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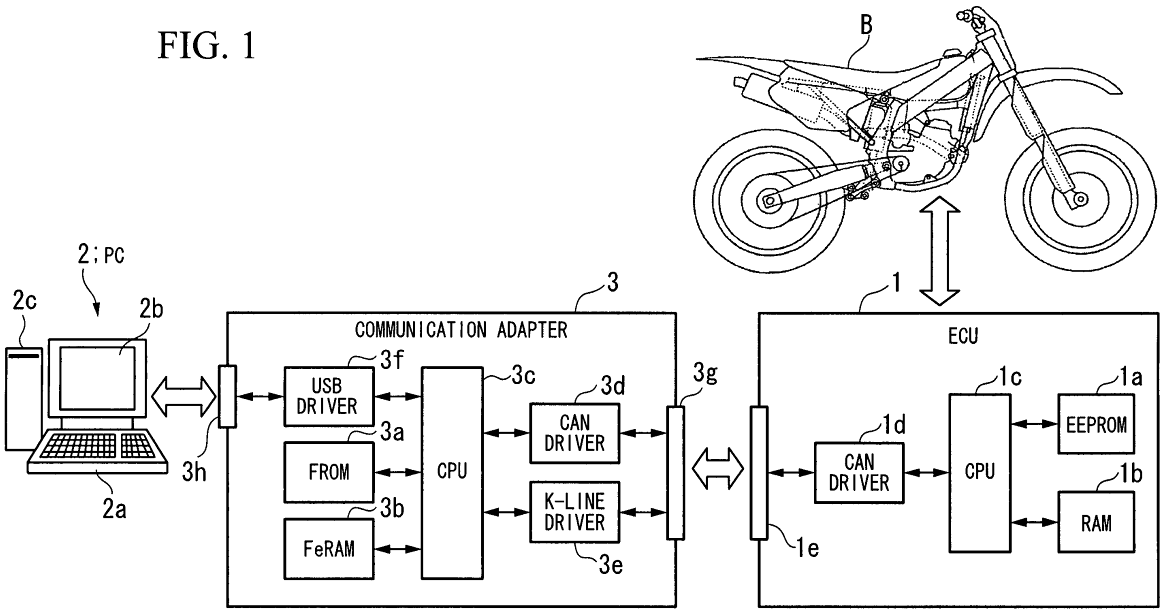
(54) Engine setting system and engine setting method

(57) An engine setting system includes: an engine control device (1) and a terminal device (2), the engine control device (1) including: a first storage medium (1a) that stores a basic control map and a correction control map, the correction control map correcting the basic control map; a second storage medium (1b) that temporarily stores data; and a control section (1c) that performs an engine control based on the basic control map and the correction control map which are stored in the first storage medium (1a) during normal driving, the terminal device (2) being connected to and capable of communicating with the engine control device (1) and defining the correction control map based on input information, the control section (1c) writing the correction control map as a provisional correction control map in the second storage medium (1b) at the time of engine setting, the correction control map being transmitted from the terminal device (2), the control section (1c) performing the engine control based on the basic control map stored in the first storage medium (1a) and the provisional correction control map stored in the second storage medium (1b), and the control section (1c) rewriting the provisional correction control map as a new correction control map in the first storage medium (1a) when the control section (1c) receives from the terminal device (2), an instruction to apply the provisional correction control map.

FIG. 1



Description

BACKGROUND OF THE INVENTION

Field of the invention

[0001] The present invention relates to an engine setting system and an engine setting method used for setting an engine of a saddle-riding-type vehicle.

Description of Related Art

[0002] In recent years, an electronic control unit (hereinafter, referred to as an "ECU") is generally employed in a variety of saddle-riding-type vehicles. In the ECU, a control map for driving an engine in a preferred condition is stored. Here, the control map indicates a data group representing a correspondence relationship between quantity of state representing an engine drive condition (engine speed, load to the engine, and the like), and a target level for controlling the engine (target level relative to controlled variables such as fuel injection amount, engine ignition timing, and the like).

[0003] Namely, the ECU obtains a control target level in accordance with a current drive condition of the engine from the control map, controls a fuel injection amount or engine ignition timing based on the obtained control target level, and thereby drives the engine in a preferred condition.

[0004] However, there is a case where it is required that the control target level that has been preliminarily set in the above-described control map is modified in accordance with a condition in which a vehicle runs. In a race, when setting of various control target levels (hereinafter, referred to as a "setting") is modified, for example, in accordance with road surface conditions of the course (an amount of gradient of the road surface, dry / wet condition, a number of corners, size of corner, or the like), weather, or the like, it is possible to drive the engine in a further-preferred condition.

[0005] For example, in Japanese Unexamined Patent Application, First Publication No. 2008-19843, an engine setting system is disclosed in which a preferred engine setting in accordance with a racecourse is easily performed by using a terminal device that is connected to and capable of communicating with a server device via Internet. Specifically, a recommended control map that is suitable for each racecourse is downloaded from the server device, the recommended control map is transferred from the terminal device to an ECU, a control map that is preliminarily stored in the ECU is rewritten to the recommended control map, and a preferred engine setting in accordance with the racecourse is thereby performed.

[0006] As described above, when performing the engine setting, since it is necessary to rewrite the control map that is preliminarily stored in the ECU, the control map is generally stored in a storage medium that can be rewritten, such as an EEPROM (Electrically Erasable and Programmable Read Only Memory). However, since the number of times for writing data in the EEPROM is limited, it is impossible to write the control map and also other data in the EEPROM, in the case where the number of times for writing data in the EEPROM has exceeded the limitation thereof, which is caused by rewriting the control map every engine setting. Consequently, there is a concern that the ECU itself cannot be used.

[0007] In advance of memory technology in recent years, the maximum number of times for writing data in the EEPROM has increased approximately 1000 times.

[0008] However, for example, at the time of engine setting before starting a race, in order to determine the control map that is suitable for the racecourse, there is a case where adjustment of the control map (rewriting the control map) and running tests are repeated approximately several tens of times. Therefore, the maximum number of times for writing data in the EEPROM is reached in a short amount time.

[0009] In addition, in the above-described conventional technique, it is possible to download a recommended control map suitable for each racecourse from the server device. However, the recommended control map that is obtained via download is not always suitable for each user.

[0010] That is, for example, a novice racer is different from a professional racer in terms of how they drive a vehicle (operation, handling). In addition, users' driving techniques are different from each other in terms of how they approach a race. For example, one user's technique may be to drive the vehicle so as to accelerate from a corner of the racecourse, while another user's technique may be to drive to a corner of the racecourse without breaking or breaking very little. Therefore, it is difficult to obtain a control map suitable for each user. Furthermore, in the above-described conventional technique, in order to obtain a recommended control map, it is necessary to download the control map via a communication line such as the Internet.

[0011] In a racecourse in which a communications infrastructure has not been built, there is a problem in that it is impossible to perform the engine setting in an actual case in the racecourse.

SUMMARY OF THE INVENTION

[0012] The present invention was conceived in view of the above-described circumstances and it is a first object thereof to provide an engine setting system and an engine setting method where it is possible to reduce the number of times necessary for writing control maps at the time of engine setting and prolong the product life of a storage medium storing a control map. In addition, it is a second object of the present invention to provide an engine setting system and an engine setting method where it is possible to easily perform a setting suitable for each user at the time of engine setting.

[0013] In order to achieve the above-described first object, an engine setting system of a first aspect of the present invention includes an engine control device and a terminal device. The engine control device includes: a first storage medium that stores a basic control map and a correction control map, the correction control map correcting the basic control map; a second storage medium that temporarily stores data; and a control section that performs an engine control based on the basic control map and the correction control map which are stored in the first storage medium during normal driving. The terminal device is connected to and capable of communicating with the engine control device, and defines the correction control map based on input information. In the engine setting system of the first aspect of the present invention, the control section writes the correction control map as a provisional correction control map in the second storage medium at the time of engine setting, the correction control map being transmitted from the terminal device, the control section performing the engine control based on the basic control map stored in the first storage medium and the provisional correction control map stored in the second storage medium, and the control section rewriting the provisional correction control map as a new correction control map in the first storage medium when the control section receives, from the terminal device, an instruction to apply the provisional correction control map.

[0014] It is preferable that, in the engine setting system of the first aspect of the present invention, the control section write the correction control map stored in the first storage medium in the second storage medium after an activation at the time of engine setting, and perform the engine control based on the basic control map stored in the first storage medium and the correction control map written in the second storage medium until the provisional correction control map is transmitted from the terminal device.

[0015] It is preferable that the engine setting system of the first aspect of the present invention further include: a relay device that relays data communication between the engine control device and the terminal device. The relay device includes: a third storage medium that temporarily stores data and a relay control section that causes the correction control map transmitted from the terminal device to be stored in the third storage medium and transmits the correction control map to the engine control device.

[0016] It is preferable that, in the engine setting system of the first aspect of the present invention, the relay device be a communication adapter mountable to the engine control device.

[0017] It is preferable that, in the engine setting system of the first aspect of the present invention, the third storage medium be a rewritable nonvolatile storage medium.

[0018] It is preferable that, in the engine setting system of the first aspect of the present invention, the second storage medium be a rewritable volatile storage medium.

[0019] In order to achieve the above-described first object, an engine setting method of a second aspect of the present invention includes: preparing an engine control device and a terminal device, the engine control device including: a first storage medium that stores a basic control map and a correction control map, the correction control map correcting the basic control map; a second storage medium that temporarily stores data; and a control section that performs an engine control based on the basic control map and the correction control map which are stored in the first storage medium during normal driving, the terminal device being connected to and capable of communicating with the engine control device, and defining the correction control map based on input information; writing the correction control map as a provisional correction control map in the second storage medium at the time of engine setting, the correction control map being defined by the terminal device; performing the engine control based on the basic control map stored in the first storage medium and the provisional correction control map stored in the second storage medium; and rewriting the provisional correction control map as a new correction control map in the first storage medium when an instruction to apply the provisional correction control map is received from the terminal device.

[0020] In order to achieve the above-described second object, an engine setting system of a third aspect of the present invention includes an engine control device and a terminal device. The engine control device engine control device performs engine control based on a control map. The terminal device is connected to and capable of communicating with the engine control device, and defines the control map. The terminal device includes: a historical data storage section that stores a historical control map that is previously defined in previous cases and historical data including running environment data input when the historical control map is defined, the historical control map corresponding to the historical data; and a control map redefinition section that searches the historical data corresponding to a search condition input at the time of engine setting, obtains the historical control map corresponding to the searched historical data, and redefines the obtained historical control map as the control map used for the engine control device.

[0021] It is preferable that, in the engine setting system of the third aspect of the present invention, the historical data include engine condition data representing a engine drive condition in addition to the running environment data, the engine condition data be collected by the engine control device when the historical control map is defined and be transmitted to the terminal device.

[0022] It is preferable that, in the engine setting system of the third aspect of the present invention, the historical data include impression data in addition to the running environment data, and the impression data including a comment document that is input when the historical control map is defined.

[0023] It is preferable that the engine setting system of the third aspect of the present invention further include: a relay device that relays data communication between the engine control device and the terminal device.

[0024] It is preferable that, in the engine setting system of the third aspect of the present invention, the relay device be a communication adapter mountable to the engine control device.

[0025] In order to achieve the above-described second object, an engine setting method of a fourth aspect of the present invention includes: preparing an engine control device that performs engine control based on a control map and a terminal device that is connected to and capable of communicating with the engine control device, and defines the control map; storing a historical control map that is previously defined in previous cases and historical data including running environment data input when the historical control map is defined, the historical control map corresponding to the historical data; searching the historical data corresponding to a search condition input at the time of engine setting; obtaining the historical control map corresponding to the searched historical data; and redefining the obtained historical control map as the control map used for the engine control device.

[0026] In the first and the second aspects of the present invention, the correction control map that is defined by the terminal device is written as the provisional correction control map in the second storage medium of the engine control device.

[0027] Furthermore, the engine control is performed based on the basic control map stored in the first storage medium and the provisional correction control map stored in the second storage medium.

[0028] In addition, when an instruction to apply the provisional correction control map is received from the terminal device, the provisional correction control map stored in the second storage medium is rewritten as a new correction control map in the first storage medium. In the engine setting, while defining various correction control maps, an optimal map which is used as the correction control map during normal driving is searched from the various maps due to actual running tests, simulation, or the like.

[0029] In the present invention, the first storage medium in which the correction control map is stored is not rewritten every actual running test, simulation, or the like, the provisional correction control map is stored in the second storage medium that temporarily stores data, and the engine control is performed.

[0030] As a result, it is possible to considerably reduce the number of times for writing data in the first storage medium. That is, since the correction control map that is reviewed by reiteration of the actual running tests, the simulation, or the like is applied as a new correction control map, unnecessary rewriting of the first storage medium is not performed. Therefore, it is possible to prolong the product life of the first storage medium.

[0031] In the third and the fourth aspects of the present invention, historical control maps that have been previously defined in previous cases and historical data including running environment data that represents previous run environments are preliminarily stored. The historical control map corresponds to the historical data.

[0032] At the time of subsequent engine setting, a search condition is specified and the historical data is searched. Historical data that coincides with or is similar to the specified run environment is then obtained. Therefore, it is possible to obtain a control map that is very suitable for a user and is selected from a plurality of control maps that are used (defined) previously. Namely, it is possible to easily perform a setting suitable for each user at the time of engine setting.

BRIEF DESCRIPTION OF THE DRAWINGS

[0033]

FIG. 1 is a schematic view showing a structure of an engine setting system relating to a first embodiment of the present invention.

FIG. 2 is a sequence chart indicating an operation of the engine setting system of the first embodiment of the present invention, at the time of activation.

FIG. 3 is a view showing an example of a screen displayed on a personal computer of the first embodiment of the present invention when a correction control map is defined.

FIG. 4 is a sequence chart indicating an operation of the engine setting system of the first embodiment of the present invention when setting the correction control map.

FIG. 5 is a sequence chart indicating an operation of the engine setting system of the first embodiment of the present invention when driving test.

FIG. 6 is a sequence chart indicating an operation of the engine setting system of the first embodiment of the present invention when the correction control map is applied.

FIG. 7 is a sequence chart indicating an operation of the engine setting system of the first embodiment of the present invention when the correction control map is discarded.

FIG. 8 is a schematic view showing a structure of an engine setting system relating to a second embodiment of the present invention.

FIG. 9 is a block diagram showing a personal computer of the second embodiment of the present invention.

FIG. 10 is a view showing an example of a screen displayed on the personal computer of the second embodiment of the present invention when historical data is input.

FIG. 11 is a view showing an example of a screen displayed on the personal computer of the second embodiment of the present invention when a search condition is input.

FIGS. 12A to 12C are flowcharts representing an operation of the engine setting system of the second embodiment of the present invention (search process for searching the historical data by the personal computer).

FIG. 13 is a view showing an example of a screen displayed on the personal computer of the second embodiment of the present invention, on which compendium of a search result of the historical data is displayed.

DETAILED DESCRIPTION OF THE INVENTION

[0034] Hereinafter, embodiments of the present invention will be described with reference to the drawings.

First Embodiment

[0035] FIG. 1 is a schematic view showing a structure of an engine setting system relating to a first embodiment of the present invention.

