FILED

IN THE UNITED STATES DISTRICT COURT
FOR THE MIDDLE DISTRICT OF FLORIDA
ORLANDO DIVISION

03 MAY -6 PM 3:28
CLERK, U.S. DISTRICT COURT
MIDDLE DISTRICT OF FLORIDA
ORLANDO, FLORIDA

OMEGA PATENTS, L.L.C.,
a Georgia corporation,

Plaintiff,

6:03-cv-578-Orl-22KRS

vs.

Civil Action No. _____

TRILOGIX ELECTRONIC SYSTEMS INC., an alien business organization,

JURY TRIAL AND INJUNCTIVE RELIEF REQUESTED

Defendant.
_____/

COMPLAINT

COMES NOW, Plaintiff Omega Patents, LLC, by and through its undersigned attorneys, and for its complaint against Defendant Trilogix Electronic Systems, Inc., states:

PARTIES, JURISDICTION AND VENUE

1. Plaintiff OMEGA PATENTS, L.L.C., is a Georgia limited liability company.

2. Defendant TRILOGIX ELECTRONIC SYSTEMS INC. is, upon information and belief, an alien business corporation formed under Canadian laws which sells and offers for sale infringing products in the United States, including the Middle District of Florida.

3. Defendant sells and offers for sale throughout the United States,

including within this judicial district and division, data communications bus adaptors and/or vehicle remote control systems which infringe Plaintiff's United States Patent Nos. 5,719,551; 6,243,004 B1; 6,249,216 B1; 6,275,147 B1; and 6,529,124 B2 ("patents in suit"). The patents in suit are attached hereto as Exhibits 1 - 5. Upon information and belief, Defendant has substantial and not isolated contacts with the State of Florida and has committed acts of infringement in the State of Florida, including the Middle District of Florida, sufficient to confer personal jurisdiction upon Defendant.

4. This Court has jurisdiction over the subject matter of this action pursuant to 28 U.S.C. §1338(a), and has *in personam* jurisdiction over the parties. Venue properly lies in this judicial district and division pursuant to 28 U.S.C. §1391(c) and (d).

STATEMENT OF FACTS

5. Vehicle security devices rely upon electronic communications to perform many of the security functions. Kenneth E. Flick, the inventor of the patents in suit, is recognized as an innovator in the vehicle security systems industry.

6. A series of inventions by Mr. Flick involve vehicle data communications bus products including interfaces such as for remotely controlling certain functions of the vehicle. The patents in suit describe some of Mr. Flick's inventions in the field. Mr. Flick has assigned all of his rights to the inventions to Plaintiff.

7. Defendant has offered for sale in the United States and in this judicial district vehicle data communications bus products which infringe upon one or more claims of each of the patents in suit.

8. Defendant has no license to practice the patents.

COUNT I

Action for Infringement of U.S. Patent No. 5,719,551

9. Count I is an action by Plaintiff against Defendant for monetary damages and injunctive relief for Defendant's infringement of U.S. Patent No. 5,719,551 ('551 patent).

10. Plaintiff herein restates and reincorporates into this Count the allegations of Paragraph 1 through 8 hereinabove.

11. Defendant has offered for sale, sold and/or distributed vehicle remote control products which infringe either directly, by inducement or contributorily one or more claims of the '551 patent.

12. The infringing activities of Defendant as outlined in this Count have been engaged in without authorization by Plaintiff.

13. Plaintiff is entitled to compensatory damages and injunctive relief for Defendant's infringing activities.

14. Upon information and belief, the activities of Defendant outlined in this Count have been engaged in without justifiable belief by Defendant that there is no infringement or that the infringed claims are invalid. Therefore, Plaintiff is entitled

to an award of exemplary damages, attorney's fees and costs of this action.

COUNT II

Action for Infringement of U.S. Patent No. 6,243,004 B1

15. Count II is an action by Plaintiff against Defendant for monetary damages and injunctive relief for Defendant's infringement of U.S. Patent No. 6,243,004 B1 ('004 patent).

16. Plaintiff herein restates and reincorporates into this Count the allegations of Paragraph 1 through 8 hereinabove.

17. Defendant has offered for sale, sold and/or distributed vehicle remote control products which infringe either directly, by inducement or contributorily one or more claims of the '004 patent.

18. The infringing activities of Defendant as outlined in this Count have been engaged in without authorization by Plaintiff.

19. Plaintiff is entitled to compensatory damages and injunctive relief for Defendant's infringing activities.

20. Upon information and belief, the activities of Defendant outlined in this Count have been engaged in without justifiable belief by Defendant that there is no infringement or that the infringed claims are invalid. Therefore, Plaintiff is entitled to an award of exemplary damages, attorney's fees and costs of this action.

COUNT III

Action for Infringement of U.S. Patent No. 6,249,216 B1

21. Count III is an action by Plaintiff against Defendant for monetary damages and injunctive relief for Defendant's infringement of U.S. Patent No. 6,249,215 B1 ('216 patent).

22. Plaintiff herein restates and reincorporates into this Count the allegations of Paragraph 1 through 8 hereinabove.

23. Defendant has offered for sale, sold and/or distributed vehicle remote control products which infringe either directly, by inducement or contributorily one or more claims of the '216 patent.

24. The infringing activities of Defendant as outlined in this Count have been engaged in without authorization by Plaintiff.

25. Plaintiff is entitled to compensatory damages and injunctive relief for Defendant's infringing activities.

26. Upon information and belief, the activities of Defendant outlined in this Count have been engaged in without justifiable belief by Defendant that there is no infringement or that the infringed claims are invalid. Therefore, Plaintiff is entitled to an award of exemplary damages, attorney's fees and costs of this action.

COUNT IV

Action for Infringement of U.S. Patent No. 6,275,147 B1

27. Count IV is an action by Plaintiff against Defendant for monetary

damages and injunctive relief for Defendant's infringement of U.S. Patent No. 6,275,147 B1 ('147 patent).

28. Plaintiff herein restates and reincorporates into this Count the allegations of Paragraph 1 through 8 hereinabove.

29. Defendant has offered for sale, sold and/or distributed vehicle remote control products which infringe either directly, by inducement or contributorily one or more claims of the '147 patent.

30. The infringing activities of Defendant as outlined in this Count have been engaged in without authorization by Plaintiff.

31. Plaintiff is entitled to compensatory damages and injunctive relief for Defendant's infringing activities.

32. Upon information and belief, the activities of Defendant outlined in this Count have been engaged in without justifiable belief by Defendant that there is no infringement or that the infringed claims are invalid. Therefore, Plaintiff is entitled to an award of exemplary damages, attorney's fees and costs of this action.

COUNT V

Action for Infringement of U.S. Patent No. 6,529,124 B2

33. Count V is an action by Plaintiff against Defendant for monetary damages and injunctive relief for Defendant's infringement of U.S. Patent No. 6,529,124 B2 ('124 patent).

34. Plaintiff herein restates and reincorporates into this Count the

allegations of Paragraph 1 through 8 hereinabove.

35. Defendant has offered for sale, sold and/or distributed vehicle remote control products which infringe either directly, by inducement or contributorily one or more claims of the '124 patent.

36. The infringing activities of Defendant as outlined in this Count have been engaged in without authorization by Plaintiff.

37. Plaintiff is entitled to compensatory damages and injunctive relief for Defendant's infringing activities.

38. Upon information and belief, the activities of Defendant outlined in this Count have been engaged in without justifiable belief by Defendant that there is no infringement or that the infringed claims are invalid. Therefore, Plaintiff is entitled to an award of exemplary damages, attorney's fees and costs of this action.

JURY TRIAL REQUEST

Plaintiff requests a trial by jury as to all matters so triable.

PRAYER FOR RELIEF

WHEREFORE, Plaintiff prays that this Honorable Court enter such preliminary and final orders and judgments as are necessary to provide Plaintiff with the following relief:

a. A preliminary and then permanent injunction enjoining Defendant from infringing the patents in suit in this case;

b. An award of damages under 35 U.S.C. §284 in an amount adequate

to compensate Plaintiff for Defendant's infringement, but in no event less than a reasonable royalty for the use made by Defendant of the inventions set forth in the patents in suit.

c. An award of exemplary damages, attorney's fees and costs under 35 U.S.C. §285

d. Such other and further relief as this Court deems just and proper.

Date: 5.6.03

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Orlando, FL 32802-3791
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Facsimile: 407/841-2343

US005719551A

United States Patent [19]

Flick

[11] Patent Number: 5,719,551

[45] Date of Patent: Feb. 17, 1998

[54] **VEHICLE SECURITY SYSTEM FOR A VEHICLE HAVING A DATA COMMUNICATIONS BUS AND RELATED METHODS**

[76] Inventor: **Kenneth E. Flick**, 5236 Presley Pl., Douglasville, Ga. 30135

[21] Appl. No.: **701,356**

[22] Filed: **Aug. 22, 1996**

[51] **Int. Cl.**[6] **B60R 25/10**

[52] **U.S. Cl.** **340/426**; 340/531; 340/533; 340/825.31; 340/825.32; 340/825.69; 180/287; 307/10.2

[58] **Field of Search** 340/426, 427, 340/428, 429, 531, 532, 533, 534, 825.31, 825.32, 825.69, 825.72; 180/173, 287; 307/10.2, 10.3; 395/200.12, 200.05, 309, 310, 830–33

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,055,772	10/1977	Leung	307/10 R
4,288,778	9/1981	Zucker	340/64
4,538,262	8/1985	Sinniger et al.	370/85
4,697,092	9/1987	Roggendorf et al.	307/10 R
4,754,255	6/1988	Saunders et al.	340/64
4,760,275	7/1988	Sato et al.	307/10 R
4,792,783	12/1988	Burgess et al.	340/22
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4,926,332	5/1990	Komuro et al.	364/424.05
5,006,843	4/1991	Hauer	340/825.31
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5,049,867	9/1991	Stouffer	340/426
5,054,569	10/1991	Scott et al.	180/167
5,081,667	1/1992	Drori et al.	379/59
5,142,278	8/1992	Moallemi et al.	340/825.06
5,146,215	9/1992	Drori	340/825.32
5,243,322	9/1993	Thompson et al.	340/429
5,252,966	10/1993	Lambropoulos et al.	340/825.69
5,406,270	4/1995	Van Lente	340/825.34
5,475,818	12/1995	Molyneaux et al.	395/200.05
5,555,498	9/1996	Berra et al.	364/424.03
5,606,306	2/1997	Mutoh et al.	340/426

OTHER PUBLICATIONS

Society of Automotive Engineers, Inc., "Surface Vehicle Information Report", SAE J2058 (Jun. 21, 1990).

Society of Automotive Engineers, Inc., "Surface Vehicle Standard", SAE J1850 (rev'd Jul. 1995).

Mark Thompson, "The Thick and Thin of Car Cabling", *IEEE Spectrum*, pp. 42–45 (Feb. 1996).

Primary Examiner—Thomas Mullen

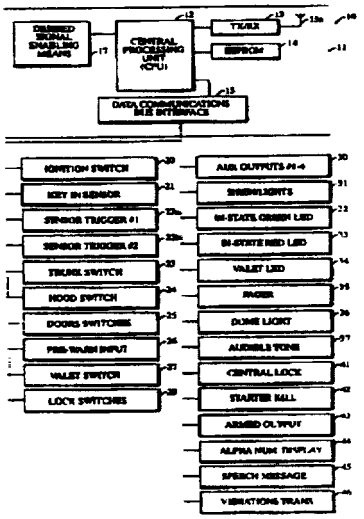
Assistant Examiner—Ashok Mannava

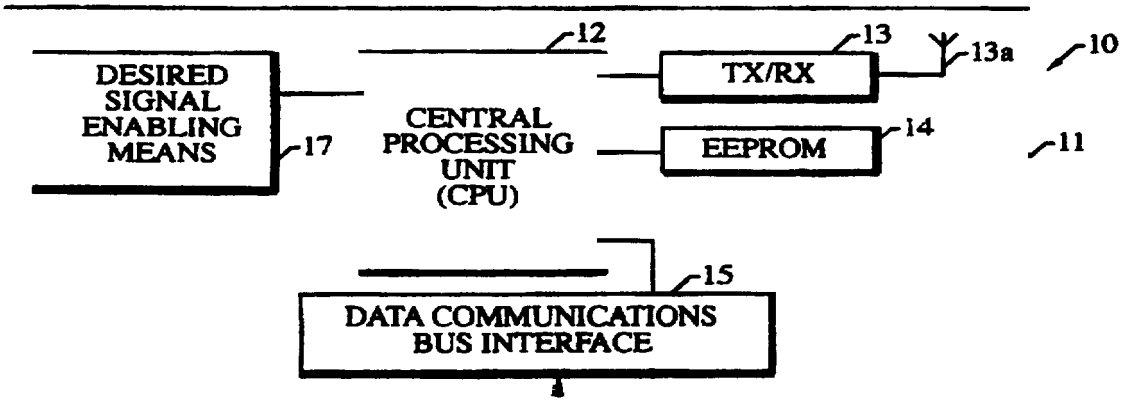
Attorney, Agent, or Firm—Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.

[57] **ABSTRACT**

A vehicle security system includes a vehicle security sensor and associated sensor bus interface, an alarm indicator and associated alarm indicator bus interface, and an alarm controller and associated alarm controller bus interface for interfacing the alarm controller. The vehicle security system is for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices. The security system preferably further includes a desired signal enabling circuit for enabling the alarm controller to operate using a set of desired signals for a desired vehicle from among a plurality of possible sets of signals for different vehicles. Accordingly, the desired signal enabling circuit permits the alarm controller to communicate with the vehicle security sensor and the alarm indicator via the data communications bus so that the alarm controller is capable of operating the alarm indicator responsive to the vehicle security sensor. The desired signal enabling circuit may preferably include a memory for storing a plurality of respective sets of signals for different vehicles, and a selecting circuit for selecting the desired set of signals from the plurality of different sets of signals for different vehicles. The desired signal enabling circuit may also be included in other vehicle remote control systems. Method aspects of the invention are also disclosed.

59 Claims, 8 Drawing Sheets




DESIRED SIGNAL ENABLING MEANS
17
12
CENTRAL PROCESSING UNIT (CPU)
13
TX/RX
13a
10
EEPROM
14
11
15
DATA COMMUNICATIONS BUS INTERFACE

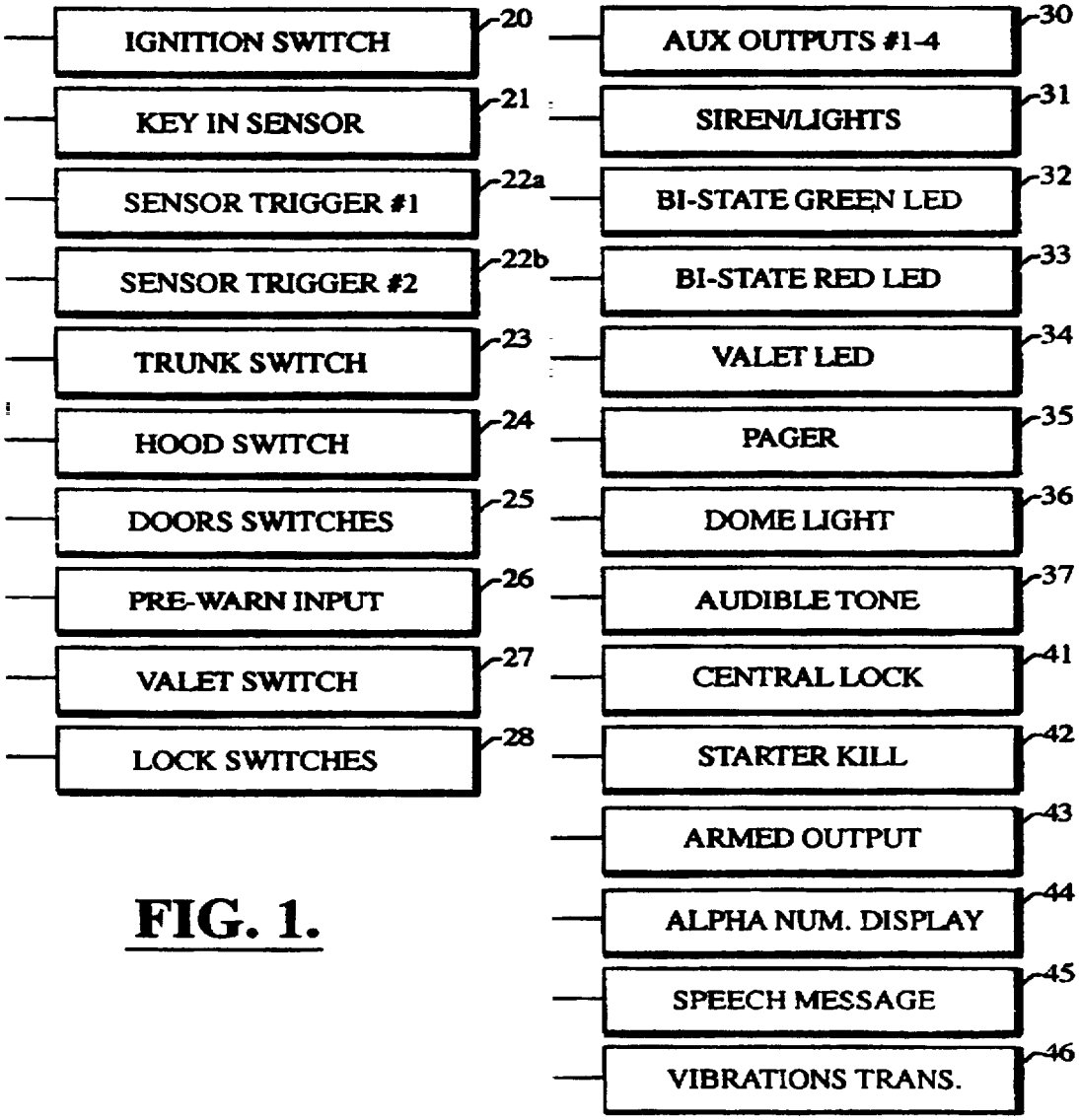

IGNITION SWITCH
20
KEY IN SENSOR
21
SENSOR TRIGGER #1
22a
SENSOR TRIGGER #2
22b
TRUNK SWITCH
23
HOOD SWITCH
24
DOORS SWITCHES
25
PRE-WARN INPUT
26
VALET SWITCH
27
LOCK SWITCHES
28
AUX OUTPUTS #1-4
30
SIREN/LIGHTS
31
BI-STATE GREEN LED
32
BI-STATE RED LED
33
VALET LED
34
PAGER
35
DOME LIGHT
36
AUDIBLE TONE
37
CENTRAL LOCK
41
STARTER KILL
42
ARMED OUTPUT
43
ALPHA NUM. DISPLAY
44
SPEECH MESSAGE
45
VIBRATIONS TRANS.
46

FIG. 1.

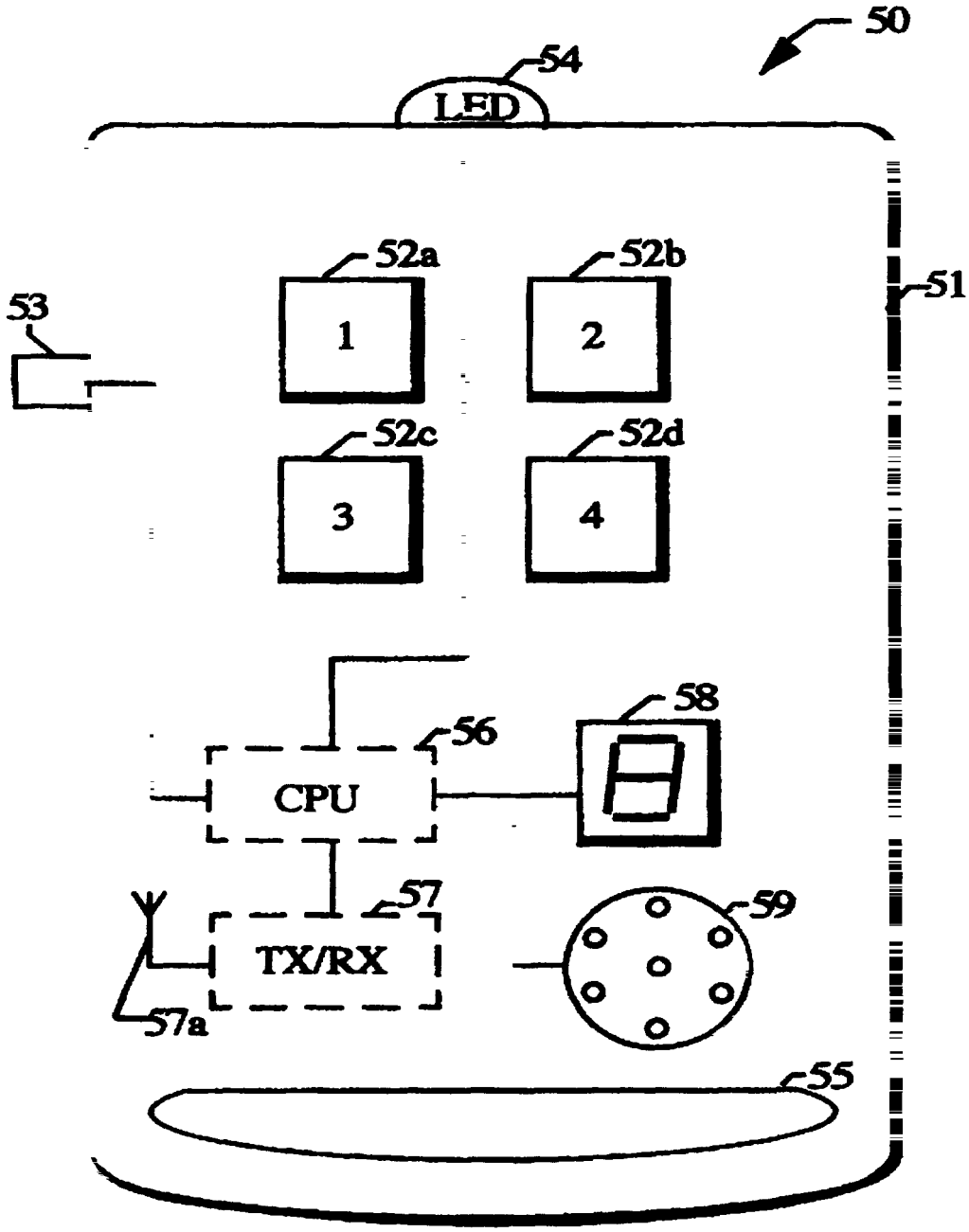


FIG. 2.

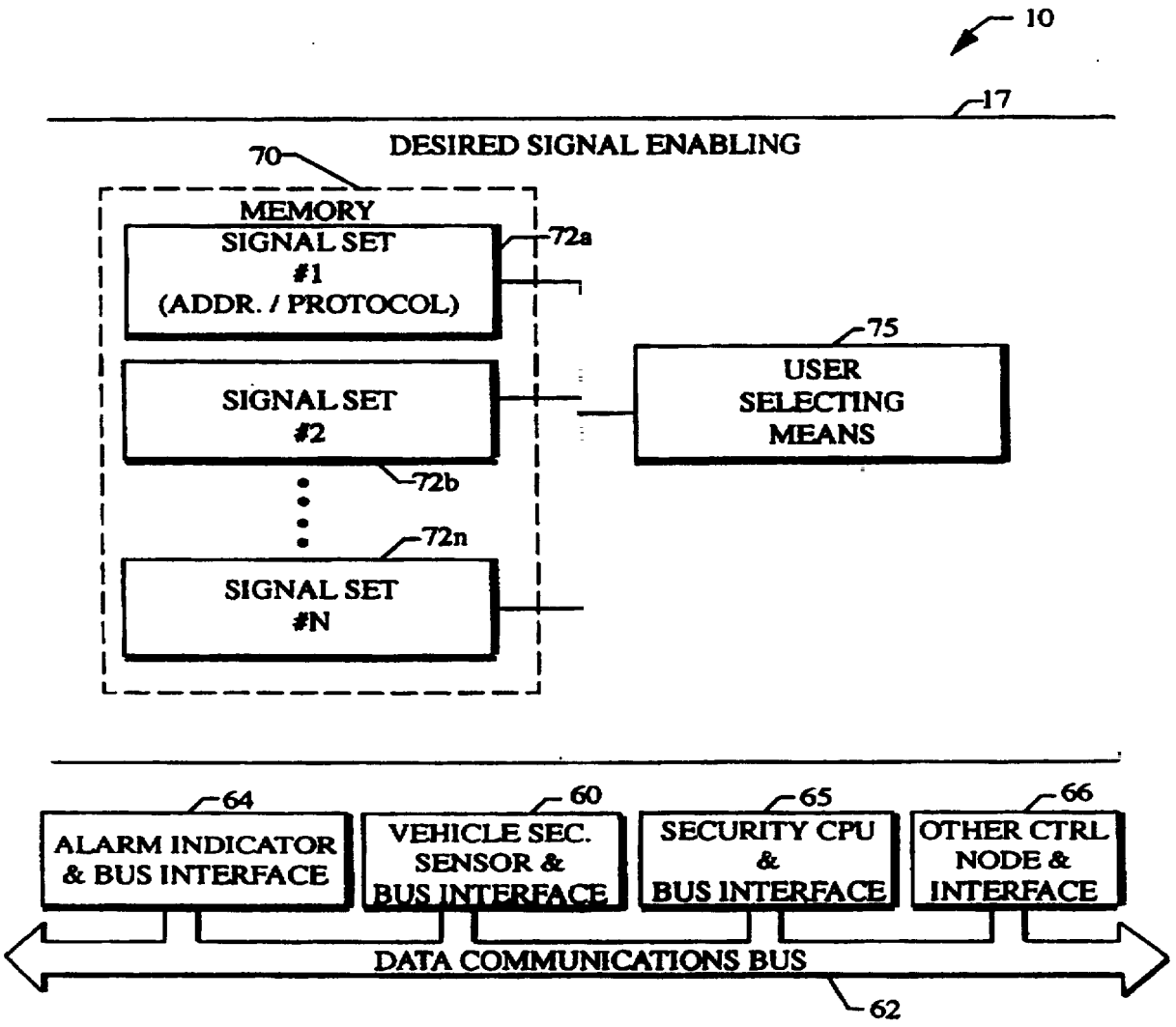

10
17
DESIRED SIGNAL ENABLING
70
MEMORY
SIGNAL SET #1 (ADDR. / PROTOCOL)
72a
SIGNAL SET #2
72b
SIGNAL SET #N
72n
75
USER SELECTING MEANS
64
ALARM INDICATOR & BUS INTERFACE
60
VEHICLE SEC. SENSOR & BUS INTERFACE
65
SECURITY CPU & BUS INTERFACE
66
OTHER CTRL NODE & INTERFACE
DATA COMMUNICATIONS BUS
62

FIG. 3.

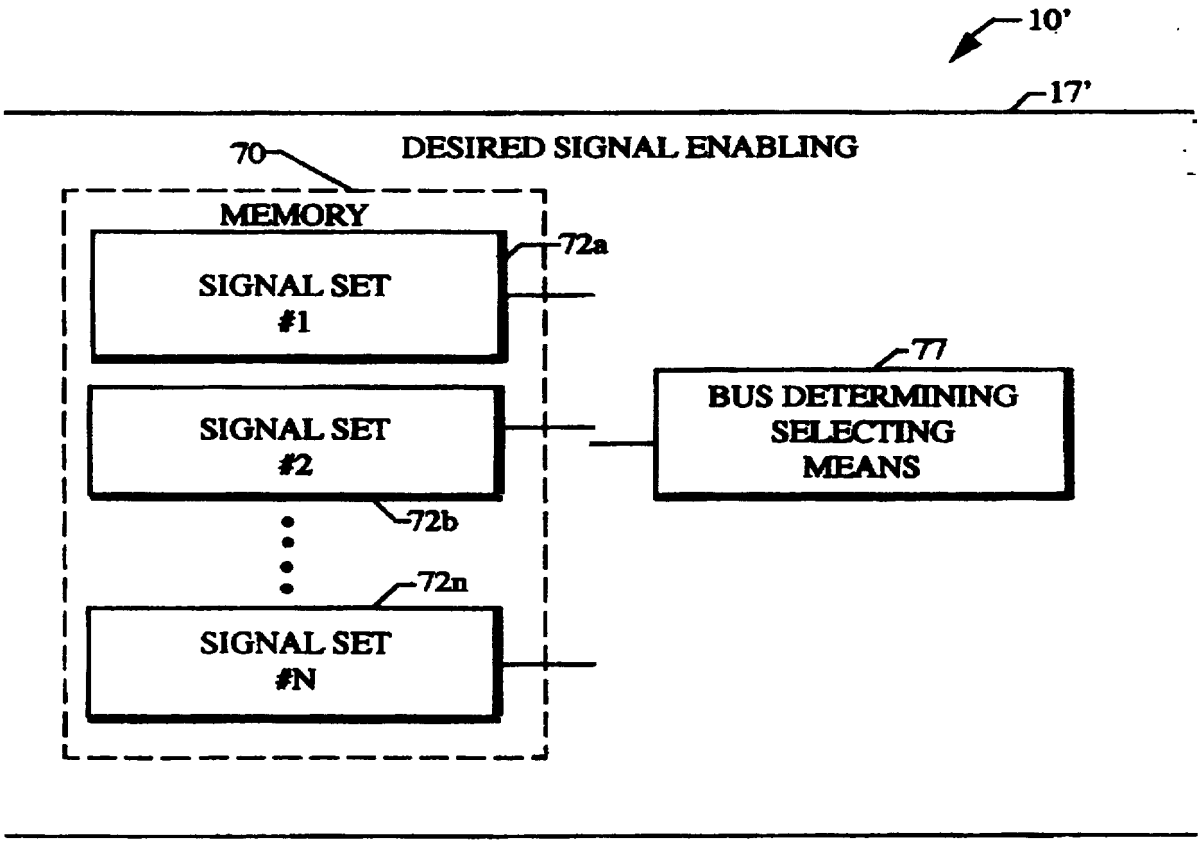
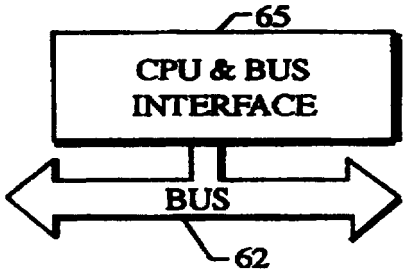

10'
17'
DESIRED SIGNAL ENABLING
70
MEMORY
SIGNAL SET #1
72a
SIGNAL SET #2
72b
SIGNAL SET #N
72n
77
BUS DETERMINING SELECTING MEANS

FIG. 4.


65
CPU & BUS INTERFACE
BUS
62

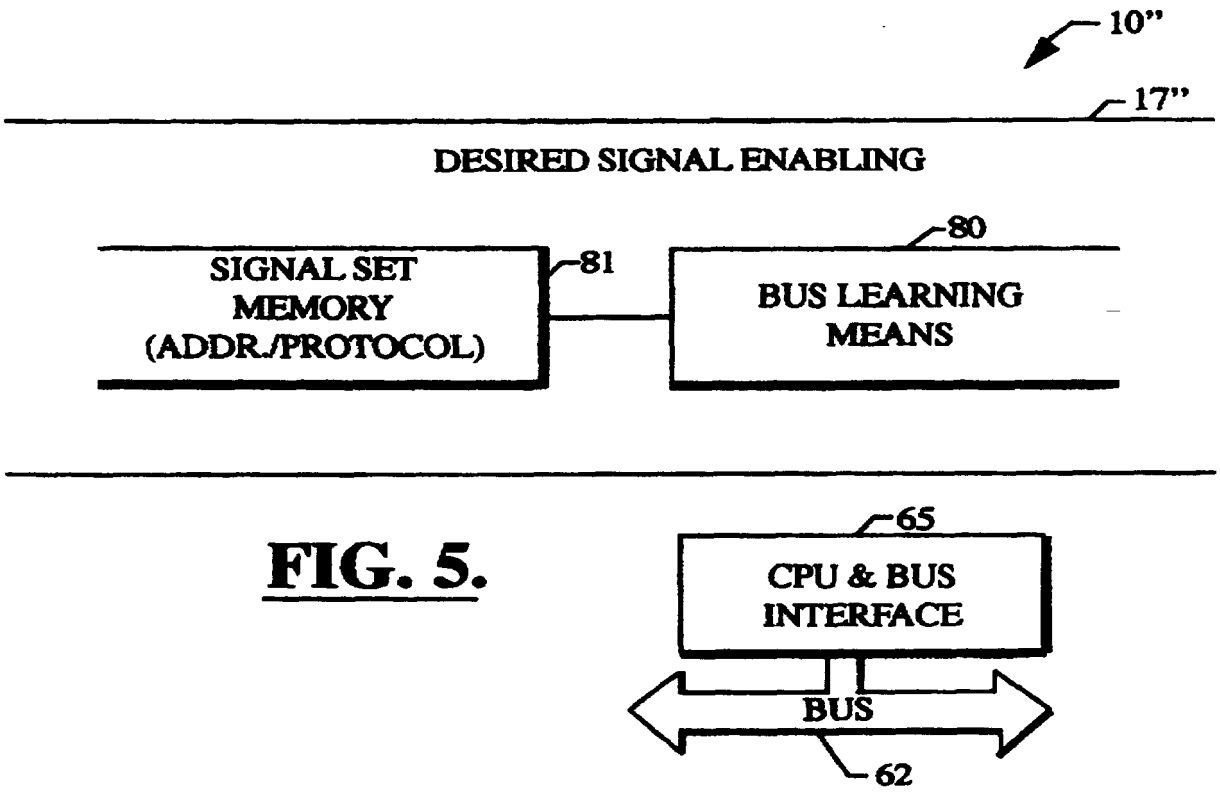

10"
17"
DESIRED SIGNAL ENABLING
SIGNAL SET MEMORY (ADDR./PROTOCOL)
81
80
BUS LEARNING MEANS

FIG. 5.

65
CPU & BUS INTERFACE
BUS
62

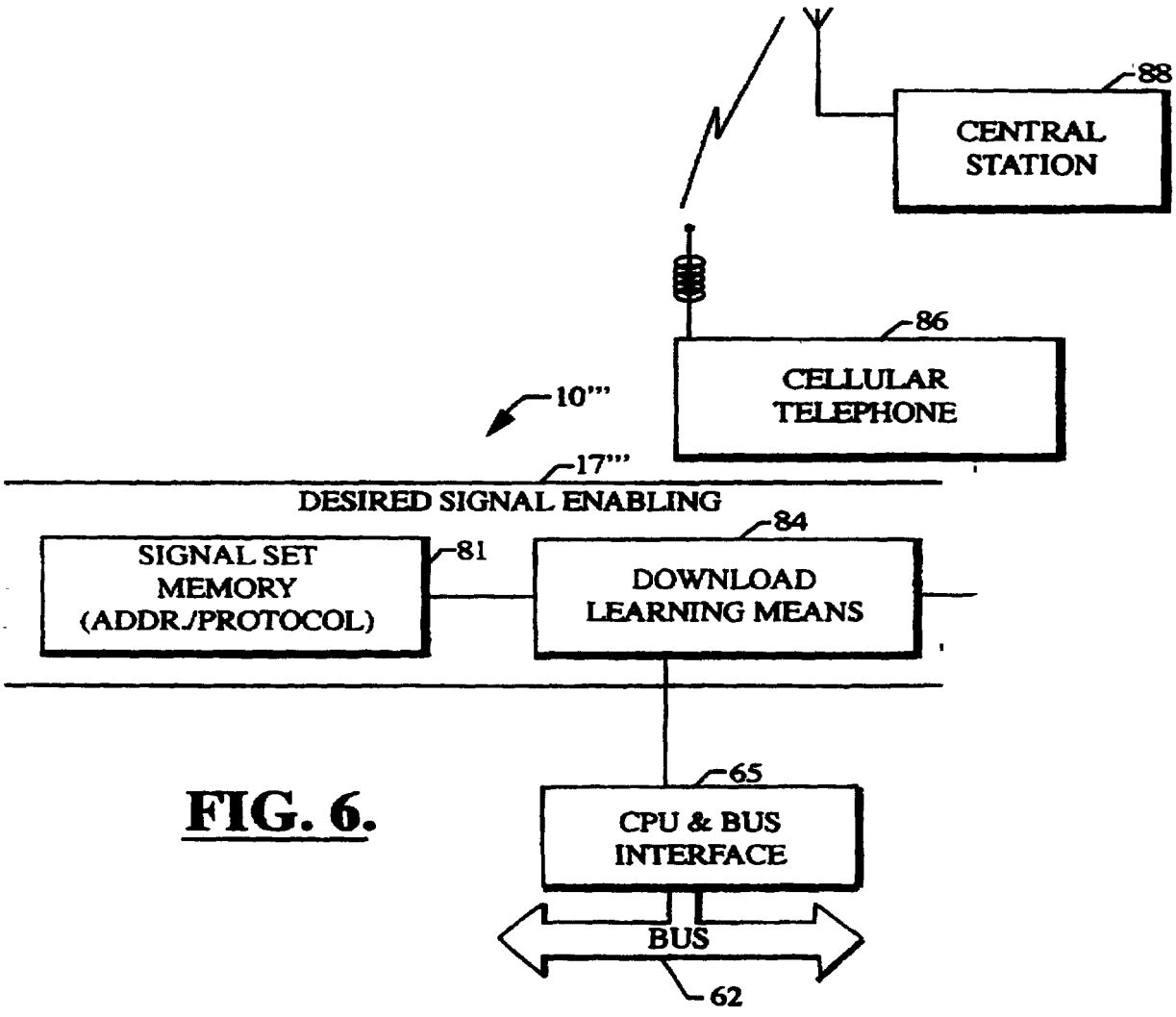

88
CENTRAL STATION
86
CELLULAR TELEPHONE
10'''
17'''
DESIRED SIGNAL ENABLING
84
SIGNAL SET MEMORY (ADDR./PROTOCOL)
81
DOWNLOAD LEARNING MEANS
65
CPU & BUS INTERFACE
BUS
62

FIG. 6.

