setting and release of the parking brake could be
35 sensed by means of a sensor arranged to sense the position of

the operating member by means of which the driver of the vehicle controls the parking brake.

5 The control unit 7 may be adapted to receive information regarding the state of the ignition directly from the operating member 14, such as a conventional ignition switch, by means of which the driver of the vehicle controls switching on and switching off of the ignition, or from a control unit of the vehicle connected to such an operating member 14. In this case, the
10 control unit 7 is with advantage adapted to deactivate the retention function with a certain time delay, for instance in the magnitude of 5 seconds, after the control unit 7 has received an indication that said operating member 14 has been manoeuvred for switching off the ignition. This time delay will secure that a
15 switching off of the ignition ordered by means of the operating member 14 has had time to be accomplished before a manoeuvring of the disconnecter 5 to switched-off position is allowed.

20 If the inventive system is used in a vehicle provided with an emergency stop function, the control unit 7 should be adapted to deactivate the retention function when the following conditions, optionally in combination with one or several further conditions, are simultaneously fulfilled:

- 25 - the control unit 7 receives information indicating that the velocity of the vehicle does not exceed the predetermined threshold value,
- the control unit 7 receives information indicating that the emergency stop function of the vehicle is activated, and
- 30 - the control unit 7 receives information indicating that the driving engine of the vehicle is not in operation.

The emergency stop function is hereby allowed, when activated, to achieve an automatic switching off of the current supply of the vehicle in a conventional manner.

35 Lacking information regarding the velocity of the vehicle, the operating state of the driving engine or the setting of the parking

brake, or erroneous information making it impossible to establish whether one of said deactivation conditions regarding the velocity of the vehicle, the operating state of the driving engine or the setting of the parking brake is fulfilled, is suitably treated
5 by the control unit 7 as an indication that the deactivation condition in question is fulfilled. Hereby, a blocking of the possibility to turn off the current supply is avoided in case of malfunctions of the sensors and control units connected to the control unit 7 or in case of interference in the signal transfer from these to the
10 control unit 7.

Computer program code for implementing a method according to the invention is suitably included in a computer program, which is loadable directly into the internal memory of a computer, such
15 as the internal memory of the above-mentioned control unit 7. Such a computer program is suitably provided via a computer program product comprising a data storage medium readable by an electronic control unit, which data storage medium has the computer program stored thereon. Said data storage medium is
20 for instance an optical data storage medium in the form of a CD-ROM disc, a DVD disc etc, a magnetic data storage medium in the form of a hard disk, a diskette, a cassette tape etc, or a memory of the type ROM, PROM, EPROM or EEPROM or a Flash memory.

25 The inventive computer program comprises computer program code for causing the computer, under predetermined conditions, for instance the above-indicated conditions, to activate a retention function that causes the above-mentioned disconnecter 5 of
30 a vehicle to be retained in switched-on position and thereby prevents the disconnecter from being manoeuvred from switched-on position to switched-off position under the effect of a manually manoeuvrable operating member 6.

According to an embodiment of the invention, the computer program comprises computer program code for causing the computer:

- 5 - to establish whether the driving engine of the vehicle is in operation, preferably by establishing whether a generator driven by the driving engine is active, or receive information about that,
- 10 - to establish whether the velocity of the vehicle exceeds a predetermined threshold value or receive information about that,
- 15 - in case the vehicle is provided with an emergency stop function, to establish whether the emergency stop function is activated or receive information about that, and
- 15 - to activate the retention function when the following conditions, optionally in combination with one or several further conditions, are simultaneously fulfilled:
 - 20 - the driving engine of the vehicle is in operation or the velocity of the vehicle exceeds the predetermined threshold value, and
 - 20 - the emergency stop function, in case the vehicle is provided with a such, is not activated.

Fig 2 very schematically illustrates an electronic control unit 7 comprising an execution means 21, such as a central processing unit (CPU), for executing computer software. The execution means 21 communicates with a memory 23, for instance of the type RAM, via a data bus 22. The control unit 7 also comprises a data storage medium 24, for instance in the form of a memory of the type ROM, PROM, EPROM or EEPROM or a Flash memory. The execution means 21 communicates with the data storage medium 24 via the data bus 22. A computer program comprising computer program code for implementing a method according to the invention is stored on the data storage medium 24.

The invention is intended to be used in a motor vehicle, such as for instance a bus, a towing vehicle or a lorry.

- 5 The invention is of course not in any way restricted to the embodiments described above. On the contrary, many possibilities to modifications thereof should be apparent to a person with ordinary skill in the art without departing from the basic idea of the invention as defined in the appended claims.