[0036] As shown in FIG. 1, the engine setting system relating to the first embodiment of the present invention is constituted of an ECU (engine control device) 1 that performs an engine control of a saddle-riding-type vehicle B; a personal computer 2 that defines a correction control map based on input information (terminal device : hereinafter, referred to PC 2); and a communication adapter 3 that is mountable to ECU 1 and serves as a relay device relaying data communication between the ECU 1 and the PC 2.

[0037] The foregoing engine setting system is a system for performing a preferred engine setting, for example, in accordance with a racecourse, that is, for correcting the control map stored in the ECU 1. Hereinafter, a control map used during normal driving, more specifically, a basic control map that is used for calculating a target controlled variable of the engine is called a "basic control map". In addition, a provisional control map that is in trial use at the time of engine setting is called a "provisional correction control map".

[0038] In FIG. 1, for convenience, the ECU 1 and the saddle-riding-type vehicle B are indicated so as to be separated from each other, but the ECU 1 is installed inside the saddle-riding-type vehicle B as a practical matter. In addition, the ECU 1 and the communication adapter 3 are also indicated so as to be separated from each other, but communication adapter 3 is attached to the ECU 1 and connected to PC 2 with a USB cable interposed therebetween as a practical matter.

[0039] Namely, the ECU 1 is connected to and capable of communicating with the PC 2 with the communication adapter 3 interposed therebetween.

[0040] As shown in FIG. 1, the ECU 1 includes an EEPROM 1a, a RAM (Random Access Memory) 1b, a CPU (Central Processing Unit) 1c, a CAN (Controller Area Network) driver 1d, and a communication connector 1e.

[0041] The EEPROM 1a (first storage medium) is a rewritable nonvolatile storage medium that stores the basic control map used during normal driving of the saddle-riding-type vehicle B, the correction control map that corrects the basic control map, the other data that is necessary for the engine control, a program to be executed in the CPU 1c, or the like. The RAM 1b (second storage medium) is a rewritable volatile storage medium used for temporal data storage.

[0042] The CPU 1c (control section) performs the engine control of the saddle-riding-type vehicle B based on the basic control map stored in the EEPROM 1a and the correction control map that corrects basic control map during normal driving. Specifically, as the engine control of the vehicle B, a fuel injection amount, an engine ignition timing, an air intake quantity, an air-fuel ratio, or the like are controlled.

[0043] In addition, the CPU 1c includes the functions described below in detail as the discriminative function of the first embodiment. Specifically, the CPU 1c provisionally writes the correction control map transmitted from the PC 2 via the communication adapter 3 in the RAM 1b at the time of engine setting, and performs the engine control based on the basic control map and the provisional correction control map. Furthermore, when the CPU 1c receives, from the PC 2, an instruction to apply the provisional correction control map, the CPU 1c rewrites the provisional correction control map as a new correction control map in the EEPROM 1a.

[0044] In addition, a DIP switch may be provided, for example, at a predetermined position of the ECU 1, and the CPU 1c may be set up depending on the DIP switch being set to "ON" or "OFF", corresponding to the condition of normal driving or to the condition of the engine setting.

[0045] In addition, the CPU 1c writes the correction control map stored in the EEPROM 1a in the RAM 1b after an activation at the time of engine setting, and performs the engine control based on the basic control map stored in the EEPROM 1a and the correction control map written in the RAM 1b until the provisional correction control map is transmitted from the PC 2 (because the RAM 1b is a volatile storage medium and a provisional correction control map does not exist in the RAM 1b shortly after activation of the ECU 1).

[0046] In addition, when the CPU 1c receives an instruction to discard the provisional correction control map from the PC 2, the CPU 1c clears the provisional correction control map stored in the RAM 1b and writes the correction control map stored in the EEPROM 1a in the RAM 1b. The CPU 1c corrects the basic control map using the correction control map written in the RAM 1b and performs the engine control until a new correction control map is transmitted from the PC 2.

[0047] Furthermore, at the time of engine setting, the CPU 1c stores actual values (e.g., torque, engine speed, throttle valve opening angle, temperature of cooling water, intake pressure, intake temperature, or the like) representing the drive condition of the saddle-riding-type vehicle B in the RAM 1b, and the drive condition is obtained by the engine control. When the CPU 1c receives a transferring request of the actual values from the PC 2, the CPU 1c transmits the above-described actual values stored in the RAM 1b to the PC 2 via the communication adapter 3. The actual values that represent the above-described engine drive condition can be obtained from output of various sensors disposed in the saddle-riding-type vehicle B.

[0048] Namely, the output from the various sensors is input to the ECU 1, converted into digital data using an A/D converter (not shown), thereafter transmitted to the CPU 1c.

[0049] The CAN driver 1d converts data (e.g., above-described actual values) transmitted from the CPU 1c into a data format based on a CAN communication protocol, and transmits the converted data to the communication adapter 3. The CAN driver 1d converts data (data format based on a CAN communication protocol) received from the communication adapter 3 into data that can be processed by the CPU 1c, and outputs the converted data to the CPU 1c. The communication connector 1e is a connector used for attachment to the communication adapter 3, and is electrically and mechanically connected to a communication connector 3 g of the communication adapter 3 when the communication connector 1e is attached to the communication adapter 3.

[0050] The PC 2 is a personal computer that defines a correction control map based on input information, and is constituted of a keyboard 2a, a liquid crystal display 2b, and a main body 2c. The keyboard 2a is used as one of an input section, and outputs the input information input by an operator to the main body 2c. The liquid crystal display 2b is used as one of a display section, and displays a predetermined image by controlling the main body 2c.

[0051] The main body 2c includes a CPU controlling whole operation of the PC 2 or a hard disk in which a program, an application software, or the like to be executed by the CPU are stored. In addition, the main body 2c is connected to the communication adapter 3 with a USB cable interposed therebetween. Namely, the main body 2c (PC 2) can perform a data communication based on a USB protocol between the main body 2c and the communication adapter 3.

[0052] In addition, the main body 2c (CPU built-in the main body 2c) has a function for defining the correction control map based on the input information transmitted from the keyboard 2a and transmitting the correction control map to the ECU 1 via the communication adapter 3 when a screen for setting the correction control map is displayed on the liquid crystal display 2b.

[0053] In addition, the main body 2c has a function for determining whether an instruction to apply the correction control map or an instruction to discard the correction control map are input by the operator, based on the input information transmitted from the keyboard 2a, while displaying the screen for setting the correction control map.

[0054] When the instruction to apply the correction control map is input, the main body 2c transmits the instruction to apply the correction control map to the ECU 1 via the communication adapter 3. When the instruction to discard the correction control map is input, the main body 2c transmits the instruction to discard the correction control map to the ECU 1 via the communication adapter 3.

[0055] Furthermore, the main body 2c has a function for transmitting a transferring request of the actual values to the ECU 1 via the communication adapter 3 in accordance with the transferring request, and for displaying the actual values transmitted from the ECU 1 on the liquid crystal display 2b.

[0056] The communication adapter 3 includes a FROM (flash ROM) 3a, a FeRAM (Ferroelectric RAM) 3b, a CPU 3c, a CAN driver 3d, a K-Line driver 3e, a USB driver 3f, a communication connector 3g, and a USB connector 3h. FROM 3a is a rewritable nonvolatile storage medium that stores a program to be executed in the CPU 3c or other data that is necessary to control the communication adapter 3. The FeRAM 3b (third storage medium) is a nonvolatile storage medium used for temporal data storage.

[0057] The CPU 3c (relay control section) controls whole operation of communication adapter 3 (namely, data relay operation), and stores the correction control map received from the PC 2 via the USB driver 3f in the FeRAM 3b. The CPU 3c transmits the correction control map to the ECU 1 via the CAN driver 3d. In addition, the CPU 3c stores the data (actual values or the like) received from the ECU 1 via the CAN driver 3d in the FeRAM 3b. The CPU 3c transmits the actual values to the PC 2 via the USB driver 3f. Furthermore, the CPU 3c transmits, to the ECU 1 via the CAN driver 3d, the instruction to apply the correction control map or the instruction to discard the correction control map which is received from the PC 2 via the USB driver 3f.

[0058] The CAN driver 3d converts the data (the correction control map, the instruction to apply the correction control map, the instruction to discard the correction control map, or the like) transmitted from the CPU 3c into a data format based on a CAN communication protocol, and transmits the converted data to the ECU 1. The CAN driver 3d converts the data (data format based on the CAN communication protocol) received from the ECU 1 into data that can be processed by the CPU 3c, and outputs the converted data to the CPU 3c. The K-Line driver 3e converts the data (the correction control map, the instruction to apply the correction control map, the instruction to discard the correction control map, or the like) transmitted from the CPU 3c into a data format based on a K-Line communication protocol, and transmits the converted data to the ECU 1. The K-Line driver 3e converts the data (data format based on the K-Line communication protocol) received from the ECU 1 into data that can be processed by the CPU 3c, and outputs the converted data to the CPU 3c. The CAN driver 3d and the K-Line driver 3e are drivers that are selectively used in accordance with a communication protocol of the ECU 1. In the first embodiment, since the communication protocol of the ECU 1 is CAN, the CAN driver 3d is thereby used.

[0059] The USB driver 3f converts the data (above-described actual values or the like) transmitted from the CPU 3c into a data format based on a USB communication protocol, and transmits the converted data to the PC 2. The USB driver 3f converts the data (data format based on a USB communication protocol) received from the PC 2 into data that can be processed by the CPU 3c, and outputs the converted data to the CPU 3c. The communication connector 3g is a connector used for attaching the communication adapter 3 to the ECU 1, and is electrically and mechanically connected to the communication connector 1e of the ECU 1 when the communication connector 3 g is attached to the communication adapter 3. The USB connector 3h is a connector used for connecting the communication adapter 3 to the PC 2 with a USB cable interposed therebetween.

[0060] Subsequently, operation of the engine setting system relating to the first embodiment of the present invention constituted as described above will be described.

(Operation at the time of activation)

[0061] FIG. 2 indicates a sequence chart of an operation of the engine setting system at the time of activation.

[0062] As shown in FIG. 2, a start-up operation (e.g., power source is turned on) is performed such that an operator operates the PC 2 (step S1), the PC 2 is activated, and an initializing process is performed in the main body 2c (CPU built-in the main body 2c) (step S2).

[0063] When the initializing process is completed, a start-up request is transmitted to the communication adapter 3 by the main body 2c (step S3).

[0064] When the start-up request is received, the communication adapter 3 is activated, and an initializing process is performed by the CPU 3c (step S4).

[0065] In contrast, the operator operates the PC 2 so that a start-up operation of the engine setting application (input operation using the keyboard 2a or the like) is performed (step S5), the main body 2c performs an engine setting application start-up process (step S6), a definition screen is displayed on the liquid crystal display 2b under the application program when a correction control map is defined (step S7).

[0066] At this time, the main body 2c causes initial values of the correction control map (values of the correction control map eventually applied at the time of previous engine setting) to be displayed on the screen (step S7).

[0067] FIG. 3 shows an example of the definition screen displayed on the liquid crystal display 2b when the correction control map is defined.

[0068] As shown in FIG. 3, a setting data operation tab key 21, applying operation tab key 22, discarding operation tab key 23, or the like are displayed on the definition screen when the correction control map is defined. The setting data operation tab key 21 is used for transmitting an edit region 10 of the correction control map and the correction control map edited on the edit region 10 to the ECU 1, and writes them in the RAM 1b. The applying operation tab key 22 is used for applying the correction control map written in the RAM 1b as a basic control map. The discarding operation tab key 23 is used for discarding (clearing) the correction control map written in the RAM 1b.

[0069] In addition, FIG. 3 illustrates a correction control map used for controlling engine ignition timing relative to the engine speed by an example.

[0070] Returning to FIG. 2 and continuing explanation, when a start-up operation (e.g., power source is turned on) is performed so as to activate the saddle-riding-type vehicle B by the operator (step S8), the ECU 1 receives supply of power source from a battery built-in the saddle-riding-type vehicle B, and starts up (step S9). An initializing process for initializing the EEPROM 1a, the RAM 1b, or the like is performed by the CPU 1c (step S10). Consequently, the CPU 1c reads out the correction control map from the EEPROM 1a (step S11), and writes the read correction control map in the RAM 1b (step S 12). As described above, the reason that the correction control map of the EEPROM 1a is written in the RAM 1b at the time of activation of the ECU 1 is that the RAM 1b is a volatile storage medium and the correction control map does not exist in the RAM 1b shortly after activation.

[0071] After that, the ECU 1 (CPU 1c) corrects the basic control map using the correction control map written in the RAM 1b, performs the engine control of the saddle-riding-type vehicle B (step S13), obtains the actual values representing the drive condition from the saddle-riding-type vehicle B (step S 14), and stores the obtained actual values in the RAM 1b (step S15). The actual values are cumulatively stored in the RAM 1b of the ECU 1 by reiteration of the above-described steps S 13 to S 15.

[0072] Consequently, the main body 2c of the PC 2 transmits a transferring request of the actual values to the communication adapter 3 (step S16). The CPU 3c of the communication adapter 3 transmits a transferring request of the actual values, which is received from the PC 2, to the ECU 1 (step S17). When the CPU 1c of the ECU 1 receives the transferring request of the actual values, the CPU 1c reads out the actual values stored in the RAM 1b, and transmits the actual values to the communication adapter 3 (step S18). The CPU 3c of the communication adapter 3 stores the actual values received from the ECU 1 in the FeRAM 3b (step S19), and transmits the actual values to the PC 2 (step S20).

[0073] The actual values that are cumulatively stored in the RAM 1b of the ECU 1 are transferred to the PC 2 by reiteration of the above-described steps S16 to S20. Consequently, the main body 2c of the PC 2 displays the actual values transferred as described above on the liquid crystal display 2b (step S21). The operator checks the actual values displayed on the liquid crystal display

2b, grasps the drive condition of the saddle-riding-type vehicle B which is caused by the engine control using the current correction control map (the correction control map stored in the EEPROM 1a), and can use the actual values as reference for preparing a correction control map.

(Operation of the time of setting the correction control map)

[0074] FIG. 4 indicates a sequence chart of an operation of setting the correction control map.

[0075] As shown in FIG. 4, when the operator operates the keyboard 2a or the like of the PC 2 so as to input a numerical value to the edit region 10 of the definition screen indicated in the FIG. 3 (step S30), the main body 2c of the PC 2 prepares a correction control map based on the input numerical values and displays on the liquid crystal display 2b (step S31).

[0076] Consequently, when the operator oprates the keyboard 2a or the like of the PC 2 so as to select the setting data operation tab key 21 on the definition screen (step S32), the main body 2c of the PC 2 transmits the prepared correction control map to the communication adapter 3 as described above (step S33). The CPU 3c of the communication adapter 3 stores the correction control map received from the PC 2 in the FeRAM 3b (step S34), and transmits the correction control map to the ECU 1 (step S35).

[0077] The CPU 1c of the ECU 1 writes the correction control map received from the communication adapter 3 as a provisional correction control map in the RAM 1b (step S36). After that, the CPU 1c of the ECU 1 corrects the basic control map using the provisional correction control map written in the RAM 1b, and performs the engine control of the saddle-riding-type vehicle B (step S37), obtains the actual values representing the drive condition from the addle-riding-type vehicle B (step S38), and stores the obtained actual values in the RAM 1b (step S39). The actual values that are obtained by the engine control using the provisional correction control map are cumulatively stored by reiteration of the above-described steps S37 to S39.