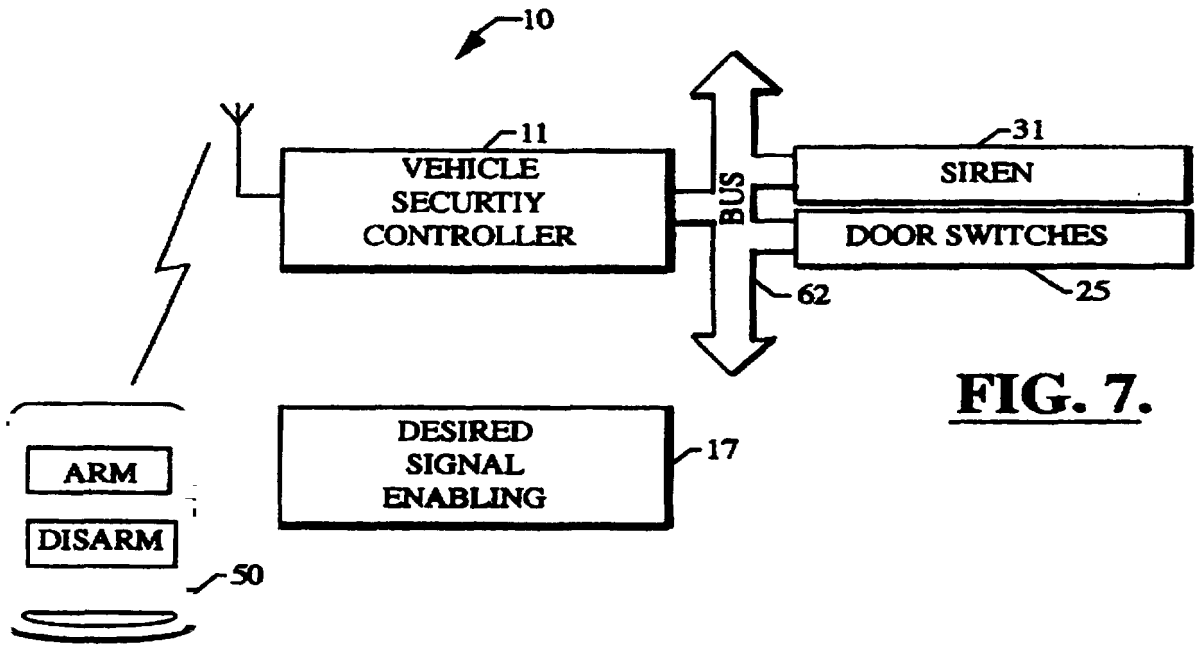

10
11
VEHICLE SECURTIY CONTROLLER
BUS
31
SIREN
DOOR SWITCHES
25
62
DESIRED SIGNAL ENABLING
17
ARM
DISARM
50

FIG. 7.

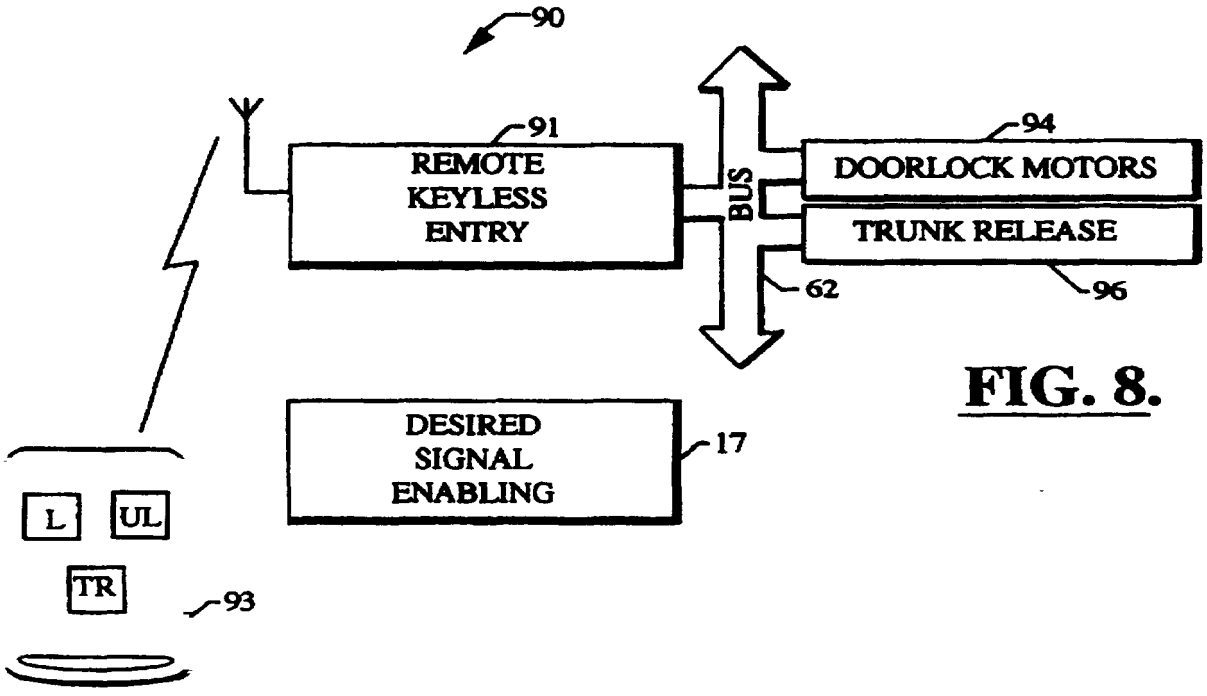

90
91
REMOTE KEYLESS ENTRY
BUS
94
DOORLOCK MOTORS
TRUNK RELEASE
96
62
DESIRED SIGNAL ENABLING
17
L
UL
TR
93

FIG. 8.

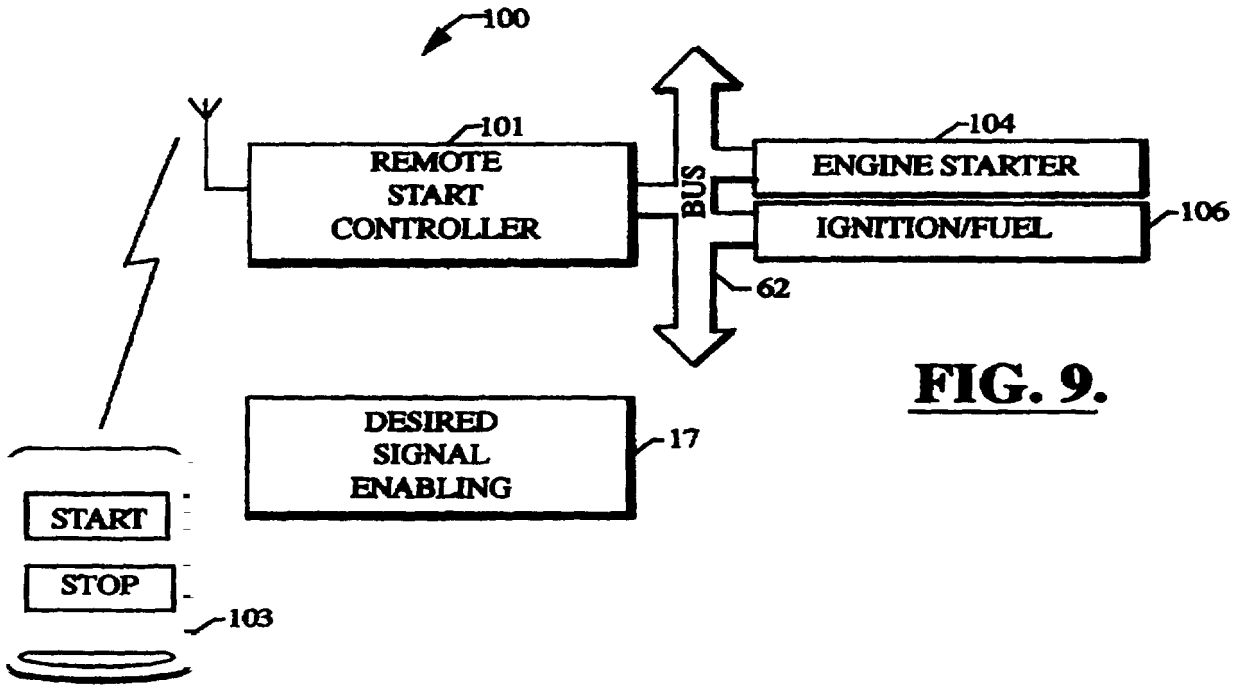

100
101
REMOTE START CONTROLLER
BUS
104
ENGINE STARTER
IGNITION/FUEL
106
62
DESIRED SIGNAL ENABLING
17
START
STOP
103

FIG. 9.

VEHICLE SECURITY SYSTEM FOR A VEHICLE HAVING A DATA COMMUNICATIONS BUS AND RELATED METHODS

FIELD OF THE INVENTION

This application is related to the field of security systems and, more particularly, to a security system and related methods for vehicles.

BACKGROUND OF THE INVENTION

Vehicle security systems are widely used to deter vehicle theft, prevent theft of valuables from a vehicle, deter vandalism, and to protect vehicle owners and occupants. A typical automobile security system, for example, includes a central processor or controller connected to a plurality of vehicle sensors. The sensors, for example, may detect opening of the trunk, hood, doors, windows, and also movement of the vehicle or within the vehicle. Ultrasonic and microwave motion detectors, vibration sensors, sound discriminators, differential pressure sensors, and switches may be used as sensors. In addition, radar sensors may be used to monitor the area proximate the vehicle.

The controller typically operates to give an alarm indication in the event of triggering of a vehicle sensor. The alarm indication may typically be a flashing of the lights and/or the sounding of the vehicle horn or a siren. In addition, the vehicle fuel supply and/or ignition power may be selectively disabled based upon an alarm condition.

A typical security system also includes a receiver associated with the controller that cooperates with one or more remote transmitters typically carried by the user as disclosed, for example, in U.S. Pat. No. 4,383,242 to Sassover et al. and U.S. Pat. No. 5,146,215 to Drori. The remote transmitter may be used to arm and disarm the vehicle security system or provide other remote control features from a predetermined range away from the vehicle. Also related to remote control of a vehicle function U.S. Pat. No. 5,252,966 to Lambropoulous et al. discloses a remote keyless entry system for a vehicle. The keyless entry system permits the user to remotely open the vehicle doors or open the vehicle trunk using a small handheld transmitter.

Unfortunately, the majority of vehicle security systems need to be directly connected by wires to individual vehicle devices, such as the vehicle horn or door switches of the vehicle. In other words, a conventional vehicle security system is hardwired to various vehicle components, typically by splicing into vehicle wiring harnesses or via interposing T-harnesses and connectors. The number of electrical devices in a vehicle has increased so that the size and complexity of wiring harnesses has also increased. For example, the steering wheel may include horn switches, an airbag, turn-signal and headlight switches, wiper controls, cruise control switches, ignition wiring, an emergency flasher switch, and/or radio controls. Likewise, a door of a vehicle, for example, may include window controls, locks, outside mirror switches, and/or door-panel light switches.

In response to the increased wiring complexity and costs, vehicle manufacturers have begun attempts to reduce the amount of wiring within vehicles to reduce weight, reduce wire routing problems, decrease costs, and reduce complications which may arise when troubleshooting the electrical system. For example, some manufacturers have adopted multiplexing schemes to reduce cables to three or four wires and to simplify the exchange of data among the various onboard electronic systems as disclosed, for example, in

"The Thick and Thin of Car Cabling" by Thompson appearing in the IEEE Spectrum, Feb. 1996, pp. 42–45.

Implementing multiplexing concepts in vehicles in a cost-effective and reliable manner may not be easy. Successful implementation, for example, may require the development of low or error-free communications in what can be harsh vehicle environments. With multiplexing technology, the various electronic modules or devices may be linked by a single signal wire in a bus also containing a power wire, and one or more ground wires. Digital messages are communicated to all modules over the data communications bus. Each message may have one or more addresses associated with it so that the devices can recognize which messages to ignore and which messages to respond to or read.

The Thompson article describes a number of multiplexed networks for vehicles. In particular, the Grand Cherokee made by Chrysler is described as having five multiplex nodes or controllers: the engine controller, the temperature controller, the airbag controller, the theft alarm, and the overhead console. Other nodes for different vehicles may include a transmission controller, a trip computer, an instrument cluster controller, an antilock braking controller, an active suspension controller, and a body controller for devices in the passenger compartment.

A number of patent references are also directed to digital or multiplex communications networks or circuits, such as may be used in a vehicle. For example, U.S. Pat. No. 4,538,262 Sinniger et al. discloses a multiplex bus system including a master control unit and a plurality of receiver-transmitter units connected thereto. Similarly, U.S. Pat. No. 4,055,772 to Leung discloses a power bus in a vehicle controlled by a low current digitally coded communications system. Other references disclosing various vehicle multiplex control systems include, for example, U.S. Pat. No. 4,760,275 to Sato et al.; U.S. Pat. No. 4,697,092 to Roggendorf et al.; and U.S. Pat. No. 4,792,783 to Burgess et al.

Several standards have been proposed for vehicle multiplex networks including, for example, the Society of Automotive Engineers "Surface Vehicle Standard, Class B Data Communications Network Interface", SAE J1850, July 1995. Another report by the SAE is the "Surface Vehicle Information Report, Chrysler Sensor and Control (CSC) Bus Multiplexing Network for Class 'A' Applications", SAE J2058, July 1990. Many other networks are also being implemented or proposed for communications between vehicle devices and nodes or controllers.

Unfortunately, conventional vehicle security systems for hardwired connection to vehicle devices, such as aftermarket vehicle security systems, are not readily adaptable to a vehicle including a data communications bus. Moreover, a vehicle security system if adapted for a communications bus and devices for one particular model, model year, and manufacturer, may not be compatible with any other models, model years, or manufacturers. Other systems for remote control of vehicle functions may also suffer from such shortcomings.

SUMMARY OF THE INVENTION

In view of the foregoing background, it is therefore an object of the present invention to provide a vehicle security system and associated method which is readily adapted or adaptable for installation in a vehicle having a data communications bus.

It is another object of the present invention to provide a security system or other remote control function systems and associated methods for installation in a vehicle having a data

communications bus, and wherein the vehicle is one from among a plurality of different vehicles with different device addresses and/or signal protocols for communicating with the vehicle devices.

These and other objects, advantages and features of the present invention are provided by a vehicle security system for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices. In particular, the vehicle security system preferably comprises a vehicle security sensor and associated sensor bus interface means for interfacing the vehicle security sensor to the data communications bus. The vehicle security system also preferably includes an alarm indicator and associated alarm indicator bus interface means for interfacing the alarm indicator to the data communications bus. An alarm controller and associated alarm controller bus interface means are also preferably included. The security system further preferably comprises desired signal enabling means for enabling the alarm controller to operate using a desired set of signals for a desired vehicle from among a plurality of possible sets of signals for different vehicles. Accordingly, the desired signal enabling means permits the alarm controller to communicate with the vehicle security sensor and the alarm indicator via the data communications bus so that the alarm controller is capable of operating the alarm indicator responsive to the vehicle security sensor. The security system is thus advantageously compatible with many different types of vehicle data communications formats or protocols.

The data communications bus may preferably be a multiplexed data bus. Accordingly, the sensor bus interface means, the alarm bus interface means, and the alarm controller bus interface means may each comprise multiplexing means for interfacing with the multiplexed data bus of the vehicle.

The desired signal enabling means may preferably include memory means for storing a plurality of sets of signals for different vehicles, and selecting means for selecting the desired set of signals from the plurality of different sets of signals. In one embodiment, the selecting means may comprise user selecting means for permitting a user to select the desired set of signals. In another embodiment, the selecting means may comprise determining means for determining the desired set of signals based upon signals on the data communications bus.

The memory means may include device address memory means for storing a plurality of different sets of signals representative of different device addresses for different vehicles. Alternatively, or in addition thereto, the memory means may comprise protocol memory means for storing a plurality of different protocols for different vehicles.

In yet another embodiment, the desired signal enabling means may comprise learning means for learning the desired set of signals. For example, the learning means may comprise downloading learning means for learning the desired set of signals from another device or central station. In particular, the security system may interface to a cellular telephone and the desired set of signals may be downloaded or received and stored via the cellular telephone. In another variation, the learning means may comprise bus learning means for learning the desired set of signals based upon signals on the data communications bus. The security system, according to another aspect of the invention, may also interface with an existing vehicle controller or a communications bus node which is operatively connected to the data communications bus.

A method aspect of the invention is for operating a vehicle security system for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices. The method preferably comprises the steps of interfacing an alarm controller to the data communications bus, and enabling the alarm controller to operate using a desired set of digital signals for a desired vehicle from a plurality of sets of signals for different vehicles to thereby permit the alarm controller to communicate with at least one of a vehicle security sensor and an alarm indicator via the data communications bus. Accordingly, the alarm controller is capable of operating the alarm indicator responsive to the vehicle security sensor and via the data communication bus.

The concepts and features of the invention may also be desirably incorporated in a remote control system for a vehicle, such as a vehicle security system, a remote engine starter system, or a remote keyless entry system, for example. The remote control system preferably comprises a remote transmitter and a receiver within the vehicle for receiving a signal from the remote transmitter. A vehicle function controller is provided along with an associated vehicle function controller bus interface means for interfacing the vehicle function controller to the data communications bus. The remote control system also includes desired signal enabling means for causing the vehicle function controller to operate using a desired set of signals for a desired vehicle from a plurality of possible sets of digital signals for different vehicles. Accordingly, the vehicle function controller can communicate with a vehicle device via the data communications bus so that the vehicle function controller is capable of operating the vehicle device responsive to the remote transmitter. Method aspects of this embodiment of the invention are also disclosed.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a schematic block diagram of the vehicle security system in accordance with the invention.

FIG. 2 is a schematic diagram of a remote transmitter of the vehicle security system in accordance with the invention.

FIG. 3 is a schematic block diagram of a portion of a first embodiment of the vehicle security system in accordance with the present invention.

FIG. 4 is a schematic block diagram of a portion of a second embodiment of the vehicle security system in accordance with the present invention.

FIG. 5 is a schematic block diagram of a portion of a third embodiment of the vehicle security system in accordance with the present invention.

FIG. 6 is a schematic block diagram of a portion of a fourth embodiment of the vehicle security system in accordance with the present invention.

FIG. 7 is a schematic block diagram of the vehicle security system in accordance with the present invention.

FIG. 8 is a schematic block diagram of a remote keyless entry system in accordance with the present invention.

FIG. 9 is a schematic block diagram of a remote engine starting system in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will now be described more fully hereinafter with reference to the accompanying drawings in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the illustrated embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough

and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout. Prime and multiple prime notation are used in alternate embodiments to indicate similar elements.

Referring now to the schematic block diagram of FIG. 1, a vehicle security system **10** according to one aspect of the invention is first described. The security system includes a controller **11** which, in turn, in the illustrated embodiment includes a central processing unit (CPU) or microprocessor **12** operating under stored program control.

In the illustrated embodiment, a transmitter and receiver **13** are connected to the CPU **12** for receiving signals from a remote transmitter and for transmitting signals to a remote unit, as will be described in greater detail below. As would be readily understood by those skilled in the art, the transmitter portion of the controller **11** may not be needed in some embodiments of the invention. An antenna **13***a* is illustratively connected to the transmitter and receiver **13**.

In the illustrated embodiment, the CPU **12** is also operatively connected to a memory (EEPROM) **14** and a data communications bus interface **15** which provides both input and output interfaces to various vehicle devices. As would be readily understood by those skilled in the art, the CPU **12** may alternately or additionally have its own on-board memory.

The data communications bus interface **15** is illustratively connected to various vehicle input devices including: an ignition switch **20**; a key in the ignition sensor **21**; two zone sensors **22***a*, **22***b*; conventional trunk hood and door pin sensors or switches **23**, **24**, and **25**, respectively; and door lock switches **28**. In addition, a pre-warn sensor **26** and valet switch **27** also provide inputs to the controller **11** in the illustrated embodiment. As would be readily understood by those skilled in the art, other inputs are also contemplated by the present invention and are generally described herein by the term sensor. In addition, an input signal may also be received from a remote transmitter **50** (FIG. 2).

The data communications bus interface **15** of the controller **11** may also preferably be connected to a plurality of output devices. The outputs may include auxiliary relay outputs **30**, such as for window control, remote starting, or a remote alarm indication, as would be readily understood by those skilled in the art. A siren and/or lights **31**, and green and red light emitting diodes (LEDs) **32**, **33** for dashboard mounting are also illustratively connected to the controller **11**. Other outputs may be directed to a valet LED **34**, a dome light **36**, a central lock relay or lock control unit **41**, a starter kill circuit **42**, and an armed relay output **43**. In addition, other outputs may be directed to one or more of an audible tone generator **37**, an alphanumeric display **44**, a speech message annunciator **45**, and a vibration transducer **46**, as will be readily appreciated by those skilled in the art. Other similar indicating devices are also contemplated by the present invention, as would be readily understood by those skilled in the art. Some of the illustrated devices may be hardwired to various control nodes as would be readily understood by those skilled in the art. The control nodes may be connected by the data communications bus as would also be known to those skilled in the art.

Referring now more particularly to FIG. **2**, a remote transmitter **50** in accordance with the invention is described. The remote transmitter **50** illustratively includes a housing **51** and a plurality of first momentary contact switches **52***a*–**52***d* carried by the housing. A second momentary contact switch **53** and an indicating light, such as the illustrated LED **54** are also carried by or mounted on the housing **51**. As would be readily understood by those skilled in the art, the remote transmitter **50** is typically relatively small and includes an opening **55** for facilitating connection to a vehicle key ring, for example. In addition, the remote transmitter **50** includes a central processing unit or microprocessor **56** operatively connected to the plurality of first switches **52***a*–**52***d*, the second switch **53**, and the LED **54**. The microprocessor is also connected to a transmitter and/or receiver circuit **57** and its associated antenna **57***a* for transmitting and/or receiving signals to and from the controller **11** of the vehicle security system **10**. Accordingly, the term "remote transmitter" is used broadly herein to describe the embodiment also including receiver means.

The remote transmitter **50** may also include a numeric or alphanumeric display **58**, and a speaker **59** coupled to an audible tone generator or a speech message generator, as may be provided by the microprocessor **56**. A vibration transducer, not shown, may also be incorporated into the remote transmitter **50** for communicating to the user as would be readily understood by those skilled in the art.

Turning now additionally to FIG. **3** a first embodiment of the desired signal enabling means **17** is described. The vehicle security system **10** preferably comprises a vehicle security sensor and associated sensor bus interface means **60** for interfacing the vehicle security sensor to the data communications bus **62**. The vehicle security system **10** also preferably includes an alarm indicator and associated alarm indicator bus interface means **64** for interfacing the alarm indicator to the data communications bus. Examples of vehicle security sensors and alarm indicators are described above in greater detail with reference to FIG. **1**.

The security system **10** further preferably comprises desired signal enabling means **17** for enabling the alarm controller **10** to operate using a desired set of signals for a desired vehicle from among a plurality of possible sets of signals for different vehicles. As would be readily understood by those skilled in the art, the term different vehicles may include vehicles from different manufacturers, different models, or even different trim levels of the same make and model. Accordingly, the desired signal enabling means **17** permits the alarm controller, that is, the security CPU and bus interface **65**, to communicate with the vehicle security sensor and the alarm indicator via the data communications bus **62** so that the CPU is capable of operating the alarm indicator responsive to the vehicle security sensor.

The data communications bus **62** may preferably be a multiplexed data bus as would be readily understood by those skilled in the art. Accordingly, the sensor bus interface means, the alarm bus interface means, and the alarm controller bus interface means may each comprise multiplexing means for interfacing with the multiplexed data bus of the vehicle. For example, any of the various multiplexing schemes as disclosed in "The Thick and Thin of Car Cabling" by Thompson appearing in the IEEE Spectrum, February 1996, pp. 42–45 may be used. Other data bus connection schemes are also contemplated by the present invention.

As illustrated in FIG. **3**, one embodiment of the desired signal enabling means **17** may preferably include a memory **70** for storing a plurality of sets **72***a*, **72***b* and **72***n* of signals for different vehicles, and selecting means for selecting the desired set of signals from the plurality of different sets of signals for different vehicles. By storing sets of signals is meant storing information or data necessary to generate the desired signals on the data bus **62** as would be readily

understood by those skilled in the art. The memory 70 may include device address memory means for storing a plurality of different sets of signals representative of different device addresses for different vehicles. Alternatively, or in addition thereto, the memory means may comprise protocol memory means for storing a plurality of different protocols for different vehicles. One or more other control nodes and associated bus interfaces 66 may also be connected to the data communications bus 62 as would also be readily understood by those skilled in the art. For example, other control nodes may include an engine controller thereby permitting the alarm controller to disable the engine, or the body controller thereby permitting the alarm controller to control the vehicle door locks as would be readily understood by those skilled in the art.

In the illustrated embodiment of FIG. 3, the selecting means may comprise user selecting means 75 for permitting a user to select the desired set of signals. A keypad or other input means may be used to permit the user to select the desired signal set for his vehicle. The valet switch 27 (FIG. 1), for example, may also be operated by the user to select the desired signal set. The user may select the desired set of signals by entering a unique digital code similar to the selection of signals for a home electronics universal remote control. Other techniques for permitting the user to select the desired signal set from a plurality of stored sets are also contemplated by the invention as would be readily appreciated by those skilled in the art.

Referring now additionally to FIG. 4 another embodiment of the desired signal enabling means 17' is described in accordance with the security system 10' of the present invention. In this embodiment, the selecting means may comprise bus determining means 77 for determining the desired set of signals based upon signals on the data communications bus. For example, the bus determining means could determine the desired set of signals based upon sensed voltage levels or based upon the timing of signal pulses on the data communications bus 62. The other components of this embodiment of the desired signal enabling means 17' are similar to those described above with reference to FIG. 3 and need no further description.

Yet another embodiment of the security system 10" according to the invention is explained with reference to FIG. 5. In this illustrated embodiment, the desired signal enabling means 17" includes a desired signal set memory 81 operatively connected to the illustrated bus learning means 80. The bus learning means 80 may determine and store in the signal set memory 81 the protocol and/or device addresses for the vehicle devices. For example, the bus learning means 80 may permit the user to operate various vehicle devices and store a desired signal set based thereon as would be readily understood by those skilled in the art. The other components of the desired signal enabling means 17" are similar to those described above with reference to FIG. 3 and need no further description.

Still another embodiment of the desired signal enabling means 17'" is explained with reference to FIG. 6. The desired signal enabling means 17'" includes a signal set memory 81 operatively connected to the schematically illustrated download learning means 84. The download learning means 84 may include an interface connected to the illustrated vehicle cellular telephone 86 to permit learning or downloading of the desired signal set from a remote or central monitoring and control station 88, for example. As would be readily understood by those skilled in the art, the download learning means as well as the other desired signal enabling means may be implemented by software in the CPU 12 of the controller 11 or in a separate microprocessor or circuits.

One implementation of the security system 10 is shown in FIG. 7 and includes the vehicle security controller 11. The remote transmitter 50 can switch the controller 11 between the armed and disarmed modes. The controller 11 in the armed mode is capable of generating an alarm indication via the siren 31 (FIG. 1) and based upon the door switches 25 (FIG. 1), for example. The communications are via the data communications bus 62 and, are based upon the desired signal set from the desired signal enabling means 17.

The features and aspects described above may also be readily implemented into other vehicle related systems, such as for performing remote control functions. As shown in FIG. 8, the invention may be embodied in a remote keyless entry system 90 including a remote keyless entry controller 91 operated by a remote handheld transmitter 93. The controller 91 communicates with the door lock motors 94 and illustrated trunk release 96 via the data communications bus 62. The remote keyless entry system 90 also includes the desired signal enabling means 17 which permits the controller 91 to perform the desired door locking and trunk release remote control functions or operations as would also be readily understood by those skilled in the art. As would be readily appreciated by those skilled in the art, any of the desired signal enabling means described herein and equivalent thereto may be used for the remote keyless entry system 90 in accordance with the present invention.

Turning now to FIG. 9, yet another vehicle associated remote control function is illustrated and now explained. The remote engine starting system 100 includes a remote start controller 101 operable by a remote transmitter 103. The remote controller 101 may communicate via the data communications bus 62 to enable the ignition and fuel systems 106 and crank the engine starter 104. Various sensors may also be monitored as would be readily understood by those skilled in the art.

A method aspect of the invention is for operating a vehicle security system 10 for a vehicle of a type including a data communications bus 62 connecting a plurality of vehicle devices. The method preferably comprises the steps of interfacing an alarm controller 11 to the data communications bus 62, and enabling the alarm controller to operate using a desired set of digital signals for a desired vehicle from a plurality of possible sets of signals for different vehicles to thereby permit the alarm controller to communicate with at least one of a vehicle security sensor 60 and an alarm indicator 64 via the data communications bus 62 (FIG. 3). Accordingly, the alarm controller is capable of operating the alarm indicator responsive to the vehicle security sensor and via the data communication bus.

Another method of the invention is for remotely controlling a vehicle function for a vehicle of a type including a data communications bus 62 connecting a plurality of vehicle devices, and a vehicle function controller and associated bus interface means for interfacing the vehicle function controller to the data communications bus. The method comprising the steps of: enabling the vehicle function controller to operate using a desired set of signals for a desired vehicle from a plurality of sets of signals for different vehicles for permitting the vehicle function controller to communicate via the data communications bus with at least one of the vehicle devices; and receiving a signal at the vehicle from a remote transmitter so that the vehicle function controller remotely controls a vehicle function responsive to the remote transmitter.

Those of skill in the art will readily recognize the benefits and advantages of the present invention for aftermarket

security systems and other aftermarket systems for implementing remote control functions wherein compatibility with a potentially large number of different protocols and/or device addresses is desired. Of course, many modifications and other embodiments of the invention will come to the mind of one skilled in the art having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Accordingly, it is understood that the invention is not to be limited to the illustrated embodiments disclosed, and that the modifications and embodiments are intended to be included within the spirit and scope of the appended claims.

That which is claimed is:

1. A vehicle security system for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices, said vehicle security system comprising:

a vehicle security sensor and associated sensor bus interface means for interfacing said vehicle security sensor to the data communications bus;

an alarm indicator and associated alarm indicator bus interface means for interfacing said alarm indicator to the data communications bus;

an alarm controller and associated alarm controller bus interface means for interfacing said alarm controller to the data communications bus; and

desired signal enabling means for enabling said alarm controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting said alarm controller to communicate with said vehicle security sensor and said alarm indicator via the data communications bus so that said alarm controller is capable of operating said alarm indicator responsive to said vehicle security sensor.

2. A vehicle security system according to claim 1 wherein said desired signal enabling means comprises:

memory means for storing a plurality of sets of signals for different vehicles; and

selecting means for selecting the desired set of signals from the plurality of different sets of signals for different vehicles.

3. A vehicle security system according to claim 2 wherein said selecting means comprises user selecting means for permitting a user to select the desired set of signals.

4. A vehicle security system according to claim 2 wherein said selecting means comprises bus determining means for determining the desired set of signals based upon signals on the data communications bus.

5. A vehicle security system according to claim 2 wherein said memory means comprises device address memory means for storing a plurality of different sets of signals for different device addresses.

6. A vehicle security system according to claim 2 wherein said memory means comprises protocol memory means for storing a plurality of different sets of signals for different protocols.

7. A vehicle security system according to claim 1 wherein said desired signal enabling means comprises bus learning means for learning the desired set of signals based upon signals on the data communications bus.

8. A vehicle security system according to claim 1 wherein said desired signal enabling means comprises download learning means for leaving the desired set of signals from a downloading device.

9. A vehicle security system according to claim 1 wherein said desired signal enabling means comprises protocol providing means for providing a protocol for the desired vehicle.

10. A vehicle security system according to claim 1 wherein said desired signal enabling means comprises device address providing means for providing device addresses for the desired vehicle.

11. A vehicle security system according to claim 1 further comprising a vehicle controller and associated vehicle controller bus interface means for connecting the vehicle controller to the data communications bus; and wherein said alarm controller is operatively connected to said vehicle controller.

12. A vehicle security system according to claim 1 wherein the data communications bus is a multiplexed data bus; and wherein the sensor bus interface means, the alarm bus interface means, and the alarm controller bus interface means each comprises multiplex interface means for interfacing with the multiplexed data bus.

13. A vehicle security system according to claim 1 wherein said vehicle security sensor comprises one of a door switch, a trunk switch, a proximity sensor, and a motion sensor.

14. A vehicle security system according to claim 1 wherein said alarm indicator comprises one of a vehicle light, a vehicle horn, a siren, a speech message generator, and a remote pager.

15. A vehicle security system for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices, the vehicle devices comprising at least one of a vehicle security sensor and an alarm indicator, said vehicle security system comprising:

an alarm controller and associated alarm controller bus interface means for interfacing said alarm controller to the data communications bus;

memory means for storing a plurality of sets of signals for different vehicles; and

selecting means for selecting a desired set of signals for a desired vehicle from the plurality of sets of signals for different vehicles, the desired set of signals for enabling said alarm controller to communicate via the data communications bus with at least one of the vehicle security sensor and the alarm indicator.

16. A vehicle security system according to claim 15 wherein said selecting means comprises user selecting means for permitting a user to select the desired set of signals.

17. A vehicle security system according to claim 15 wherein said selecting means comprises bus determining means for determining the desired set of signals based upon signals on the data communications bus.

18. A vehicle security system according to claim 15 wherein said memory means comprises device address memory means for storing a plurality of different sets of signals for different device addresses.

19. A vehicle security system according to claim 15 wherein said memory means comprises protocol memory means for storing a plurality of different sets of signals for different protocols.

20. A vehicle security system according to claim 15 wherein the data communications bus is a multiplexed data bus; and wherein the alarm controller bus interface means comprises multiplex interface means for interfacing with the multiplexed data bus.

21. A vehicle security system for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices, the vehicle devices comprising at least one of a vehicle security sensor and an alarm indicator, said vehicle security system comprising:

an alarm controller and associated alarm controller bus interface means for interfacing said alarm controller to the data communications bus; and

desired signal enabling means for enabling said alarm controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting said alarm controller to communicate via the data communications bus with at least one of the vehicle security sensor and the alarm indicator, said desired signal enabling means comprising learning means for learning the desired set of signals.

22. A vehicle security system according to claim 21 wherein said learning means comprises bus learning means for learning the desired set of signals based upon signals on the data communications bus.

23. A vehicle security system according to claim 21 wherein said learning means comprises download learning means for learning the desired set of signals from a downloading device.

24. A vehicle security system according to claim 23 further comprising cellular telephone means cooperating with said download learning means for receiving signals from a remote downloading device.

25. A vehicle security system according to claim 21 wherein said signal desired enabling means comprises protocol providing means for providing a protocol for the desired vehicle.

26. A vehicle security system according to claim 21 wherein said desired signal enabling means comprises device address providing means for providing desired addresses for the desired vehicle.

27. A vehicle security system according to claim 21 wherein the data communications bus is a multiplexed data bus; and wherein the alarm controller bus interface means comprises multiplex interface means for interfacing with the multiplexed data bus.

28. A method for operating a vehicle security system for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices, the method comprising the steps of:

interfacing an alarm controller to the data communications bus; and

enabling said alarm controller to operate using a set of desired signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting said alarm controller to communicate via the data communications bus with at least one of a vehicle security sensor and an alarm indicator.

29. A method according to claim 28 wherein the step of enabling the alarm controller to operate using a set of desired signals comprises the steps of:

storing in a memory a plurality of sets of signals for different vehicles; and

selecting the desired set of signals from the plurality of different sets of signals for different vehicles.

30. A method according to claim 29 wherein the step of selecting comprises permitting user selection of the desired set of signals.