Claims

1. A system for controlling the current supply of a motor vehicle that is provided with a current source for supplying electric current to different vehicle components, which system comprises:
- 5
- a disconnecter (5) that is manoeuvrable between a switched-off position, in which the disconnecter (5) is arranged to keep the current source of the vehicle electrically disconnected from said components, and a

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 - switched-on position, in which the disconnecter (5) is arranged to keep the current source of the vehicle electrically connected to said components for supplying electric current to them, and

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 - a manually manoeuvrable operating member (6), by means of which the disconnecter (5) is manoeuvrable to an fro between switched-off position and switched-on position,
- characterized in that the system (1) comprises an electronic control unit (7) that is adapted to activate a retention function under predetermined conditions, the control unit (7) being adapted, when the retention function is activated, to retain the disconnecter (5) in switched-on position and thereby prevent the disconnecter (5) from being manoeuvred from switched-on position to switched-off position under the effect of the operating member (6).
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2. A system according to claim 1, characterized in that the disconnecter (5) is a relay, and that the control unit (7) is
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- adapted, when the retention function is activated, to retain the disconnecter (5) in switched-on position by supplying electric current to the disconnecter.
3. A system according to claim 2, characterized in that the
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- operating member (6) is an electric switch, the operating member (6) being manoeuvrable between a closed ON po-

5 sition, in which electric current is supplied to the disconnect-
nector (5) via the operating member so that the disconnect-
tor thereby is retained in switched-on position, and an open
OFF position, in which electric current is not supplied to the
5 disconnecter (5) via the operating member.

10 4. A system according to any of claims 1-3, characterized in
that the control unit (7) is adapted to activate the retention
function when the following conditions, optionally in combi-
nation with one or several further conditions, are simultane-
ously fulfilled:

- 15 - the control unit (7) receives information indicating that
the driving engine of the vehicle is in operation or re-
ceives information indicating that the velocity of the ve-
hicle exceeds a predetermined threshold value, and
- the control unit (7) receives, in case the vehicle is pro-
vided with an emergency stop function, information indi-
cating that the emergency stop function is not activated.

20 5. A system according to claim 4, characterized in that the
control unit (7) is adapted to deactivate the retention func-
tion, and thereby allow the disconnecter (5) to be manoeu-
vred from switched-on position to switched-off position un-
der the effect of the operating member (6), when the fol-
25 lowing conditions, optionally in combination with one or sev-
eral further conditions, are simultaneously fulfilled:

- the control unit (7) receives information indicating that
the driving engine of the vehicle is not in operation,
- the control unit (7) receives information indicating that
30 the velocity of the vehicle does not exceed the prede-
termined threshold value,
- the control unit (7) receives, in case the vehicle is pro-
vided with an emergency stop function, information indi-
cating that the emergency stop function is not activated,
- 35 - the control unit (7) receives information indicating that
the parking brake of the vehicle is set, and

- the control unit (7) receives information indicating that the ignition of the vehicle has been switched off.
- 5 6. A system according to claim 4 or 5 for controlling the current supply of a motor vehicle that is provided with an emergency stop function, characterized in that the control unit (7) is adapted to deactivate the retention function, and thereby allow the disconnecter (5) to be manoeuvred from
- 10 switched-on position to switched-off position under the effect of the operating member (6), when the following conditions, optionally in combination with one or several further conditions, are simultaneously fulfilled:
- the control unit (7) receives information indicating that the velocity of the vehicle does not exceed the pre-
 - 15 determined threshold value,
 - the control unit (7) receives information indicating that the emergency stop function of the vehicle is activated, and
 - the control unit (7) receives information indicating that
 - 20 the driving engine of the vehicle is not in operation.
7. A method for controlling the current supply of a motor vehicle that is provided with:
- a current source (2) for supplying electric current to
 - 25 different vehicle components,
 - a disconnecter (5) that is manoeuvrable between a switched-off position, in which the disconnecter (5) keeps the current source of the vehicle electrically disconnected from said components, and a switched-on position, in which the disconnecter (5) keeps the current
 - 30 source of the vehicle electrically connected to said components for supplying electric current to them, and
 - a manually manoeuvrable operating member (6), by means of which the disconnecter (5) is manoeuvrable to
 - 35 and fro between switched-off position and switched-on position,