[0078] Consequently, the main body 2c of the PC 2 transmits a transferring request of the actual values to the communication adapter 3 (step S40), and the CPU 3c of the communication adapter 3 transmits the transferring request of the actual values which is received from the PC 2 to the ECU 1 (step S41). When the CPU 1c of the ECU 1 receives the transferring request of the actual values, the CPU 1c of the ECU 1 reads out the actual values stored in the RAM 1b, and transmits the actual values to the communication adapter 3 (step S42). The CPU 3c of the communication adapter 3 stores the actual values received from the ECU 1 in the FeRAM 3b (step S43), and transmits the actual values to the PC 2 (step S44).

[0079] The actual values that are cumulatively stored in the RAM 1b of the ECU 1 are transferred to the PC 2 by reiteration of the above-described steps S40 to S44. Consequently, the main body 2c of the PC 2 displays the actual values transferred as described above on the liquid crystal display 2b (step S45). The operator checks the actual values displayed on the liquid crystal display 2b, determines the drive condition of the saddle-riding-type vehicle B which is caused by the engine control using the current correction control map (provisional correction control map), and can use the actual values as reference for preparing a subsequent correction control map.

(Operation at the time of driving test)

[0080] FIG. 5 indicates a sequence chart of an operation of the engine setting system at the time of driving test.

[0081] As shown in FIG. 5, at the time of driving test of the saddle-riding-type vehicle B (actual running test, simulation test, or the like), the CPU 1c of the ECU 1 performs the engine control of the saddle-riding-type vehicle B based on the provisional correction control map written in the RAM 1b (step S50), obtains the actual values representing the drive condition from the saddle-riding-type vehicle B (step S51), and stores the obtained actual values in the RAM 1b (step S52). The actual values that are obtained by the engine control using the provisional correction control map are cumulatively stored by reiteration of the above-described steps S50 to S52.

[0082] Consequently, the main body 2c of the PC 2 transmits a transferring request of the actual values to the communication adapter 3 (step S53), the CPU 3c of the communication adapter 3 transmits the transferring request of the actual values which is received from the PC 2 to the ECU 1 (step S54). When the CPU 1c of the ECU 1 receives the transferring request of the actual values, the CPU 1c of the ECU 1 reads out the actual values stored in the RAM 1b, and transmits the actual values to the communication adapter 3 (step S55). The CPU 3c of the communication adapter 3 stores the actual values received from the ECU 1 in the FeRAM 3b (step S56), and transmits the actual values to the PC 2 (step S57).

[0083] The actual values that are cumulatively stored in the RAM 1b of the ECU 1 are transferred to the PC 2 by reiteration of the above-described steps S53 to S57. Consequently, the main body 2c of the PC 2 displays the actual values transferred as described above on the liquid crystal display 2b (step S58). The operator checks the actual values displayed on the liquid crystal display 2b, determines the drive condition of the saddle-riding-type vehicle B which is caused by the engine control using the current correction control map (provisional correction control map), and can use the actual values as reference for preparing a subsequent correction control map.

(Operation at the time of applying correction control map)

[0084] FIG. 6 indicates a sequence chart of an operation of the engine setting system at the time of applying a correction control map.

[0085] As shown in FIG. 6, when the operator operates the keyboard 2a or the like of the PC 2 so as to select the applying operation tab key 22 on the definition screen for defining the correction control map (step S60), the main body 2c of the PC 2 transmits to, the communication adapter 3, an instruction to apply the correction control map (step S61), the CPU 3c of the communication adapter 3 transmits, to the ECU 1, the instruction to apply the correction control map, the instruction being received from the PC 2 (step S62).

[0086] When the CPU 1c of the ECU 1 receives the instruction to apply the provisional correction control map, the CPU 1c of the ECU 1 reads out the provisional correction control map stored in the RAM 1b (step S63), and rewrites the provisional correction control map as a new correction control map in the EEPROM 1a (step S64). That is, when the operator determines that the provisional correction control map that is currently used is the optimal correction control map for the racecourse based on the actual values displayed on the liquid crystal display 2b, the operator selects applying operation tab key 22 on the definition screen for defining the correction control map as described above. As a result, the rewriting of the EEPROM 1a of the ECU 1 is performed, the optimal correction control map stored in the EEPROM 1a is used in a real race after the engine setting is completed.

[0087] In a case where the engine setting is not completed after performing the rewriting the correction control map of the EEPROM 1a, the same operation as the steps S50 to S58 is performed as described in the FIG. 5.

(Operation at the time of discarding correction control map)

[0088] FIG. 7 indicates a sequence chart of an operation at the time of discarding correction control map.

[0089] As shown in FIG. 7, when the operator operates the keyboard 2a or the like of the PC 2 so as to select the discarding operation tab key 23 on the definition screen for defining the correction control map (step S70), the main body 2c of the PC 2 transmits, to the communication adapter 3, an instruction to discard the correction control map (step S71), the CPU 3c of the communication adapter 3 transmits, to the ECU 1, the instruction to discard the the correction control map received from the PC 2 (step S72).

[0090] When the CPU 1c of the ECU 1 receives the instruction to discard the the correction control map, the CPU 1c of the ECU 1 clears the provisional correction control map stored in the RAM 1b (step S73). Consequently, the CPU 1c reads out the correction control map from the EEPROM 1a (step S74), and writes the read correction control map in the RAM 1b (step S75). After that, the same operation as the steps S13 to S21 described in FIG. 3 is performed.

[0091] As described above, according to the engine setting system relating to the first embodiment of the present invention, the EEPROM 1a is not rewritten every running test or simulation using a newly prepared correction control map, the correction control map is provisionally written in the RAM 1b, and the engine control is performed. As a result, it is possible to considerably reduce the number of times for writing data in the EEPROM 1a. Namely, the provisional correction control map is reviewed by reiteration of the actual running tests, the simulation, or the like, and this provisional correction control map is applied as a correction control map. Therefore, unnecessary rewriting of the EEPROM 1a is not performed, and it is possible to prolong the product life of the EEPROM 1a.

[0092] In addition, in a conventional system, the PC 2 defining the correction control map and the communication adapter 3 recording the correction control map have combined. Comparing such a conventional system and the first embodiment, it is possible to separate the PC 2 from the communication adapter 3 and obtain a downsized system in the first embodiment. In addition, it is possible to perform actual running tests in a state where the PC 2 is separated from the vehicle B and the communication adapter 3 is attached to the ECU 1. In this case, actual values are stored in the FeRAM 3b of the communication adapter 3, and the PC 2 is connected with the communication adapter 3. Therefore, it is possible to display the actual values without problems after actual running tests

[0093] In addition, even if the engine stops and the power source of the saddle-riding-type vehicle B turns off (case of clearing the provisional correction control map of the RAM 1b), since the provisional correction control map is stored in the FeRAM 3b of the communication adapter 3, it is possible to rewrite the provisional correction control map in the RAM 1b of the ECU 1 when the engine is start-up again.

[0094] In the above-described first embodiment, as a relay device relaying a data communication between the ECU 1 and the PC 2, the structure in which the communication adapter 3 directly attached to the ECU 1 (mountable communication adapter) is used is described. However, it is not necessary to use the mountable communication adapter 3, a relay device that is capable of connecting the ECU 1 using a communication cable or the like may be used. In addition, a structure in which the ECU 1 is directly connected with the PC 2 may be used without providing a relay device. In addition, a structure in which a communication adapter 3 having a radio communication function is used may be employed, and a data communication may be performed between the communication adapter 3 and the PC 2 by the radio communication.

Second Embodiment

[0095] FIG. 8 is a schematic view showing a structure of an engine setting system relating to a second embodiment of the present invention.

[0096] As shown in FIG. 8, the engine setting system relating to the second embodiment of the present invention is constituted of an ECU (engine control device) 11 that performs an engine control of a saddle-riding-type vehicle B; a personal computer 12 that defines a control map (terminal device : hereinafter, referred to PC 12); and a communication adapter 13 that is mountable to ECU 11 and serves as a relay device relaying data communication between the ECU 11 and the PC 12.

[0097] The foregoing engine setting system is a system for performing a preferred engine setting, for example, in accordance with a racecourse, that is, for setting the control map stored in the ECU 11.

[0098] In FIG. 8, for convenience, the ECU 11 and the saddle-riding-type vehicle B are indicated so as to be separated from each other, but the ECU 11 is installed inside the saddle-riding-type vehicle B as a practical matter. In addition, the ECU 11 and the communication adapter 13 are also indicated so as to be separated from each other, but communication adapter 13 is attached to the ECU 11 and connected to PC 12 with a USB cable interposed therebetween as a practical matter. Namely, the ECU 11 is connected to and capable of communicating with the PC 12 with the communication adapter 13 interposed therebetween.

[0099] As shown in FIG. 8, the ECU 11 includes an EEPROM 11a, a RAM (Random Access Memory) 11b, a CPU (Central Processing Unit) 11c, a CAN (Controller Area Network) driver 11d, and a communication connector 11e. The EEPROM 11 a is a rewritable nonvolatile storage medium that stores the control map used during normal driving of the saddle-riding-type vehicle B, the other data that is necessary for the engine control, a program to be executed in the CPU 11c, or the like. The RAM 116 is a rewritable volatile storage medium used for temporal data storage.

[0100] The CPU 11c performs the engine control of the saddle-riding-type vehicle B based on the control map stored in the EEPROM 11a during normal driving. Specifically, as the engine control of the vehicle B, a fuel injection amount, an engine ignition timing, an air intake quantity, an air-fuel ratio, or the like are controlled. In addition, the CPU 11c has a function for rewriting the control map of the EEPROM 11a based on the control map that is defined by the PC 12 and transmitted from the PC 12 via the communication adapter 13, at the time of engine setting.

[0101] Furthermore, at the time of engine setting, the CPU 11c stores engine condition data (e.g., torque, engine speed, throttle valve opening angle, temperature of cooling water, intake pressure, intake temperature, or the like) representing the engine drive condition of the saddle-riding-type vehicle B in the RAM 11b. When the CPU 11c receives a data transferring request from the PC 12, the CPU 11c transmits the above-described engine condition data stored in the RAM 11b to the PC 12 via the communication adapter 13. The above-described engine condition data can be obtained from output of various sensors disposed in the saddle-riding-type vehicle B.

[0102] Namely, the output from the various sensors is input to the ECU 11, converted into digital data using an A/D converter (not shown), thereafter transmitted to the CPU 11c.

[0103] The CAN driver 11d converts data (e.g., above-described engine condition data or the like) transmitted from the CPU 11c into a data format based on a CAN communication protocol, and transmits the converted data to the communication adapter 13. The CAN driver 11d converts data (data format based on a CAN communication protocol) received from the communication adapter 13 into data that can be processed by the CPU 11c, and outputs the converted data to the CPU 11c. The communication connector 11e is a connector used for attachment to the communication adapter 13, and is electrically and mechanically connected to a communication connector 13g of the communication adapter 13 when the communication connector 11e is attached to the communication adapter 13.

[0104] The PC 12 is a personal computer that defines a control map based on input information, and is constituted of an input device 12a, a display device 12b, a storage device 12c, and a control device 12d as shown in FIG. 9. The input device 12a is, for example, a keyboard, a mouse, or the like, and outputs input information that is input by operation of user to the control device 12d. The display device 12b is, for example, a liquid crystal display, and displays a predetermined image by controlling the control device 12d.

[0105] The storage device (historical data storage section) 12c is, for example, a hard disk, and stores a program, an application software, or the like to be executed by the control device 12d. The storage device 12c stores a control map (historical control map) that has been defined in previous cases and historical data that has been input via the input device 12a at the time of defining the control map, and causes the control map to correspond to the historical data. Here, the historical data includes running environment data representing a run environment when a previous control map has been defined in previous cases, and impression data. The impression data includes a comment document in which impression or the like has been obtained by the user at the previous cases. The run environment includes, for example, road surface condition, weather, air temperature, degree of humidity, atmosphere pressure, water temperature, or the like.

[0106] FIG. 10 shows an example of the screen displayed on the display device 12b when historical data is input.

[0107] Namely, in the second embodiment, at the time of engine setting, an optimal control map is defined every racecourse, the control map of the EEPROM 11a in the ECU 11 is rewritten, an input screen indicated in FIG. 10 is used when historical data is input, a user inputs the running environment data (road surface condition, weather, air temperature, degree of humidity, atmosphere pressure, water temperature) and the impression data (comment document) at that time, the control map and the historical data are stored in the storage device 12c so that the control map corresponds to the historical data.

[0108] The control device (control map redefinition section) 12d is, for example, a CPU, executes a program or an application software stored in the storage device 12c, and thereby controls whole operation of PC 12. The control device 12d is connected to the communication adapter 13 with a USB cable interposed therebetween, and can perform a data communication between the control device 12d and the communication adapter 13 based on a USB protocol.

[0109] The control device 12d has a function for defining the control map based on input information transmitted from the input device 12a, and transmits the control map to the ECU 11 via the communication adapter 13. As described below, the control device 12d has a function for searching the historical data corresponding to the search condition that is input at the time of engine setting, reading out the control map corresponding to the historical data that is obtained by the searching, from the storage device 12c, and redefining the read control map as the control map to be used in the ECU 11.

[0110] Returning to FIG. 8, explanation is continued.

[0111] The communication adapter 13 includes a FROM (flash ROM) 13a, a FeRAM (Ferroelectric RAM) 13b, a CPU 13c, a CAN driver 13d, a K-Line driver 13e, a USB driver 13f, a communication connector 13g, and a USB connector 13h. FROM 13a is a rewritable nonvolatile storage medium that stores a program to be executed in the CPU 13c or other data that is necessary to control the communication adapter 13. The FeRAM 13b is a nonvolatile storage medium used for temporal data storage.

[0112] The CPU 13c controls whole operation of communication adapter 13 (namely, data relay operation), and stores data (control map or the like) received from the PC 12 via the USB driver 13f in the FeRAM 13b. The CPU 13c transmits the data to the ECU 11 via the CAN driver 13d. In addition, the CPU 13c stores the data (engine condition data or the like) received from the ECU 11 via the CAN driver 13d in the FeRAM 13b. The CPU 13c transmits the data to the PC 12 via the USB driver 13f.

[0113] The CAN driver 13d converts the data transmitted from the CPU 13c into a data format based on a CAN communication protocol, and transmits the converted data to the ECU 11. The CAN driver 13d converts the data (data format based on the CAN communication protocol) received from the ECU 11 into data that can be processed by the CPU 13c, and outputs the converted data to the CPU 13c. The K-Line driver 13e converts the data transmitted from the CPU 13c into a data format based on a K-Line communication protocol, and transmits the converted data to the ECU 11. The K-Line driver 13e converts the data (data format based on the K-Line communication protocol) received from the ECU 11 into data that can be processed by the CPU 13c, and outputs the converted data to the CPU 13c. The CAN driver 13d and the K-Line driver 13e are drivers that are selectively used in accordance with a communication protocol of the ECU 11. In the second embodiment, since the communication protocol of the ECU 11 is CAN, the CAN driver 13d is thereby used.

[0114] The USB driver 13f converts the data transmitted from the CPU 13c into a data format based on a USB communication protocol, and transmits the converted data to the PC 12. The USB driver 13f converts the data (data format based on a USB communication protocol) received from the PC 12 into data that can be processed by the CPU 13c, and outputs the converted data to the CPU 13c. The communication connector 13g is a connector used for attaching the communication adapter 13 to the ECU 11, and is electrically and mechanically connected to the communication connector 1e of the ECU 11 when the communication connector 13g is attached to the communication adapter 13. The USB connector 13h is a connector used for connecting the communication adapter 13 to the PC 12 with a USB cable interposed therebetween.