31. A method according to claim 28 wherein the step of selecting comprises determining the desired set of signals based upon signals on the data communications bus.

32. A method according to claim 29 wherein the step of storing in memory comprises storing a plurality of different sets of signals representative of different device addresses.

33. A method according to claim 29 wherein the step of storing in memory comprises storing a plurality of different sets of signals representative of different protocols.

34. A method according to claim 28 wherein the step of enabling the alarm controller to operate using a set of desired signals comprises the step of learning the desired set of signals based upon signals on the data communications bus.

35. A method according to claim 28 wherein the step of enabling the alarm controller to operate using a set of desired signals comprises the step of downloading the desired signals from a downloading device.

36. A remote control system for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices, said remote control system comprising:

a remote transmitter;

a receiver within the vehicle for receiving a signal from said remote transmitter;

a vehicle function controller, operatively connected to said receiver, and associated vehicle function controller bus interface means for interfacing said vehicle function controller to the data communications bus; and

desired signal enabling means for enabling said vehicle function controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting said vehicle function controller to communicate via the data communications bus with a vehicle device so that said vehicle function controller is capable of operating the vehicle device responsive to said remote transmitter.

37. A remote control system for a vehicle according to claim 36 wherein the plurality of vehicle devices comprises a vehicle security sensor and associated sensor bus interface means for interfacing said vehicle security sensor to the data communications bus; and wherein said vehicle function controller comprises an alarm controller being capable of generating an alarm responsive to the vehicle security sensor.

38. A remote control system for a vehicle according to claim 36 wherein the plurality of vehicle devices comprises a plurality of vehicle door locks movable between locked and unlocked positions and associated bus interface means for interfacing said door locks to the data communications bus; and wherein said vehicle function controller comprises a door lock controller for moving the vehicle door locks between locked and unlocked positions responsive to said remote transmitter.

39. A remote control system for a vehicle according to claim 36 wherein said plurality of vehicle devices comprises vehicle engine starting means and associated bus interface means for interfacing said vehicle engine starting means to the data communications bus; and wherein said vehicle function controller comprises a remote start controller for operating the vehicle engine starting means responsive to said remote transmitter.

40. A remote control system for a vehicle according to claim 36 wherein said desired signal enabling means comprises:

memory means for storing a plurality of sets of signals for different vehicles; and

selecting means for selecting the desired set of signals from the plurality of different sets of signals for different vehicles.

41. A remote control system for a vehicle according to claim 40 wherein said selecting means comprises user selecting means for permitting a user to select the desired set of signals.

42. A remote control system for a vehicle according to claim 40 wherein said selecting means comprises determining means for determining the desired set of signals based upon signals on the data communications bus.

43. A remote control system for a vehicle according to claim 40 wherein said memory means comprises address memory means for storing a plurality of different sets of digital signals for different device addresses.

44. A remote control system for a vehicle according to claim 40 wherein said memory means comprises protocol memory means for storing a plurality of different sets of signals for different protocols.

45. A remote control system for a vehicle according to claim 36 wherein said desired signal enabling means comprises learning means for learning the desired set of signals.

46. A remote control system for a vehicle according to claim 36 wherein said desired signal enabling means comprises protocol providing means for providing a protocol for the desired vehicle.

47. A remote control system for a vehicle according to claim 36 wherein said desired signal enabling means comprises device address providing means for providing device addresses for the desired vehicle.

48. A remote control system for a vehicle according to claim 36 further comprising a second vehicle controller and associated vehicle controller bus interface means for connecting to the data communications bus; and wherein said vehicle function controller is operatively connected to said second vehicle controller.

49. A remote control system for a vehicle according to claim 36 wherein the data communications bus is a multiplexed data bus; and wherein the vehicle function controller bus interface means comprises multiplexing means for interfacing with the multiplexed data bus.

50. A method for remotely controlling a vehicle function for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices, and a vehicle function controller and associated bus interface means for interfacing the vehicle function controller to the data communications bus; the method comprising the steps of:

enabling the vehicle function controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting the vehicle function controller to communicate via the data communications bus with at least one of the vehicle devices; and

receiving a signal at the vehicle from a remote transmitter so that the vehicle function controller remotely controls a vehicle function responsive to the remote transmitter.

51. A method according to claim 50 wherein the plurality of vehicle devices comprises a vehicle security sensor and associated sensor bus interface means for interfacing the vehicle security sensor to the data communications bus; wherein the vehicle function controller comprises an alarm controller movable between armed and disarmed modes, the alarm controller when in the armed mode being capable of generating an alarm indication responsive to the vehicle security sensor; and wherein the step of receiving comprises receiving a signal so that the vehicle function controller is moved to one of the armed and disarmed modes.

52. A method according to claim 50 wherein the plurality of vehicle devices comprises a plurality of vehicle door locks movable between locked and unlocked positions and associated bus interface means for interfacing the door locks to the data communications bus; and wherein the step of receiving comprises moving the vehicle door locks to one of locked and unlocked positions responsive to the remote transmitter.

53. A method according to claim 50 wherein the plurality of vehicle devices comprises vehicle engine starting means and associated bus interface means for interfacing the vehicle engine starting means to the data communications bus; and wherein the step of receiving comprises operating the vehicle engine starting means responsive to the remote transmitter.

54. A method according to claim 50 wherein the step of enabling the alarm controller to operate using a set of desired signals comprises the steps of:

storing in a memory a plurality of sets of signals for different vehicles; and

selecting the desired set of signals from the plurality of different sets of signals for different vehicles.

55. A method according to claim 54 wherein the step of selecting comprises permitting user selection of the desired set of signals.

56. A method according to claim 54 wherein the step of selecting comprises determining the desired set of signals based upon signals on the data communications bus.

57. A method according to claim 54 wherein the step of storing in memory comprises storing a plurality of different sets of signals representative of different device addresses.

58. A method according to claim 54 wherein the step of storing in memory comprises storing a plurality of different sets of signals representative of different protocols.

59. A method according to claim 50 wherein the step of enabling the alarm controller to operate using a set of desired signals comprises the step of learning the desired set of signals.

* * * * *

43. A remote control system for a vehicle according to claim 40 wherein said memory means comprises address memory means for storing a plurality of different sets of digital signals for different device addresses.

44. A remote control system for a vehicle according to claim 40 wherein said memory means comprises protocol memory means for storing a plurality of different sets of signals for different protocols.

45. A remote control system for a vehicle according to claim 36 wherein said desired signal enabling means comprises learning means for learning the desired set of signals.

46. A remote control system for a vehicle according to claim 36 wherein said desired signal enabling means comprises protocol providing means for providing a protocol for the desired vehicle.

47. A remote control system for a vehicle according to claim 36 wherein said desired signal enabling means comprises device address providing means for providing device addresses for the desired vehicle.

48. A remote control system for a vehicle according to claim 36 further comprising a second vehicle controller and associated vehicle controller bus interface means for connecting to the data communications bus; and wherein said vehicle function controller is operatively connected to said second vehicle controller.

49. A remote control system for a vehicle according to claim 36 wherein the data communications bus is a multiplexed data bus; and wherein the vehicle function controller bus interface means comprises multiplexing means for interfacing with the multiplexed data bus.

50. A method for remotely controlling a vehicle function for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices, and a vehicle function controller and associated bus interface means for interfacing the vehicle function controller to the data communications bus; the method comprising the steps of:

enabling the vehicle function controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting the vehicle function controller to communicate via the data communications bus with at least one of the vehicle devices; and

receiving a signal at the vehicle from a remote transmitter so that the vehicle function controller remotely controls a vehicle function responsive to the remote transmitter.

51. A method according to claim 50 wherein the plurality of vehicle devices comprises a vehicle security sensor and associated sensor bus interface means for interfacing the vehicle security sensor to the data communications bus; wherein the vehicle function controller comprises an alarm controller movable between armed and disarmed modes, the alarm controller when in the armed mode being capable of generating an alarm indication responsive to the vehicle security sensor; and wherein the step of receiving comprises receiving a signal so that the vehicle function controller is moved to one of the armed and disarmed modes.

52. A method according to claim 50 wherein the plurality of vehicle devices comprises a plurality of vehicle door locks movable between locked and unlocked positions and associated bus interface means for interfacing the door locks to the data communications bus; and wherein the step of receiving comprises moving the vehicle door locks to one of locked and unlocked positions responsive to the remote transmitter.

53. A method according to claim 50 wherein the plurality of vehicle devices comprises vehicle engine starting means and associated bus interface means for interfacing the vehicle engine starting means to the data communications bus; and wherein the step of receiving comprises operating the vehicle engine starting means responsive to the remote transmitter.

54. A method according to claim 50 wherein the step of enabling the alarm controller to operate using a set of desired signals comprises the steps of:

storing in a memory a plurality of sets of signals for different vehicles; and

selecting the desired set of signals from the plurality of different sets of signals for different vehicles.

55. A method according to claim 54 wherein the step of selecting comprises permitting user selection of the desired set of signals.

56. A method according to claim 54 wherein the step of selecting comprises determining the desired set of signals based upon signals on the data communications bus.

57. A method according to claim 54 wherein the step of storing in memory comprises storing a plurality of different sets of signals representative of different device addresses.

58. A method according to claim 54 wherein the step of storing in memory comprises storing a plurality of different sets of signals representative of different protocols.

59. A method according to claim 50 wherein the step of enabling the alarm controller to operate using a set of desired signals comprises the step of learning the desired set of signals.

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(54) **VEHICLE SECURITY SYSTEM WITH INDUCTIVE COUPLING TO A VEHICLE HAVING A DATA COMMUNICATIONS BUS AND RELATED METHODS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

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(63) Continuation-in-part of application No. 09/023,838, filed on Feb. 13, 1998, now Pat. No. 6,011,460, which is a continuation-in-part of application No. 08/701,356, filed on Aug. 22, 1996, now Pat. No. 5,719,551.

(51) **Int. Cl.**[7] **B60R 25/10**

(52) **U.S. Cl.** **340/426**; 340/425.5; 340/531; 340/533; 307/10.2; 180/287

(58) **Field of Search** 340/425.5, 426, 340/427, 428, 429, 531, 533, 825.31, 941, 942; 307/10.2, 10.3; 180/287, 173

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Primary Examiner—Van T. Trieu
(74) *Attorney, Agent, or Firm*—Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.

(57) **ABSTRACT**

A vehicle security system includes a vehicle security sensor and associated sensor bus interface, an alarm indicator and associated alarm indicator bus interface, and an alarm controller and associated alarm controller bus interface for interfacing the alarm controller. The interface to the bus may include an inductive coupler to avoid the need to hard wire aftermarket components and devices. The vehicle security system is for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices. The security system preferably further includes a desired signal enabling circuit for enabling the alarm controller to operate using a set of desired signals for a desired vehicle from among a plurality of possible sets of signals for different vehicles. Accordingly, the desired signal enabling circuit permits the alarm controller to communicate with the vehicle security sensor and the alarm indicator via the data communications bus so that the alarm controller is capable of operating the alarm indicator responsive to the vehicle security sensor. The vehicle security controller may cooperate with a remote transmitter that generates changing code signals.

67 Claims, 9 Drawing Sheets

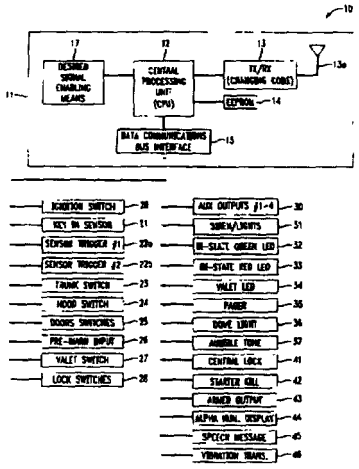

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FIG. 1

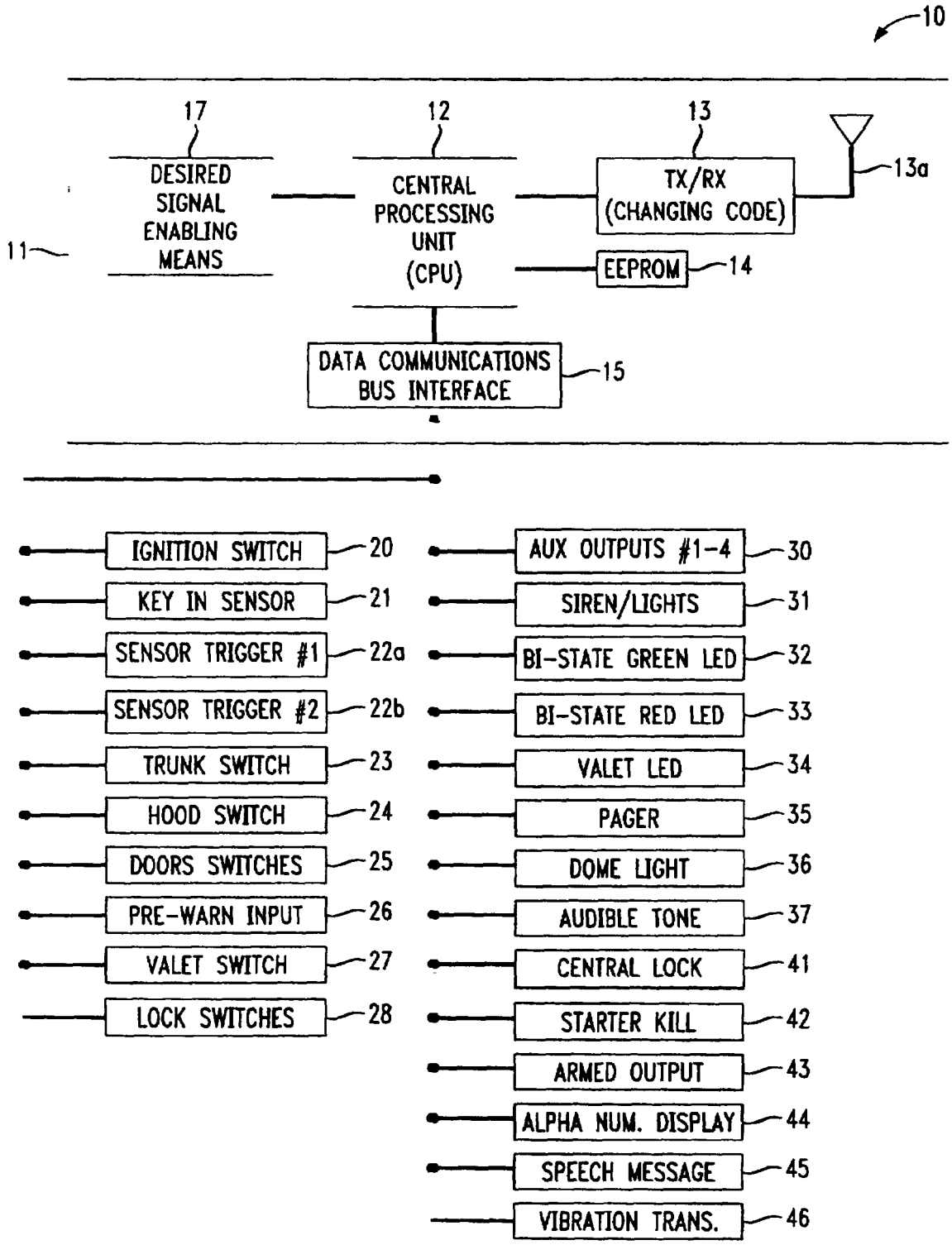

10
17
12
13
13a
DESIRED SIGNAL ENABLING MEANS
CENTRAL PROCESSING UNIT (CPU)
TX/RX (CHANGING CODE)
11
EEPROM
14
DATA COMMUNICATIONS BUS INTERFACE
15
IGNITION SWITCH
20
KEY IN SENSOR
21
SENSOR TRIGGER #1
22a
SENSOR TRIGGER #2
22b
TRUNK SWITCH
23
HOOD SWITCH
24
DOORS SWITCHES
25
PRE-WARN INPUT
26
VALET SWITCH
27
LOCK SWITCHES
28
AUX OUTPUTS #1-4
30
SIREN/LIGHTS
31
BI-STATE GREEN LED
32
BI-STATE RED LED
33
VALET LED
34
PAGER
35
DOME LIGHT
36
AUDIBLE TONE
37
CENTRAL LOCK
41
STARTER KILL
42
ARMED OUTPUT
43
ALPHA NUM. DISPLAY
44
SPEECH MESSAGE
45
VIBRATION TRANS.
46

FIG. 2

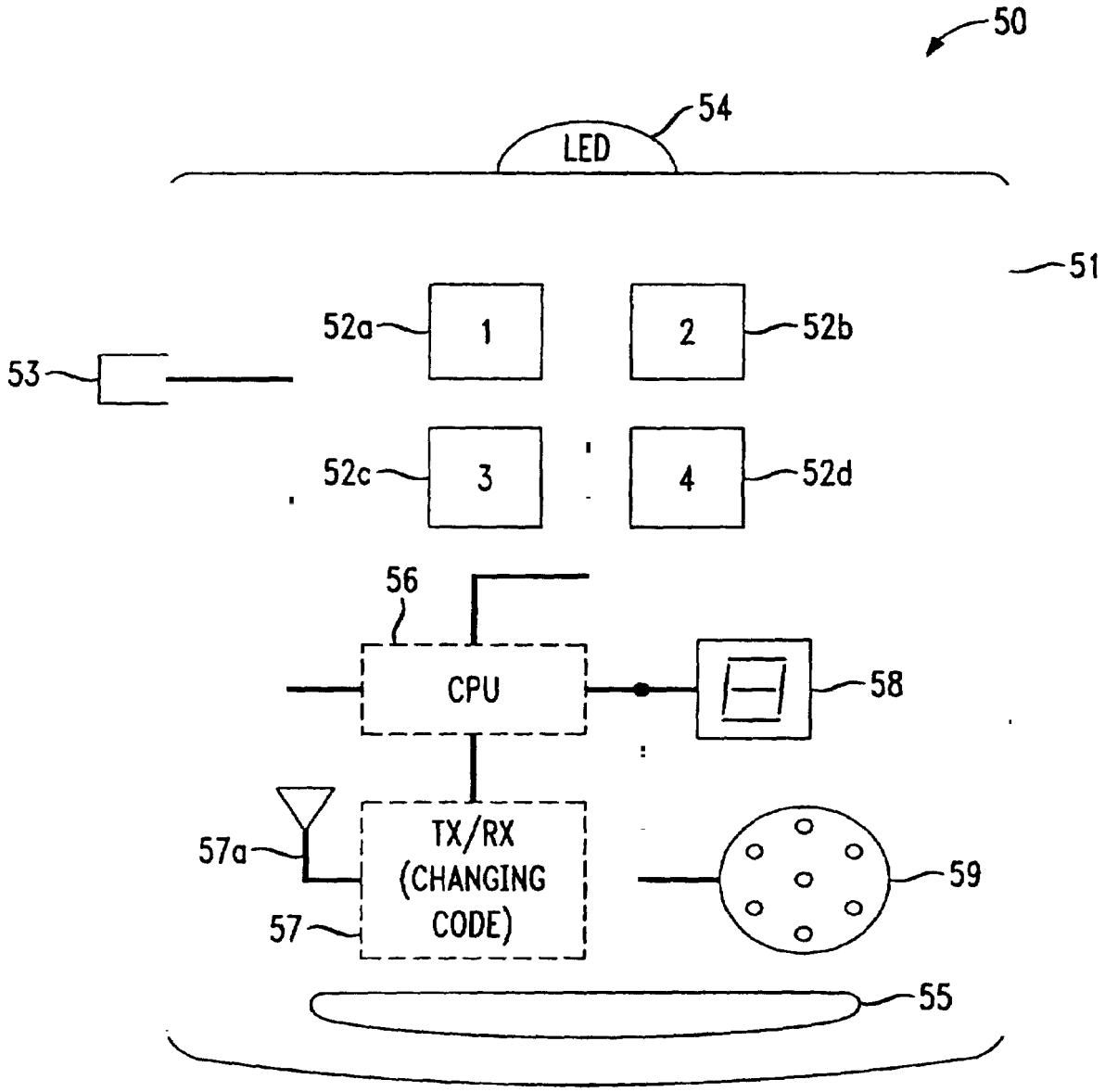

50
54
LED
51
52a
1
2
52b
53
52c
3
4
52d
56
CPU
58
57a
TX/RX
(CHANGING
CODE)
59
57
55

FIG. 3

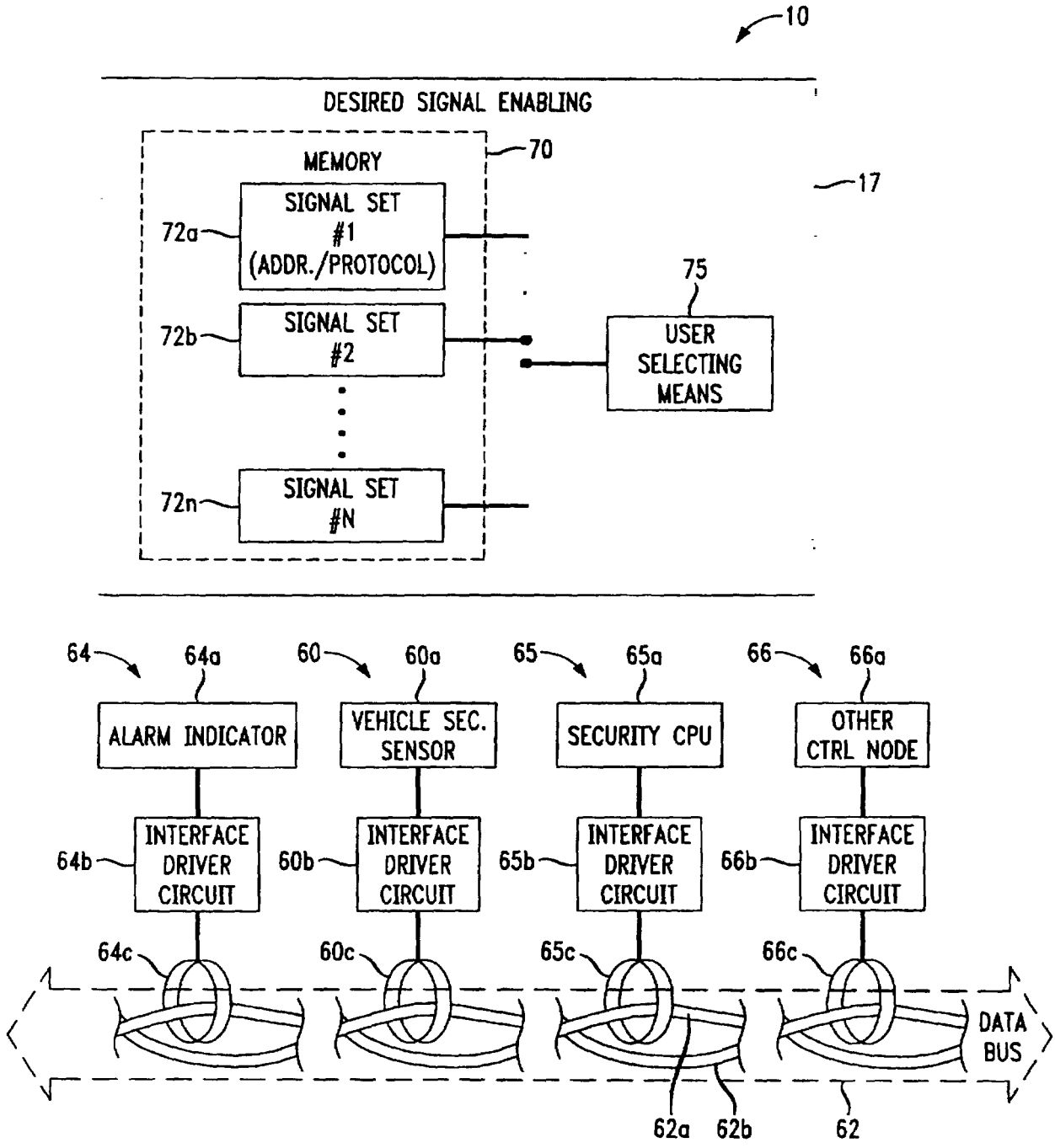

10
DESIRED SIGNAL ENABLING
MEMORY
70
17
SIGNAL SET #1 (ADDR./PROTOCOL)
72a
SIGNAL SET #2
72b
SIGNAL SET #N
72n
75
USER SELECTING MEANS
64
64a
ALARM INDICATOR
60
60a
VEHICLE SEC. SENSOR
65
65a
SECURITY CPU
66
66a
OTHER CTRL NODE
INTERFACE DRIVER CIRCUIT
64b
60b
65b
66b
64c
60c
65c
66c
DATA BUS
62a
62b
62

FIG. 4

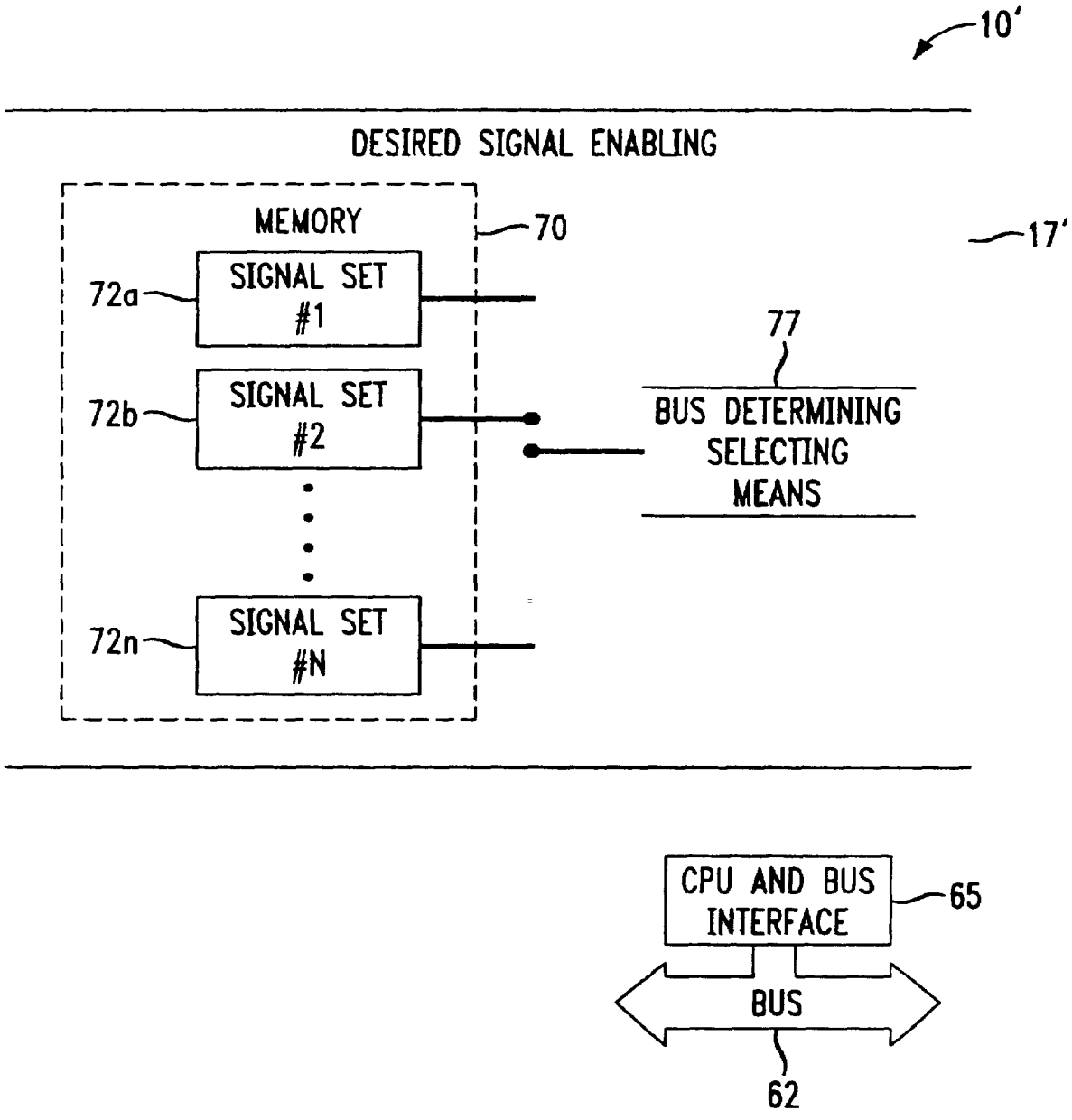

10'
DESIRED SIGNAL ENABLING
MEMORY
70
17'
72a
SIGNAL SET #1
77
72b
SIGNAL SET #2
BUS DETERMINING SELECTING MEANS
72n
SIGNAL SET #N
CPU AND BUS INTERFACE
65
BUS
62

FIG. 5

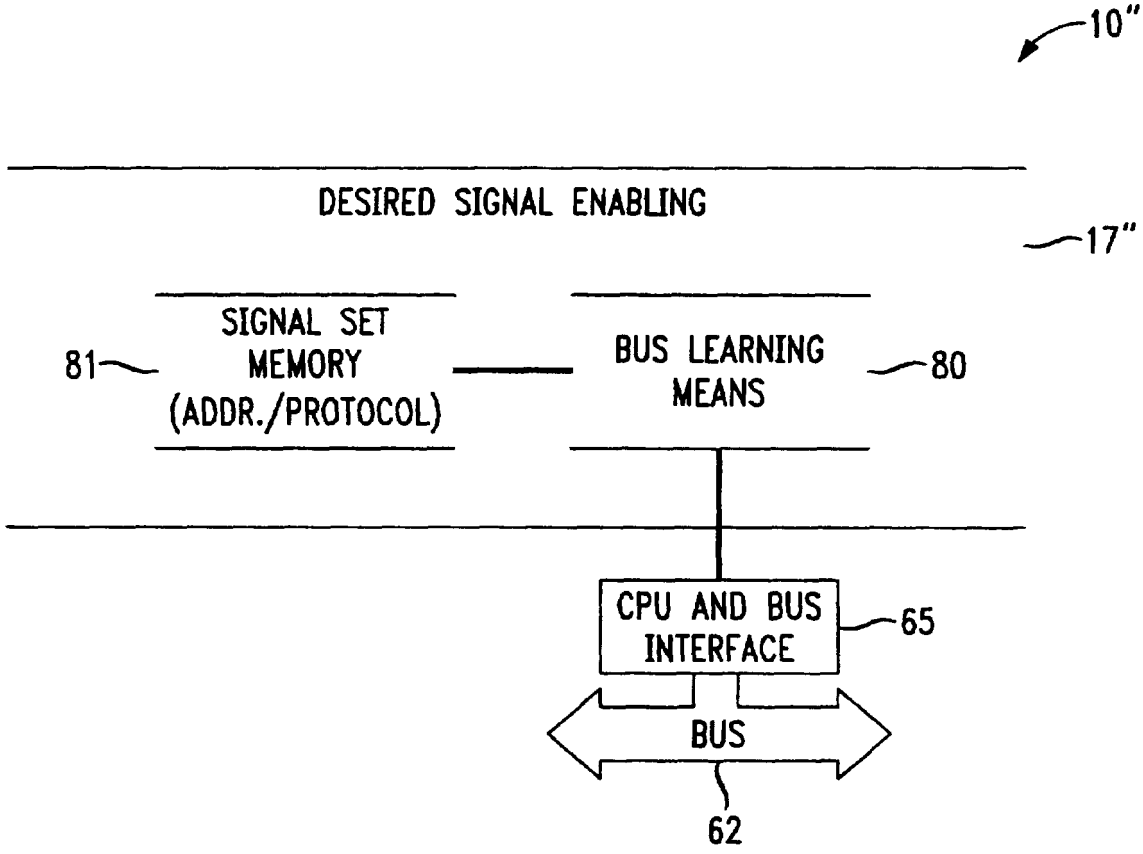

10"
DESIRED SIGNAL ENABLING
17"
SIGNAL SET MEMORY (ADDR./PROTOCOL)
81
BUS LEARNING MEANS
80
CPU AND BUS INTERFACE
65
BUS
62

FIG. 6A

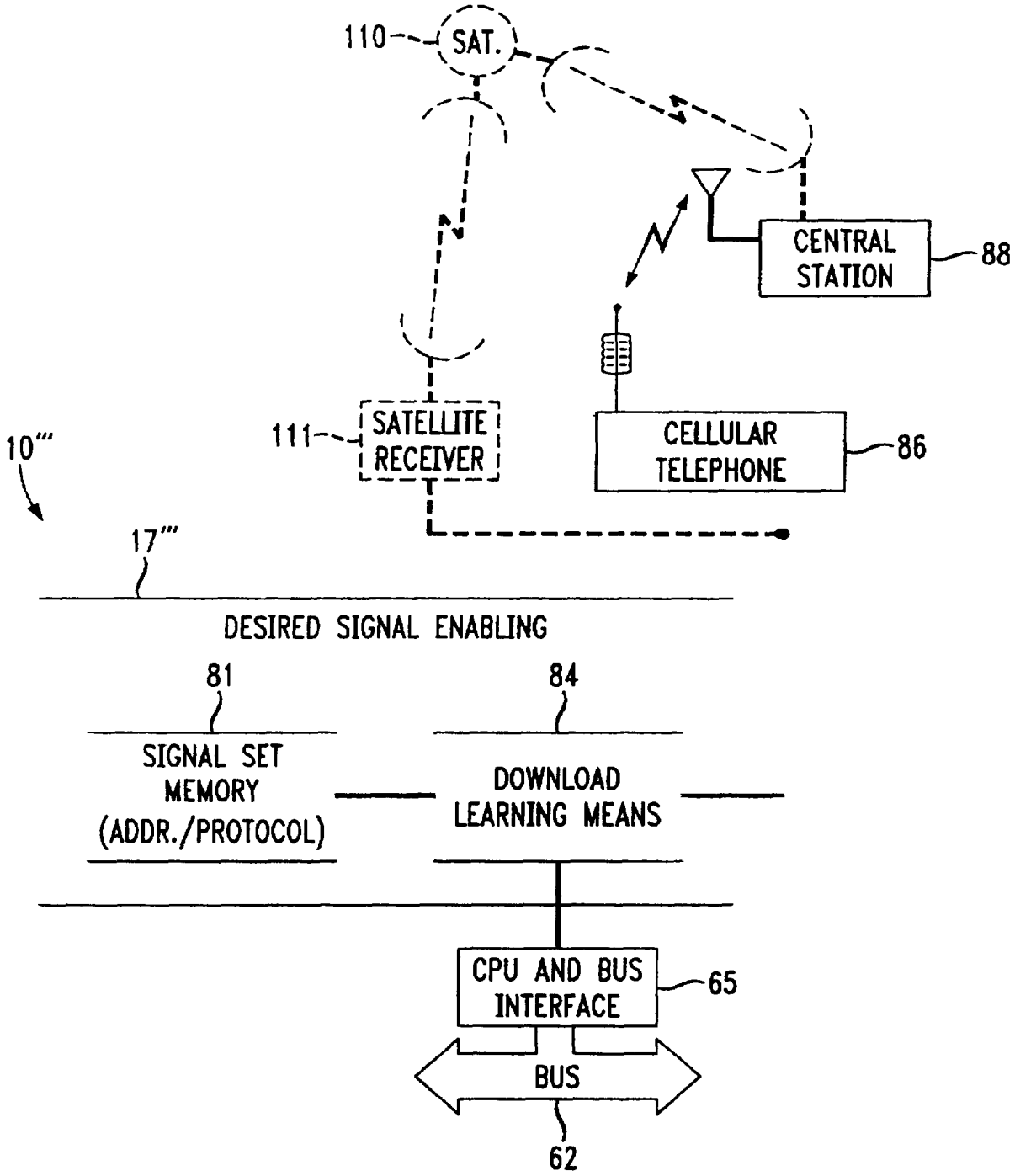

110
SAT.
CENTRAL STATION
88
111
SATELLITE RECEIVER
CELLULAR TELEPHONE
86
10'''
17'''
DESIRED SIGNAL ENABLING
81
84
SIGNAL SET MEMORY (ADDR./PROTOCOL)
DOWNLOAD LEARNING MEANS
CPU AND BUS INTERFACE
65
BUS
62