- 5 characterized in that a retention function under predetermined conditions is activated by an electronic control unit (7) connected to the disconnecter (5) so that the disconnecter (5) under the effect of the control unit is retained in switched-on position and thereby prevented from being manoeuvred from switched-on position to switched-off position under the effect of the operating member (6).
- 10 8. A method according to claim 7, characterized in that the control unit (7), when the retention function is activated, retains the disconnecter (5) in switched-on position by supplying an electric current to the disconnecter.
- 15 9. A method according to claim 7 or 8, characterized in that the retention function is activated when the following conditions, optionally in combination with one or several further conditions, are simultaneously fulfilled:
- 20 - it is established that the driving engine of the vehicle is in operation or it is established that the velocity of the vehicle exceeds a predetermined threshold value, and
- it is established, in case the vehicle is provided with an emergency stop function, that the emergency stop function is not activated.
- 25 10. A method according to claim 9, characterized in that the retention function is deactivated, so that the disconnecter (5) thereby is allowed to be manoeuvred from switched-on position to switched-off position under the effect of the operating member (6), when the following conditions, optionally in combination with one or several further conditions, are simultaneously fulfilled:
- 30 - it is established that the driving engine of the vehicle is not in operation,
- 35 - it is established that the velocity of the vehicle does not exceed the predetermined threshold value,

- it is established, in case the vehicle is provided with an emergency stop function, that the emergency stop function is not activated,
 - it is established that the parking brake of the vehicle is set, and
 - it is established that the ignition of the vehicle has been switched off.
11. A method according to claim 9 or 10 for controlling the current supply of a motor vehicle that is provided with an emergency stop function, characterized in that the retention function is deactivated, so that the disconnecter (5) thereby is allowed to be manoeuvred from switched-on position to switched-off position under the effect of the operating member (6), when the following conditions, optionally in combination with one or several further conditions, are simultaneously fulfilled:
- it is established that the velocity of the vehicle does not exceed the predetermined threshold value,
 - it is established that the emergency stop function is activated, and
 - it is established that the driving engine of the vehicle is not in operation.
12. A computer program loadable directly into the internal memory of a computer, characterized in that the computer program comprises computer program code for causing the computer to activate, under predetermined conditions, a retention function that causes a disconnecter of a motor vehicle, which disconnecter is manoeuvrable between a switched-on position, in which the disconnecter keeps the current source of the vehicle electrically connected to different vehicle components for supplying electric current to them, and a switched-off position, in which the disconnecter keeps the current source of the vehicle electrically disconnected from said components, to be retained in switched-on

position and thereby prevents the disconnecter from being manoeuvred from switched-on position to switched-off position under the effect of a manually manoeuvrable operating member.

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13. A computer program according to claim 12, characterized in that the computer program comprises computer program code for causing the computer:

- 10 - to establish whether the driving engine of the vehicle is in operation or receive information about that,
- to establish whether the velocity of the vehicle exceeds a predetermined threshold value or receive information about that,
- 15 - in case the vehicle is provided with an emergency stop function, to establish whether the emergency stop function is activated or receive information about that, and
- to activate the retention function when the following conditions, optionally in combination with one or several further conditions, are simultaneously fulfilled:
- 20 - the driving engine of the vehicle is in operation or the velocity of the vehicle exceeds the predetermined threshold value, and
- the emergency stop function, in case the vehicle is provided with a such, is not activated.

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14. A computer program according to claim 13, characterized in that the computer program comprises computer program code for causing the computer:

- 30 - to establish whether the parking brake of the vehicle is set or receive information about that,
- to establish whether the ignition of the vehicle has been switched off or receive information about that, and
- to deactivate the retention function, so that the disconnecter thereby is allowed to be manoeuvred from
- 35 switched-on position to switched-off position under the effect of the operating member, when the following con-

ditions, optionally in combination with one or several further conditions, are simultaneously fulfilled:

- the driving engine of the vehicle is not in operation,
- the velocity of the vehicle does not exceed the predetermined threshold value,
- the emergency stop function of the vehicle, in case the vehicle is provided with a such, is not activated,
- the parking brake of the vehicle is set, and
- the ignition of the vehicle has been switched off.

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15. A computer program according to claim 13 or 14, characterized in that the computer program comprises computer program code for causing the computer to deactivate the retention function, so that the disconnecter thereby is allowed to be manoeuvred from switched-on position to switched-off position under the effect of the operating member, when the following conditions, optionally in combination with one or several further conditions, are simultaneously fulfilled:

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- the velocity of the vehicle does not exceed the predetermined threshold value,
- the emergency stop function of the vehicle is activated, and
- the driving engine of the vehicle is not in operation.

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16. A computer program product comprising a data storage medium readable by an electronic control unit (7), a computer program according to any of claims 12-15 being stored on said data storage medium.

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17. An electronic control unit (7) comprising an execution means (21), a memory (23) connected to the execution means and a data storage medium (24) connected to the execution means, a computer program according to any of claims 12-15 being stored on said data storage medium (24).

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