[0115] Subsequently, operation of the engine setting system relating to the second embodiment of the present invention constituted as described above will be described.

[0116] FIG. 11 shows an example of an input screen displayed on the display device 12b at the time of engine setting when a search condition for searching historical data is input.

[0117] As shown in FIG. 11, input boxes are provided on the input screen for inputting the search conditions in order to input a "folder name", "start date", "completion date", "road surface condition", "weather", "air temperature", "degree of humidity", "atmosphere pressure", "water temperature", or "comment" as search conditions.

[0118] In these input boxes, the "road surface condition", the "weather", the "air temperature", the "degree of humidity", the "atmosphere pressure", and the "water temperature" are search conditions corresponding to running environment data, and "comment" is a search condition corresponding to impression data.

[0119] The input box "folder name" is a box to specify a folder in which historical data is stored in the storage device 12c. The input box "start date" input box is a box to specify a date of starting a search condition. The "completion date" input box is a box to specify a date of completing a search condition. The "road surface condition" input box is a box to specify a search keyword for searching a road surface condition (road surface condition search keyword). The "weather" input box is a box to specify a search keyword for searching a weather condition (weather condition search keyword). The "air temperature" input box is a box to specify a search range for searching a temperature condition (temperature condition search range). The "degree of humidity" input box is a box to specify a search range for searching a degree of humidity condition (humidity condition search range). The "atmosphere pressure" input box is a box to specify a search range for searching an atmosphere pressure (atmosphere pressure condition search range). The "water temperature" input box is a box to specify a search range for searching a water temperature condition (water temperature condition search range). The "comment" input box is a box to specify a search keyword for searching a comment condition (comment condition search keyword).

[0120] A check box is provided to each search condition, that is, each of "start date", "completion date", "road surface condition", "weather", "air temperature", "degree of humidity", "atmosphere pressure", "water temperature", and "comment". Historical data is searched from the search conditions whose check box is "ON". FIG. 11 illustrate by an example of case in which all of check boxes are "ON".

[0121] A user operates the input device 12a at the time of engine setting, and inputs search condition that corresponds to a run environment or an impression relating to the current racecourse, to the above-described input screen for inputting the search conditions. When search conditions are input to the input screen for inputting the search conditions and a start key for searching is operated, the control device 12d searches the historical data corresponding to the search condition from the historical data stored in the storage device 12c.

[0122] Hereinafter, a search process for searching historical data using the foregoing control device 12d will be described with reference to FIGS. 12A to 12C.

[0123] FIGS. 12A to 12C show flowcharts representing the search process for searching the historical data. In FIGS. 12A to 12C, the circled numbers "1", "2", and "3" correspond to each other.

[0124] Firstly, the control device 12d performs a read-in of logging data (step S101), and determines whether or not logging data exists (step S102). In step S102, "Yes", namely, in the case where the logging data does not exist, the control device 12d completes the search process for searching the historical data.

[0125] In contrast, in the above-described step S102, "No", namely, in the case where the logging data exists, the control device 12d reads out one of the historical data stored in the storage device 12c and in the folder whose name has been input in the input box "folder name", and initializes a registry flag to be "OFF" (step S103).

[0126] Hereinafter, the historical data that has been read out is referred to search targeted historical data.

[0127] Consequently, the control device 12d determinates whether or not the check box of the search condition "start date" is "ON" (step S 104). In the case of "Yes", the control device 12d determines whether or not the date of the search targeted historical data is late to or identical to the date that has been input to the input box "start date" (step S105). In step S105, in the case of "Yes", the control device 12d sets the registry flag to be "ON" (step S 106). In the above-described step S 104, in the case of "No", moving to a process of step S 107, and the process of step S 107 is performed. In addition, in the above-described step S 105, in the case of "No", returning to the process of step S101, and the process of step S101 is performed.

[0128] Subsequently, the control device 12d determinates whether or not the check box of the search condition "completion date" is "ON" (step S 107). In the case of "Yes", the control device 12d determines whether or not the date of the search targeted historical data is previous to or identical to the date that has been input to the input box "completion date" (step S108). In step S108, in the case of "Yes", the control device 12d sets the registry flag to be "ON" (step S 109). In the above-described step S 107, in the case of "No", moving to a process of step S 110, and the process of step S110 is performed. In addition, in the above-described step S 108, in the case of "No", returning to step S101, and the process of step S101 is performed.

[0129] Subsequently, the control device 12d determines whether or not the check box of the search condition "road surface condition" is "ON" (step S 110). In the case of "Yes", the control device 12d determines whether or not the road surface condition search keyword that is input to the input box "road surface condition" is included in the search targeted historical data (step S111). In step S111, in the case of "Yes", the control device 12d sets the registry flag to be "ON" (step S 112). In the above-described step S 110, in the case of "No", moving to a process of step S 113, and the process of step S113 is performed. In addition, in the above-described step S111, in the case of "No", returning to step S101, and the process of step S101 is performed.

[0130] Subsequently, the control device 12d determines whether or not the check box of the search condition "weather" is "ON" (step S113). In the case of "Yes", the control device 12d determines whether or not the weather condition search keyword that is input to the input box "weather" is included in the search targeted historical data (step S 114). In step S114, in the case of "Yes", the control device 12d sets the registry flag to be "ON" (step S 115). In the above-described step S113, in the case of "No", moving to a process of step S 116, and the process of step S 116 is performed. In addition, in the above-described step S 114, in the case of "No", returning to step S101, and the process of step S101 is performed.

[0131] Subsequently, the control device 12d determines whether or not the check box of the search condition "air temperature" is "ON" (step S 116). In the case of "Yes", the control device 12d determines whether or not air temperature data included in the search targeted historical data is greater than or equal to the lower limit of the temperature condition search range that is input to the input box "air temperature" (step S 117). In step S 117, in the case of "Yes", the control device 12d determines whether or not the air temperature data included in the search targeted historical data is less than or equal to the upper limit of the temperature condition search range that is input to the input box "air temperature" (step S118). In step S118, in the case of "Yes", the control device 12d sets the registry flag to be "ON" (step S 119). In the above-described step S 116, in the case of "No", moving to a process of step S120, and the process of step S 120 is performed. In addition, in the above-described steps S 117 and S 118, in the case of "No", returning to step S101, and the process of step S101 is performed.

[0132] Subsequently, the control device 12d determines whether or not the check box of the search condition "degree of humidity" is "ON" (step S 120). In the case of "Yes", the control device 12d determines whether or not degree of humidity data included in the search targeted historical data is greater than or equal to the lower limit of the humidity condition search range that is input to the input box "degree of humidity" (step S121). In step S121, in the case of "Yes", the control device 12d determines whether or not the degree of humidity data included in the search targeted historical data is less than or equal to the upper limit of the humidity condition search range that is input to the input box "degree of humidity" (step S 122). In step S 122, in the case of "Yes", the control device 12d sets the registry flag to be "ON" (step S123). In the above-described step S120, in the case of "No", moving to a process of step S124, and the process of step S 124 is performed. In addition, in the above-described steps S121 and S122, in the case of "No", returning to step S 101, the process of step S101 is performed.

[0133] Subsequently, the control device 12d determines whether or not the check box of the search condition "atmosphere pressure" is "ON" (step S124). In the case of "Yes", the control device 12d determines whether or not atmosphere pressure data included in the search targeted historical data is greater than or equal to the lower limit of the atmosphere pressure condition search range that is input to the input box "atmosphere pressure" (step S125). In step S125, in the case of "Yes", the control device 12d determines whether or not the atmosphere pressure data included in the search targeted historical data is less than or equal to the upper limit of the atmosphere pressure condition search range that is input to the input box "atmosphere pressure" (step S126). In step S126, in the case of "Yes", the control device 12d sets the registry flag to be "ON" (step S127). In the above-described step S124, in the case of "No", moving to a process of step S 128, and the process of step S 128 is performed. In addition, in the above-described steps S125 and S126, in the case of "No", returning to step S101, the process of step S101 is performed.

[0134] Subsequently, the control device 12d determines whether or not the check box of the search condition "water temperature" is "ON" (step S128). In the case of "Yes", the control device 12d determines whether or not water temperature data included in the search targeted historical data is greater than or equal to the lower limit of the water temperature condition search range that is input to the input box "water temperature" (step S 129). In step S 129, in the case of "Yes", the control device 12d determines whether or not the water temperature data included in the search targeted historical data is less than or equal to the upper limit of the water temperature condition search range that is input to the input box "water temperature" (step S130). In step S130, in the case of "Yes", the control device 12d sets the registry flag to be "ON" (step S 131). In the above-described step S128, in the case of "No", moving to a process of step S132, and the process of step S132 is performed. In addition, in the above-described steps S129 and S 130, in the case of "No", returning to step S 101, the process of step S101 is performed.

[0135] Subsequently, the control device 12d determines whether or not the check box of the search condition "comment" is "ON" (step S132). In the case of "Yes", the control device 12d determines whether or not the comment condition search keyword that is input to the input box "comment" is included in a comment field of the search targeted historical data (step S133). In step S133, in the case of "Yes", the control device 12d sets the registry flag to be "ON" (step S 134). In the above-described step S 132, in the case of "No", moving to a process of step S135, and the process of step S135 is performed. In addition, in the above-described step S133, in the case of "No", returning to step S101, the process of step S101 is performed.

[0136] Consequently, the control device 12d eventually determines whether or not the registry flag of the search targeted historical data is "ON" (step S135). In the case of "No", returning to step S101, the process of step S101 is performed. In the case of "Yes", the control device 12d registers the search targeted historical data as the historical data corresponding to the search condition, adds and displays them on a search result compendium screen as indicated in FIG. 13.

[0137] By reiteration of the processes of steps S101 to S135 described above for all of the historical data stored in the folders that have been input to the input box "folder name", all of the historical data corresponding to the search conditions are obtained.

[0138] The control device 12d reads out the control map corresponding to the historical data that corresponds to the search condition obtained by the above-described search process, from the storage device 12c, and redefines the read control map as the control map used in the ECU 11. At this time, in a case where a transmission instruction to transmit the control map is input to the control device 12d when the user operates the input device 12a, the control device 12d transmits the redefined control map to the ECU 11 via the communication adapter 13. Consequently, the CPU 11c of the ECU 11 rewrites the control map of the EEPROM 11a, based on the control map that is transmitted via the communication adapter 13.

[0139] As described above, according to the engine setting system relating to the second embodiment, the control maps (historical control maps) that have been previously obtained when actual running in racecourses in previous cases is performed, and the historical data are preliminarily stored while the control maps corresponding to the historical data. The historical data includes running environment data that represents previous run environments in the previous cases, and impression data including a comment document in which impressions are described when the user has obtained the impressions in the previous cases. At the time of subsequent engine setting, a search condition is specified and the historical data is searched. Historical data that coincides with or is similar to the specified run environment is then obtained. Therefore, it is possible to obtain a control map that is very suitable for a user and is selected from a plurality of control maps that are used previously.

[0140] Namely, it is possible to easily perform a setting suitable for each user at the time of engine setting.

[0141] In the above-described second embodiment, the case where the running environment data and the impression data are used as the historical data is described as an example, but a search condition may be particularly searched in addition to the engine condition data that is obtained by the ECU 11. In addition, it is not necessary to include the running environment data and the impression data in the historical data, the running environment data may be only included in the historical data, and the running environment data may be included in combination with the engine condition data in the historical data.

[0142] In the above-described second embodiment, as a relay device relaying a data communication between the ECU 11 and the PC 12, the structure in which the communication adapter 13 directly attached to the ECU 11 (mountable communication adapter) is used is described. However, it is not necessary to use the mountable communication adapter 13, a relay device that is capable of connecting the ECU 11 using a communication cable or the like may be used. In addition, a structure in which the ECU 11 is directly connected with the PC 12 may be used without providing a relay device. In addition, a structure in which a communication adapter 13 having a radio communication function is used may be employed, and a data communication may be performed between the communication adapter 13 and the PC 12 by the radio communication.

Claims

1. An engine setting system comprising:

    an engine control device (1) that comprises:

        a first storage medium (1a) that stores a basic control map and a correction control map, the correction control map correcting the basic control map;
        a second storage medium (1b) that temporarily stores data; and
        a control section (1c) that performs an engine control based on the basic control map and the correction control map which are stored in the first storage medium (1a) during normal driving; and

    a terminal device (2) that is connected to and capable of communicating with the engine control device (1) and defines the correction control map based on input information,

wherein

    the control section (1c) writes the correction control map as a provisional correction control map in the second storage medium (1b) at the time of engine setting, the correction control map is transmitted from the terminal device (2), the control section (1c) performs the engine control based on the basic control map stored in the first storage medium (1a) and the provisional correction control map stored in the second storage medium (1b), and the control section (1c) rewrites the provisional correction control map as a new correction control map in the first storage medium (1a) when the control section (1c) receives, from the terminal device (2), an instruction to apply the provisional correction control map.

2. The engine setting system according to claim 1, wherein

    the control section (1c) writes the correction control map stored in the first storage medium (1a) in the second storage medium (1b) after an activation at the time of engine setting, and performs the engine control based on the basic control map stored in the first storage medium (1a) and the correction control map written in the second storage medium (1b) until the provisional correction control map is transmitted from the terminal device (2).

3. The engine setting system according to one of claims 1 and 2, further comprising:

    a relay device (3) that relays data communication between the engine control device (1) and the terminal device (2), and comprises:

        a third storage medium (3b) that temporarily stores data; and
        a relay control section (3c) that causes the

correction control map transmitted from the terminal device (2) to be stored in the third storage medium (3b) and transmits the correction control map to the engine control device (1).

4. The engine setting system according to claim 3, wherein

the relay device (3) is a communication adapter mountable to the engine control device (1).

5. The engine setting system according to one of claims 3 and 4, wherein

the third storage medium (3b) is a rewritable nonvolatile storage medium.

6. The engine setting system according to any one of claims 1 to 5, wherein

the second storage medium (1b) is a rewritable volatile storage medium.

7. The engine setting method, comprising:

preparing an engine control device (1) and a terminal device (2), the engine control device (1) including: a first storage medium (1a) that stores a basic control map and a correction control map, the correction control map correcting the basic control map; a second storage medium (1b) that temporarily stores data; and a control section (1c) that performs an engine control based on the basic control map and the correction control map which are stored in the first storage medium (1a) during normal driving, the terminal device (2) being connected to and capable of communicating with the engine control device (1), and defines the correction control map based on input information;
writing the correction control map as a provisional correction control map in the second storage medium (1b) at the time of engine setting, the correction control map being defined by the terminal device (2);
performing the engine control based on the basic control map stored in the first storage medium (1a) and the provisional correction control map stored in the second storage medium (1b); and
rewriting the provisional correction control map as a new correction control map in the first storage medium (1a) when an instruction to apply the provisional correction control map is received from the terminal device (2).

8. An engine setting system comprising:

an engine control device (11) that performs engine control based on a control map; and
a terminal device (12) that is connected to and capable of communicating with the engine control device (11), and defines the control map, the terminal device (12) comprising:

a historical data storage section (12c) that stores a historical control map that is previously defined in previous cases and historical data including running environment data input when the historical control map is defined, the historical control map corresponding to the historical data; and
a control map redefinition section (12d) that searches the historical data corresponding to a search condition input at the time of engine setting, obtains the historical control map corresponding to the searched historical data, and redefines the obtained historical control map as the control map used for the engine control device (11).