FIG. 6B

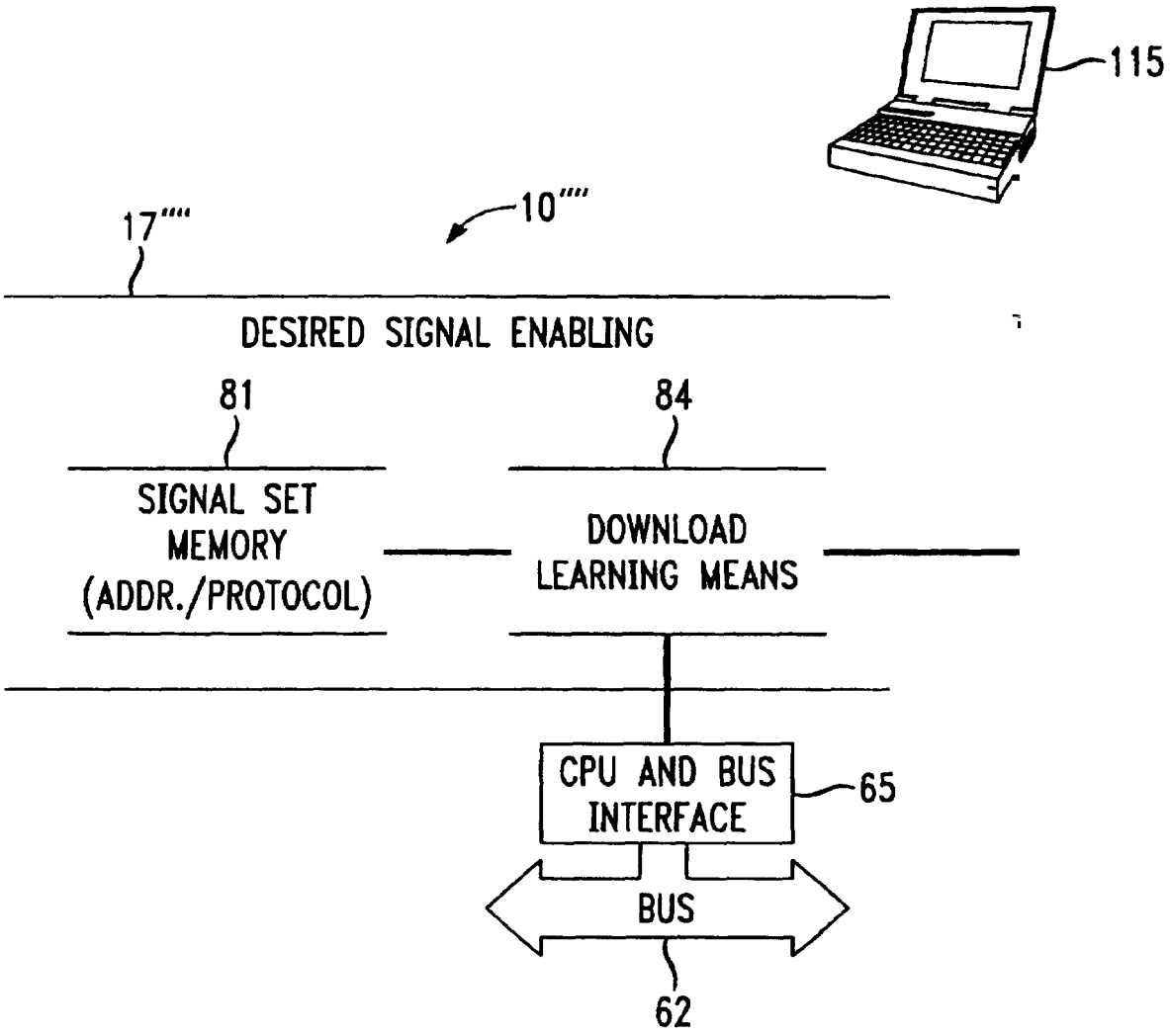

115
17''''
10''''
DESIRED SIGNAL ENABLING
81
84
SIGNAL SET MEMORY (ADDR./PROTOCOL)
DOWNLOAD LEARNING MEANS
CPU AND BUS INTERFACE
65
BUS
62

FIG. 7

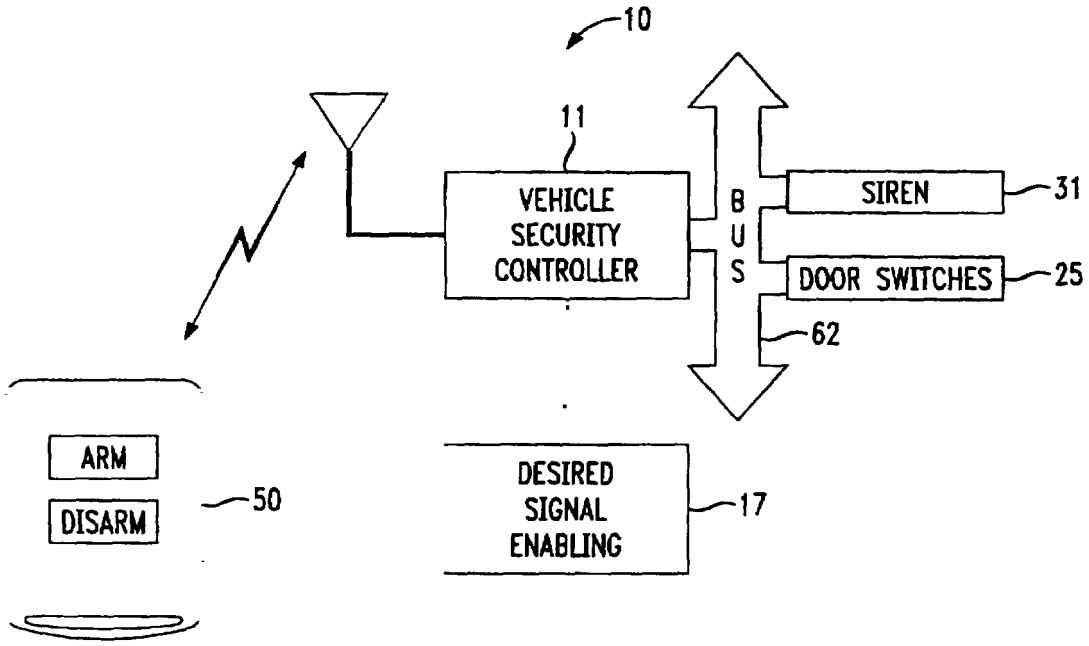

10
11
VEHICLE SECURITY CONTROLLER
BUS
SIREN
31
DOOR SWITCHES
25
62
ARM
DISARM
50
DESIRED SIGNAL ENABLING
17

FIG. 8

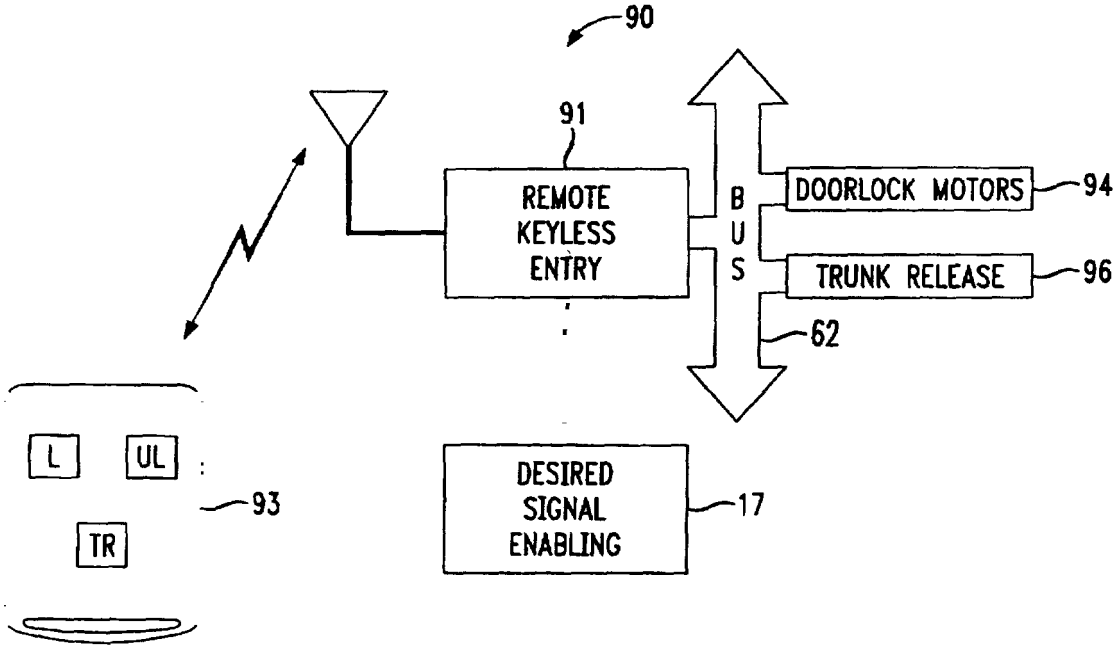
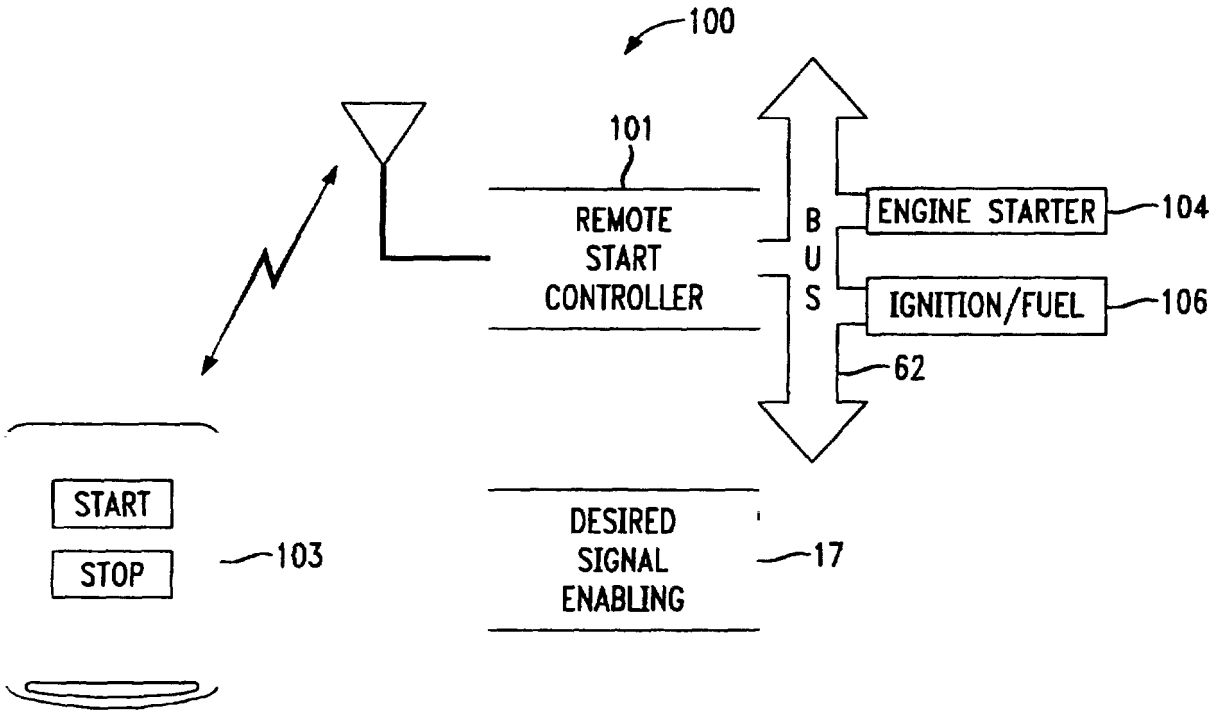

90
91
REMOTE KEYLESS ENTRY
BUS
DOORLOCK MOTORS
94
TRUNK RELEASE
96
62
L
UL
TR
93
DESIRED SIGNAL ENABLING
17

FIG. 9


100
101
REMOTE START CONTROLLER
B U S
ENGINE STARTER
104
IGNITION/FUEL
106
62
START
STOP
103
DESIRED SIGNAL ENABLING
17

VEHICLE SECURITY SYSTEM WITH INDUCTIVE COUPLING TO A VEHICLE HAVING A DATA COMMUNICATIONS BUS AND RELATED METHODS

RELATED APPLICATION

The present application is a continuation-in-part of U.S. patent application Ser. No. 09/023,838 filed Feb. 13, 1998 now U.S. Pat. No. 6,011,460 which, in turn, is a continuation-in-part of Ser. No. 08/701,356 filed Aug. 22, 1996 now U.S. Pat. No. 5,719,551.

FIELD OF THE INVENTION

This application is related to the field of security systems and, more particularly, to a security system and related methods for vehicles.

BACKGROUND OF THE INVENTION

Vehicle security systems are widely used to deter vehicle theft, prevent theft of valuables from a vehicle, deter vandalism, and to protect vehicle owners and occupants. A typical automobile security system, for example, includes a central processor or controller connected to a plurality of vehicle sensors. The sensors, for example, may detect opening of the trunk, hood, doors, windows, and also movement of the vehicle or within the vehicle. Ultrasonic and microwave motion detectors, vibration sensors, sound discriminators, differential pressure sensors, and switches may be used as sensors. In addition, radar sensors may be used to monitor the area proximate the vehicle.

The controller typically operates to give an alarm indication in the event of triggering of a vehicle sensor. The alarm indication may typically be a flashing of the lights and/or the sounding of the vehicle horn or a siren. In addition, the vehicle fuel supply and/or ignition power may be selectively disabled based upon an alarm condition.

A typical security system also includes a receiver associated with the controller that cooperates with one or more remote transmitters typically carried by the user as disclosed, for example, in U.S. Pat. No. 4,383,242 to Sassover et al. and U.S. Pat. No. 5,146,215 to Drori. The remote transmitter may be used to arm and disarm the vehicle security system or provide other remote control features from a predetermined range away from the vehicle. Also related to remote control of a vehicle function U.S. Pat. No. 5,252,966 to Lambropoulous et al. discloses a remote keyless entry system for a vehicle. The keyless entry system permits the user to remotely open the vehicle doors or open the vehicle trunk using a small handheld transmitter.

Unfortunately, the majority of vehicle security systems need to be directly connected by wires to individual vehicle devices, such as the vehicle horn or door switches of the vehicle. In other words, a conventional vehicle security system is hardwired to various vehicle components, typically by splicing into vehicle wiring harnesses or via interposing T-harnesses and connectors. The number of electrical devices in a vehicle has increased so that the size and complexity of wiring harnesses has also increased. For example, the steering wheel may include horn switches, an airbag, turn-signal and headlight switches, wiper controls, cruise control switches, ignition wiring, an emergency flasher switch, and/or radio controls. Likewise, a door of a vehicle, for example, may include window controls, locks, outside mirror switches, and/or door-panel light switches.

In response to the increased wiring complexity and costs, vehicle manufacturers have begun attempts to reduce the amount of wiring within vehicles to reduce weight, reduce wire routing problems, decrease costs, and reduce complications which may arise when troubleshooting the electrical system. For example, some manufacturers have adopted multiplexing schemes to reduce cables to three or four wires and to simplify the exchange of data among the various onboard electronic systems as disclosed, for example, in "The Thick and Thin of Car Cabling" by Thompson appearing in the IEEE Spectrum, February 1996, pp. 42–45.

Implementing multiplexing concepts in vehicles in a cost-effective and reliable manner may not be easy. Successful implementation, for example, may require the development of low or error-free communications in what can be harsh vehicle environments. With multiplexing technology, the various electronic modules or devices may be linked by a single signal wire in a bus also containing a power wire, and one or more ground wires. Digital messages are communicated to all modules over the data communications bus. Each message may have one or more addresses associated with it so that the devices can recognize which messages to ignore and which messages to respond to or read.

The Thompson article describes a number of multiplexed networks for vehicles. In particular, the Grand Cherokee made by Chrysler is described as having five multiplex nodes or controllers: the engine controller, the temperature controller, the airbag controller, the theft alarm, and the overhead console. Other nodes for different vehicles may include a transmission controller, a trip computer, an instrument cluster controller, an antilock braking controller, an active suspension controller, and a body controller for devices in the passenger compartment.

A number of patents are also directed to digital or multiplex communications networks or circuits, such as may be used in a vehicle. For example, U.S. Pat. No. 4,538,262 Sinniger et al. discloses a multiplex bus system including a master control unit and a plurality of receiver-transmitter units connected thereto. Similarly, U.S. Pat. No. 4,055,772 to Leung discloses a power bus in a vehicle controlled by a low current digitally coded communications system. Other references disclosing various vehicle multiplex control systems include, for example, U.S. Pat. No. 4,760,275 to Sato et al.; U.S. Pat. No. 4,697,092 to Roggendorf et al.; and U.S. Pat. No. 4,792,783 to Burgess et al.

Several standards have been proposed for vehicle multiplex networks including, for example, the Society of Automotive Engineers "Surface Vehicle Standard, Class B Data Communications Network Interface", SAE J1850, July 1995. Another report by the SAE is the "Surface Vehicle Information Report, Chrysler Sensor and Control (CSC) Bus Multiplexing Network for Class 'A' Applications", SAE J2058, July 1990. Many other networks are also being implemented or proposed for communications between vehicle devices and nodes or controllers.

Unfortunately, conventional vehicle security systems for hardwired connection to vehicle devices, such as aftermarket vehicle security systems, are not readily adaptable to a vehicle including a data communications bus. One difficulty is that vehicle manufacturers discourage cutting and splicing into existing wiring to install aftermarket components. For example, a manufacturer may void a warranty for such activity. Moreover, a vehicle security system if adapted for a communications bus and devices for one particular model, model year, and manufacturer, may not be compatible with any other models, model years, or manufacturers. Other systems for remote control of vehicle functions may also suffer from such shortcomings.

SUMMARY OF THE INVENTION

In view of the foregoing background, it is therefore an object of the present invention to provide a vehicle security system and associated method which is readily adapted or adaptable for installation in a vehicle having a data communications bus.

It is another object of the present invention to provide a vehicle security system and associated method which is readily adapted or adaptable for installation in a vehicle having a data communications bus and without requiring cutting and splicing of existing bus wiring.

It is yet another object of the present invention to provide a security system or other remote control function systems and associated methods for installation in a vehicle having a data communications bus, and wherein the vehicle is one from among a plurality of different vehicles with different device addresses and/or signal protocols for communicating with the vehicle devices.

These and other objects, advantages and features of the present invention are provided by a vehicle security system for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices. In particular, the vehicle security system preferably comprises a vehicle security sensor and associated sensor bus interface means for interfacing the vehicle security sensor to the data communications bus. The vehicle security system also preferably includes an alarm indicator and associated alarm indicator bus interface means for interfacing the alarm indicator to the data communications bus. An alarm controller and associated alarm controller bus interface means are also preferably included. At least one of these bus interface means may be provided by an inductive coupler to thereby remove the need to cut and splice into existing bus wiring.

The security system further preferably comprises desired signal enabling means for enabling the alarm controller to operate using a desired set of signals for a desired vehicle from among a plurality of possible sets of signals for different vehicles. Accordingly, the desired signal enabling means permits the alarm controller to communicate with the vehicle security sensor and the alarm indicator via the data communications bus so that the alarm controller is capable of operating the alarm indicator responsive to the vehicle security sensor. The security system is thus advantageously compatible with many different types of vehicle data communications formats or protocols.

The data communications bus may preferably be a multiplexed data bus. Accordingly, the sensor bus interface means, the alarm bus interface means, and the alarm controller bus interface means may each comprise multiplexing means for interfacing with the multiplexed data bus of the vehicle.

The desired signal enabling means may comprise learning means for learning the desired set of signals. Moreover, the learning means may comprise downloading learning means for learning the desired set of signals from another device which is temporarily connected thereto, such as a portable or laptop computer or other downloading device.

The concepts and features of the invention may also be desirably incorporated in a remote control system for a vehicle, such as a vehicle security system, a remote engine starter system, or a remote keyless entry system, for example. The remote control system preferably comprises a remote transmitter and a receiver within the vehicle for receiving a signal from the remote transmitter. The remote transmitter is preferably of a type generating a changing code signal, such as a pseudorandom changing code or a more simple rolling code.

A vehicle function controller is provided along with an associated vehicle function controller bus interface means for interfacing the vehicle function controller to the data communications bus. The remote control system also includes desired signal enabling means for causing the vehicle function controller to operate using a desired set of signals for a desired vehicle from a plurality of possible sets of digital signals for different vehicles, as may be downloaded from a downloading device temporarily connected thereto. Accordingly, the vehicle function controller can communicate with a vehicle device via the data communications bus so that the vehicle function controller is capable of operating the vehicle device responsive to the changing code from the remote transmitter. Method aspects of this embodiment of the invention are also disclosed in greater detail below.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic block diagram of the vehicle security system in accordance with the invention.

FIG. **2** is a schematic diagram of a remote transmitter of the vehicle security system in accordance with the invention.

FIG. **3** is a schematic block diagram of a portion of a first embodiment of the vehicle security system in accordance with the present invention.

FIG. **4** is a schematic block diagram of a portion of a second embodiment of the vehicle security system in accordance with the present invention.

FIG. **5** is a schematic block diagram of a portion of a third embodiment of the vehicle security system in accordance with the present invention.

FIG. **6A** is a schematic block diagram of a portion of a fourth embodiment of the vehicle security system in accordance with the present invention.

FIG. **6B** is a schematic block diagram of a portion of a variation of the fourth embodiment of the vehicle security system in accordance with the present invention.

FIG. **7** is a schematic block diagram of the vehicle security system in accordance with the present invention.

FIG. **8** is a schematic block diagram of a remote keyless entry system in accordance with the present invention.

FIG. **9** is a schematic block diagram of a remote engine starting system in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will now be described more fully hereinafter with reference to the accompanying drawings in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the illustrated embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout. Prime and multiple prime notation are used in alternate embodiments to indicate similar elements.

Referring now to the schematic block diagram of FIG. **1**, a vehicle security system **10** according to one aspect of the invention is first described. The security system includes a controller **11** which, in turn, in the illustrated embodiment

includes a central processing unit (CPU) or microprocessor **12** operating under stored program control.

In the illustrated embodiment, a transmitter and receiver **13** are connected to the CPU **12** for receiving signals from a remote transmitter and for transmitting signals to a remote unit, as will be described in greater detail below. As would be readily understood by those skilled in the art, the transmitter portion of the controller **11** may not be needed in some embodiments of the invention. In particular, in many applications the controller **11** would require only a receiver and not need the transmitter. An antenna **13***a* is illustratively connected to the transmitter and receiver **13**.

In one particularly advantageous embodiment, the receiver portion of the controller **11** is of the changing code type as will be readily appreciated by those skilled in the art. By changing code is meant that the remote transmitter **50** (FIG. **2**) sends a signal including a series of bits modulated on a radio frequency carrier, for example. These bits would typically include fixed code portions as well as changing code portions. The changing code portion provides additional security for the system **11**, so that unauthorized transmitters cannot be used to activate the controller **11**. In particular, the term changing code is meant to cover fairly short repeating codes, such as are generally described as rolling codes. Such rolling codes may repeat as often as every eight transmissions, for example. In addition, changing code is also intended to cover pseudorandom codes that may only repeat after many thousands or even millions of operations as will be understood by those skilled in the art. The remote transmitter **50** and receiver of the controller **11** are synchronized together with each having the changing code pattern stored therein or generated internally as will be readily understood by those skilled in the art.

As will also be appreciated by those skilled in the art, the processing of the changing code portions and other code portions of received signals may be shared with the CPU **12**. Alternately, the CPU may perform all of the changing code processing and the receiver provides only a demodulated radio signal, for example. The important aspect of the invention is that the controller **11** operates with changing code remote transmitters **50**.

In the illustrated embodiment, the CPU **12** is also operatively connected to a memory (EEPROM) **14** and a data communications bus interface **15** which provides both input and output interfaces to various vehicle devices. As would be readily understood by those skilled in the art, the CPU **12** may alternately or additionally have its own on-board memory.

The data communications bus interface **15** is illustratively connected to various vehicle input devices including: an ignition switch **20**; a key in the ignition sensor **21**; two zone sensors **22***a*, **22***b*; conventional trunk hood and door pin sensors or switches **23**, **24**, and **25**, respectively; and door lock switches **28**. In addition, a pre-warn sensor **26** and valet switch **27** also provide inputs to the controller **11** in the illustrated embodiment. As would be readily understood by those skilled in the art, other inputs are also contemplated by the present invention and are generally described herein by the term sensor. In addition, an input signal may also be received from a remote transmitter **50** (FIG. **2**).

The data communications bus interface **15** of the controller **11** may also preferably be connected to a plurality of output devices. The outputs may include auxiliary relay outputs **30**, such as for window control, remote starting, or a remote alarm indication, as would be readily understood by those skilled in the art. A siren and/or lights **31**, and green and red light emitting diodes (LEDs) **32**, **33** for dashboard mounting are also illustratively connected to the controller **11**. Other outputs may be directed to a valet LED **34**, a dome light **36**, a central lock relay or lock control unit **41**, a starter kill circuit **42**, and an armed relay output **43**. In addition, other outputs may be directed to one or more of an audible tone generator **37**, an alphanumeric display **44**, a speech message annunciator **45**, and a vibration transducer **46**, as will be readily appreciated by those skilled in the art. Other similar indicating devices are also contemplated by the present invention, as would be readily understood by those skilled in the art. Some of the illustrated devices may be hardwired to various control nodes as would be readily understood by those skilled in the art. The control nodes may be connected by the data communications bus as would also be known to those skilled in the art.

Referring now more particularly to FIG. **2**, a remote transmitter **50** in accordance with the invention is described. The remote transmitter **50** illustratively includes a housing **51** and a plurality of first momentary contact switches **52***a*–**52***d* carried by the housing. A second momentary contact switch **53** and an indicating light, such as the illustrated LED **54** are also carried by or mounted on the housing **51**. As would be readily understood by those skilled in the art, the remote transmitter **50** is typically relatively small and includes an opening **55** for facilitating connection to a vehicle key ring, for example. In addition, the remote transmitter **50** includes a central processing unit or microprocessor **56** operatively connected to the plurality of first switches **52***a*–**52***d*, the second switch **53**, and the LED **54**. The microprocessor is also connected to a transmitter and/or receiver circuit **57** and its associated antenna **57***a* for transmitting and/or receiving signals to and from the controller **11** of the vehicle security system **10**. Accordingly, the term "remote transmitter" is used broadly herein to describe the embodiment also including receiver means.

The remote transmitter **50** also preferably generates or transmits changing code signals to increase security as discussed extensively above. In the illustrated embodiment, this feature is shown incorporated into the transmitter and receiver block **57**, although those of skill in the art will recognize that this could be done in combination with the CPU **56**, or by the CPU alone, for example.

The remote transmitter **50** may also include a numeric or alphanumeric display **58**, and a speaker **59** coupled to an audible tone generator or a speech message generator, as may be provided by the microprocessor **56**. A vibration transducer, not shown, may also be incorporated into the remote transmitter **50** for communicating to the user as would be readily understood by those skilled in the art.

Of course, as will be readily appreciated by those skilled in the art, the remote transmitter may be a central station, for example, rather than a handheld unit **50** as shown in FIG. **2**. Also the remote transmitter may include a handheld unit that communicates first to a central station. Other forms of remote transmitters are also contemplated by the invention as will be understood by those skilled in the art.

Turning now additionally to FIG. **3** a first embodiment of the desired signal enabling means **17** is described. The vehicle security system **10** preferably comprises a vehicle security sensor and associated sensor bus interface means **60** for interfacing the vehicle security sensor to the data communications bus **62**. The vehicle security sensor and bus interface **60** is provided by the schematically illustrated vehicle security sensor **60***a*, the interface driver circuit **60***b* connected to the sensor, and the schematically illustrated

inductive coupler in the form of a coil **60***c*. Although illustrated in the form of a closed coil, the inductive coupler may have other configurations as well. The interface driver circuit **60***b* provides the necessary driving signals to inductively couple signals to the data bus **62**, which in the illustrated embodiment is provided by the twisted pair conductors **62***a*, **62***b* as will be readily appreciated by those skilled in the art. The interface driver circuit **60***b* also includes the sensing circuitry to sense signals present on the data bus **62** as will also be readily appreciated by those skilled in the art. The data bus **62** may have conductor configurations other than the illustrated twisted pair configuration.

The inductive coupling interface for the vehicle security sensor **60***a* is especially advantageous for aftermarket sensors, such as a shock sensor, for example. As noted in the Background section above, many manufacturers discourage cutting or splicing into existing wiring of the vehicle. This presents a difficulty for aftermarket accessories, such as vehicle security systems. Accordingly, the inductive coupling to the data bus **62** overcomes this difficulty.

As would be readily understood by those skilled in the art, in some vehicles the only sensors needed for security may be already hard wired into the data bus **62**. In such an arrangement, none of the vehicle sensors would be inductively coupled to the data bus **62**. In other embodiments of the invention, all of the sensors or only selected sensors would be inductively coupled as will be appreciated by those skilled in the art.

The vehicle security system **10** also preferably includes an alarm indicator and associated alarm indicator bus interface means **64** for interfacing the alarm indicator to the data communications bus. This portion of the system also includes the alarm indicator **64***a*, the interface driver circuit **64***b* and the inductive coupling coil **64***c*. Of course, in other embodiments, the alarm indicator **64***a* could be hard wired to the data bus **62**. Examples of vehicle security sensors and alarm indicators are described above in greater detail with reference to FIG. **1**.

The security system **10** further preferably comprises desired signal enabling means **17** for enabling the alarm controller **10** to operate using a desired set of signals for a desired vehicle from among a plurality of possible sets of signals for different vehicles. As would be readily understood by those skilled in the art, the term different vehicles may include vehicles from different manufacturers, different models, or even different trim levels of the same make and model. Accordingly, the desired signal enabling means **17** permits the alarm controller, that is, the security CPU and bus interface **65**, to communicate with the vehicle security sensor and the alarm indicator via the data communications bus **62** so that the CPU is capable of operating the alarm indicator responsive to the vehicle security sensor.

The security CPU and bus interface **65** also illustratively includes the security CPU **65***a*, the interface driver circuit **65***b* connected to the security CPU, and the inductive coupler or coil **65***c* connected to the driver circuit. For an aftermarket security system, the inductive coupling of the security CPU **65***a* to the data bus **62** provides a significant advantage over a hard wired installation.

The data communications bus **62** may preferably be a multiplexed data bus as would be readily understood by those skilled in the art. Accordingly, the sensor bus interface means, the alarm bus interface means, and the alarm controller bus interface means may each comprise multiplexing means for interfacing with the multiplexed data bus of the vehicle. For example, any of the various multiplexing schemes as disclosed in "The Thick and Thin of Car Cabling" by Thompson appearing in the IEEE Spectrum, February 1996, pp. 42–45 may be used. Other data bus connection schemes are also contemplated by the present invention.

As illustrated in FIG. **3**, one embodiment of the desired signal enabling means **17** may preferably include a memory **70** for storing a plurality of sets **72***a*, **72***b* and **72***n* of signals for different vehicles, and selecting means for selecting the desired set of signals from the plurality of different sets of signals for different vehicles. By storing sets of signals is meant storing information or data necessary to generate the desired signals on the data bus **62** as would be readily understood by those skilled in the art. The memory **70** may include device address memory means for storing a plurality of different sets of signals representative of different device addresses for different vehicles. Alternatively, or in addition thereto, the memory means may comprise protocol memory means for storing a plurality of different protocols for different vehicles. One or more other control nodes and associated bus interfaces **66** may also be connected to the data communications bus **62** as would also be readily understood by those skilled in the art. The control node and interface **66** may include the control node **66***a*, the interface driver circuit **66***b*, and the inductive coupling coil **66***c*, although in other embodiments, a hard wired connection may be used. For example, other control nodes may include an engine controller thereby permitting the alarm controller to disable the engine, or the body controller thereby permitting the alarm controller to control the vehicle door locks as would be readily understood by those skilled in the art.

In the illustrated embodiment of FIG. **3**, the selecting means may comprise user selecting means **75** for permitting a user to select the desired set of signals. A keypad or other input means may be used to permit the user to select the desired signal set for his vehicle. The valet switch **27** (FIG. **1**), for example, may also be operated by the user to select the desired signal set. The user may select the desired set of signals by entering a unique digital code similar to the selection of signals for a home electronics universal remote control. Other techniques for permitting the user to select the desired signal set from a plurality of stored sets are also contemplated by the invention as would be readily appreciated by those Skilled in the art.

Referring now additionally to FIG. **4** another embodiment of the desired signal enabling means **17'** is described in accordance with the security system **10'** of the present invention. In this embodiment, the selecting means may comprise bus determining means **77** for determining the desired set of signals based upon signals on the data communications bus. For example, the bus determining means could determine the desired set of signals based upon sensed voltage levels or based upon the timing of signal pulses on the data communications bus **62**. The other components of this embodiment of the desired signal enabling means **17'** are similar to those described above with reference to FIG. **3** and need no further description.

Yet another embodiment of the security system **10"** according to the invention is explained with reference to FIG. **5**. In this illustrated embodiment the desired signal enabling means **17"** includes a desired signal set memory **81** operatively connected to the illustrated bus learning circuit or means **80**. The bus learning circuit or means **80** may determine and store in the signal set memory **81** the protocol and/or device addresses for the vehicle devices. For example, the bus learning circuit or means **80** may permit

the user to operate various vehicle devices and store a desired signal set based thereon as would be readily understood by those skilled in the art. The other components of the desired signal enabling means **17"** are similar to those described above with reference to FIG. **3** and need no further description.

Still another embodiment of the desired signal enabling means **17"** is explained with reference to FIG. **6A**. The desired signal enabling means **17'"** includes a signal set memory **81** operatively connected to the schematically illustrated download learning means **84**. The download learning means **84** may include an interface connected to the illustrated vehicle cellular telephone **86** to permit learning or downloading of the desired signal set from a remote or central monitoring and control station **88**, for example. The desired signal set may also alternately be learned from the central station **88** through the satellite link provided by the satellite **110** and vehicle mounted satellite receiver **111** and associated antennas. As would be readily understood by those skilled in the art, the download learning means, as well as the other desired signal enabling leans may be implemented by software in the CPU **12** of the controller **11** or in a separate microprocessor or circuits.

Turning now additionally to FIG. **6B**, another variation of programming, learning or downloading of the download learning means **84** is explained. In this variation the download learning means **84** is temporarily connected to a computer, such as the illustrated portable laptop computer **115**. The connection, may be via a wire cable or wireless communications link as will be readily understood by those skilled in the art. Of course, the desired signal enabling means **17'"** in this embodiment may be programmed in the vehicle or prior to installation in the vehicle.

One implementation of the security system **10** is shown in FIG. **7** and includes the vehicle security controller **11**. The remote transmitter **50** can switch the controller **11** between the armed and disarmed modes. The controller **11** in the armed mode is capable of generating an alarm indication via the siren **31** (FIG. **1**) and based upon the door switches **25** (FIG. **1**), for example. The communications are via the data communications bus **62**, and are based upon the desired signal set from the desired signal enabling means **17**.

The features and aspects described above may also be readily implemented into other vehicle related systems, such as for performing remote control functions. As shown in FIG. **8**, the invention may be embodied in a remote keyless entry system **90** including a remote keyless entry controller **91** operated by a remote handheld transmitter **93**. The controller **91** communicates with the door lock motors **94** and illustrated trunk release **96** via the data communications bus **62**. The remote keyless entry system **90** also includes the desired signal enabling means **17** which permits the controller **91** to perform the desired door locking and trunk release remote control functions or operations as would also be readily understood by those skilled in the art. As would be readily appreciated by those skilled in the art, any of the desired signal enabling means described herein and equivalent thereto may be used for the remote keyless entry system **90** in accordance with the present invention.

Turning now to FIG. **9**, yet another vehicle associated remote control function is illustrated and now explained. The remote engine starting system **100** includes a remote start controller **101** operable by a remote transmitter **103**. The remote controller **101** may communicate via the data communications bus **62** to enable the ignition and fuel systems **106** and crank the engine starter **104**. Various sensors may also be monitored as would be readily understood by those skilled in the art.

A method aspect of the invention is for operating a vehicle security system **10** for a vehicle of a type including a data communications bus **62** connecting a plurality of vehicle devices. The method preferably comprises the steps of interfacing an alarm controller **11** to the data communications bus **62**, and enabling the alarm controller to operate using a desired set of digital signals for a desired vehicle from a plurality of possible sets of signals for different vehicles to thereby permit the alarm controller to communicate with at least one of a vehicle security sensor **60** and an alarm indicator **64** via the data communications bus **62** (FIG. **3**). Accordingly, the alarm controller is capable of operating the alarm indicator responsive to the vehicle security sensor and via the data communication bus.

Another method of the invention is for remotely controlling a vehicle function for a vehicle of a type including a data communications bus **62** connecting a plurality of vehicle devices, and a vehicle function controller and associated bus interface means for interfacing the vehicle function controller to the data communications bus. The method comprising the steps of: enabling the vehicle function controller to operate using a desired set of signals for a desired vehicle from a plurality of sets of signals for different vehicles for permitting the vehicle function controller to communicate via the data communications bus with at least one of the vehicle devices; and receiving a signal at the vehicle from a remote transmitter so that the vehicle function controller remotely controls a vehicle function responsive to the remote transmitter.

Those of skill in the art will readily recognize the benefits and advantages of the present invention for aftermarket security systems and other aftermarket systems for implementing remote control functions wherein compatibility with a potentially large number of different protocols and/or device addresses is desired. Of course, many modifications and other embodiments of the invention will come to the mind of one skilled in the art having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Accordingly, it is understood that the invention is not to be limited to the illustrated embodiments disclosed, and that the modifications and embodiments are intended to be included within the spirit and scope of the appended claims.