9. The engine setting system according to claim 8, wherein

the historical data includes engine condition data representing a engine drive condition in addition to the running environment data, and the engine condition data being collected by the engine control device (11) when the historical control map is defined and being transmitted to the terminal device (12).

10. The engine setting system according to one of claims 8 and 9, wherein

the historical data includes impression data in addition to the running environment data, and the impression data including a comment document that is input when the historical control map is defined.

11. The engine setting system according to any one of claims 8 to 10, further comprising:

a relay device (13) that relays data communication between the engine control device (11) and the terminal device (12).

12. The engine setting system according to claim 11, wherein

the relay device (13) is a communication adapter mountable to the engine control device (11).

13. An engine setting method comprising:

preparing an engine control device (11) that performs engine control based on a control map and a terminal device (12) that is connected to and capable of communicating with the engine control device (11), and defines the control map;
storing a historical control map that is previously defined in previous cases and historical data including running environment data input when the historical control map is defined, the historical control map corresponding to the historical data;
searching the historical data corresponding to a search condition input at the time of engine setting;
obtaining the historical control map corresponding to the searched historical data; and
redefining the obtained historical control map as the control map used for the engine control device (11).

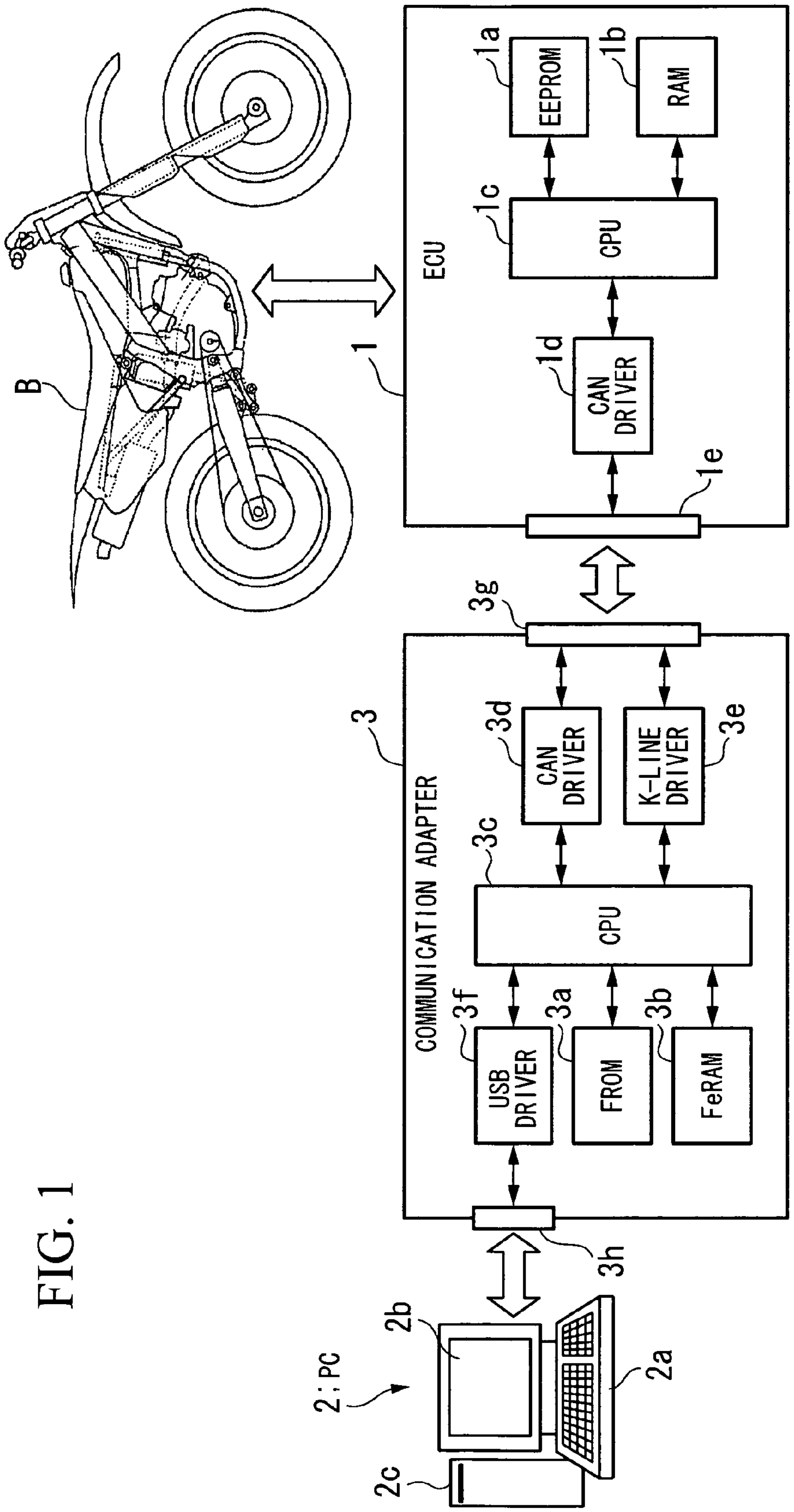
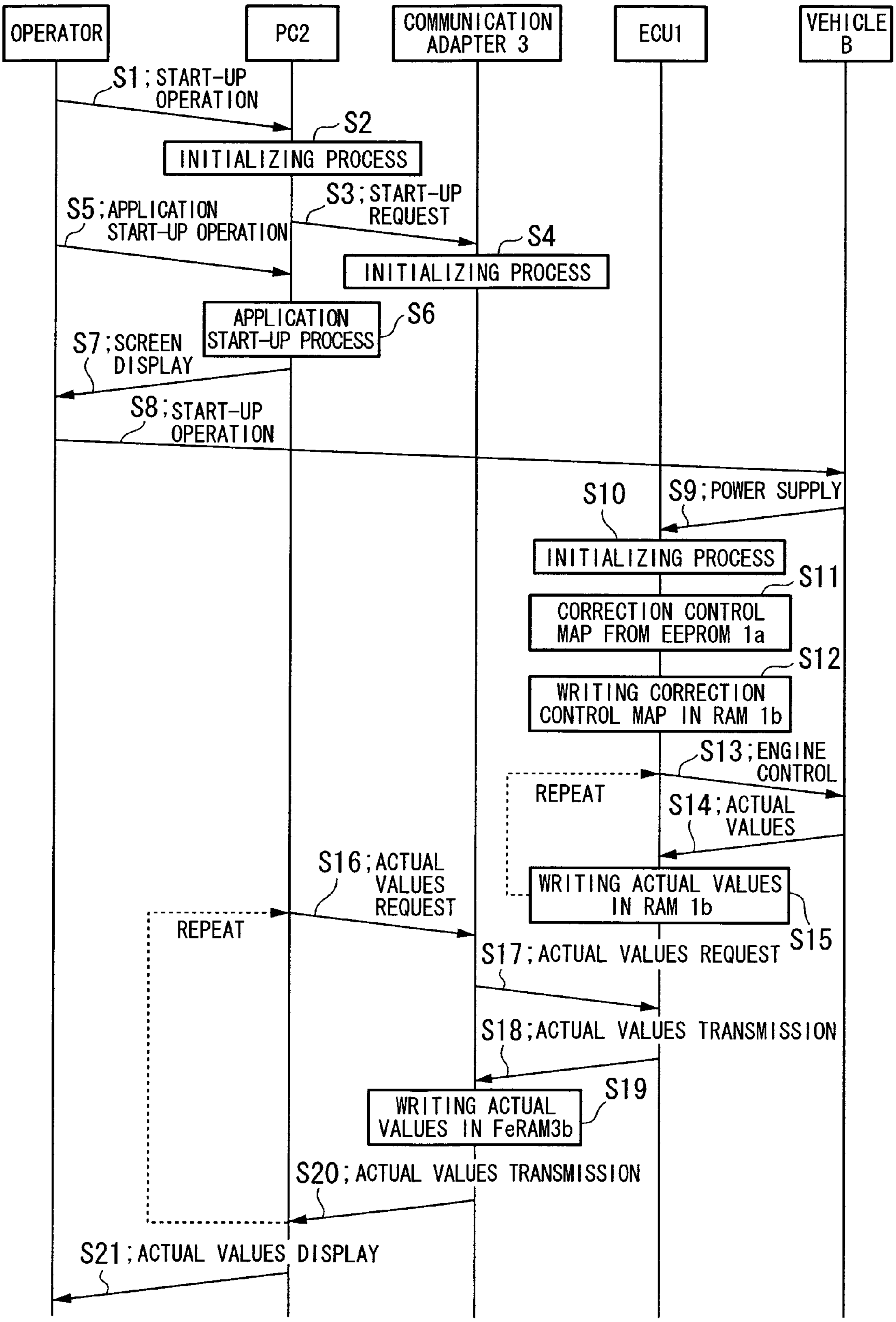

B
1
ECU
1a
EEPROM
1b
RAM
1c
CPU
1d
CAN DRIVER
1e
3g
3
COMMUNICATION ADAPTER
3d
CAN DRIVER
3e
K-LINE DRIVER
3c
CPU
3f
USB DRIVER
3a
FROM
3b
FeRAM
3h
2;PC
2b
2a
2c

FIG. 1

FIG. 2



OPERATOR
PC2
COMMUNICATION ADAPTER 3
ECU1
VEHICLE B
S1; START-UP OPERATION
S2
INITIALIZING PROCESS
S3; START-UP REQUEST
S5; APPLICATION START-UP OPERATION
S4
INITIALIZING PROCESS
APPLICATION START-UP PROCESS
S6
S7; SCREEN DISPLAY
S8; START-UP OPERATION
S10
S9; POWER SUPPLY
INITIALIZING PROCESS
S11
CORRECTION CONTROL MAP FROM EEPROM 1a
S12
WRITING CORRECTION CONTROL MAP IN RAM 1b
S13; ENGINE CONTROL
REPEAT
S14; ACTUAL VALUES
S16; ACTUAL VALUES REQUEST
WRITING ACTUAL VALUES IN RAM 1b
REPEAT
S15
S17; ACTUAL VALUES REQUEST
S18; ACTUAL VALUES TRANSMISSION
S19
WRITING ACTUAL VALUES IN FeRAM3b
S20; ACTUAL VALUES TRANSMISSION
S21; ACTUAL VALUES DISPLAY

FIG. 3

21 SETTING DATA

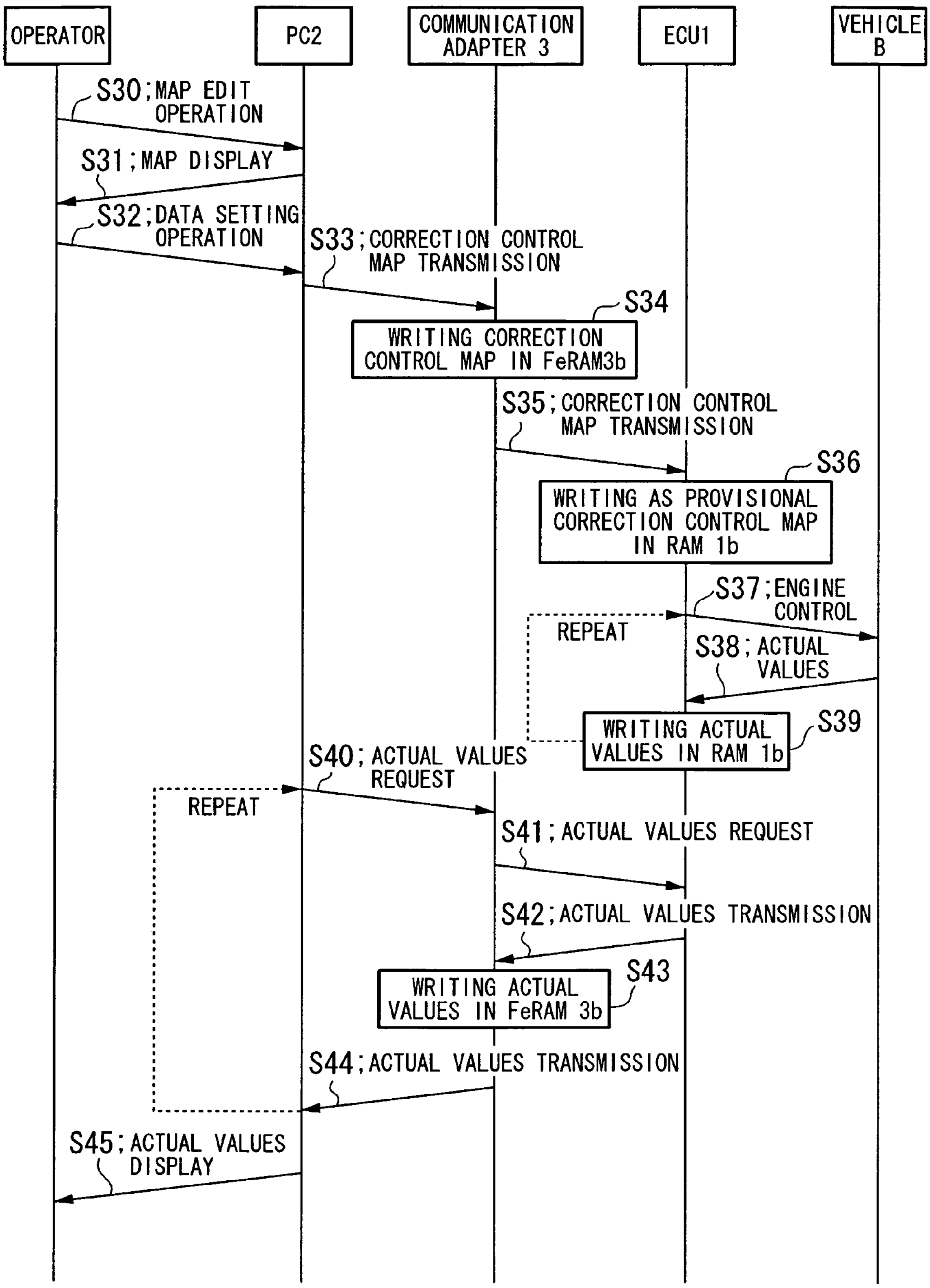
22 APPLYING

23 DISCARDING

10

ADJUSTED VALUE (%)	1000 (rpm)	2000 (rpm)	3000 (rpm)	4000 (rpm)	5000 (rpm)	6000 (rpm)
10.0 (deg)	0	0	0	0	0	0
20.0 (deg)	0	0	0	0	0	0
30.0 (deg)	0	0	0	0	0	0
40.0 (deg)	0	0	0	0	0	0
50.0 (deg)	0	0	0	0	0	0
60.0 (deg)	0	0	0	0	0	0

FIG. 4



OPERATOR
PC2
COMMUNICATION ADAPTER 3
ECU1
VEHICLE B
S30;MAP EDIT OPERATION
S31;MAP DISPLAY
S32;DATA SETTING OPERATION
S33;CORRECTION CONTROL MAP TRANSMISSION
S34
WRITING CORRECTION CONTROL MAP IN FeRAM3b
S35;CORRECTION CONTROL MAP TRANSMISSION
S36
WRITING AS PROVISIONAL CORRECTION CONTROL MAP IN RAM 1b
S37;ENGINE CONTROL
REPEAT
S38;ACTUAL VALUES
WRITING ACTUAL VALUES IN RAM 1b
S39
S40;ACTUAL VALUES REQUEST
REPEAT
S41;ACTUAL VALUES REQUEST
S42;ACTUAL VALUES TRANSMISSION
WRITING ACTUAL VALUES IN FeRAM 3b
S43
S44;ACTUAL VALUES TRANSMISSION
S45;ACTUAL VALUES DISPLAY

FIG. 5

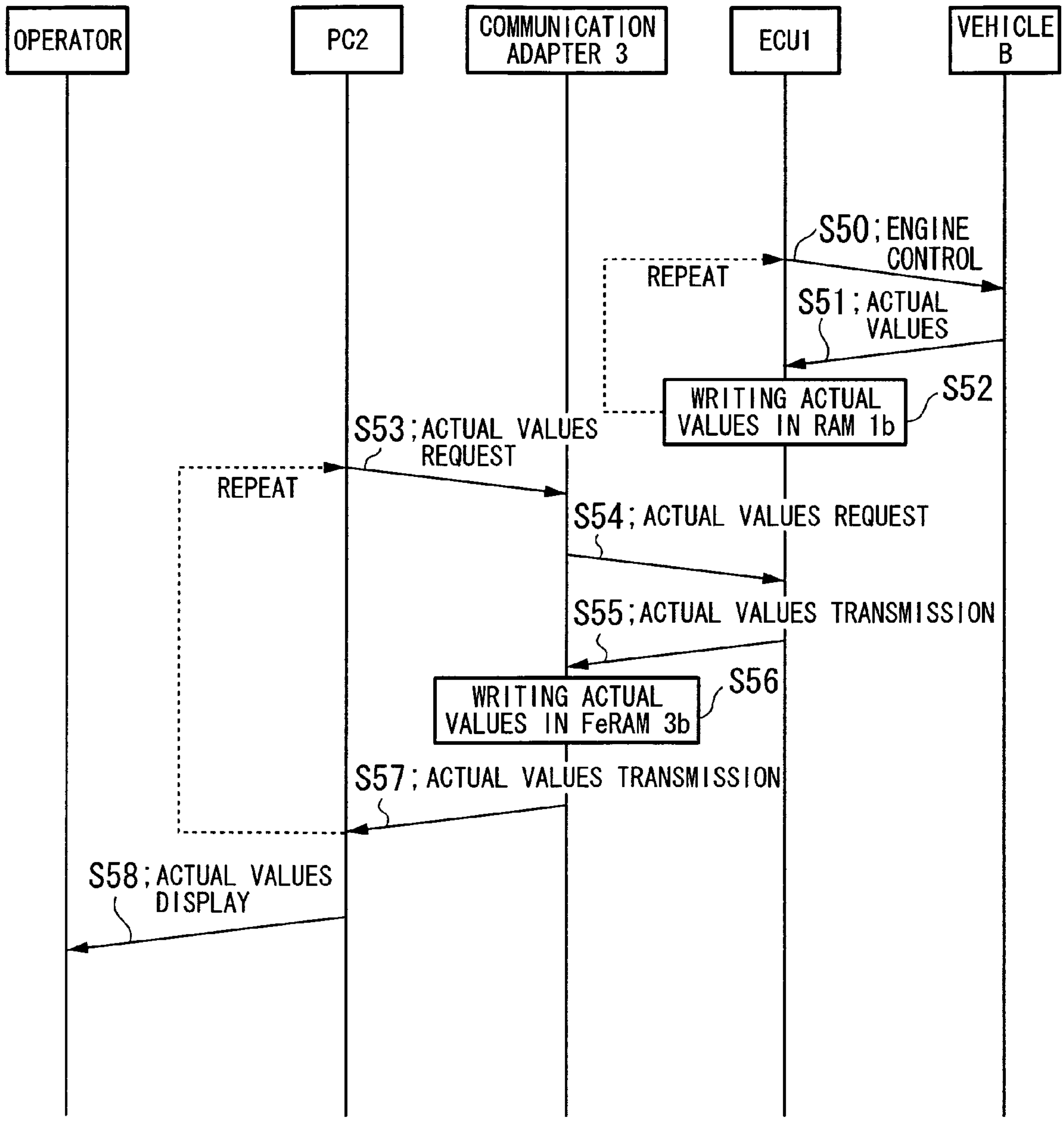

OPERATOR
PC2
COMMUNICATION ADAPTER 3
ECU1
VEHICLE B
S50; ENGINE CONTROL
REPEAT
S51; ACTUAL VALUES
WRITING ACTUAL VALUES IN RAM 1b
S52
S53; ACTUAL VALUES REQUEST
REPEAT
S54; ACTUAL VALUES REQUEST
S55; ACTUAL VALUES TRANSMISSION
WRITING ACTUAL VALUES IN FeRAM 3b
S56
S57; ACTUAL VALUES TRANSMISSION
S58; ACTUAL VALUES DISPLAY

FIG. 6

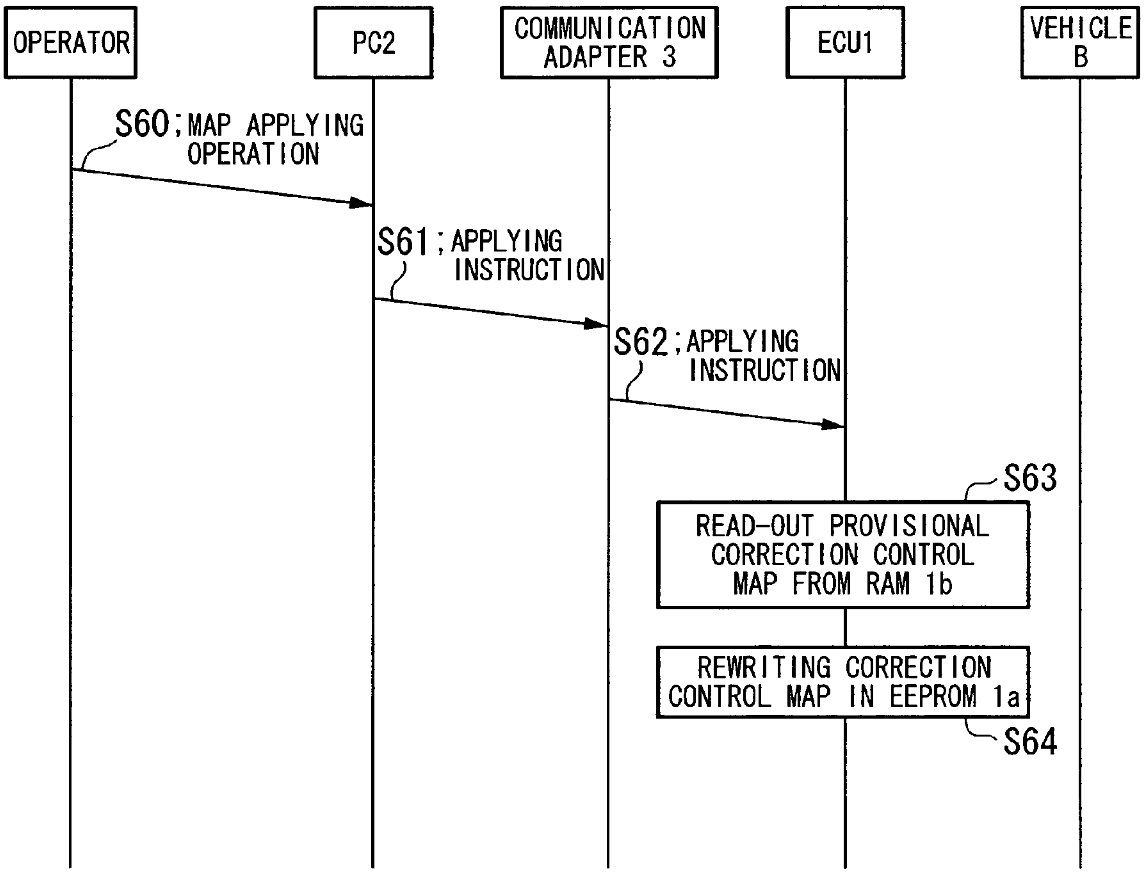

OPERATOR
PC2
COMMUNICATION ADAPTER 3
ECU1
VEHICLE B
S60;MAP APPLYING OPERATION
S61;APPLYING INSTRUCTION
S62;APPLYING INSTRUCTION
S63
READ-OUT PROVISIONAL CORRECTION CONTROL MAP FROM RAM 1b
REWRITING CORRECTION CONTROL MAP IN EEPROM 1a
S64

FIG. 7

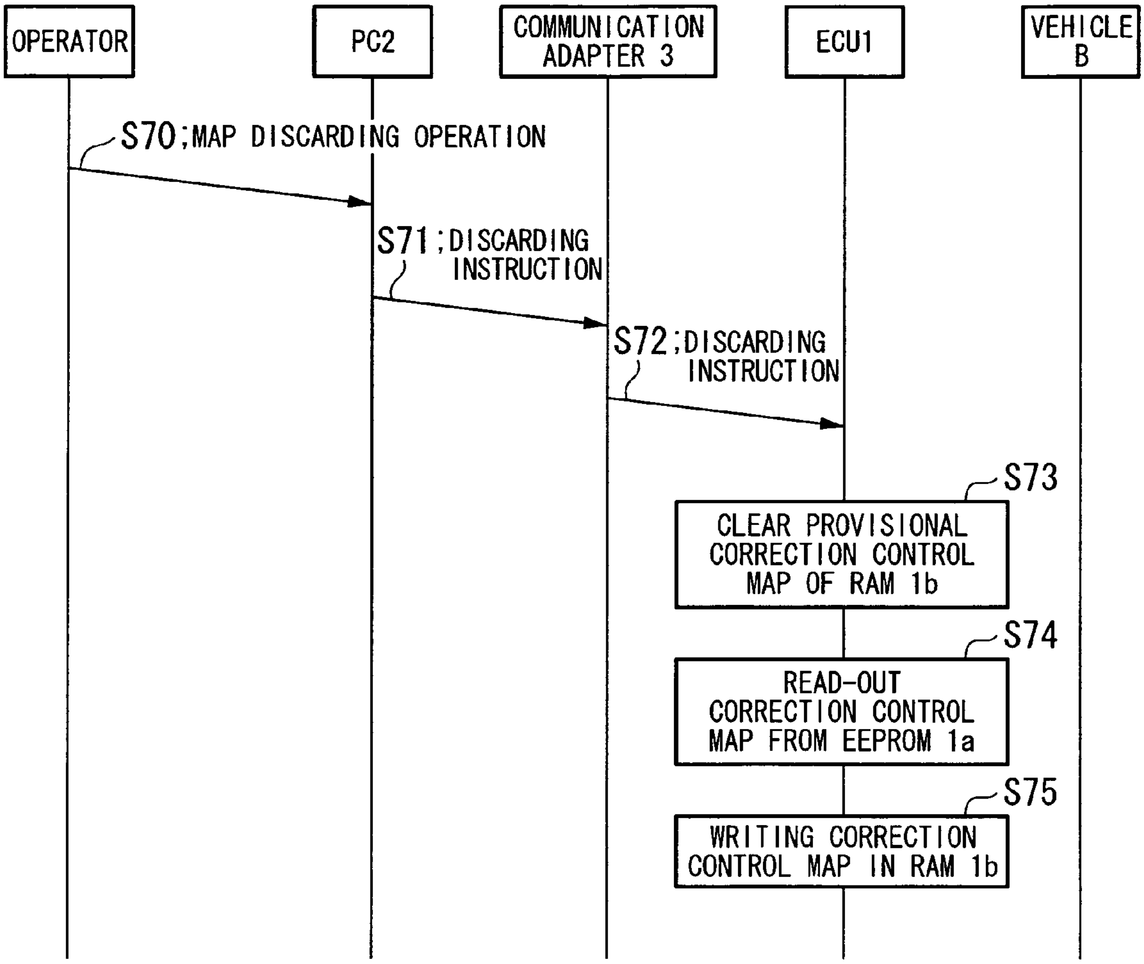

OPERATOR
PC2
COMMUNICATION ADAPTER 3
ECU1
VEHICLE B
S70;MAP DISCARDING OPERATION
S71;DISCARDING INSTRUCTION
S72;DISCARDING INSTRUCTION
S73
CLEAR PROVISIONAL CORRECTION CONTROL MAP OF RAM 1b
S74
READ-OUT CORRECTION CONTROL MAP FROM EEPROM 1a
S75
WRITING CORRECTION CONTROL MAP IN RAM 1b

FIG. 8

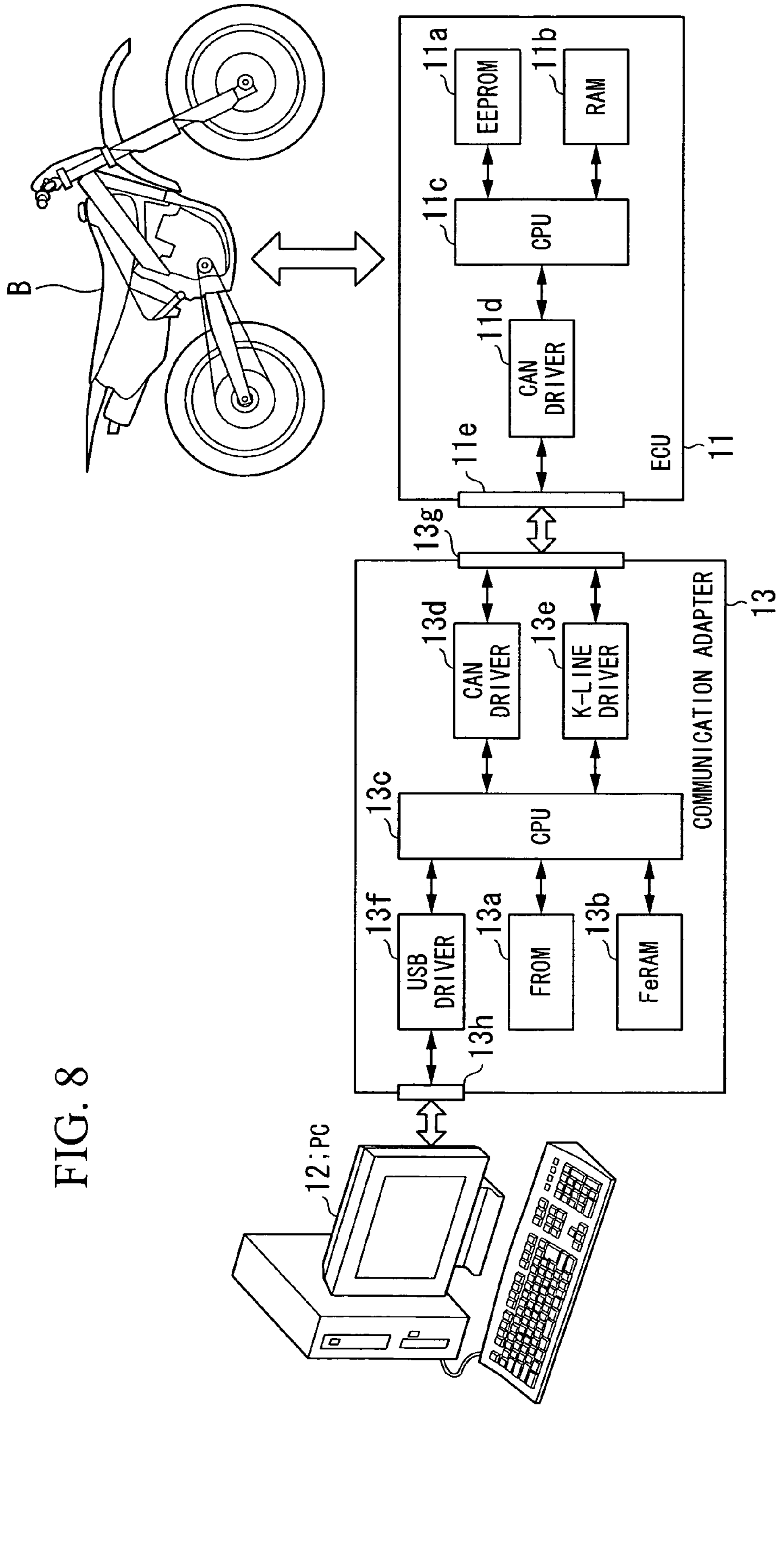

B
11a
EEPROM
11b
RAM
11c
CPU
11d
CAN DRIVER
11e
ECU
11
13g
13d
CAN DRIVER
13e
K-LINE DRIVER
13c
CPU
COMMUNICATION ADAPTER
13
13f
USB DRIVER
13a
FROM
13b
FeRAM
13h
12;PC