That which is claimed is:

1. A vehicle security system for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices, said vehicle security system comprising:

a vehicle security sensor and associated sensor bus interface means for interfacing said vehicle security sensor to the data communications bus;

an alarm indicator and associated alarm indicator bus interface means for interfacing said alarm indicator to the data communications bus;

an alarm controller and associated alarm controller bus interface means for interfacing said alarm controller to the data communications bus; and

desired signal enabling means for enabling said alarm controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting said alarm controller to communicate with said vehicle security sensor and said alarm indicator via the data communications bus so that said alarm controller is capable of operating said alarm indicator responsive to said vehicle security sensor;

at least one of said sensor bus interface means, said alarm indicator bus interface means, and said alarm controller bus interface means comprising an inductive coupler for inductively coupling to the data communications bus.

2. A vehicle security system according to claim 1 further comprising a vehicle controller and associated vehicle controller bus interface means for connecting the vehicle controller to the data communications bus; and wherein said alarm controller is operatively connected to said vehicle controller.

3. A vehicle security system according to claim 2 wherein said vehicle controller bus interface means comprises an inductive coupler for inductively coupling to the data communications bus.

4. A vehicle security system according to claim 1 wherein the data communications bus is a multiplexed data bus; and wherein the sensor bus interface means, the alarm bus interface means, and the alarm controller bus interface means each comprises multiplex interface means including an inductive coupler for inductively coupling and interfacing with the multiplexed data bus.

5. A vehicle security system according to claim 1 wherein said desired signal enabling means comprises:

memory means for storing a plurality of sets of signals for different vehicles; and

selecting means for selecting the desired set of signals from the plurality of different sets of signals for different vehicles.

6. A vehicle security system according to claim 5 wherein said selecting means comprises user selecting means for permitting a user to select the desired set of signals.

7. A vehicle security system according to claim 5 wherein said selecting means comprises bus determining means for determining the desired set of signals based upon signals on the data communications bus.

8. A vehicle security system according to claim 5 wherein said memory means comprises device address memory means for storing a plurality of different sets of signals for different device addresses.

9. A vehicle security system according to claim 5 wherein said memory means comprises protocol memory means for storing a plurality of different sets of signals for different protocols.

10. A vehicle security system according to claim 1 wherein said desired signal enabling means comprises bus learning means for learning the desired set of signals based upon signals on the data communications bus.

11. A vehicle security system according to claim 1 wherein said desired signal enabling means comprises download learning means for learning the desired set of signals from a downloading device.

12. A vehicle security system according to claim 11 wherein said downloading learning means comprises means for learning the desired set of signals from a computer temporarily connected thereto.

13. A vehicle security system according to claim 1 wherein said desired signal enabling means comprises protocol providing means for providing a protocol for the desired vehicle.

14. A vehicle security system according to claim 1 wherein said desired signal enabling means comprises device address providing means for providing device addresses for the desired vehicle.

15. A vehicle security system according to claim 1 wherein said vehicle security sensor comprises one of a door switch, a trunk switch, a proximity sensor, and a motion sensor.

16. A vehicle security system according to claim 1 wherein said alarm indicator comprises one of a vehicle light, a vehicle horn, a siren, a speech message generator, and a remote pager.

17. A vehicle security system for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices, the vehicle devices comprising at least one of a vehicle security sensor and an alarm indicator, said vehicle security system comprising:

an alarm controller and associated alarm controller bus interface means for interfacing said alarm controller to the data communications bus, said alarm controller bus interface means comprising an inductive coupler for inductively coupling to the data communications bus;

memory means for storing a plurality of sets of signals for different vehicles; and

selecting means for selecting a desired set of signals for a desired vehicle from the plurality of sets of signals for different vehicles, the desired set of signals for enabling said alarm controller to communicate via the data communications bus with at least one of the vehicle security sensor and the alarm indicator.

18. A vehicle security system according to claim 17 wherein the data communications bus is a multiplexed data bus; and wherein the alarm controller bus interface means comprises multiplex interface means for interfacing with the multiplexed data bus.

19. A vehicle security system according to claim 17 wherein said selecting means comprises user selecting means for permitting a user to select the desired set of signals.

20. A vehicle security system according to claim 17 wherein said selecting means comprises bus determining means for determining the desired set of signals based upon signals on the data communications bus.

21. A vehicle security system according to claim 17 wherein said memory means comprises device address memory means for storing a plurality of different sets of signals for different device addresses.

22. A vehicle security system according to claim 17 wherein said memory means comprises protocol memory means for storing a plurality of different sets of signals for different protocols.

23. A vehicle security system for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices, the vehicle devices comprising at least one of a vehicle security sensor and an alarm indicator, said vehicle security system comprising:

an alarm controller and associated alarm controller bus interface means including an inductive coupler for interfacing said alarm controller to the data communications bus; and

desired signal enabling means for enabling said alarm controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting said alarm controller to communicate via the data communications bus with at least one of the vehicle security sensor and the alarm indicator, said desired signal enabling means comprising learning means for learning the desired set of signals.

24. A vehicle security system according to claim 23 wherein said learning means comprises bus learning means for learning the desired set of signals based upon signals on the data communications bus.

25. A vehicle security system according to claim 23 wherein said learning means comprises download learning

means for learning the desired set of signals from a downloading device.

26. A vehicle security system according to claim **25** further comprising cellular telephone means cooperating with said download learning means for receiving signals from a remote downloading device.

27. A vehicle security system according to claim **25** wherein said download learning means comprises means for learning the desired set of signals from a computer temporarily connected thereto.

28. A vehicle security system according to claim **23** wherein said signal desired enabling means comprises protocol providing means for providing a protocol for the desired vehicle.

29. A vehicle security system according to claim **23** wherein said desired signal enabling means comprises device address providing means for providing desired addresses for the desired vehicle.

30. A vehicle security system according to claim **23** wherein the data communications bus is a multiplexed data bus; and where in the alarm controller bus interface means comprises multiplex interface means for interfacing with the multiplexed data bus.

31. A method for operating a vehicle security system for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices, the method comprising the steps of:

interfacing an alarm controller to the data communications bus via an inductive coupler; and

enabling said alarm controller to operate using a set of desired signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting said alarm controller to communicate via the data communications bus with at least one of a vehicle security sensor and an alarm indicator.

32. A method according to claim **31** wherein the step of enabling the alarm controller to operate using a set of desired signals comprises the steps of:

storing in a memory a plurality of sets of signals for different vehicles; and

selecting the desired set of signals from the plurality of different sets of signals for different vehicles.

33. A method according to claim **31** wherein the step of selecting comprises permitting user selection of the desired set of signals.

34. A method according to claim **31** wherein the step of selecting comprises determining the desired set of signals based upon signals on the data communications bus.

35. A method according to claim **31** wherein the step of storing in memory comprises storing a plurality of different sets of signals representative of different device addresses.

36. A method according to claim **31** wherein the step of storing in memory comprises storing a plurality of different sets of signals representative of different protocols.

37. A method according to claim **31** wherein the step of enabling the alarm controller to operate using a set of desired signals comprises the step of learning the desired set of signals based upon signals on the data communications bus.

38. A method according to claim **31** wherein the step of enabling the alarm controller to operate using a set of desired signals comprises the step of downloading the desired signals from a downloading device.

39. A remote control system for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices, said remote control system comprising:

a remote transmitter for transmitting a changing code signal;

a receiver within the vehicle for receiving the changing code signal from said remote transmitter;

a vehicle function controller, operatively connected to said receiver, and associated vehicle function controller bus interface means for interfacing said vehicle function controller to the data communications bus; and

desired signal enabling means for enabling said vehicle function controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting said vehicle function controller to communicate via the data communications bus with a vehicle device so that said vehicle function controller is capable of operating the vehicle device responsive to the changing code signal from said remote transmitter.

40. A remote control system for a vehicle according to claim **39** wherein the changing code signal is a pseudorandom code signal.

41. A remote control system for a vehicle according to claim **39** wherein the changing code signal is a rolling code signal.

42. A remote control system for a vehicle according to claim **39** wherein said vehicle function controller bus interface means comprises an inductive coupler for inductively coupling to the data communications bus.

43. A remote control system for a vehicle according to claim **39** wherein the plurality of vehicle devices comprises a vehicle security sensor and associated sensor bus interface means for interfacing said vehicle security sensor to the data communications bus; and wherein said vehicle function controller comprises an alarm controller being capable of generating an alarm responsive to the vehicle security sensor.

44. A remote control system for a vehicle according to claim **39** wherein the plurality of vehicle devices comprises a plurality of vehicle door locks movable between locked and unlocked positions and associated bus interface means for interfacing said door locks to the data communications bus; and wherein said vehicle function controller comprises a door lock controller for moving the vehicle door locks between locked and unlocked positions responsive to said remote transmitter.

45. A remote control system for a vehicle according to claim **39** where said plurality of vehicle devices comprises vehicle engine starting means and associated bus interface means for interfacing said vehicle engine starting means to the data communications bus; and wherein said vehicle function controller comprises a remote start controller for operating the vehicle engine starting means responsive to said remote transmitter.

46. A remote control system for a vehicle according to claim **45** wherein the associated interface means for said vehicle engine starting means comprises an inductive coupler.

47. A remote control system for a vehicle according to claim **39** wherein said desired signal enabling means comprises:

memory means for storing a plurality of sets of signals for different vehicles; and

selecting means for selecting the desired set of signals from the plurality of different sets of signals for different vehicles.

48. A remote control system for a vehicle according to claim **47** wherein said selecting means comprises user selecting means for permitting a user to select the desired set of signals.

49. A remote control system for a vehicle according to claim **47** wherein said selecting means comprises determin-

ing means for determining the desired set of signals based upon signals on the data communications bus.

50. A remote control system for a vehicle according to claim **47** wherein said memory means comprises address memory means for storing a plurality of different sets of digital signals for different device addresses.

51. A remote control system for a vehicle according to claim **47** wherein said memory means comprises protocol memory means for storing a plurality of different sets of signals for different protocols.

52. A remote control system for a vehicle according to claim **39** wherein said desired signal enabling means comprises learning means for learning the desired set of signals.

53. A remote control system for a vehicle according to claim **39** wherein said desired signal enabling means comprises protocol providing means for providing a protocol for the desired vehicle.

54. A remote control system for a vehicle according to claim **39** wherein said desired signal enabling means comprises device address providing means for providing device addresses for the desired vehicle.

55. A remote control system for a vehicle according to claim **39** further comprising a second vehicle controller and associated vehicle controller bus interface means for connecting to the data communications bus; and wherein said vehicle function controller is operatively connected to said second vehicle controller.

56. A remote control system for a vehicle according to claim **39** wherein the data communications bus is a multiplexed data bus; and wherein the vehicle function controller bus interface means comprises multiplex interface means for interfacing with the multiplexed data bus.

57. A remote control system for a vehicle according to claim **56** wherein said multiplex interface means comprises an inductive coupler.

58. A method for remotely controlling a vehicle function for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices, and a vehicle function controller and associated bus interface means for interfacing the vehicle function controller to the data communications bus, the method comprising the steps of:

enabling the vehicle function controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting the vehicle function controller to communicate via the data communications bus with at least one of the vehicle devices; and

receiving a changing code signal at the vehicle from a remote transmitter so that the vehicle function controller remotely controls a vehicle function responsive to the changing code signal from the remote transmitter.

59. A method according to claim **58** wherein the plurality of vehicle devices comprises a vehicle security sensor and associated sensor bus interface means for interfacing the vehicle security sensor to the data communications bus; wherein the vehicle function controller comprises an alarm controller movable between armed and disarmed modes, the alarm controller when in the armed mode being capable of generating an alarm indication responsive to the vehicle security sensor; and wherein the step of receiving comprises receiving a signal so that the vehicle function controller is moved to one of the armed and disarmed modes.

60. A method according to claim **58** wherein the plurality of vehicle devices comprises a plurality of vehicle door locks movable between locked and unlocked positions and associated bus interface means for interfacing the door locks to the data communications bus; and wherein the step of receiving comprises moving the vehicle door locks to one of locked and unlocked positions responsive to the remote transmitter.

61. A method according to claim **58** wherein the plurality of vehicle devices comprises vehicle engine starting means and associated bus interface means for interfacing the vehicle engine starting means to the data communications bus; and wherein the step of receiving comprises operating the vehicle engine starting means responsive to the remote transmitter.

62. A method according to claim **58** wherein the step of enabling the alarm controller to operate using a set of desired signals comprises the steps of:

storing in a memory a plurality of sets of signals for different vehicles; and

selecting the desired set of signals from the plurality of different sets of signals for different vehicles.

63. A method according to claim **62** wherein the step of selecting comprises permitting user selection of the desired set of signals.

64. A method according to claim **62** wherein the step of selecting comprises determining the desired set of signals based upon signals on the data communications bus.

65. A method according to claim **62** wherein the step of storing in memory comprises storing a plurality of different sets of signals representative of different device addresses.

66. A method according to claim **62** wherein the step of storing in memory comprises storing a plurality of different sets of signals representative of different protocols.

67. A method according to claim **58** wherein the step of enabling the alarm controller to operate using a set of desired signals comprises the step of learning the desired set of signals.

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Flick

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(45) **Date of Patent: *Jun. 19, 2001**

(54) **VEHICLE SECURITY SYSTEM INCLUDING ADAPTOR FOR DATA COMMUNICATIONS BUS AND RELATED METHODS**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

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(51) **Int. Cl.**[7] **B60R 25/10**

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(58) **Field of Search** 340/426, 427, 340/428, 429, 531, 532, 533, 825.31, 825.32, 825.69, 941, 942; 307/10.1, 10.2, 10.3; 180/287

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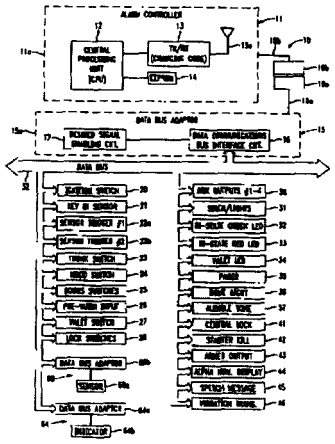
(57) **ABSTRACT**

A vehicle security system is for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices. The vehicle security system preferably comprises an alarm controller and a data bus adaptor connected between the alarm controller and the data communications bus. In particular, the data bus adaptor preferably implements a desired signal enabling feature for enabling the alarm controller to operate using a desired set of signals for a desired vehicle from among a plurality of possible sets of signals for different vehicles. An alarm controller bus interface is also provided for interfacing to the data communications bus. Accordingly, the desired signal enabling feature permits the alarm controller to communicate with other vehicle devices, such as a vehicle security sensor and/or an alarm indicator via the data communications bus. The security system is thus advantageously compatible with many different types of vehicle data communications formats or protocols. Moreover, the data bus adaptor permits existing conventional alarm controllers, for example, to be readily used with newer vehicles including the data communications bus. The data bus adaptor may be used with remote keyless entry and remote start controllers, and also for vehicle sensors or indicators.

64 Claims, 9 Drawing Sheets



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5,245,335	*	9/1993	Hill et al.	340/941
5,252,966		10/1993	Lambropoulos et al.	340/825.64
5,406,270		4/1995	Van Lente	340/825.54
5,473,540		12/1995	Schmitz	701/1
5,475,818		12/1995	Molyneaux et al.	709/208
5,521,588		5/1996	Kuhner et al.	340/825.22
5,523,948		6/1996	Adrain	701/99
5,555,498		9/1996	Berra et al.	701/33
5,606,306		2/1997	Mutoh et al.	340/426
5,699,430	*	12/1997	Krizay et al.	340/825.04
5,719,551	*	2/1998	Flick	340/426
5,832,397		11/1998	Yoshida et al.	701/29
6,011,460	*	1/2000	Flick	340/426
6,111,524	*	8/2000	Lesesky et al.	340/942

* cited by examiner

FIG. 1

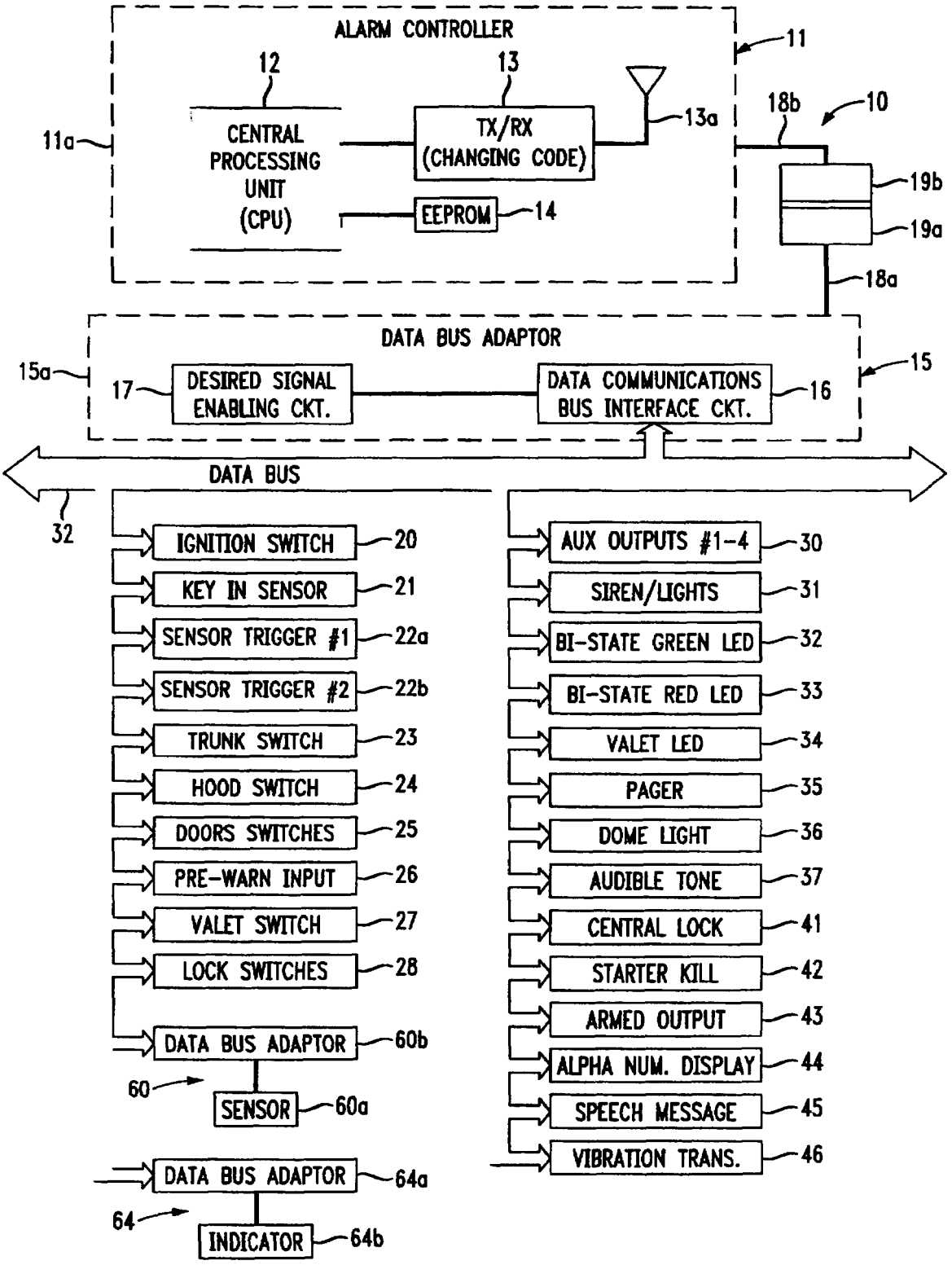

ALARM CONTROLLER
11
12
13
CENTRAL PROCESSING UNIT (CPU)
TX/RX (CHANGING CODE)
13a
11a
18b
10
EEPROM
14
19b
19a
18a
DATA BUS ADAPTOR
15a
17
DESIRED SIGNAL ENABLING CKT.
DATA COMMUNICATIONS BUS INTERFACE CKT.
16
15
DATA BUS
32
IGNITION SWITCH
20
KEY IN SENSOR
21
SENSOR TRIGGER #1
22a
SENSOR TRIGGER #2
22b
TRUNK SWITCH
23
HOOD SWITCH
24
DOORS SWITCHES
25
PRE-WARN INPUT
26
VALET SWITCH
27
LOCK SWITCHES
28
DATA BUS ADAPTOR
60b
60
SENSOR
60a
DATA BUS ADAPTOR
64a
64
INDICATOR
64b
AUX OUTPUTS #1-4
30
SIREN/LIGHTS
31
BI-STATE GREEN LED
32
BI-STATE RED LED
33
VALET LED
34
PAGER
35
DOME LIGHT
36
AUDIBLE TONE
37
CENTRAL LOCK
41
STARTER KILL
42
ARMED OUTPUT
43
ALPHA NUM. DISPLAY
44
SPEECH MESSAGE
45
VIBRATION TRANS.
46

FIG. 2

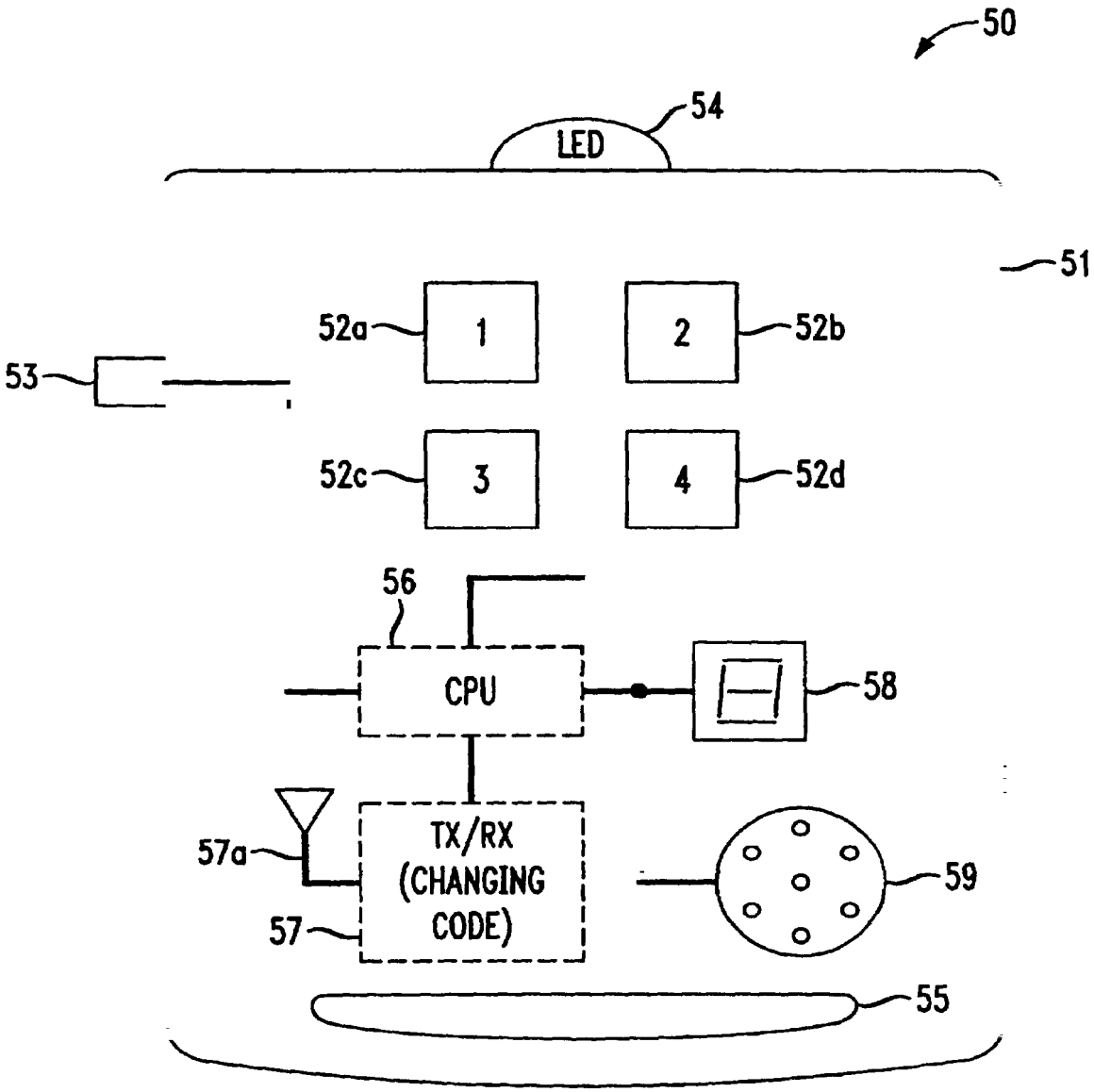

50
54
LED
51
52a
1
2
52b
53
52c
3
4
52d
56
CPU
58
57a
TX/RX
(CHANGING
CODE)
59
57
55

FIG. 3

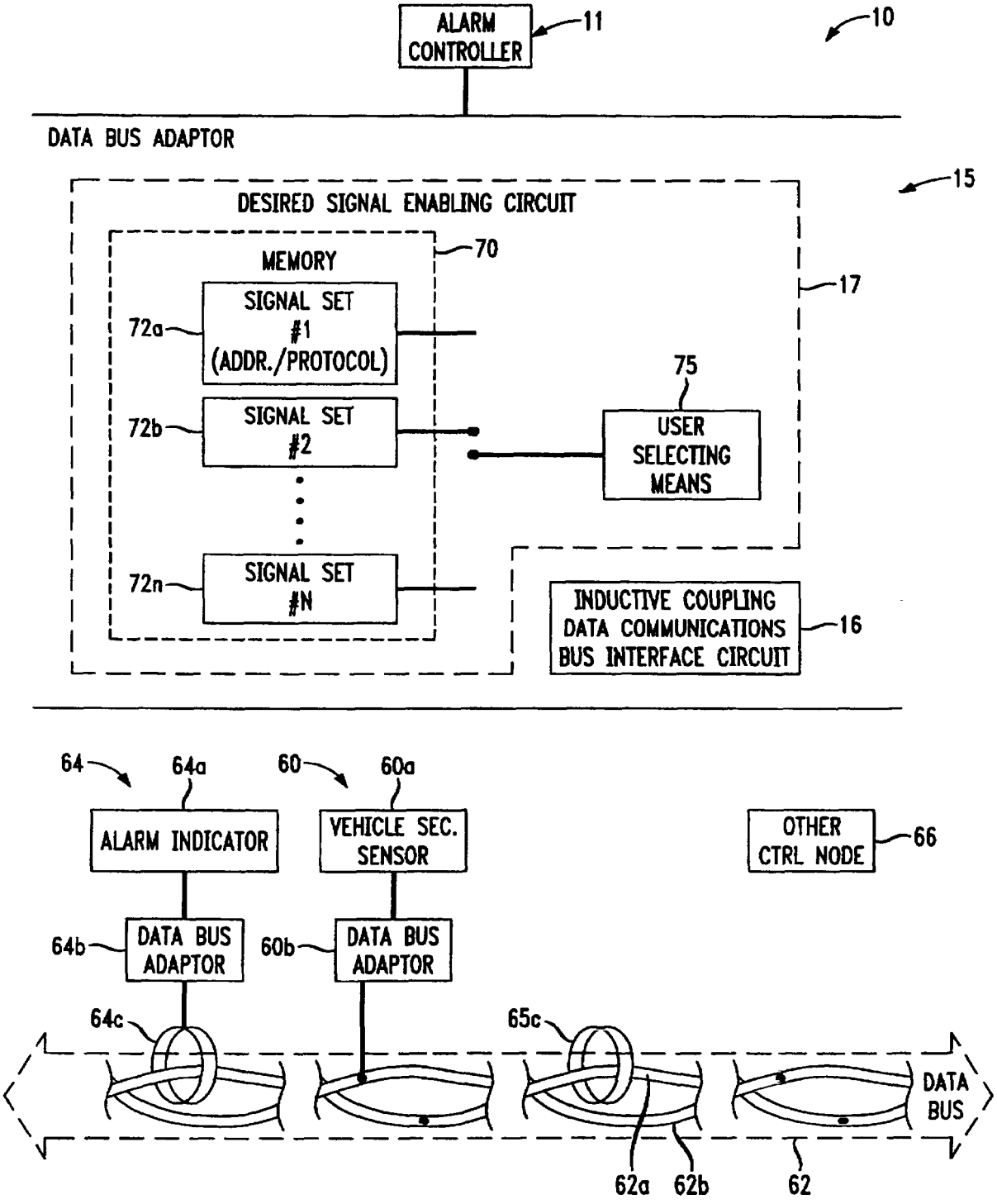

ALARM CONTROLLER
11
10
DATA BUS ADAPTOR
15
DESIRED SIGNAL ENABLING CIRCUIT
MEMORY
70
17
72a
SIGNAL SET #1 (ADDR./PROTOCOL)
72b
SIGNAL SET #2
72n
SIGNAL SET #N
75
USER SELECTING MEANS
INDUCTIVE COUPLING DATA COMMUNICATIONS BUS INTERFACE CIRCUIT
16
64
64a
60
60a
ALARM INDICATOR
VEHICLE SEC. SENSOR
OTHER CTRL NODE
66
64b
DATA BUS ADAPTOR
60b
DATA BUS ADAPTOR
64c
65c
DATA BUS
62a
62b
62

FIG. 4

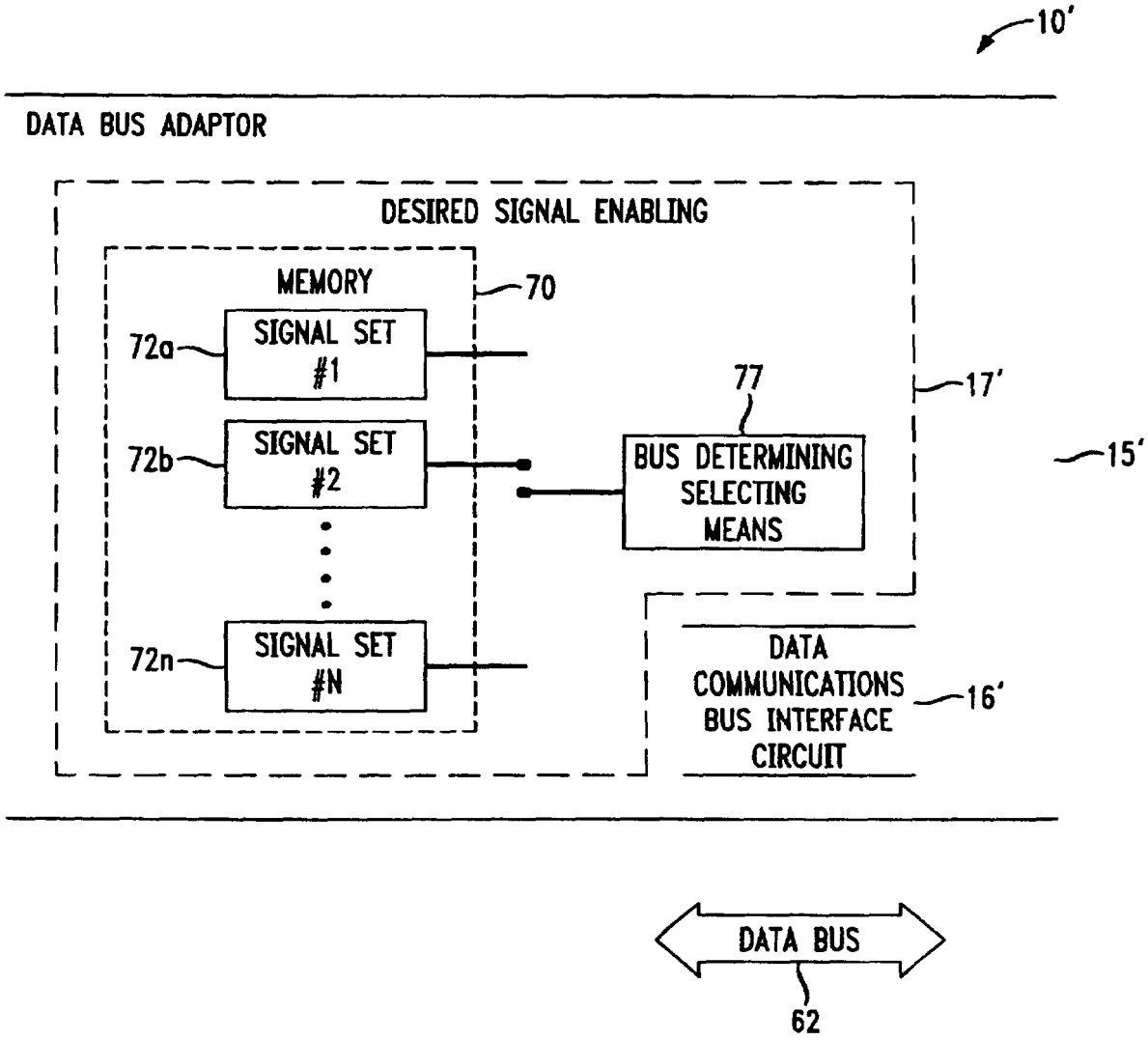

10'
DATA BUS ADAPTOR
DESIRED SIGNAL ENABLING
MEMORY
70
72a
SIGNAL SET #1
72b
SIGNAL SET #2
72n
SIGNAL SET #N
77
BUS DETERMINING SELECTING MEANS
17'
15'
DATA COMMUNICATIONS BUS INTERFACE CIRCUIT
16'
DATA BUS
62

FIG. 5

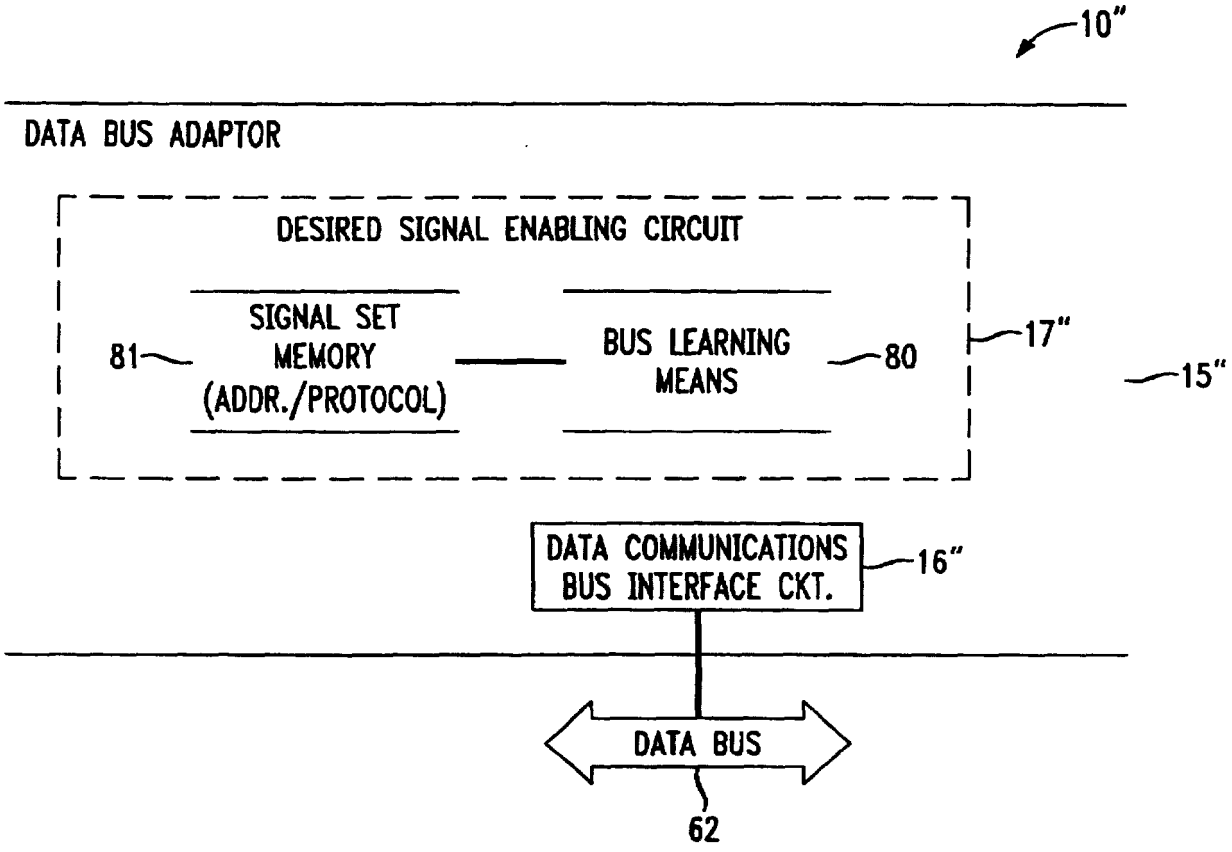

10"
DATA BUS ADAPTOR
DESIRED SIGNAL ENABLING CIRCUIT
SIGNAL SET MEMORY (ADDR./PROTOCOL)
81
BUS LEARNING MEANS
80
17"
15"
DATA COMMUNICATIONS BUS INTERFACE CKT.
16"
DATA BUS
62