FIG. 9

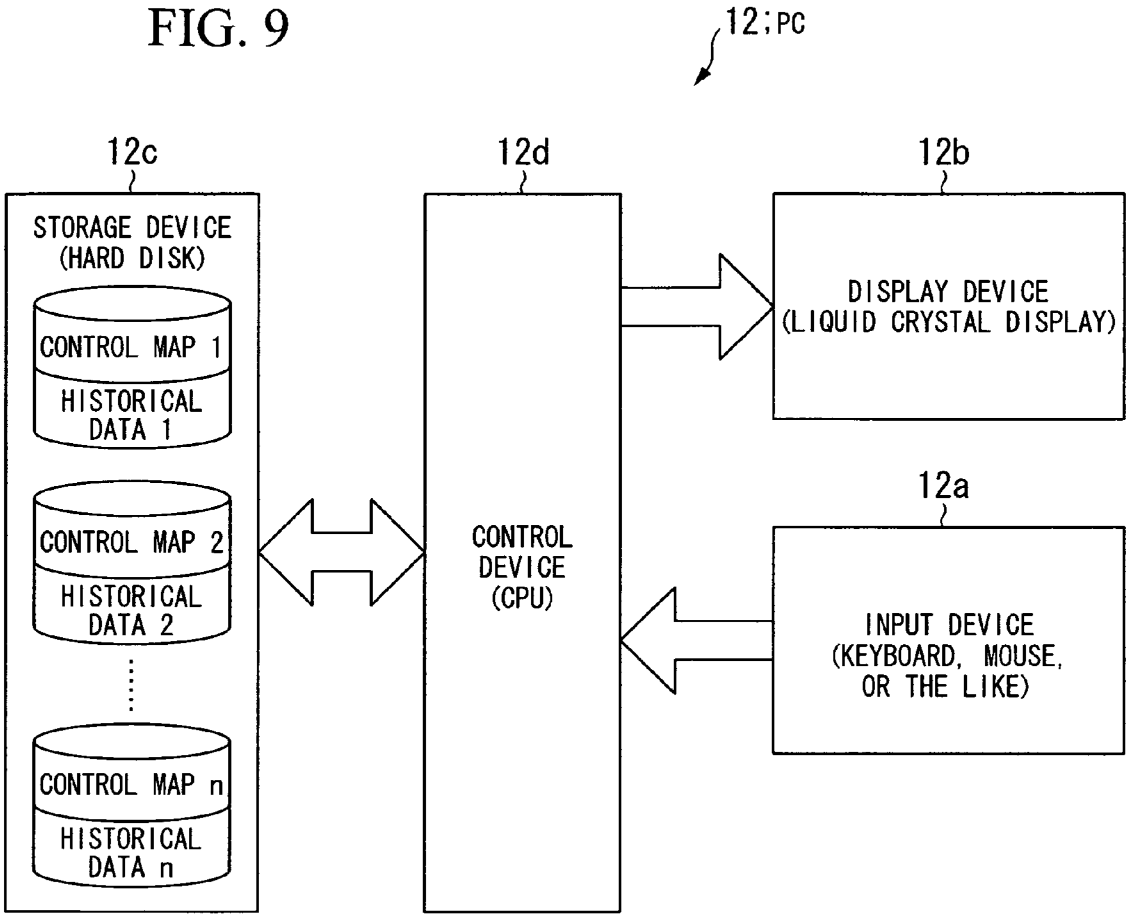

12;PC
12c
STORAGE DEVICE
(HARD DISK)
CONTROL MAP 1
HISTORICAL DATA 1
CONTROL MAP 2
HISTORICAL DATA 2
CONTROL MAP n
HISTORICAL DATA n
12d
CONTROL DEVICE (CPU)
12b
DISPLAY DEVICE
(LIQUID CRYSTAL DISPLAY)
12a
INPUT DEVICE
(KEYBOARD, MOUSE, OR THE LIKE)

FIG. 10

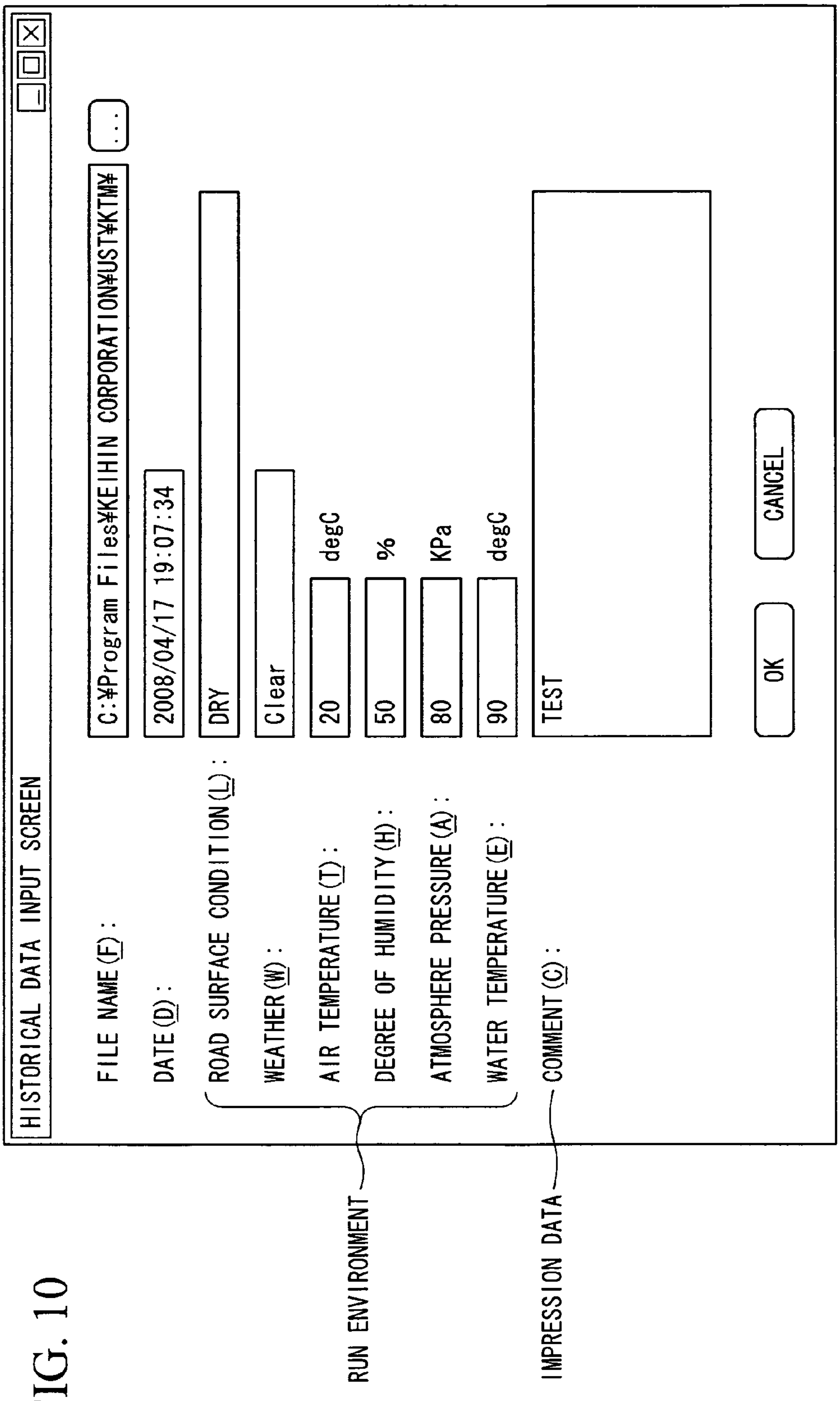

HISTORICAL DATA INPUT SCREEN
FILE NAME (F) :
C:¥Program Files¥KEIHIN CORPORATION¥UST¥KTM¥
...
DATE (D) :
2008/04/17 19:07:34
ROAD SURFACE CONDITION (L) :
DRY
WEATHER (W) :
Clear
AIR TEMPERATURE (T) :
20
degC
DEGREE OF HUMIDITY (H) :
50
%
ATMOSPHERE PRESSURE (A) :
80
KPa
WATER TEMPERATURE (E) :
90
degC
COMMENT (C) :
TEST
OK
CANCEL
RUN ENVIRONMENT
IMPRESSION DATA

FIG. 11

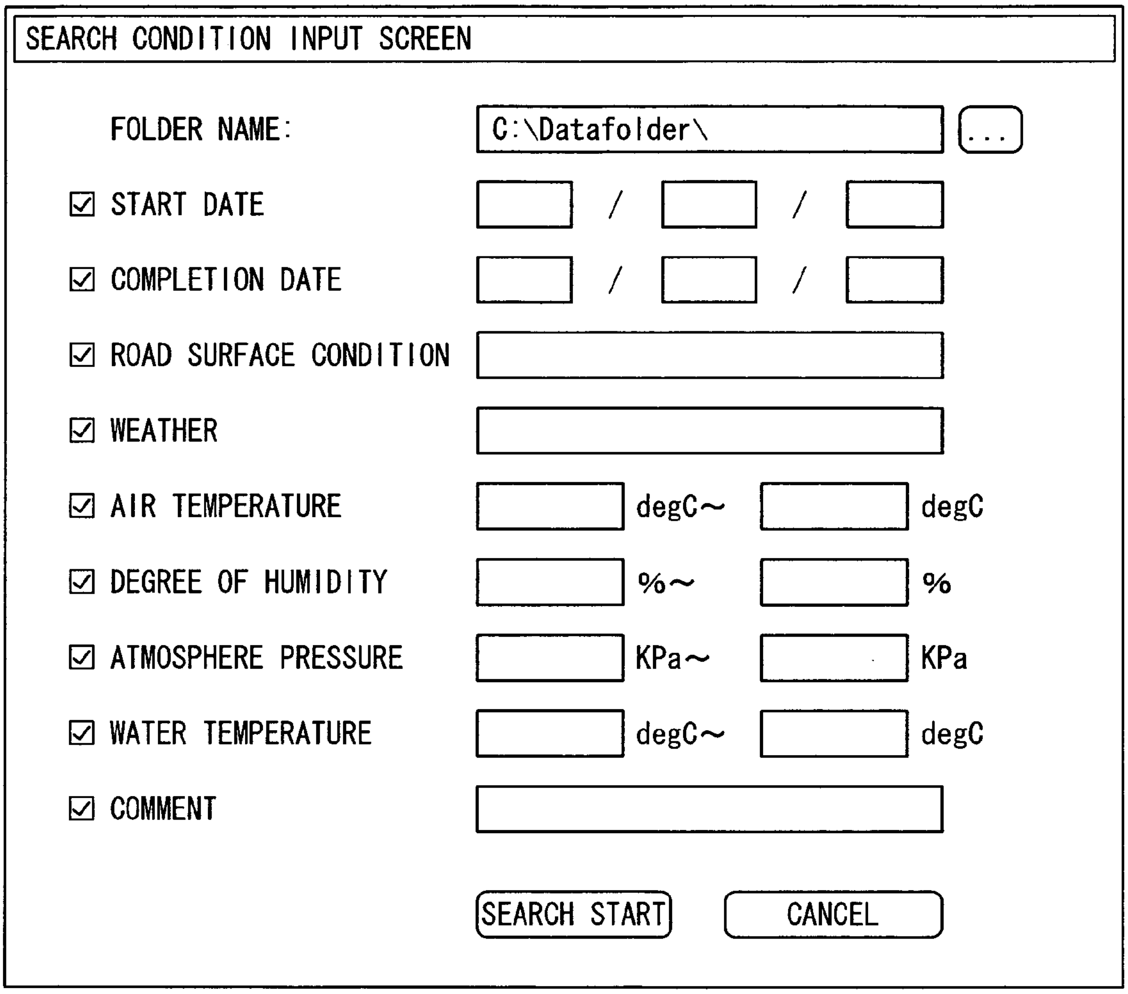

SEARCH CONDITION INPUT SCREEN
FOLDER NAME:
C:\Datafolder\
...
START DATE
/
/
COMPLETION DATE
/
/
ROAD SURFACE CONDITION
WEATHER
AIR TEMPERATURE
degC~
degC
DEGREE OF HUMIDITY
%~
%
ATMOSPHERE PRESSURE
KPa~
KPa
WATER TEMPERATURE
degC~
degC
COMMENT
SEARCH START
CANCEL

FIG. 12A

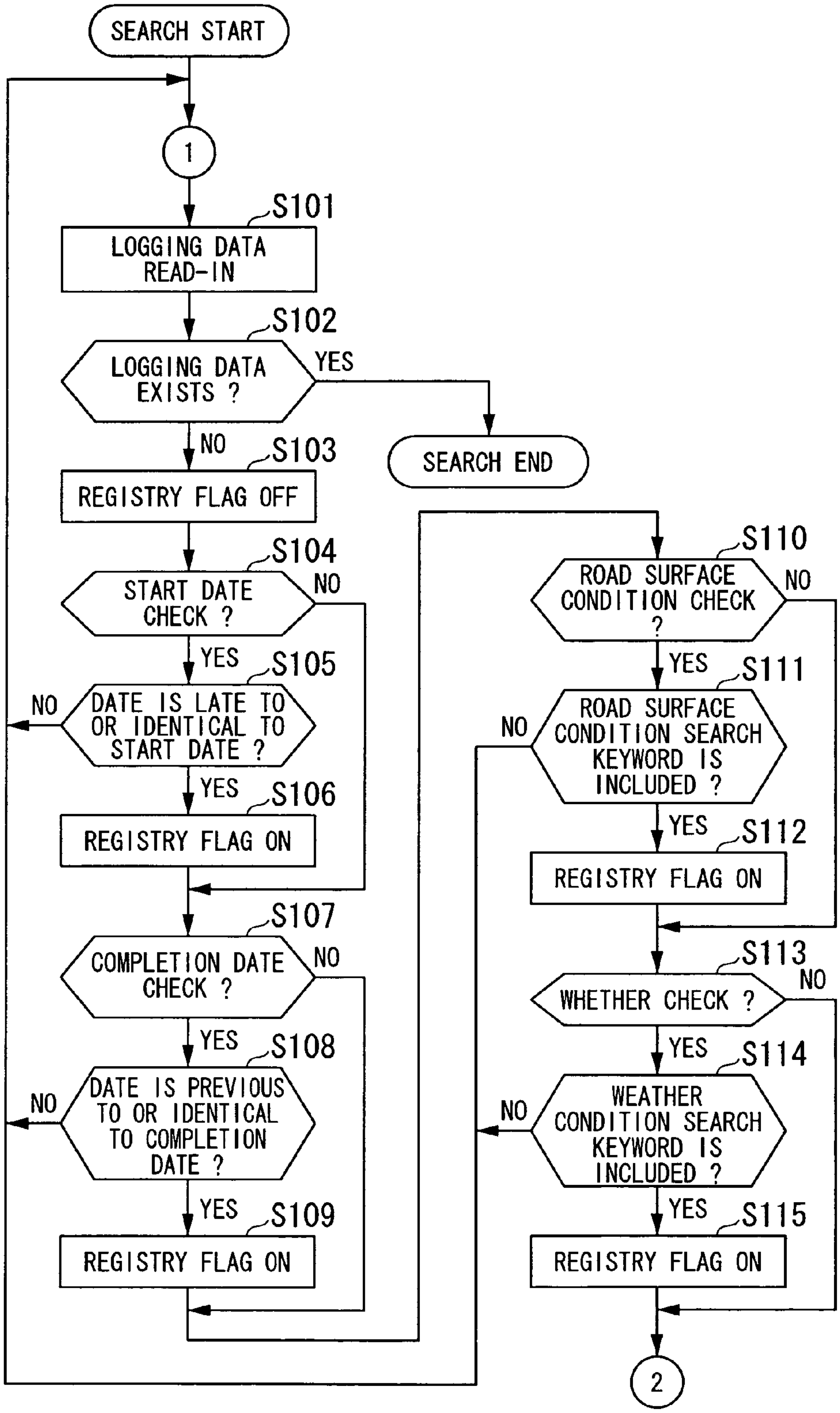

SEARCH START
1
S101
LOGGING DATA READ-IN
S102
LOGGING DATA EXISTS ?
YES
SEARCH END
NO
S103
REGISTRY FLAG OFF
S104
START DATE CHECK ?
NO
YES
S105
DATE IS LATE TO OR IDENTICAL TO START DATE ?
NO
YES
S106
REGISTRY FLAG ON
S107
COMPLETION DATE CHECK ?
NO
YES
S108
DATE IS PREVIOUS TO OR IDENTICAL TO COMPLETION DATE ?
NO
YES
S109
REGISTRY FLAG ON
S110
ROAD SURFACE CONDITION CHECK ?
NO
YES
S111
ROAD SURFACE CONDITION SEARCH KEYWORD IS INCLUDED ?
NO
YES
S112
REGISTRY FLAG ON
S113
WHETHER CHECK ?
NO
YES
S114
WEATHER CONDITION SEARCH KEYWORD IS INCLUDED ?
NO
YES
S115
REGISTRY FLAG ON
2

FIG. 12B

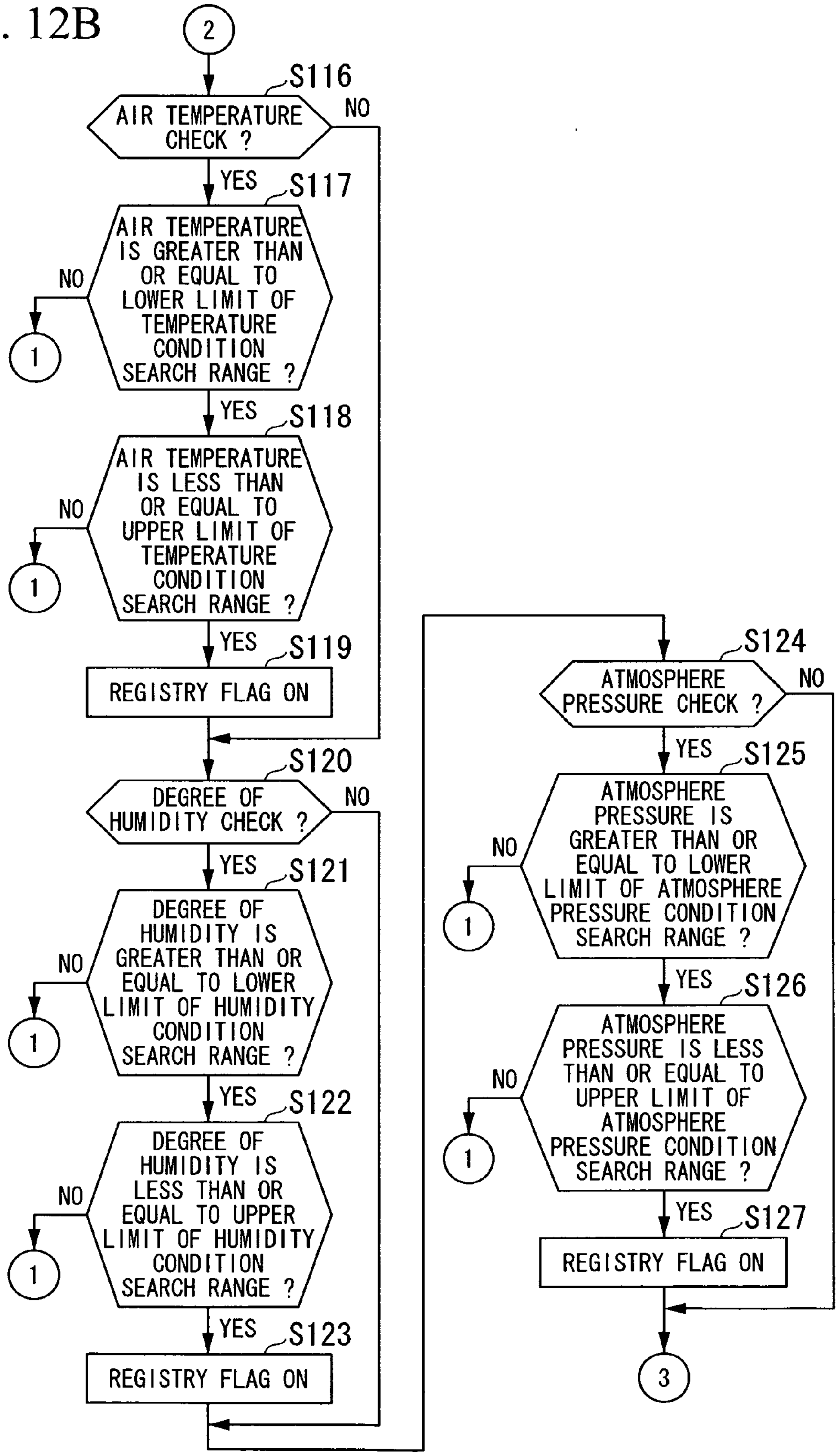

2
S116
AIR TEMPERATURE CHECK ?
NO
YES
S117
AIR TEMPERATURE IS GREATER THAN OR EQUAL TO LOWER LIMIT OF TEMPERATURE CONDITION SEARCH RANGE ?
NO
1
YES
S118
AIR TEMPERATURE IS LESS THAN OR EQUAL TO UPPER LIMIT OF TEMPERATURE CONDITION SEARCH RANGE ?
NO
1
YES
S119
REGISTRY FLAG ON
S120
DEGREE OF HUMIDITY CHECK ?
NO
YES
S121
DEGREE OF HUMIDITY IS GREATER THAN OR EQUAL TO LOWER LIMIT OF HUMIDITY CONDITION SEARCH RANGE ?
NO
1
YES
S122
DEGREE OF HUMIDITY IS LESS THAN OR EQUAL TO UPPER LIMIT OF HUMIDITY CONDITION SEARCH RANGE ?
NO
1
YES
S123
REGISTRY FLAG ON
S124
ATMOSPHERE PRESSURE CHECK ?
NO
YES
S125
ATMOSPHERE PRESSURE IS GREATER THAN OR EQUAL TO LOWER LIMIT OF ATMOSPHERE PRESSURE CONDITION SEARCH RANGE ?
NO
1
YES
S126
ATMOSPHERE PRESSURE IS LESS THAN OR EQUAL TO UPPER LIMIT OF ATMOSPHERE PRESSURE CONDITION SEARCH RANGE ?
NO
1
YES
S127
REGISTRY FLAG ON
3

FIG. 12C

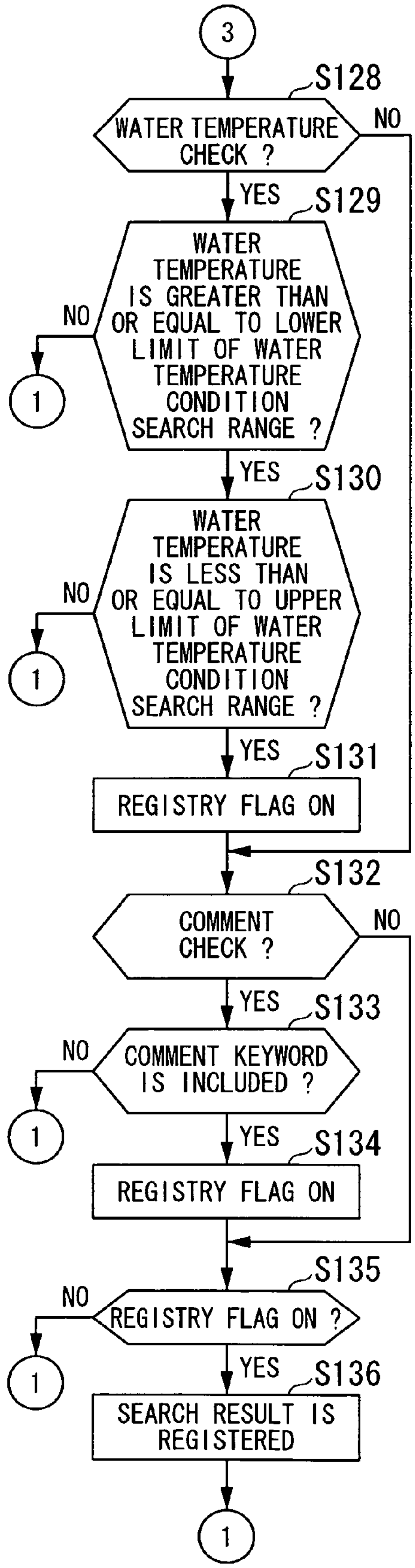
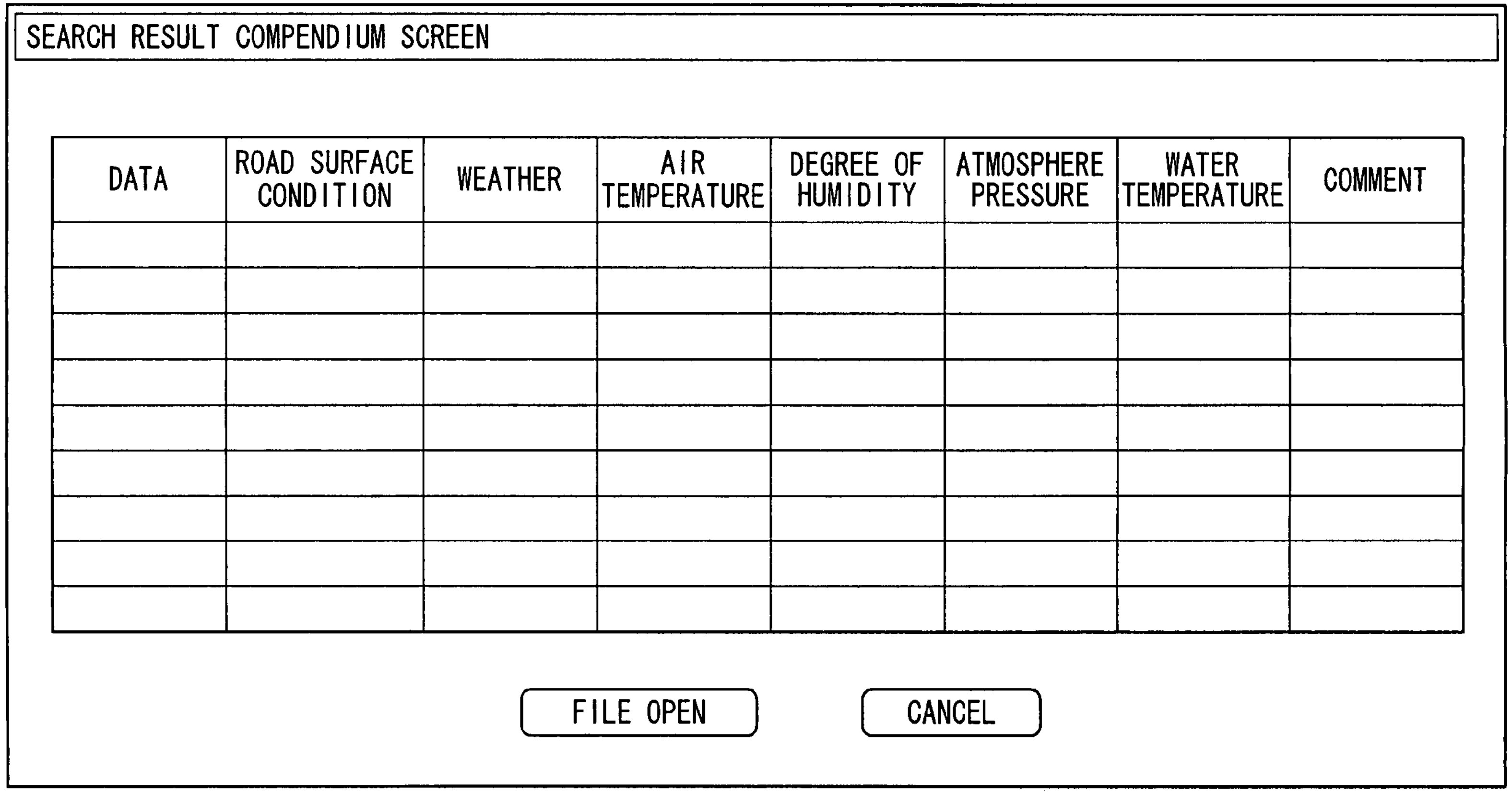

3
S128
WATER TEMPERATURE CHECK ?
NO
YES
S129
WATER TEMPERATURE IS GREATER THAN OR EQUAL TO LOWER LIMIT OF WATER TEMPERATURE CONDITION SEARCH RANGE ?
NO
1
YES
S130
WATER TEMPERATURE IS LESS THAN OR EQUAL TO UPPER LIMIT OF WATER TEMPERATURE CONDITION SEARCH RANGE ?
NO
1
YES
S131
REGISTRY FLAG ON
S132
COMMENT CHECK ?
NO
YES
S133
COMMENT KEYWORD IS INCLUDED ?
NO
1
YES
S134
REGISTRY FLAG ON
S135
REGISTRY FLAG ON ?
NO
1
YES
S136
SEARCH RESULT IS REGISTERED
1

FIG. 13


SEARCH RESULT COMPENDIUM SCREEN
DATA
ROAD SURFACE CONDITION
WEATHER
AIR TEMPERATURE
DEGREE OF HUMIDITY
ATMOSPHERE PRESSURE
WATER TEMPERATURE
COMMENT
FILE OPEN
CANCEL

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- JP 2008019843 A **[0005]**