FIG. 6A

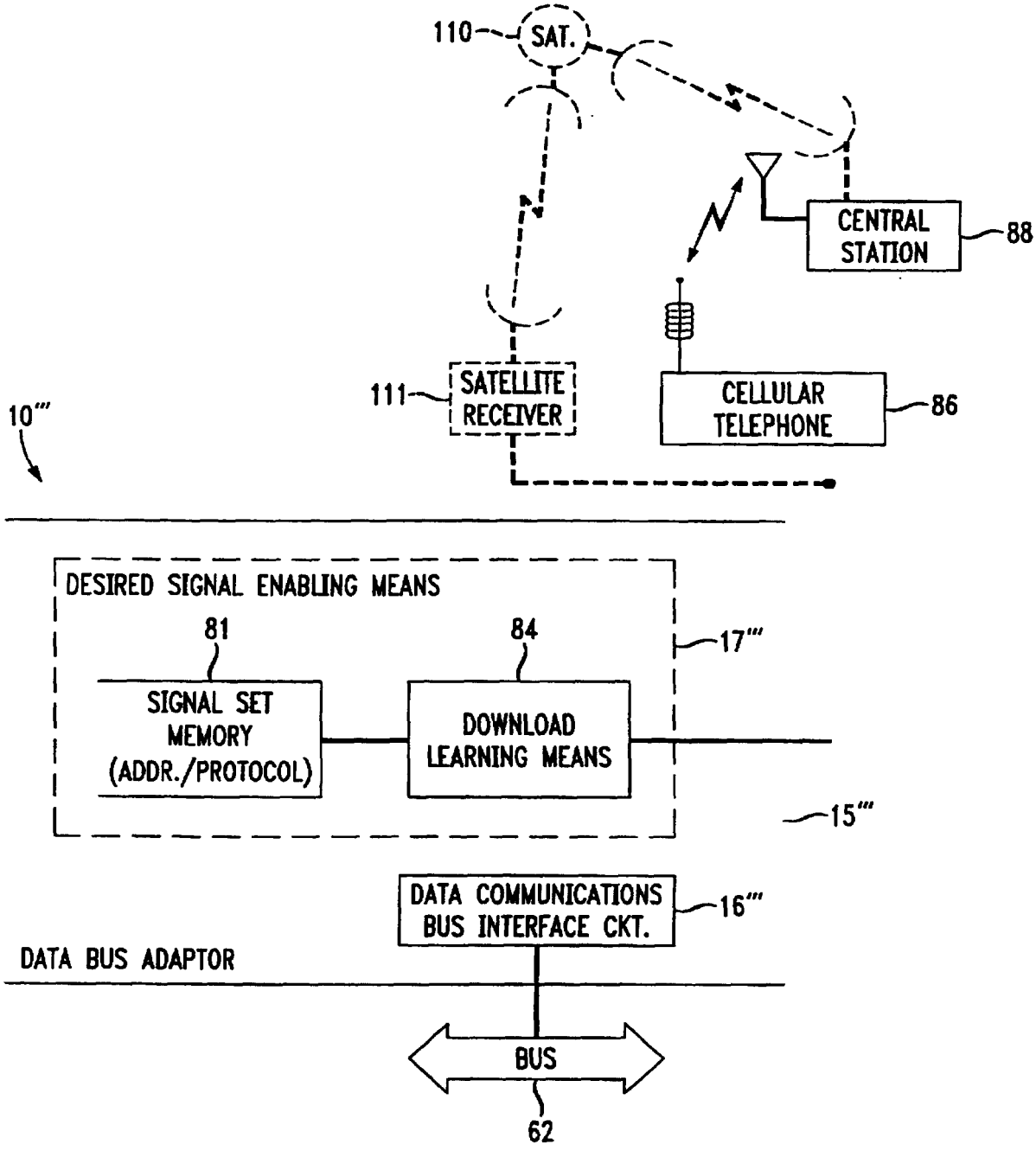

110
SAT.
CENTRAL STATION
88
111
SATELLITE RECEIVER
CELLULAR TELEPHONE
86
10'''
DESIRED SIGNAL ENABLING MEANS
81
84
17'''
SIGNAL SET MEMORY (ADDR./PROTOCOL)
DOWNLOAD LEARNING MEANS
15'''
DATA COMMUNICATIONS BUS INTERFACE CKT.
16'''
DATA BUS ADAPTOR
BUS
62

FIG. 6B

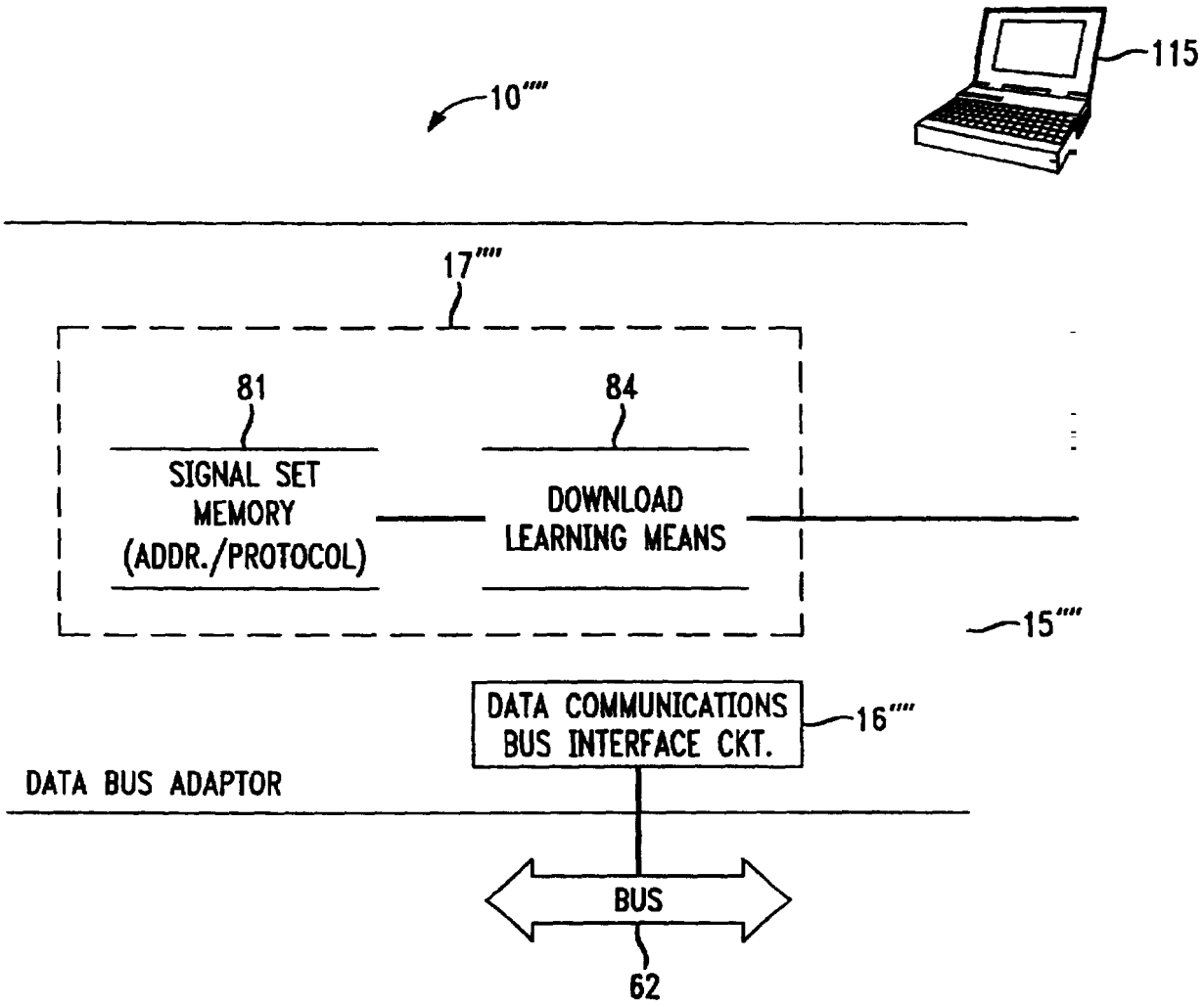

115
10''''
17''''
81
84
SIGNAL SET MEMORY (ADDR./PROTOCOL)
DOWNLOAD LEARNING MEANS
15''''
DATA COMMUNICATIONS BUS INTERFACE CKT.
16''''
DATA BUS ADAPTOR
BUS
62

FIG. 7

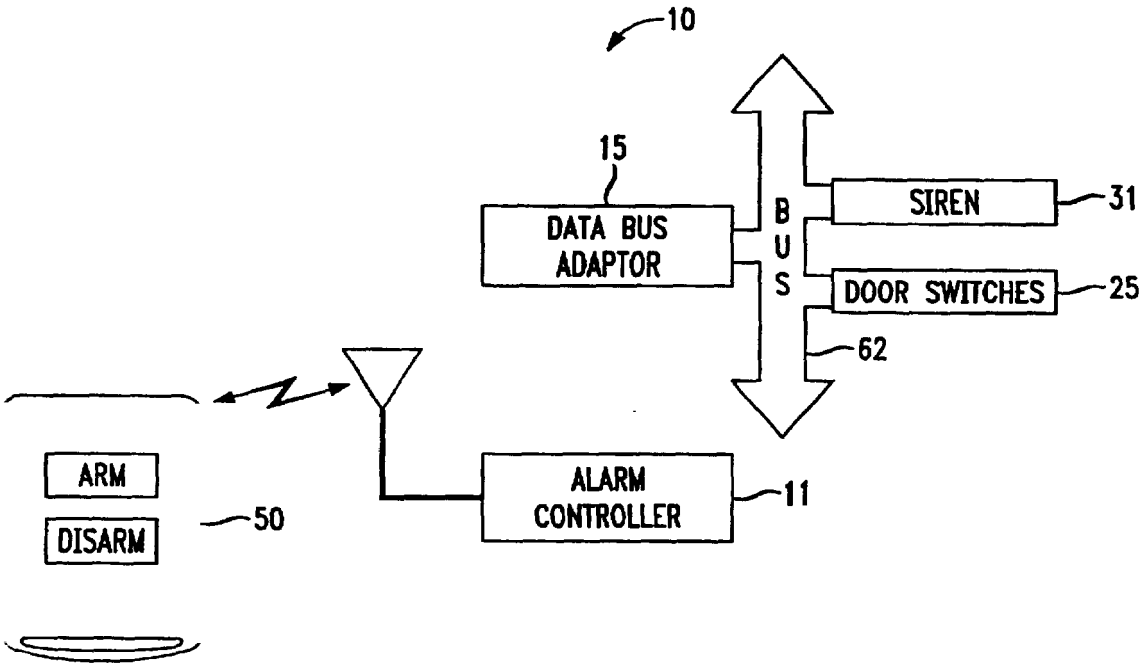

10
15
DATA BUS ADAPTOR
BUS
SIREN
31
DOOR SWITCHES
25
62
ARM
DISARM
50
ALARM CONTROLLER
11

FIG. 8

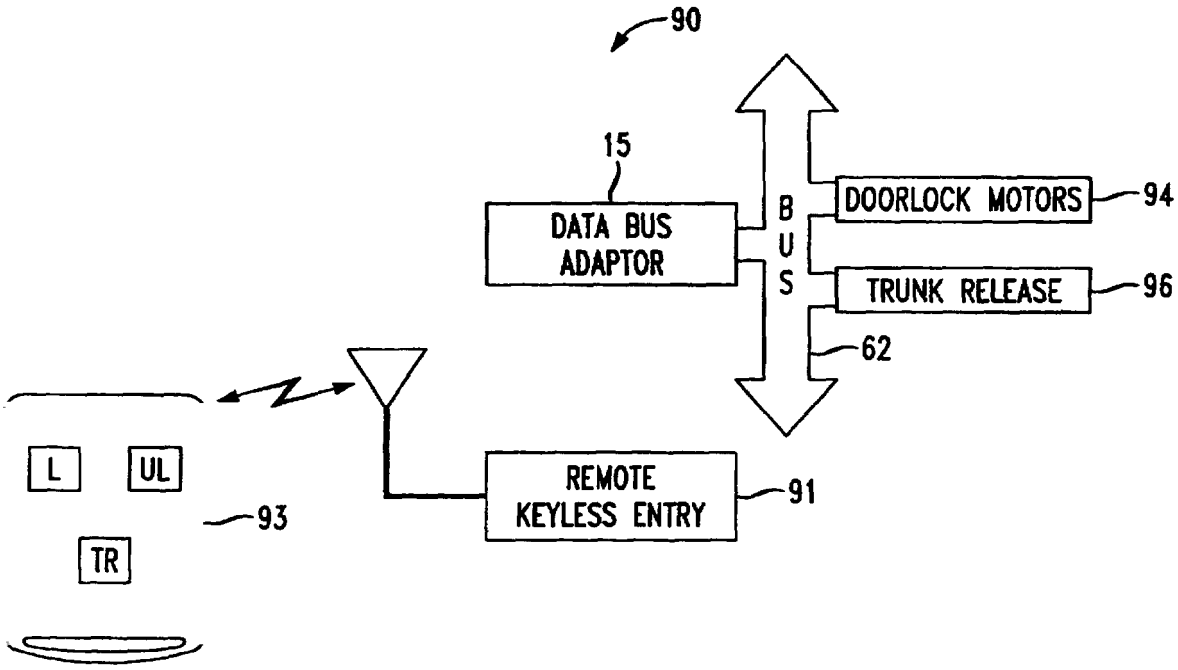
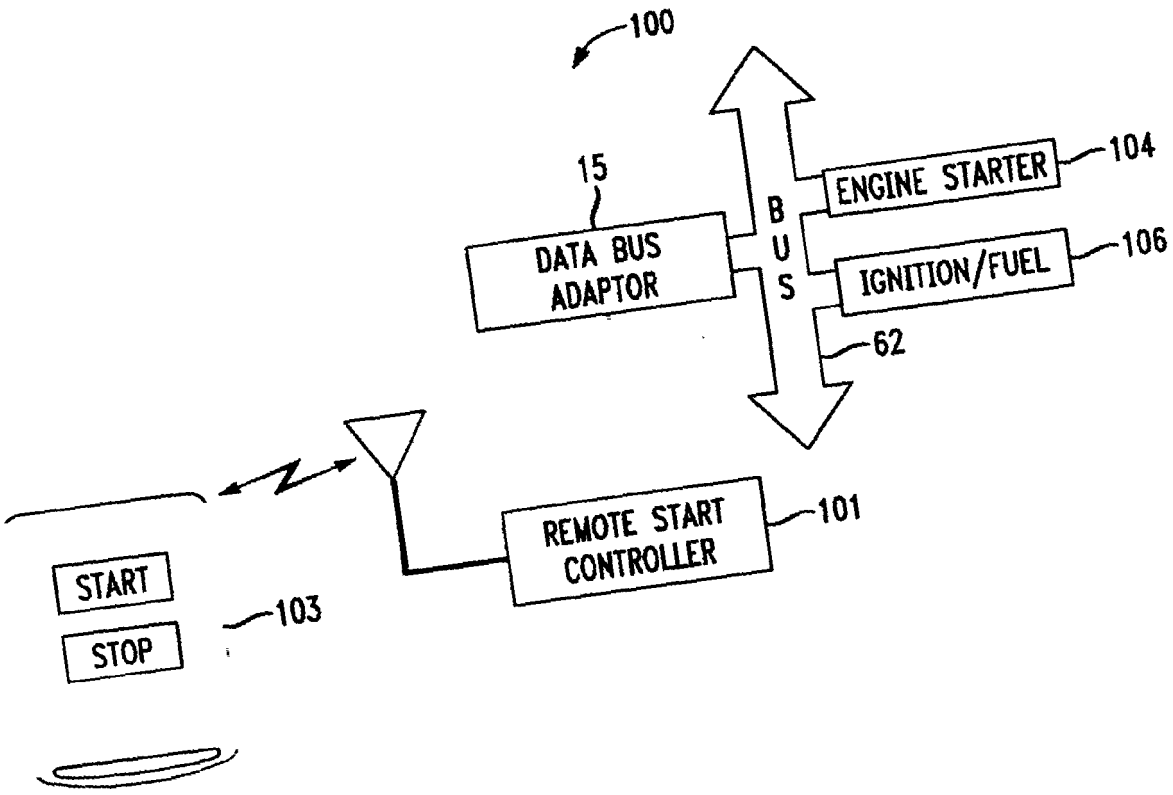

90
15
DATA BUS ADAPTOR
BUS
DOORLOCK MOTORS
94
TRUNK RELEASE
96
62
L
UL
93
TR
REMOTE KEYLESS ENTRY
91

FIG. 9


100
15
DATA BUS ADAPTOR
B U S
ENGINE STARTER
104
IGNITION/FUEL
106
62
REMOTE START CONTROLLER
101
START
STOP
103

VEHICLE SECURITY SYSTEM INCLUDING ADAPTOR FOR DATA COMMUNICATIONS BUS AND RELATED METHODS

RELATED APPLICATION

The present application is a continuation-in-part of U.S. patent application Ser. No. 09/023,838 filed Feb. 13, 1998 now U.S. Pat. No. 6,011,460 which, in turn, is a continuation-in-part of Ser. No. 08/701,356 filed Aug. 22, 1996 now U.S. Pat. No. 5,719,551.

FIELD OF THE INVENTION

This application is related to the field of security systems and, more particularly, to a security system and related methods for vehicles.

BACKGROUND OF THE INVENTION

Vehicle security systems are widely used to deter vehicle theft, prevent theft of valuables from a vehicle, deter vandalism, and to protect vehicle owners and occupants. A typical automobile security system, for example, includes a central processor or controller connected to a plurality of vehicle sensors. The sensors, for example, may detect opening of the trunk, hood, doors, windows, and also movement of the vehicle or within the vehicle. Ultrasonic and microwave motion detectors, vibration sensors, sound discriminators, differential pressure sensors, and switches may be used as sensors. In addition, radar sensors may be used to monitor the area proximate the vehicle.

The controller typically operates to give an alarm indication in the event of triggering of a vehicle sensor. The alarm indication may typically be a flashing of the lights and/or the sounding of the vehicle horn or a siren. In addition, the vehicle fuel supply and/or ignition power may be selectively disabled based upon an alarm condition.

A typical security system also includes a receiver associated with the controller that cooperates with one or more remote transmitters typically carried by the user as disclosed, for example, in U.S. Pat. No. 4,383,242 to Sassover et al. and U.S. Pat. No. 5,146,215 to Drori. The remote transmitter may be used to arm and disarm the vehicle security system or provide other remote control features from a predetermined range away from the vehicle. Also related to remote control of a vehicle function U.S. Pat. No. 5,252,966 to Lambropoulous et al. discloses a remote keyless entry system for a vehicle. The keyless entry system permits the user to remotely open the vehicle doors or open the vehicle trunk using a small handheld transmitter.

Unfortunately, the majority of vehicle security systems need to be directly connected by wires to individual vehicle devices, such as the vehicle horn or door switches of the vehicle. In other words, a conventional vehicle security system is hardwired to various vehicle components, typically by splicing into vehicle wiring harnesses or via interposing T-harnesses and connectors. The number of electrical devices in a vehicle has increased so that the size and complexity of wiring harnesses has also increased. For example, the steering wheel may include horn switches, an airbag, turn-signal and headlight switches, wiper controls, cruise control switches, ignition wiring, an emergency flasher switch, and/or radio controls. Likewise, a door of a vehicle, for example, may include window controls, locks, outside mirror switches, and/or door-panel light switches.

In response to the increased wiring complexity and costs, vehicle manufacturers have begun attempts to reduce the amount of wiring within vehicles to reduce weight, reduce wire routing problems, decrease costs, and reduce complications which may arise when troubleshooting the electrical system. For example, some manufacturers have adopted multiplexing schemes to reduce cables to three or four wires and to simplify the exchange of data among the various onboard electronic systems as disclosed, for example, in "The Thick and Thin of Car Cabling" by Thompson appearing in the IEEE Spectrum, Feb. 1996, pp. 42–45.

Implementing multiplexing concepts in vehicles in a cost-effective and reliable manner may not be easy. Successful implementation, for example, may require the development of low or error-free communications in what can be harsh vehicle environments. With multiplexing technology, the various electronic modules or devices may be linked by a single signal wire in a bus also containing a power wire, and one or more ground wires. Digital messages are communicated to all modules over the data communications bus. Each message may have one or more addresses associated with it so that the devices can recognize which messages to ignore and which messages to respond to or read.

The Thompson article describes a number of multiplexed networks for vehicles. In particular, the Grand Cherokee made by Chrysler is described as having five multiplex nodes or controllers: the engine controller, the temperature controller, the airbag controller, the theft alarm, and the overhead console. Other nodes for different vehicles may include a transmission controller, a trip computer, an instrument cluster controller, an antilock braking controller, an active suspension controller, and a body controller for devices in the passenger compartment.

A number of patents are also directed to digital or multiplex communications networks or circuits, such as may be used in a vehicle. For example, U.S. Pat. No. 4,538,262 Sinniger et al. discloses a multiplex bus system including a master control unit and a plurality of receiver-transmitter units connected thereto. Similarly, U.S. Pat. No. 4,055,772 to Leung discloses a power bus in a vehicle controlled by a low current digitally coded communications system. Other references disclosing various vehicle multiplex control systems include, for example, U.S. Pat. No. 4,760,275 to Sato et al.; U.S. Pat. No. 4,697,092 to Roggendorf et al.; and U.S. Pat. No. 4,792,783 to Burgess et al.

Several standards have been proposed for vehicle multiplex networks including, for example, the Society of Automotive Engineers "Surface Vehicle Standard, Class B Data Communications Network Interface", SAE J1850, Jul. 1995. Another report by the SAE is the "Surface Vehicle Information Report, Chrysler Sensor and Control (CSC) Bus Multiplexing Network for Class 'A' Applications", SAE J2058, Jul. 1990. Many other networks are also being implemented or proposed for communications between vehicle devices and nodes or controllers.

Unfortunately, conventional vehicle security systems for hardwired connection to vehicle devices, such as aftermarket vehicle security systems, are not readily adaptable to a vehicle including a data communications bus. One difficulty is that vehicle manufacturers discourage cutting and splicing into existing wiring to install aftermarket components. For example, a manufacturer may void a warranty for such activity. Moreover, a vehicle security system if adapted for a communications bus and devices for one particular model, model year, and manufacturer, may not be compatible with any other models, model years, or manufacturers. Other systems for remote control of vehicle functions may also suffer from such shortcomings. In addition, it may be

VEHICLE SECURITY SYSTEM INCLUDING ADAPTOR FOR DATA COMMUNICATIONS BUS AND RELATED METHODS

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The controller typically operates to give an alarm indication in the event of triggering of a vehicle sensor. The alarm indication may typically be a flashing of the lights and/or the sounding of the vehicle horn or a siren. In addition, the vehicle fuel supply and/or ignition power may be selectively disabled based upon an alarm condition.

A typical security system also includes a receiver associated with the controller that cooperates with one or more remote transmitters typically carried by the user as disclosed, for example, in U.S. Pat. No. 4,383,242 to Sassover et al. and U.S. Pat. No. 5,146,215 to Drori. The remote transmitter may be used to arm and disarm the vehicle security system or provide other remote control features from a predetermined range away from the vehicle. Also related to remote control of a vehicle function U.S. Pat. No. 5,252,966 to Lambropoulous et al. discloses a remote keyless entry system for a vehicle. The keyless entry system permits the user to remotely open the vehicle doors or open the vehicle trunk using a small handheld transmitter.

Unfortunately, the majority of vehicle security systems need to be directly connected by wires to individual vehicle devices, such as the vehicle horn or door switches of the vehicle. In other words, a conventional vehicle security system is hardwired to various vehicle components, typically by splicing into vehicle wiring harnesses or via interposing T-harnesses and connectors. The number of electrical devices in a vehicle has increased so that the size and complexity of wiring harnesses has also increased. For example, the steering wheel may include horn switches, an airbag, turn-signal and headlight switches, wiper controls, cruise control switches, ignition wiring, an emergency flasher switch, and/or radio controls. Likewise, a door of a vehicle, for example, may include window controls, locks, outside mirror switches, and/or door-panel light switches.

In response to the increased wiring complexity and costs, vehicle manufacturers have begun attempts to reduce the amount of wiring within vehicles to reduce weight, reduce wire routing problems, decrease costs, and reduce complications which may arise when troubleshooting the electrical system. For example, some manufacturers have adopted multiplexing schemes to reduce cables to three or four wires and to simplify the exchange of data among the various onboard electronic systems as disclosed, for example, in "The Thick and Thin of Car Cabling" by Thompson appearing in the IEEE Spectrum, Feb. 1996, pp. 42–45.

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Unfortunately, conventional vehicle security systems for hardwired connection to vehicle devices, such as aftermarket vehicle security systems, are not readily adaptable to a vehicle including a data communications bus. One difficulty is that vehicle manufacturers discourage cutting and splicing into existing wiring to install aftermarket components. For example, a manufacturer may void a warranty for such activity. Moreover, a vehicle security system if adapted for a communications bus and devices for one particular model, model year, and manufacturer, may not be compatible with any other models, model years, or manufacturers. Other systems for remote control of vehicle functions may also suffer from such shortcomings. In addition, it may be

code type as will be readily appreciated by those skilled in the art. By changing code is meant that the remote transmitter **50** (FIG. **2**) sends a signal including a series of bits modulated on a radio frequency carrier, for example. These bits would typically include fixed code portions as well as changing code portions. The changing code portion provides additional security for the system **11**, so that unauthorized transmitters cannot be used to activate the alarm controller **11**. In particular, the term changing code is meant to cover fairly short repeating codes, such as are generally described as rolling codes. Such rolling codes may repeat as often as every eight transmissions, for example. In addition, changing code is also intended to cover pseudorandom codes that may only repeat after many thousands or even millions of operations as will be understood by those skilled in the art. The remote transmitter **50** and receiver of the alarm controller **11** are synchronized together with each having the changing code pattern stored therein or generated internally as will be readily understood by those skilled in the art.

As will also be appreciated by those skilled in the art, the processing of the changing code portions and other code portions of received signals may be shared with the CPU **12**. Alternately, the CPU may perform all of the changing code processing and the receiver provides only a demodulated radio signal, for example. The alarm controller **11** operates with changing code remote transmitters **50**.

In the illustrated embodiment, the CPU **12** is also operatively connected to a memory (EEPROM) **14**. As would be readily understood by those skilled in the art, the CPU **12** may alternately or additionally have its own on-board memory.

The alarm controller **11** described so far may of the conventional type. However, the alarm controller **11** is connected to the data bus **32** of the vehicle via the illustrated data bus adaptor **15** in accordance with the present invention. The data bus adaptor **15** includes its own separate housing **15***a* and may be connected to the alarm controller **11** by suitable cables **18***a*, **18***b* and connector portions **19***a*, **19***b* as schematically illustrated. The data bus adaptor **15** may be hardwire connected to the data bus **32** or may be inductively coupled thereto as will be described in further detail below.

The data communications bus **32** is illustratively connected to various vehicle input devices including: an ignition switch **20**; a key in the ignition sensor **21**; two zone sensors **22***a*, **22***b*; conventional trunk hood and door pin sensors or switches **23**, **24**, and **25**, respectively; and door lock switches **28**. In addition, a pre-warn sensor **26** and valet switch **27** also provide inputs to the controller **11** in the illustrated embodiment. As would be readily understood by those skilled in the art, other inputs are also contemplated by the present invention and are generally described herein by the term sensor. In addition, an input signal may also be received from a remote transmitter **50** (FIG. **2**).

The data communications bus **32** may also preferably be connected to a plurality of output devices. The outputs may include auxiliary relay outputs **30**, such as for window control, remote starting, or a remote alarm indication, as would be readily understood by those skilled in the art. A siren and/or lights **31**, and green and red light emitting diodes (LEDs) **32**, **33** for dashboard mounting are also illustratively connected to the controller **11**. Other outputs may be directed to a valet LED **34**, a dome light **36**, a central lock relay or lock control unit **41**, a starter kill circuit **42**, and an armed relay output **43**. In addition, other outputs may be directed to one or more of an audible tone generator **37**, an alphanumeric display **44**, a speech message annunciator **45**, and a vibration transducer **46**, as will be readily appreciated by those skilled in the art. Other similar indicating devices are also contemplated by the present invention, as would be readily understood by those skilled in the art.

In alternate embodiments, some of the illustrated devices may be hardwired to various control nodes as would be readily understood by those skilled in the art. The control nodes may be, in turn, connected by the data communications bus **32** as would also be appreciated by those skilled in the art.

The data bus adaptor **15** also includes the data signal enabling means or circuit **17** and the data communications bus interface circuit **16**. Each of the these circuit blocks will be described in greater detail below.

Referring now more particularly to FIG. **2**, a remote transmitter **50** in accordance with the invention is described. The remote transmitter **50** illustratively includes a housing **51** and a plurality of first momentary contact switches **52***a*–**52***d* carried by the housing. A second momentary contact switch **53** and an indicating light, such as the illustrated LED **54** are also carried by or mounted on the housing **51**. As would be readily understood by those skilled in the art, the remote transmitter **50** is typically relatively small and includes an opening **55** for facilitating connection to a vehicle key ring, for example. In addition, the remote transmitter **50** includes a central processing unit or microprocessor **56** operatively connected to the plurality of first switches **52***a*–**52***d*, the second switch **53**, and the LED **54**. The microprocessor is also connected to a transmitter and/or receiver circuit **57** and its associated antenna **57***a* for transmitting and/or receiving signals to and from the controller **11** of the vehicle security system **10**. Accordingly, the term "remote transmitter" is used broadly herein to describe the embodiment also including receiver means.

The remote transmitter **50** also preferably generates or transmits changing code signals to increase security as discussed extensively above. In the illustrated embodiment, this feature is shown incorporated into the transmitter and receiver block **57**, although those of skill in the art will recognize that this could be done in combination with the CPU **56**, or by the CPU alone, for example.

The remote transmitter **50** may also include a numeric or alphanumeric display **58**, and a speaker **59** coupled to an audible tone generator or a speech message generator, as may be provided by the microprocessor **56**. A vibration transducer, not shown, may also be incorporated into the remote transmitter **50** for communicating to the user as would be readily understood by those skilled in the art.

Of course, as will be readily appreciated by those skilled in the art, the remote transmitter may be a central station, for example, rather than a handheld unit **50** as shown in FIG. **2**. Also the remote transmitter may include a handheld unit that communicates first to a central station. Other forms of remote transmitters are also contemplated by the invention as will be understood by those skilled in the art.

Turning now additionally to FIG. **3** a first embodiment of the desired signal enabling means **17** of the data bus adaptor **15** is described. The vehicle security system **10** illustratively comprises a vehicle security sensor assembly **60** including a sensor **60** and the illustrated data bus adaptor **60***b*. The data bus adaptor **60***b* is illustratively connected to the data bus **62** in a hardwired configuration, such as typically using an intervening connector, although direct splicing into the data bus is also contemplated. The data bus adaptor **60***b* may include the desired signal enabling means and bus interface circuit as described herein.

An alarm indicator assembly **64** is also illustratively connected to the data bus **62** via the illustrated data bus adaptor **64***b*. The alarm indicator assembly **60** also includes the schematically illustrated alarm indicator **64***a* which may be an vehicle alarm or siren, for example. In this instance, however, the data bus adaptor **64***b* is slightly modified to communicate with the data bus **62** via the inductive coupler **64***c*. Of course, in other embodiments, the data bus adaptor **64***b* could be hard wired to the data bus **62**. In addition, one or more sensors or alarm indicators could include therein the necessary electronics to interface directly with the data bus **62**, or the sensors or indicators could be connected to another control node, such as the schematically illustrated node **66**. For example, other control nodes may include an engine controller thereby permitting the alarm controller to disable the engine, or the body controller thereby permitting the alarm controller to control the vehicle door locks as would be readily understood by those skilled in the art. Further examples of vehicle security sensors and alarm indicators are described above in greater detail with reference to FIG. **1**.

The data bus adaptor **15** is connected to the data bus **62** by the schematically illustrated inductive coupler in the form of a coil **65***c*. Although illustrated in the form of a closed coil, the inductive coupler may have other configurations as well. The inductive coupling data communications bus interface circuit **16** provides the necessary driving signals to inductively couple signals to the data bus **62**, which in the illustrated embodiment is provided by the twisted pair conductors **62***a*, **62***b* as will be readily appreciated by those skilled in the art. The interface circuit **16** may also include the sensing circuitry to sense signals present on the data bus **62** as will also be readily appreciated by those skilled in the art. The data bus **62** may have conductor configurations other than the illustrated twisted pair configuration.

The inductive coupling for the vehicle alarm controller **11** may be especially advantageous for aftermarket devices. As noted in the Background section above, many manufacturers discourage cutting or splicing into existing wiring of the vehicle. This presents a difficulty for aftermarket accessories, such as vehicle security systems. Accordingly, the inductive coupling to the data bus **62** overcomes this difficulty. In other embodiments of the invention, the data communications bus interface could be connected to the data bus **62** by a suitable connector, or directly spliced to the data bus as will be readily appreciated by those skilled in the art.

The data communications bus **62** may be a multiplexed data bus as would be readily understood by those skilled in the art. Accordingly, the bus interface circuit **16** may comprise multiplexing means or circuitry for interfacing with the multiplexed data bus of the vehicle. For example, any of the various multiplexing schemes as disclosed in "The Thick and Thin of Car Cabling" by Thompson appearing in the IEEE Spectrum, February 1996, pp. 42–45 may be used. Other data bus connection schemes are also contemplated by the present invention.

The data bus adaptor **15** further preferably comprises desired signal enabling means **17** for enabling the alarm controller **10** to operate using a desired set of signals for a desired vehicle from among a plurality of possible sets of signals for different vehicles. As would be readily understood by those skilled in the art, the term different vehicles may include vehicles from different manufacturers, different models, or even different trim levels of the same make and model. Accordingly, the desired signal enabling means **17** of the data bus adaptor **15** permits the alarm controller **11** to communicate with the vehicle security sensor and the alarm indicator via the data communications bus **62** so that the alarm controller is capable of operating the alarm indicator responsive to the vehicle security sensor, for example.

As illustrated in FIG. **3**, one embodiment of the desired signal enabling means **17** may preferably include a memory **70** for storing a plurality of sets **72***a*, **72***b* and **72***n* of signals for different vehicles, and selecting means for selecting the desired set of signals from the plurality of different sets of signals for different vehicles. By storing sets of signals is meant storing information or data necessary to generate the desired signals on the data bus **62** as would be readily understood by those skilled in the art. The memory **70** may include device address memory means for storing a plurality of different sets of signals representative of different device addresses for different vehicles. Alternatively, or in addition thereto, the memory means may comprise protocol memory means for storing a plurality of different protocols for different vehicles.

In the illustrated embodiment of FIG. **3**, the selecting means may comprise user selecting means **75** for permitting a user to select the desired set of signals. A keypad or other input means may be used to permit the user to select the desired signal set for his vehicle. The valet switch **27** (FIG. **1**), for example, may also be operated by the user to select the desired signal set. The user may select the desired set of signals by entering a unique digital code similar to the selection of signals for a home electronics universal remote control. Other techniques for permitting the user to select the desired signal set from a plurality of stored sets are also contemplated by the invention as would be readily appreciated by those Skilled in the art.

Referring now additionally to FIG. **4** another embodiment of the desired signal enabling means **17'** is described in accordance with the security system **10'** of the present invention. In this embodiment, the selecting means may comprise bus determining circuitry or means **77** for determining the desired set of signals based upon signals on the data communications bus. For example, the bus determining means could determine the desired set of signals based upon sensed voltage levels or based upon the timing of signal pulses on the data communications bus **62**. The other components of this embodiment of the desired signal enabling means **17'** are similar to those described above with reference to FIG. **3** and need no further description.

For certain vehicles, a changing security code portion may be provided on digital signals sent on the data bus **62**. For example, the changing security code could be of a pseudorandom type as described above with reference to the remote transmitter **50**, and as will be readily appreciated by those skilled in the art. For such an embodiment, the desired signal enabling means **17'** would have stored therein or be able to generate the pseudorandom code, and would also synchronize with the pseudorandom code being used in the vehicle at any given time. The synchronization could be based upon sensing a changed code portion on the data bus **62** or based upon some other triggering event, such as an ignition activation, for example. Those of skill in the art will appreciate other triggering and/or timing events or features for incrementing the pseudorandom code in the desired signal enabling means **17'** without further discussion herein.

Yet another embodiment of the security system **10"** according to the invention is explained with reference to FIG. **5**. In this illustrated embodiment the desired signal enabling means **17"** includes a desired signal set memory **81** operatively connected to the illustrated bus learning circuit or means **80**. The bus learning circuit or means **80** may

determine and store in the signal set memory **81** the protocol and/or device addresses for the vehicle devices. For example, the bus learning circuit or means **80** may permit the user to operate various vehicle devices and store a desired signal set based thereon as would be readily understood by those skilled in the art. The other components of the desired signal enabling means **17"** are similar to those described above with reference to FIG. **3** and need no further description.

Still another embodiment of the desired signal enabling means **17'''** is explained with reference to FIG. **6A**. The desired signal enabling means **17'''** includes a signal set memory **81** operatively connected to the schematically illustrated download learning means **84**. The download learning means **84** may include an interface connected to the illustrated vehicle cellular telephone **86** to permit learning or downloading of the desired signal set from a remote or central monitoring and control station **88**, for example. The desired signal set may also alternately be learned from the central station **88** through the satellite link provided by the satellite **110** and vehicle mounted satellite receiver **111** and associated antennas. As would be readily understood by those skilled in the art, the download learning means, as well as the other desired signal enabling leans may be implemented by software in a microprocessor or microcontroller of the data bus adaptor **15'''**.

Turning now additionally to FIG. **6B**, another variation of programming, learning or downloading of the download learning circuit or means **84** is explained. In this variation the download learning means **84** is temporarily connected to a computer, such as the illustrated portable laptop computer **115**. The connection, may be via a wire cable or wireless communications link as will be readily understood by those skilled in the art. Of course, the desired signal enabling means **17''''** in this embodiment may be programmed in the vehicle or prior to installation in the vehicle.

One implementation of the security system **10** is shown in FIG. **7** and includes the vehicle alarm controller **11** connected to the data bus **62** using the data bus adaptor **15**. The remote transmitter **50** can switch the controller **11** between the armed and disarmed modes. The controller **11** in the armed mode is capable of generating an alarm indication via the siren **31** (FIG. **1**) and based upon the door switches **25** (FIG. **1**), for example. The communications are via the data communications bus **62**, and are based upon the desired signal set from the desired signal enabling means **17** of the data bus adaptor **15**.

The features and aspects described above may also be readily implemented in other vehicle related systems, such as for performing remote control functions. As shown in FIG. **8**, the invention may be embodied in a remote keyless entry system **90** including a remote keyless entry controller **91** operated by a remote handheld transmitter **93**. The controller **91** communicates with the door lock motors **94** and illustrated trunk release **96** via the data communications bus **62** by using the data bus adaptor **15** in accordance with the present invention. The remote keyless entry system **90** also includes the desired signal enabling means in the data bus adaptor **15** which permits the controller **91** to perform the desired door locking and trunk release remote control functions or operations as would also be readily understood by those skilled in the art. As would be readily appreciated by those skilled in the art, any of the desired signal enabling means described herein and equivalents thereto may be used for data bus adaptor **15** of the remote keyless entry system **90** in accordance with the present invention.

Turning now to FIG. **9**, yet another vehicle associated remote control function is illustrated and now explained. The remote engine starting system **100** includes a remote start controller **101** operable by a remote transmitter **103**. The remote controller **101** may communicate using the data bus adaptor **15** which, in turn, is coupled to the data communications bus **62** to enable the ignition and fuel systems **106** and crank the engine starter **104**. Various sensors may also be monitored as would be readily understood by those skilled in the art.

A method aspect of the invention is for adapting a vehicle device for installation in a vehicle of a type including a data communications bus **62**. The method preferably comprises the steps of providing a data bus adaptor **15** including a housing **15***a*, desired signal enabling means **17** in the housing for enabling the vehicle device to operate using a desired set of digital signals for a desired vehicle from a plurality of possible sets of signals for different vehicles, and an interface **16** cooperating with the desired signal enabling means for interfacing the vehicle device to the data bus. The method also preferably includes the step of connecting the data bus adaptor **15** between the vehicle device and the data communications bus **62**.

The vehicle device may be an alarm controller **11**, a remote keyless entry controller **91**, or a remote start controller **101**, for example. The vehicle device may also be an alarm indicator or a vehicle sensor, for example, as will be readily appreciated by those skilled in the art.

Those of skill in the art will readily recognize the benefits and advantages of the present invention for aftermarket security systems and other aftermarket systems for implementing remote control functions wherein compatibility with a potentially large number of different protocols and/or device addresses is desired. Of course, many modifications and other embodiments of the invention will come to the mind of one skilled in the art having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Accordingly, it is understood that the invention is not to be limited to the illustrated embodiments disclosed, and that the modifications and embodiments are intended to be included within the spirit and scope of the appended claims.

That which is claimed is:

1. A vehicle security system for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices, said vehicle security system comprising:

an alarm controller; and

a data bus adaptor connected between said alarm controller and the data communications bus, said data bus adaptor comprising

desired signal enabling means for enabling said alarm controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting said alarm controller to communicate with at least one of the vehicle devices, and

an alarm controller bus interface for interfacing to the data communications bus.

2. A vehicle security system according to claim **1** wherein said desired signal enabling means comprises:

a memory for storing a plurality of sets of signals for different vehicles; and

selecting means for selecting the desired set of signals from the plurality of different sets of signals for different vehicles.

3. A vehicle security system according to claim **2** wherein said selecting means comprises user selecting means for permitting a user to select the desired set of signals.

4. A vehicle security system according to claim 2 wherein said selecting means comprises bus determining means for determining the desired set of signals based upon signals on the data communications bus.

5. A vehicle security system according to claim 2 wherein said memory comprises device address memory means for storing a plurality of different sets of signals for different device addresses.

6. A vehicle security system according to claim 2 wherein said memory comprises protocol memory means for storing a plurality of different sets of signals for different protocols.

7. A vehicle security system according to claim 1 wherein said desired signal enabling means comprises bus learning means for learning the desired set of signals based upon signals on the data communications bus.

8. A vehicle security system according to claim 1 wherein said desired signal enabling means comprises download learning means for learning the desired set of signals from a downloading device.

9. A vehicle security system according to claim 8 wherein said downloading learning means comprises means for learning the desired set of signals from a computer temporarily connected thereto.

10. A vehicle security system according to claim 1 wherein said desired signal enabling means comprises protocol providing means for providing a protocol for the desired vehicle.

11. A vehicle security system according to claim 1 wherein said desired signal enabling means comprises device address providing means for providing device addresses for the desired vehicle.

12. A vehicle security system according to claim 1 wherein the at least one vehicle device comprises one of a security sensor and an alarm indicator.

13. A vehicle security system according to claim 1 wherein said alarm controller bus interface comprises an inductive coupler for inductively coupling to the data communications bus.

14. A vehicle security system according to claim 1 wherein the data communications bus is a multiplexed data bus; and wherein said alarm controller bus interface comprises multiplex interface means for interfacing with the multiplexed data bus.

15. A vehicle security system according to claim 1 wherein said alarm controller comprises a first housing; wherein said data bus adaptor comprises a second housing; and further comprising a cable connected between said first and second housings.

16. A remote control system for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices, said remote control system comprising:

a remote transmitter;

a receiver within the vehicle;

a vehicle function controller operatively connected to said receiver;

a data bus adaptor connected between said vehicle function controller and the data communications bus, said data bus adaptor comprising

desired signal enabling means for enabling said vehicle function controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting said vehicle function controller to communicate with at least one of the vehicle devices so that said vehicle function controller is capable of operating the vehicle device responsive to said remote transmitter, and

a vehicle function controller bus interface for interfacing to the data communications bus.

17. A remote control system for a vehicle according to claim 16 wherein the plurality of vehicle devices comprises a vehicle security sensor; and wherein said vehicle function controller comprises an alarm controller being capable of generating an alarm responsive to the vehicle security sensor.

18. A remote control system for a vehicle according to claim 16 wherein the plurality of vehicle devices comprises a plurality of vehicle door locks movable between locked and unlocked positions; and wherein said vehicle function controller comprises a door lock controller for moving the vehicle door locks between locked and unlocked positions responsive to said remote transmitter.

19. A remote control system for a vehicle according to claim 16 where said plurality of vehicle devices comprises a vehicle engine starter; and wherein said vehicle function controller comprises a remote start controller for operating the vehicle engine starter responsive to said remote transmitter.

20. A remote control system for a vehicle according to claim 16 wherein said desired signal enabling means comprises:

a memory for storing a plurality of sets of signals for different vehicles; and

selecting means for selecting the desired set of signals from the plurality of different sets of signals for different vehicles.

21. A remote control system for a vehicle according to claim 20 wherein said selecting means comprises user selecting means for permitting a user to select the desired set of signals.

22. A remote control system for a vehicle according to claim 20 wherein said selecting means comprises determining means for determining the desired set of signals based upon signals on the data communications bus.

23. A remote control system for a vehicle according to claim 20 wherein said memory comprises address memory means for storing a plurality of different sets of digital signals for different device addresses.

24. A remote control system for a vehicle according to claim 20 wherein said memory comprises protocol memory means for storing a plurality of different sets of signals for different protocols.

25. A remote control system for a vehicle according to claim 16 wherein said desired signal enabling means comprises learning means for learning the desired set of signals.

26. A remote control system for a vehicle according to claim 16 wherein said desired signal enabling means comprises protocol providing means for providing a protocol for the desired vehicle.

27. A remote control system for a vehicle according to claim 16 wherein said desired signal enabling means comprises device address providing means for providing device addresses for the desired vehicle.

28. A remote control system for a vehicle according to claim 16 further comprising a second vehicle controller; and wherein said vehicle function controller is operatively connected to said second vehicle controller.

29. A remote control system for a vehicle according to claim 16 wherein the data communications bus is a multiplexed data bus; and wherein the vehicle function controller bus interface comprises multiplex interface means for interfacing with the multiplexed data bus.

30. A remote control system for a vehicle according to claim 16 wherein said remote transmitter generates changing code signals.

31. A remote control system for a vehicle according to claim 16 wherein said vehicle function controller bus interface comprises an inductive coupler for inductively coupling to the data communications bus.

32. A remote control system for a vehicle according to claim 16 wherein said vehicle function controller comprises a first housing; wherein said data bus adaptor comprises a second housing; and further comprising a cable connected between said first and second housings.

33. A data bus adaptor for a vehicle device to be installed in a vehicle of a type including a data communications bus, the data bus adaptor comprising:

a housing;

desired signal enabling means in said housing for enabling the vehicle device to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles; and

an interface cooperating with said desired signal enabling means for interfacing the vehicle device to the data communications bus.

34. A data bus adaptor according to claim 33 wherein the vehicle device comprises a remote function controller.

35. A data bus adaptor according to claim 34 wherein the remote function controller comprises a vehicle security system controller.

36. A data bus adaptor according to claim 34 wherein the remote function controller comprises a vehicle door lock controller.

37. A data bus adaptor according to claim 34 wherein the remote function controller comprises a vehicle remote start controller.

38. A data bus adaptor according to claim 33 wherein the vehicle device comprises an alarm indicator.

39. A data bus adaptor according to claim 33 wherein the vehicle device comprises a vehicle sensor.

40. A data bus adaptor according to claim 33 wherein said desired signal enabling means comprises:

a memory for storing a plurality of sets of signals for different vehicles; and

selecting means for selecting the desired set of signals from the plurality of different sets of signals for different vehicles.

41. A data bus adaptor according to claim 40 wherein said selecting means comprises user selecting means for permitting a user to select the desired set of signals.

42. A data bus adaptor according to claim 40 wherein said selecting means comprises determining means for determining the desired set of signals based upon signals on the data communications bus.

43. A data bus adaptor according to claim 40 wherein said memory comprises address memory means for storing a plurality of different sets of digital signals for different device addresses.

44. A data bus adaptor according to claim 40 wherein said memory comprises protocol memory means for storing a plurality of different sets of signals for different protocols.

45. A data bus adaptor according to claim 33 wherein said desired signal enabling means comprises learning means for learning the desired set of signals.

46. A data bus adaptor according to claim 33 wherein said desired signal enabling means comprises protocol providing means for providing a protocol for the desired vehicle.

47. A data bus adaptor according to claim 33 wherein said desired signal enabling means comprises device address providing means for providing device addresses for the desired vehicle.

48. A data bus adaptor according to claim 33 wherein said bus interface comprises an inductive coupler for inductively coupling to the data communications bus.

49. A method for adapting a vehicle device for installation in a vehicle of a type including a data communications bus, the method comprising the steps of:

providing a data bus adaptor comprising a housing, desired signal enabling means in said housing for enabling the vehicle device to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles, and an interface cooperating with said desired signal enabling means for interfacing the vehicle device to the data communications bus; and

connecting the data bus adaptor between the vehicle device and the data communications bus.

50. A method according to claim 49 wherein the vehicle device comprises a remote function controller.

51. A method according to claim 50 wherein the remote function controller comprises a vehicle security system controller.

52. A method according to claim 50 wherein the remote function controller comprises a vehicle door lock controller.

53. A method according to claim 50 wherein the remote function controller comprises a vehicle remote start controller.

54. A method according to claim 49 wherein the vehicle device comprises an alarm indicator.

55. A method according to claim 49 wherein the vehicle device comprises a vehicle sensor.

56. A method according to claim 49 wherein said desired signal enabling means comprises:

a memory for storing a plurality of sets of signals for different vehicles; and

selecting means for selecting the desired set of signals from the plurality of different sets of signals for different vehicles.

57. A method according to claim 56 wherein said selecting means comprises user selecting means for permitting a user to select the desired set of signals.

58. A method according to claim 56 wherein said selecting means comprises determining means for determining the desired set of signals based upon signals on the data communications bus.

59. A method according to claim 56 wherein said memory comprises address memory means for storing a plurality of different sets of digital signals for different device addresses.

60. A method according to claim 56 wherein said memory comprises protocol memory means for storing a plurality of different sets of signals for different protocols.

61. A method according to claim 49 wherein said desired signal enabling means comprises learning means for learning the desired set of signals.

62. A method according to claim 49 wherein said desired signal enabling means comprises protocol providing means for providing a protocol for the desired vehicle.

63. A method according to claim 49 wherein said desired signal enabling means comprises device address providing means for providing device addresses for the desired vehicle.

64. A method according to claim 49 wherein said bus interface comprises an inductive coupler; and wherein the step of connecting comprises coupling to the data communications bus using the inductive coupler.

* * * * *

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Flick

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(45) **Date of Patent: *Aug. 14, 2001**

(54) **VEHICLE SECURITY SYSTEM FOR A VEHICLE HAVING A DATA COMMUNICATIONS BUS AND RELATED METHODS**

(76) Inventor: **Kenneth E. Flick**, 5236 Presley Pl., Douglasville, GA (US) 30135

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **09/382,245**

(22) Filed: **Aug. 25, 1999**

Related U.S. Application Data

(63) Continuation of application No. 09/023,838, filed on Feb. 13, 1998, now Pat. No. 6,011,460, which is a continuation-in-part of application No. 08/701,356, filed on Aug. 22, 1996, now Pat. No. 5,719,551.

(51) **Int. Cl.**[7] **B60R 25/10**

(52) **U.S. Cl.** **340/426**; 340/531; 340/533; 307/10.2; 180/287

(58) **Field of Search** 340/425.5, 426, 340/427, 428, 429, 531, 532, 533, 534, 825.31, 825.32, 825.69; 307/10.2, 10.3, 10.5; 180/173, 287

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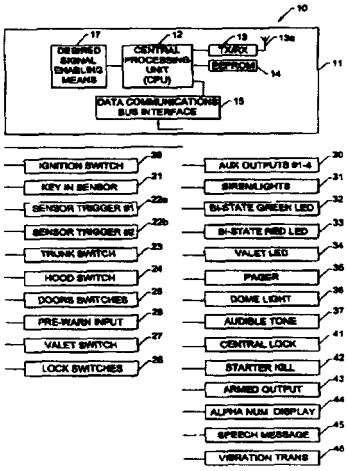
Primary Examiner—Van T. Trieu
(74) *Attorney, Agent, or Firm*—Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.

(57) **ABSTRACT**

A vehicle security system, for a vehicle of a type including a data communications bus, preferably includes at least one security function control circuit and associated interface for interfacing to the data communications bus. The system also includes a security system controller and associated interface for interfacing to the data communications bus, and a desired signal enabling circuit for enabling the security system controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles. This, in turn, permits the security system controller to communicate with the at least one security function control circuit. The at least one vehicle function control circuit may be an engine control circuit, such as a starter control circuit, or at least one of an ignition and fuel control circuit. The vehicle function control circuit may also be a door lock control circuit.

60 Claims, 7 Drawing Sheets



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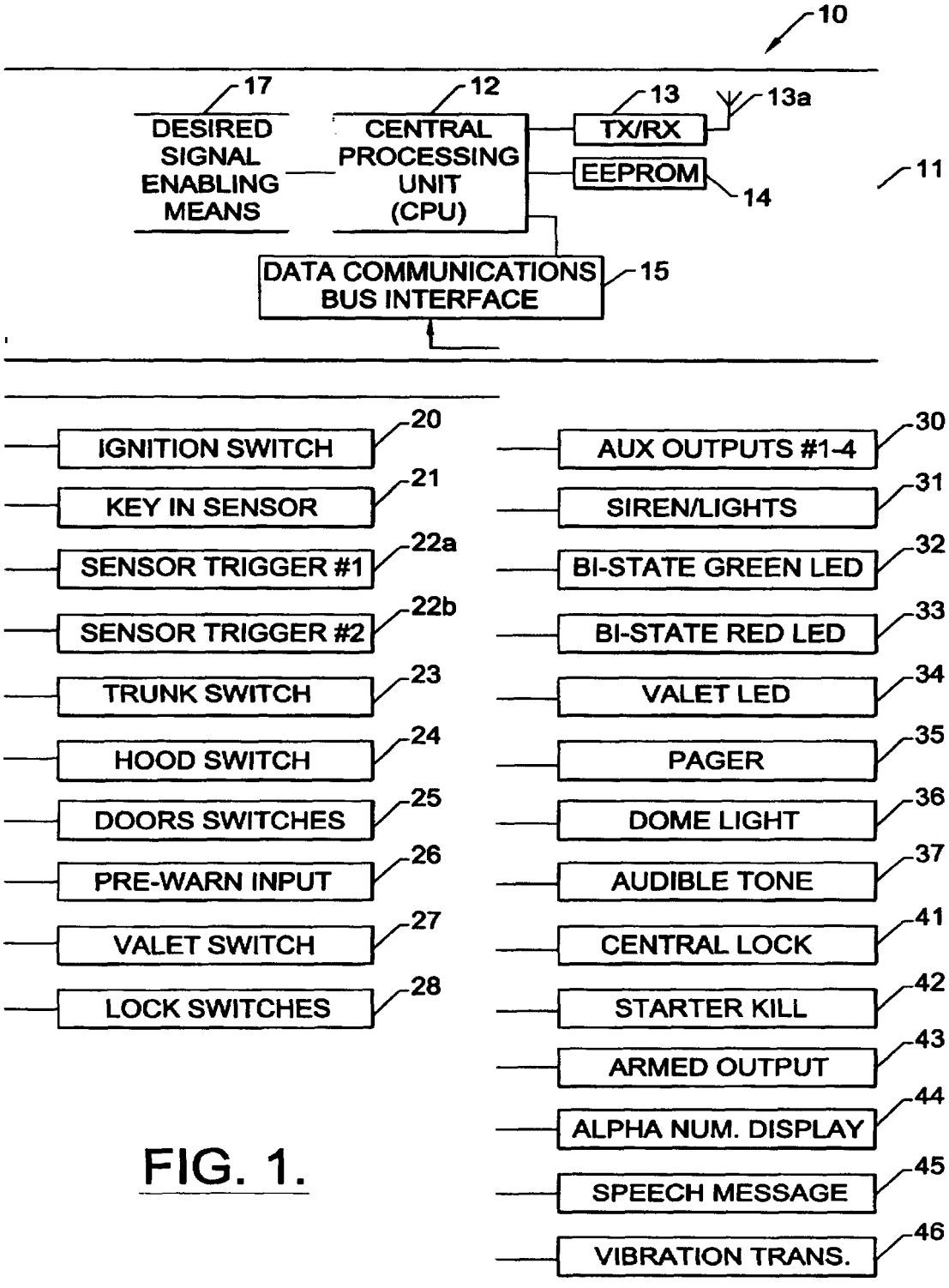

10
17
DESIRED SIGNAL ENABLING MEANS
12
CENTRAL PROCESSING UNIT (CPU)
13
TX/RX
13a
EEPROM
14
11
DATA COMMUNICATIONS BUS INTERFACE
15
IGNITION SWITCH
20
KEY IN SENSOR
21
SENSOR TRIGGER #1
22a
SENSOR TRIGGER #2
22b
TRUNK SWITCH
23
HOOD SWITCH
24
DOORS SWITCHES
25
PRE-WARN INPUT
26
VALET SWITCH
27
LOCK SWITCHES
28
AUX OUTPUTS #1-4
30
SIREN/LIGHTS
31
BI-STATE GREEN LED
32
BI-STATE RED LED
33
VALET LED
34
PAGER
35
DOME LIGHT
36
AUDIBLE TONE
37
CENTRAL LOCK
41
STARTER KILL
42
ARMED OUTPUT
43
ALPHA NUM. DISPLAY
44
SPEECH MESSAGE
45
VIBRATION TRANS.
46

FIG. 1.

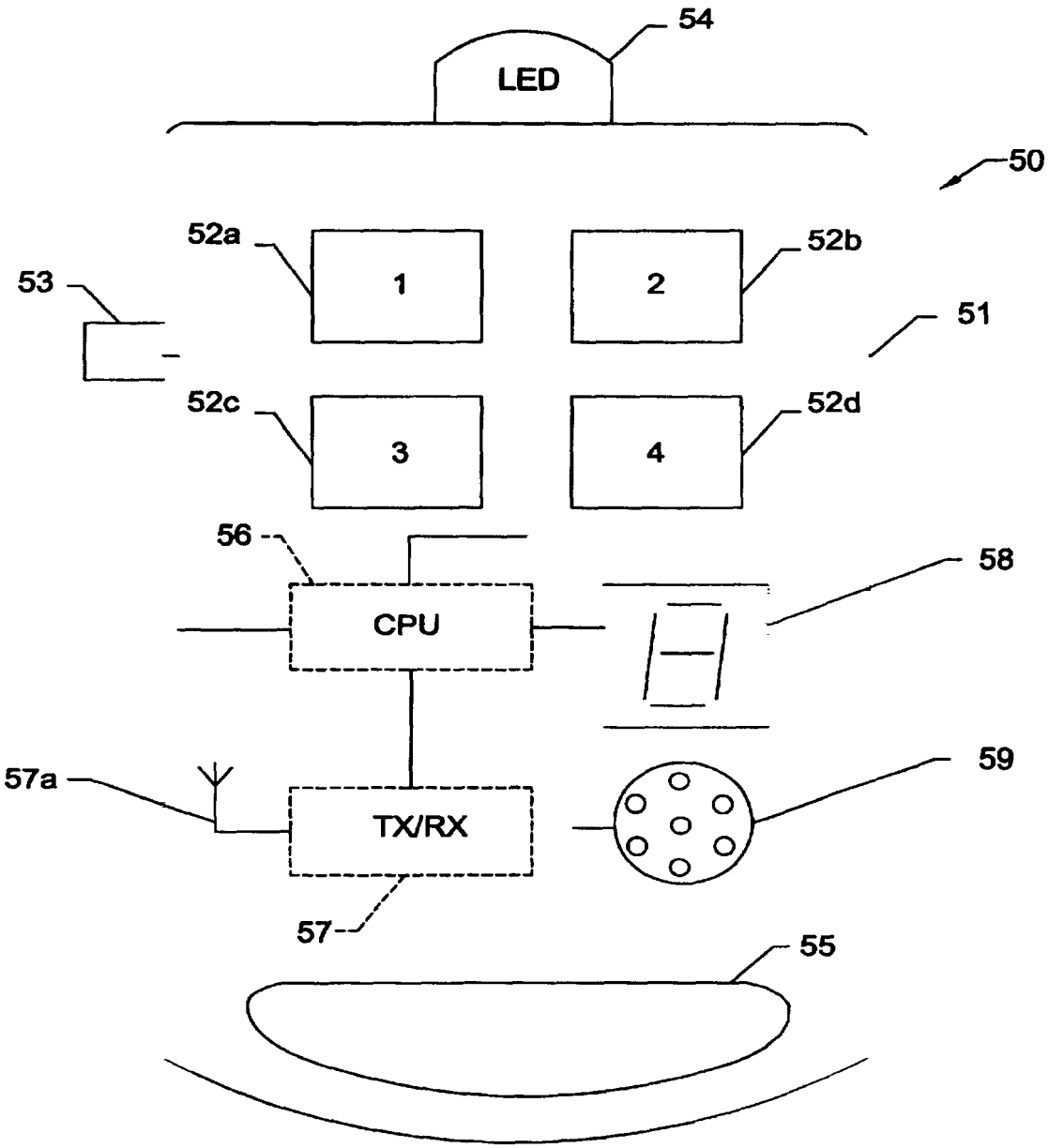


FIG. 2.

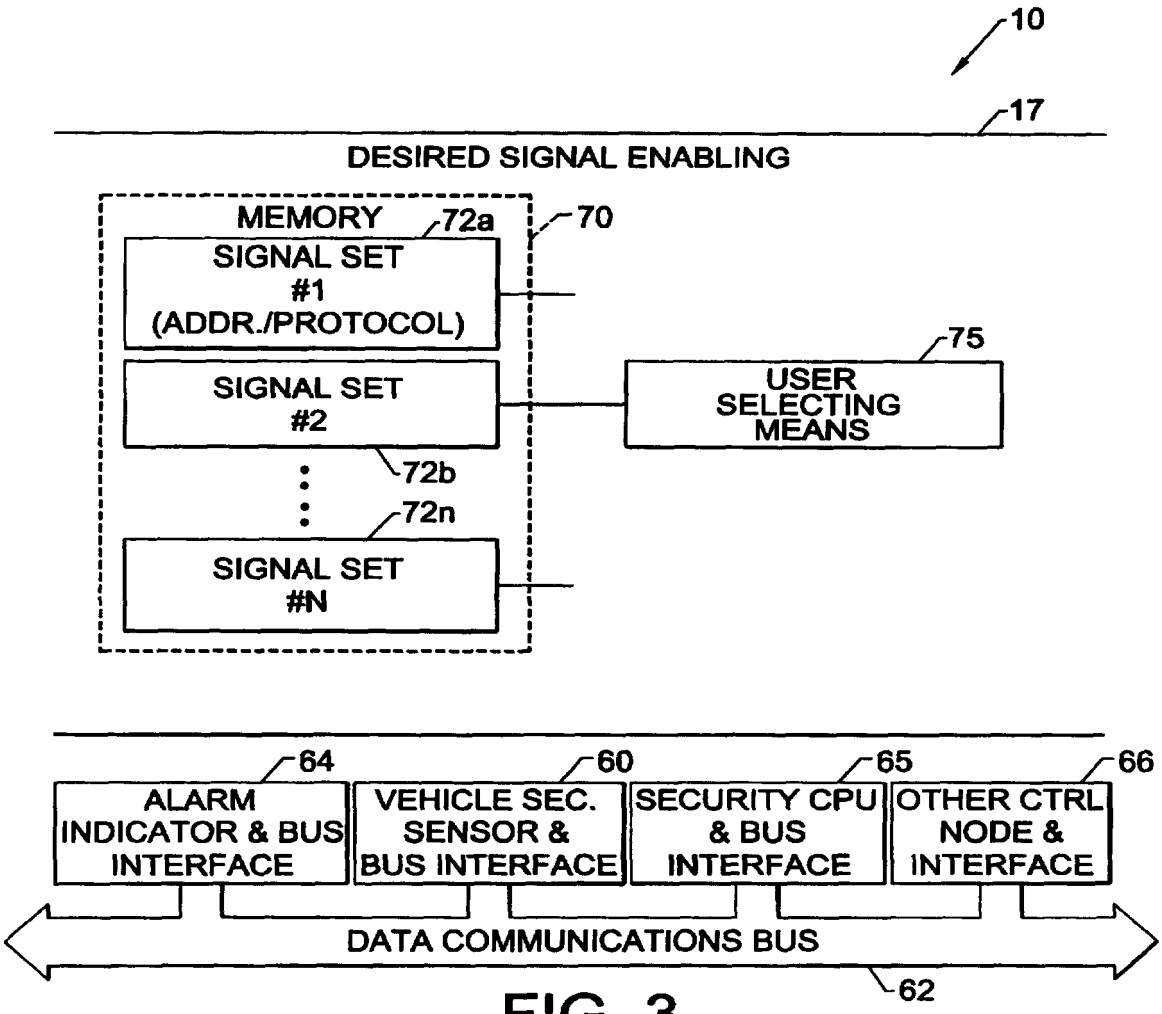

10
17
DESIRED SIGNAL ENABLING
MEMORY
72a
70
SIGNAL SET #1 (ADDR./PROTOCOL)
SIGNAL SET #2
75
USER SELECTING MEANS
72b
72n
SIGNAL SET #N
64
60
65
66
ALARM INDICATOR & BUS INTERFACE
VEHICLE SEC. SENSOR & BUS INTERFACE
SECURITY CPU & BUS INTERFACE
OTHER CTRL NODE & INTERFACE
DATA COMMUNICATIONS BUS
62

FIG. 3.

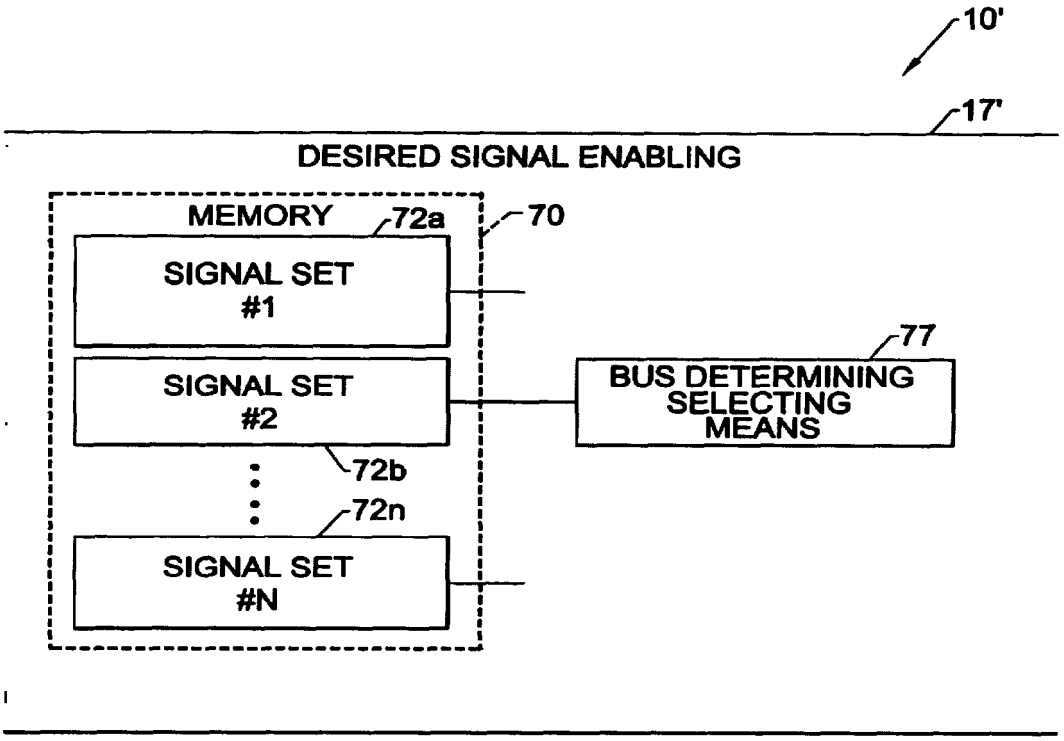
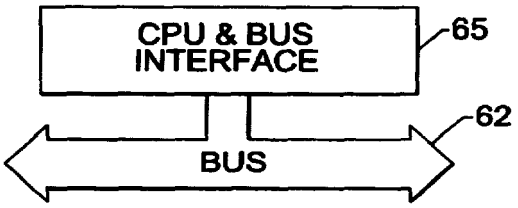

10'
17'
DESIRED SIGNAL ENABLING
MEMORY
72a
70
SIGNAL SET #1
SIGNAL SET #2
72b
72n
SIGNAL SET #N
77
BUS DETERMINING SELECTING MEANS

FIG. 4.


CPU & BUS INTERFACE
65
62
BUS

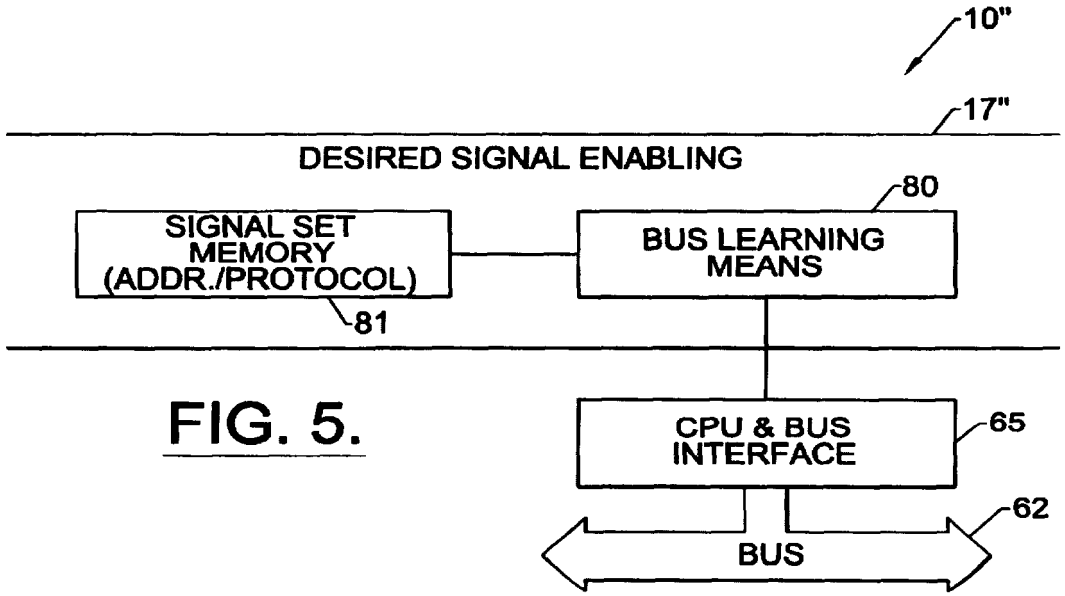

10"
17"
DESIRED SIGNAL ENABLING
80
SIGNAL SET MEMORY (ADDR./PROTOCOL)
81
BUS LEARNING MEANS
CPU & BUS INTERFACE
65
62
BUS

FIG. 5.

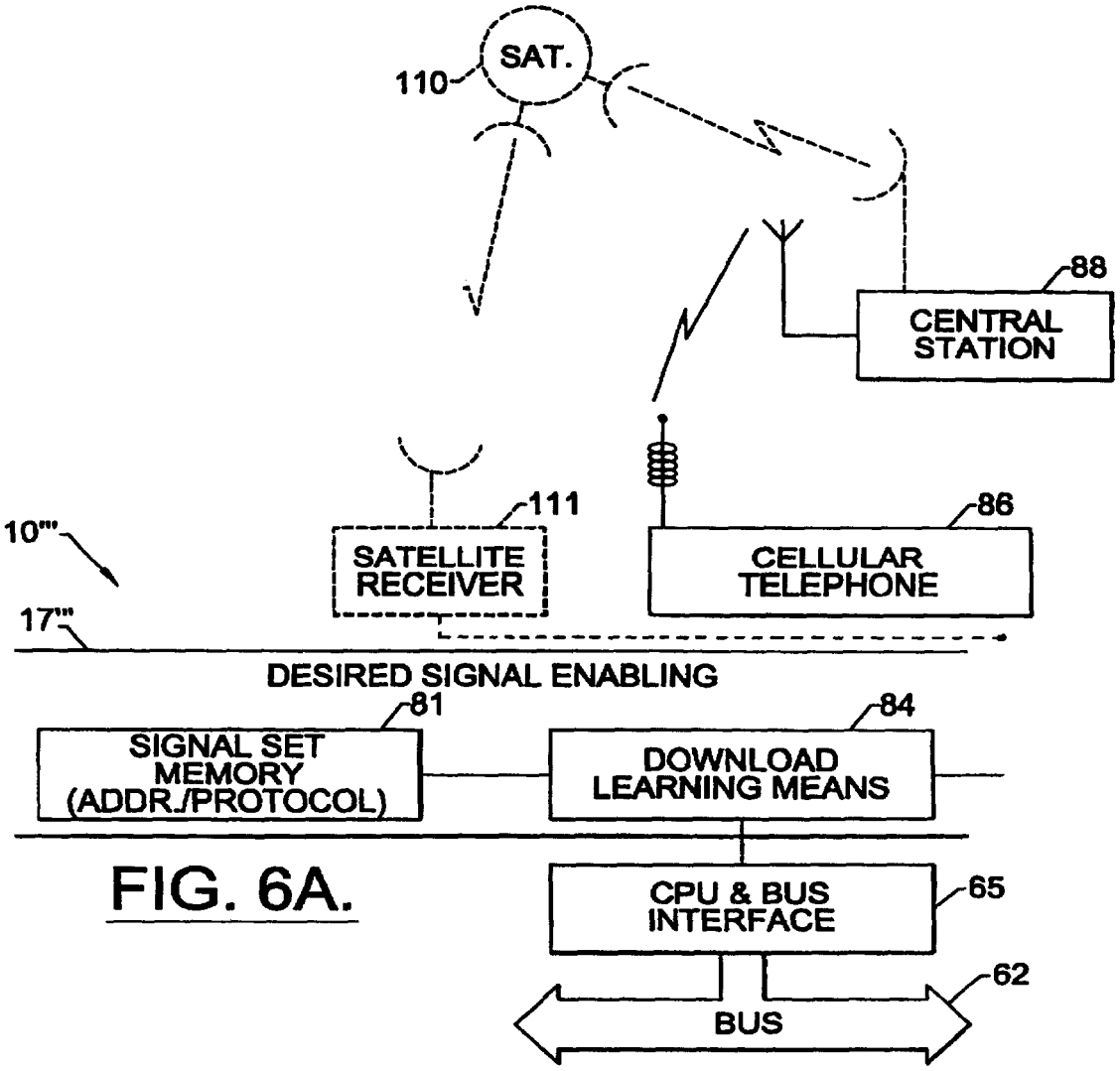

SAT.
110
88
CENTRAL STATION
111
86
10'''
SATELLITE RECEIVER
CELLULAR TELEPHONE
17'''
DESIRED SIGNAL ENABLING
81
84
SIGNAL SET MEMORY (ADDR./PROTOCOL)
DOWNLOAD LEARNING MEANS
CPU & BUS INTERFACE
65
62
BUS

FIG. 6A.

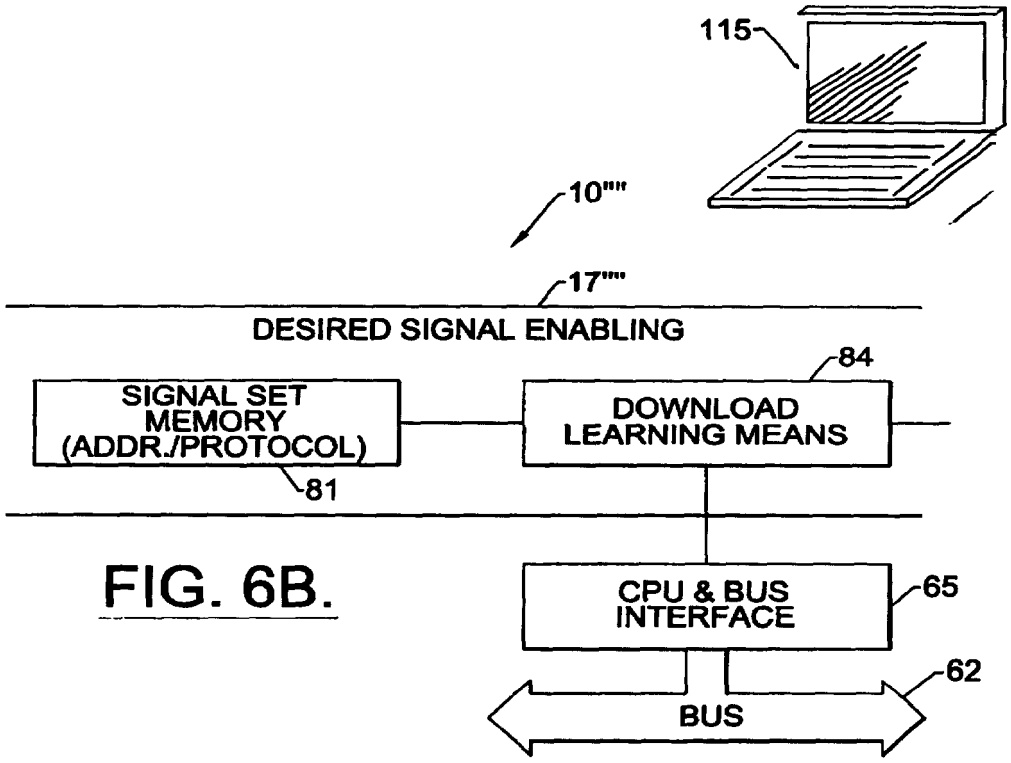

115
10''''
17''''
DESIRED SIGNAL ENABLING
84
SIGNAL SET MEMORY (ADDR./PROTOCOL)
81
DOWNLOAD LEARNING MEANS
CPU & BUS INTERFACE
65
62
BUS

FIG. 6B.

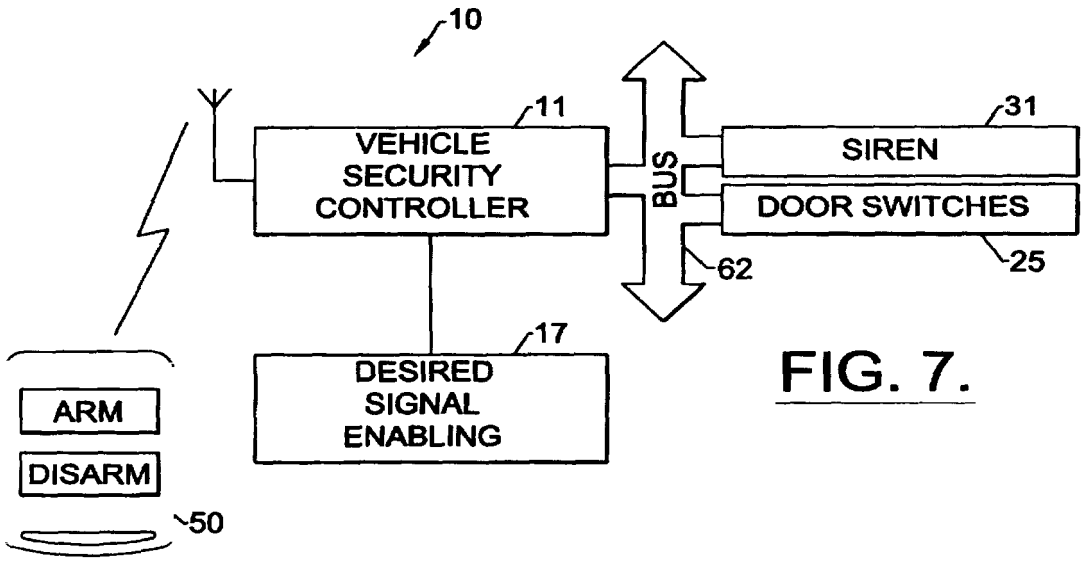

10
11
VEHICLE SECURITY CONTROLLER
BUS
31
SIREN
DOOR SWITCHES
25
62
17
DESIRED SIGNAL ENABLING
ARM
DISARM
50

FIG. 7.

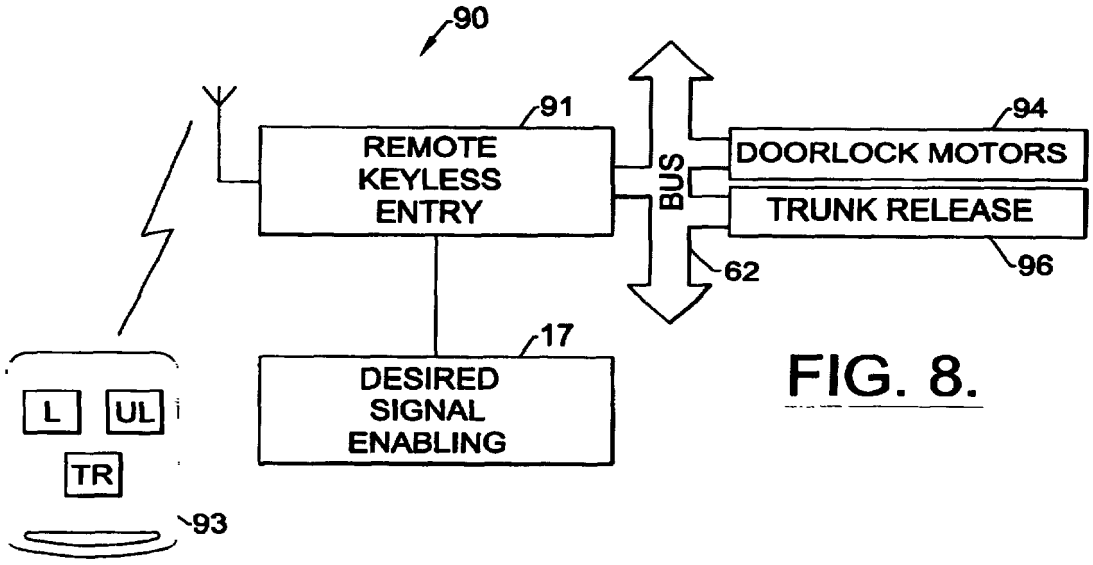

90
91
REMOTE KEYLESS ENTRY
BUS
94
DOORLOCK MOTORS
TRUNK RELEASE
96
62
17
DESIRED SIGNAL ENABLING
L
UL
TR
93

FIG. 8.

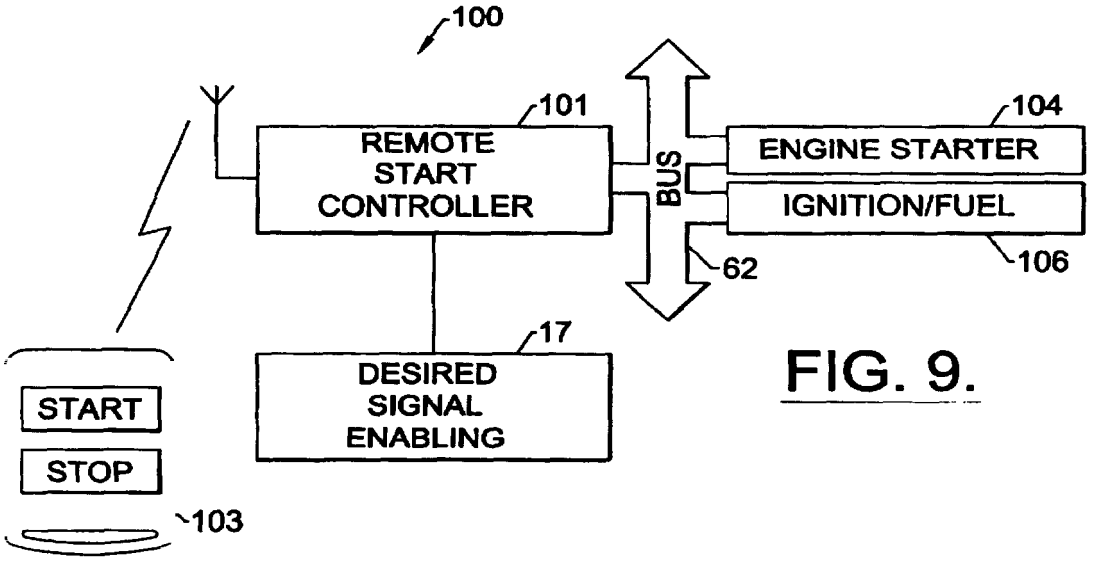

100
101
REMOTE START CONTROLLER
BUS
104
ENGINE STARTER
IGNITION/FUEL
106
62
17
DESIRED SIGNAL ENABLING
START
STOP
103

FIG. 9.

VEHICLE SECURITY SYSTEM FOR A VEHICLE HAVING A DATA COMMUNICATIONS BUS AND RELATED METHODS

RELATED APPLICATIONS

This application is a continuation of U.S. patent application Ser. No. 09/023,838 filed Feb. 13, 1998, now U.S. Pat. No. 6,011,460, which, in turn, is a continuation-in-part of U.S. patent application Ser. No. 08/701,356 filed Aug. 22, 1996, now U.S. Pat. No. 5,719,551, the entire disclosures of each of which are incorporated herein by reference.

FIELD OF THE INVENTION

This application is related to the field of security systems and, more particularly, to a security system and related methods for vehicles.

BACKGROUND OF THE INVENTION

Vehicle security systems are widely used to deter vehicle theft, prevent theft of valuables from a vehicle, deter vandalism, and to protect vehicle owners and occupants. A typical automobile security system, for example, includes a central processor or controller connected to a plurality of vehicle sensors. The sensors, for example, may detect opening of the trunk, hood, doors, windows, and also movement of the vehicle or within the vehicle. Ultrasonic and microwave motion detectors, vibration sensors, sound discriminators, differential pressure sensors, and switches may be used as sensors. In addition, radar sensors may be used to monitor the area proximate the vehicle.

The controller typically operates to give an alarm indication in the event of triggering of a vehicle sensor. The alarm indication may typically be a flashing of the lights and/or the sounding of the vehicle horn or a siren. In addition, the vehicle fuel supply and/or ignition power may be selectively disabled based upon an alarm condition.

A typical security system also includes a receiver associated with the controller that cooperates with one or more remote transmitters typically carried by the user as disclosed, for example, in U.S. Pat. No. 4,383,242 to Sassover et al. and U.S. Pat. No. 5,146,215 to Drori. The remote transmitter may be used to arm and disarm the vehicle security system or provide other remote control features from a predetermined range away from the vehicle. Also related to remote control of a vehicle function U.S. Pat. No. 5,252,966 to Lambropoulous et al. discloses a remote keyless entry system for a vehicle. The keyless entry system permits the user to remotely open the vehicle doors or open the vehicle trunk using a small handheld transmitter.

Unfortunately, the majority of vehicle security systems need to be directly connected by wires to individual vehicle devices, such as the vehicle horn or door switches of the vehicle. In other words, a conventional vehicle security system is hardwired to various vehicle components, typically by splicing into vehicle wiring harnesses or via interposing T-harnesses and connectors. The number of electrical devices in a vehicle has increased so that the size and complexity of wiring harnesses has also increased. For example, the steering wheel may include horn switches, an airbag, turn-signal and headlight switches, wiper controls, cruise control switches, ignition wiring, an emergency flasher switch, and/or radio controls. Likewise, a door of a vehicle, for example, may include window controls, locks, outside mirror switches, and/or door-panel light switches.

In response to the increased wiring complexity and costs, vehicle manufacturers have begun attempts to reduce the amount of wiring within vehicles to reduce weight, reduce wire routing problems, decrease costs, and reduce complications which may arise when troubleshooting the electrical system. For example, some manufacturers have adopted multiplexing schemes to reduce cables to three or four wires and to simplify the exchange of data among the various onboard electronic systems as disclosed, for example, in "The Thick and Thin of Car Cabling" by Thompson appearing in the IEEE Spectrum, February 1996, pp. 42–45.

Implementing multiplexing concepts in vehicles in a cost-effective and reliable manner may not be easy. Successful implementation, for example, may require the development of low or error-free communications in what can be harsh vehicle environments. With multiplexing technology, the various electronic modules or devices may be linked by a single signal wire in a bus also containing a power wire, and one or more ground wires. Digital messages are communicated to all modules over the data communications bus. Each message may have one or more addresses associated with it so that the devices can recognize which messages to ignore and which messages to respond to or read.

The Thompson article describes a number of multiplexed networks for vehicles. In particular, the Grand Cherokee made by Chrysler is described as having five multiplex nodes or controllers: the engine controller, the temperature controller, the airbag controller, the theft alarm, and the overhead console. Other nodes for different vehicles may include a transmission controller, a trip computer, an instrument cluster controller, an antilock braking controller, an active suspension controller, and a body controller for devices in the passenger compartment.

A number of patent references are also directed to digital or multiplex communications networks or circuits, such as may be used in a vehicle. For example, U.S. Pat. No. 4,538,262 Sinniger et al. discloses a multiplex bus system including a master control unit and a plurality of receiver-transmitter units connected thereto. Similarly, U.S. Pate. No. 4,055,772 to Leung discloses a power bus in a vehicle controlled by a low current digitally coded Communications system. Other references disclosing various vehicle multiplex control systems include, for example, U.S. Pat. No. 4,760,275 to Sato et al.; U.S. Pat. No. 4,697,092 to Roggendorf et al.; and U.S. Pat. No. 4,792,783 to Burgess et al.

Several standards have been proposed for vehicle multiplex networks including, for example, the Society of Automotive Engineers "Surface Vehicle Standard, Class B Data Communications Network Interface", SAE J1850, July 1995. Another report by the SAE is the "Surface Vehicle Information Report, Chrysler Sensor and Control (CSC) Bus Multiplexing Network for Class 'A' Applications", SAE J2058, July 1990. Many other networks are also being implemented or proposed for communications between vehicle devices and nodes or controllers.

Unfortunately, conventional vehicle security systems for hardwired connection to vehicle devices, such as aftermarket vehicle security systems, are not readily adaptable to a vehicle including a data communications bus. Moreover, a vehicle security system if adapted for a communications bus and devices for one particular model, model year, and manufacturer, may not be compatible with any other models, model years, or manufacturers. Other systems for remote control of vehicle functions may also suffer from such shortcomings.

SUMMARY OF THE INVENTION

In view of the foregoing background, it is therefore an object of the present invention to provide a vehicle security

system and associated method which is readily adapted or adaptable for installation in a vehicle having a data communications bus.

This and other objects, advantages and features in accordance with the present invention are provided by a vehicle security system for a vehicle of a type including a data communications bus connecting a plurality of vehicle devices and preferably includes at least one security function control circuit and associated interface for interfacing to the data communications bus, and a security system controller and associated interface for interfacing to the data communications bus. In addition the system also preferably includes a desired signal enabling circuit or means for enabling the security system controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles. This, in turn, permits the security system controller to communicate with the at least one security function control circuit. For example, the at least one vehicle function control circuit may be an engine control circuit, such as a starter control circuit, or at least one of an ignition and fuel control circuit. The vehicle function control circuit may also alternately be, or additionally include, a door lock control circuit.

Accordingly, the desired signal enabling means permits the alarm controller to communicate with the vehicle security function control circuit, such as the engine control or door lock circuit via the data communications bus. The security system is thus advantageously compatible with many different types of vehicle data communications formats or protocols.

The desired signal enabling means may preferably include a memory for storing a plurality of sets of signals for different vehicles, and selecting means for selecting the desired set of signals from the plurality of different sets of signals. In one embodiment, the selecting means may comprise user selecting means for permitting a user to select the desired set of signals. In another embodiment, the selecting means may comprise determining means for determining the desired set of signals based upon signals on the data communications bus.

The memory may include device address memory means for storing a plurality of different sets of signals representative of different device addresses for different vehicles. Alternatively, or in addition thereto, the memory may comprise protocol memory means for storing a plurality of different protocols for different vehicles.

In yet another embodiment, the desired signal enabling means may comprise learning means for learning the desired set of signals. For example, the learning means may comprise downloading learning means for learning the desired set of signals from another device, such as a temporarily connected portable laptop computer, and/or central station. In particular, the security system may interface to a cellular telephone or satellite receiver and the desired set of signals may be downloaded from a central station, or may be downloaded from a computer temporarily connected to the security system. In another variation, the learning means may comprise bus learning means for learning the desired set of signals based upon signals on the data communications bus. The security system, according to another aspect of the invention, may also interface with an existing vehicle controller or a communications bus node which is operatively connected to the data communications bus.

A method aspect of the invention is for controlling a vehicle security function for a vehicle of a type including a data communications bus, and at least one security function control circuit and associated interface for interfacing to the data communications bus. The method preferably comprises the steps of: interfacing a security system controller to the data communications bus, and enabling the security system controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting the security system controller to communicate with the at least one security function control circuit. The at least one vehicle function control circuit may comprise an engine control circuit. Alternately, or in addition, the security function control circuit may comprise a door lock circuit.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic block diagram of the vehicle security system in accordance with the invention.

FIG. **2** is a schematic diagram of a remote transmitter of the vehicle security system in accordance with the invention.

FIG. **3** is a schematic block diagram of a portion of a first embodiment of the vehicle security system in accordance with the present invention.

FIG. **4** is a schematic block diagram of a portion of a second embodiment of the vehicle security system in accordance with the present invention.

FIG. **5** is a schematic block diagram of a portion of a third embodiment of the vehicle security system in accordance with the present invention.

FIG. **6A** is a schematic block diagram of a portion of a fourth embodiment of the vehicle security system in accordance with the present invention.

FIG. **6B** is a schematic block diagram of a portion of a variation of the fourth embodiment of the vehicle security system in accordance with the present invention.

FIG. **7** is a schematic block diagram of the vehicle security system in accordance with the present invention.

FIG. **8** is a schematic block diagram of a remote keyless entry system in accordance with the present invention.

FIG. **9** is a schematic block diagram of a remote engine starting system in accordance with the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will now be described more fully hereinafter with reference to the accompanying drawings in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the illustrated embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to like elements throughout. Prime and multiple prime notation are used in alternate embodiments to indicate similar elements.

Referring now to the schematic block diagram of FIG. **1**, a vehicle security system **10** according to one aspect of the invention is first described. The security system includes a controller **11** which, in turn, in the illustrated embodiment includes a central processing unit (CPU) or microprocessor **12** operating under stored program control.

In the illustrated embodiment, a transmitter and receiver **13** are connected to the CPU **12** for receiving signals from a remote transmitter and for transmitting signals to a remote unit, as will be described in greater detail below. As would

be readily understood by those skilled in the art, the transmitter portion of the controller **11** may not be needed in some embodiments of the invention. An antenna **13***a* is illustratively connected to the transmitter and receiver **13**.

In the illustrated embodiment, the CPU **12** is also operatively connected to a memory (EEPROM) **14** and a data communications bus interface **15** which provides both input and output interfaces to various vehicle devices. As would be readily understood by those skilled in the art, the CPU **12** may alternately or additionally have its own on-board memory.

The data communications bus interface **15** is illustratively connected to various vehicle input devices including: an ignition switch **20**; a key in the ignition sensor **21**; two zone sensors **22***a*, **22***b*; conventional trunk hood and door pin sensors or switches **23**, **24**, and **25**, respectively; and door lock switches **28**. In addition, a pre-warn sensor **26** and valet switch **27** also provide inputs to the controller **11** in the illustrated embodiment. As would be readily understood by those skilled in the art, other inputs are also contemplated by the present invention and are generally described herein by the term sensor. In addition, an input signal may also be received from a remote transmitter **50** (FIG. **2**).

The data communications bus interface **15** of the controller **11** may also preferably be connected to a plurality of output devices. The outputs may include auxiliary relay outputs **30**, such as for window control, remote starting, or a remote alarm indication, as would be readily understood by those skilled in the art. A siren and/or lights **31**, and green and red light emitting diodes (LEDs) **32**, **33** for dashboard mounting are also illustratively connected to the controller **11**. Other outputs may be directed to a valet LED **34**, a dome light **36**, a central lock relay or lock control unit **41**, a starter kill circuit **42**, and an armed relay output **43**. In addition, other outputs may be directed to one or more of an audible tone generator **37**, an alphanumeric display **44**, a speech message annunciator **45**, and a vibration transducer **46**, as will be readily appreciated by those skilled in the art. Other similar indicating devices are also contemplated by the present invention, as would be readily understood by those skilled in the art. Some of the illustrated devices may be hardwired to various control nodes as would be readily understood by those skilled in the art. The control nodes may be connected by the data communications bus as would also be known to those skilled in the art.

Referring now more particularly to FIG. **2**, a remote transmitter **50** in accordance with the invention is described. The remote transmitter **50** illustratively includes a housing **51** and a plurality of first momentary contact switches **52***a*–**52***d* carried by the housing. A second momentary contact switch **53** and an indicating light, such as the illustrated LED **54** are also carried by or mounted on the housing **51**. As would be readily understood by those skilled in the art, the remote transmitter **50** is typically relatively small and includes an opening **55** for facilitating connection to a vehicle key ring, for example. In addition, the remote transmitter **50** includes a central processing unit or microprocessor **56** operatively connected to the plurality of first switches **52***a*–**52***d*, the second switch **53**, and the LED **54**. The microprocessor is also connected to a transmitter and/or receiver circuit **57** and its associated antenna **57***a* for transmitting and/or receiving signals to and from the controller **11** of the vehicle security system **10**. Accordingly, the term "remote transmitter" is used broadly herein to describe the embodiment also including receiver means.

The remote transmitter **50** may also include a numeric or alphanumeric display **58**, and a speaker **59** coupled to an audible tone generator or a speech message generator, as may be provided by the microprocessor **56**. A vibration transducer, not shown, may also be incorporated into the remote transmitter **50** for communicating to the user as would be readily understood by those skilled in the art.

Of course, as will be readily appreciated by those skilled in the art, the remote transmitter may be a central station, for example, rather than a handheld unit **50** as shown in FIG. **2**. Also the remote transmitter may include a handheld unit that communicates first to a central station. Other forms of remote transmitters are also contemplated by the invention as will be understood by those skilled in the art.

Turning now additionally to FIG. **3** a first embodiment of the desired signal enabling means **17** is described. The vehicle security system **10** preferably comprises a vehicle security sensor and associated sensor bus interface means **60** for interfacing the vehicle security sensor to the data communications bus **62**. The vehicle security system **10** also preferably includes an alarm indicator and associated alarm indicator bus interface means **64** for interfacing the alarm indicator to the data communications bus. Examples of vehicle security sensors and alarm indicators are described above in greater detail with reference to FIG. **1**.

The security system **10** further preferably comprises desired signal enabling means **17** for enabling the alarm controller **10** to operate using a desired set of signals for a desired vehicle from among a plurality of possible sets of signals for different vehicles. As would be readily understood by those skilled in the art, the term different vehicles may include vehicles from different manufacturers, different models, or even different trim levels of the same make and model. Accordingly, the desired signal enabling means **17** permits the alarm controller, that is, the security CPU and bus interface **65**, to communicate with the vehicle security sensor and the alarm indicator via the data communications bus **62** so that the CPU is capable of operating the alarm indicator responsive to the vehicle security sensor.

The data communications bus **62** may preferably be a multiplexed data bus as would be readily understood by those skilled in the art. Accordingly, the sensor bus interface means, the alarm bus interface means, and the alarm controller bus interface means may each comprise multiplexing means for interfacing with the multiplexed data bus of the vehicle. For example, any of the various multiplexing schemes as disclosed in "The Thick and Thin of Car Cabling" by Thompson appearing in the IEEE Spectrum, February 1996, pp. 42–45 may be used. Other data bus connection schemes are also contemplated by the present invention.

As illustrated in FIG. **3**, one embodiment of the desired signal enabling means **17** may preferably include a memory **70** for storing a plurality of sets **72***a*, **72***b* and **72***n* of signals for different vehicles, and selecting means for selecting the desired set of signals from the plurality of different sets of signals for different vehicles. By storing sets of signals is meant storing information or data necessary to generate the desired signals on the data bus **62** as would be readily understood by those skilled in the art. The memory **70** may include device address memory means for storing a plurality of different sets of signals representative of different device addresses for different vehicles. Alternatively, or in addition thereto, the memory means may comprise protocol memory means for storing a plurality of different protocols for different vehicles. One or more other control nodes and associated bus interfaces **66** may also be connected to the data communications bus **62** as would also be readily

understood by those skilled in the art. For example, other control nodes may include an engine controller thereby permitting the alarm controller to disable the engine, or the body controller thereby permitting the alarm controller to control the vehicle door locks as would be readily understood by those skilled in the art.

In the illustrated embodiment of FIG. **3**, the selecting means may comprise user selecting means **75** for permitting a user to select the desired set of signals. A keypad or other input means may be used to permit the user to select the desired signal set for his vehicle. The valet switch **27** (FIG. **1**), for example, may also be operated by the user to select the desired signal set. The user may select the desired set of signals by entering a unique digital code similar to the selection of signals for a home electronics universal remote control. Other techniques for permitting the user to select the desired signal set from a plurality of stored sets are also contemplated by the invention as would be readily appreciated by those Skilled in the art.

Referring now additionally to FIG. **4** another embodiment of the desired signal enabling means **17'** is described in accordance with the security system **10'** of the present invention. In this embodiment, the selecting means may comprise bus determining means **77** for determining the desired set of signals based upon signals on the data communications bus. For example, the bus determining means could determine the desired set of signals based upon sensed voltage levels or based upon the timing of signal pulses on the data communications bus **62**. The other components of this embodiment of the desired signal enabling means **17'** are similar to those described above with reference to FIG. **3** and need no further description.

Yet another embodiment of the security system **10"** according to the invention is explained with reference to FIG. **5**. In this illustrated embodiment the desired signal enabling means **17"** includes a desired signal set memory **81** operatively connected to the illustrated bus learning means **80**. The bus learning means **80** may determine and store in the signal set memory **81** the protocol and/or device addresses for the vehicle devices. For example, the bus learning means **80** may permit the user to operate various vehicle devices and store a desired signal set based thereon as would be readily understood by those skilled in the art. The other components of the desired signal enabling means **17"** are similar to those described above with reference to FIG. **3** and need no further description.

Still another embodiment of the desired signal enabling means **17'"** is explained with reference to FIG. **6A**. The desired signal enabling means **17'"** includes a signal set memory **81** operatively connected to the schematically illustrated download learning means **84**. The download learning means **84** may include an interface connected to the illustrated vehicle cellular telephone **86** to permit learning or downloading of the desired signal set from a remote or central monitoring and control station **88**, for example. The desired signal set may also alternately be learned from the central station **88** through the satellite link provided by the satellite **110** and vehicle mounted satellite receiver **111** and associated antennas. As would be readily understood by those skilled in the art, the download learning means, as well as the other desired signal enabling leans may be implemented by software in the CPU **12** of the controller **11** or in a separate microprocessor or circuits.

Turning now additionally to FIG. **6B**, another variation of programming, learning or downloading of the download learning means **84** is explained. In this variation the download learning means **84** is temporarily connected to a computer, such as the illustrated portable laptop computer **115**. The connection, may be via a wire cable or wireless communications link as will be readily understood by those skilled in the art. Of course, the desired signal enabling means **17'"** in this embodiment may be programmed in the vehicle or prior to installation in the vehicle.

One implementation of the security system **10** is shown in FIG. **7** and includes the vehicle security controller **11**. The remote transmitter **50** can switch the controller **11** between the armed and disarmed modes. The controller **11** in the armed mode is capable of generating an alarm indication via the siren **31** (FIG. **1**) and based upon the door switches **25** (FIG. **1**), for example. The communications are via the data communications bus **62**, and are based upon the desired signal set from the desired signal enabling means **17**.

The features and aspects described above may also be readily implemented into other vehicle related systems, such as for performing remote control functions. As shown in FIG. **8**, the invention may be embodied in a remote keyless entry system **90** including a remote keyless entry controller **91** operated by a remote handheld transmitter **93**. The controller **91** communicates with the door lock motors **94** and illustrated trunk release **96** via the data communications bus **62**. The remote keyless entry system **90** also includes the desired signal enabling means **17** which permits the controller **91** to perform the desired door locking and trunk release remote control functions or operations as would also be readily understood by those skilled in the art. As would be readily appreciated by those skilled in the art, any of the desired signal enabling means described herein and equivalent thereto may be used for the remote keyless entry system **90** in accordance with the present invention.

Turning now to FIG. **9**, yet another vehicle associated remote control function is illustrated and now explained. The remote engine starting system **100** includes a remote start controller **101** operable by a remote transmitter **103**. The remote controller **101** may communicate via the data communications bus **62** to enable the ignition and fuel systems **106** and crank the engine starter **104**. Various sensors may also be monitored as would be readily understood by those skilled in the art.

A method aspect of the invention is for operating a vehicle security system **10** for a vehicle of a type including a data communications bus **62** connecting a plurality of vehicle devices. The method preferably comprises the steps of interfacing an alarm controller **11** to the data communications bus **62**, and enabling the alarm controller to operate using a desired set of digital signals for a desired vehicle from a plurality of possible sets of signals for different vehicles to thereby permit the alarm controller to communicate with at least one of a vehicle security sensor **60** and an alarm indicator **64** via the data communications bus **62** (FIG. **3**). Accordingly, the alarm controller is capable of operating the alarm indicator responsive to the vehicle security sensor and via the data communication bus.

Another method of the invention is for remotely controlling a vehicle function for a vehicle of a type including a data communications bus **62** connecting a plurality of vehicle devices, and a vehicle function controller and associated bus interface means for interfacing the vehicle function controller to the data communications bus. The method comprising the steps of: enabling the vehicle function controller to operate using a desired set of signals for a desired vehicle from a plurality of sets of signals for different vehicles for permitting the vehicle function controller to communicate

via the data communications bus with at least one of the vehicle devices; and receiving a signal at the vehicle from a remote transmitter so that the vehicle function controller remotely controls a vehicle function responsive to the remote transmitter.

Those of skill in the art will readily recognize the benefits and advantages of the present invention for aftermarket security systems and other aftermarket systems for implementing remote control functions wherein compatibility with a potentially large number of different protocols and/or device addresses is desired. Of course, many modifications and other embodiments of the invention will come to the mind of one skilled in the art having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Accordingly, it is understood that the invention is not to be limited to the illustrated embodiments disclosed, and that the modifications and embodiments are intended to be included within the spirit and scope of the appended claims.

That which is claimed is:

1. A vehicle security system for a vehicle of a type including a data communications bus, said vehicle security system comprising:

at least one security function control circuit and associated interface for interfacing to the data communications bus;

a security system controller and associated interface for interfacing to the data communications bus; and

desired signal enabling means for enabling said security system controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting said security system controller to communicate with said at least one security function control circuit.

2. A vehicle security system according to claim **1** wherein said at least one security function control circuit comprises an engine control circuit.

3. A vehicle security system according to claim **2** wherein said engine control circuit comprises a starter control circuit.

4. A vehicle security system according to claim **2** wherein said engine control circuit comprises at least one of an ignition and fuel control circuit.

5. A vehicle security system according to claim **1** wherein said at least one security function control circuit comprises a door lock control circuit.

6. A vehicle security system according to claim **1** further comprising a receiver connected to said security system controller; and wherein said security system controller selectively operates said at least one security function control circuit based upon remote signals received by said receiver.

7. A vehicle security system according to claim **6** further comprising a remote transmitter for generating the remote signals.

8. A vehicle security system according to claim **1** wherein said desired signal enabling means comprises:

a memory for storing a plurality of sets of signals for different vehicles; and

selecting means for selecting the desired set of signals from the plurality of different sets of signals for different vehicles.

9. A vehicle security system according to claim **8** wherein said selecting means comprises user selecting means for permitting a user to select the desired set of signals.

10. A vehicle security system according to claim **8** wherein said selecting means comprises bus determining means for determining the desired set of signals based upon signals on the data communications bus.

11. A vehicle security system according to claim **8** wherein said memory comprises device address memory means for storing a plurality of different sets of signals for different device addresses.

12. A vehicle security system according to claim **8** wherein said memory comprises protocol memory means for storing a plurality of different sets of signals for different protocols.

13. A vehicle security system according to claim **1** wherein said desired signal enabling means comprises bus learning means for learning the desired set of signals based upon signals on the data communications bus.

14. A vehicle security system according to claim **1** wherein said desired signal enabling means comprises download learning means for learning the desired set of signals from a downloading device.

15. A vehicle security system according to claim **14** wherein said downloading learning means comprises means for learning the desired set of signals from a computer temporarily connected thereto.

16. A vehicle security system according to claim **1** wherein said desired signal enabling means comprises protocol providing means for providing a protocol for the desired vehicle.

17. A vehicle security system according to claim **1** wherein said desired signal enabling means comprises device address providing means for providing device addresses for the desired vehicle.

18. A vehicle security system according to claim **1** wherein further comprising a vehicle security sensor and associated interface for interfacing to the data communications bus; and wherein said vehicle security system controller operates responsive to the vehicle security sensor.

19. A vehicle security system according to claim **1** wherein further comprising a vehicle alarm indicator and associated interface for interfacing to the data communications bus; and wherein said vehicle security system controller operates said alarm indicator.

20. A vehicle security system for a vehicle of a type including a data communications bus, said vehicle security system comprising:

an engine control circuit and associated interface for interfacing to the data communications bus;

a security system controller and associated interface for interfacing to the data communications bus; and

desired signal enabling means for enabling said security system controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting said security system controller to communicate with said engine control circuit.

21. A vehicle security system according to claim **20** wherein said engine control circuit comprises a starter control circuit.

22. A vehicle security system according to claim **20** wherein said engine control circuit comprises at least one of an ignition and fuel control circuit.

23. A vehicle security system according to claim **20** further comprising a receiver connected to said security system controller; and wherein said security system controller selectively operates said engine control circuit based upon remote signals received by said receiver.

24. A vehicle security system according to claim **23** further comprising a remote transmitter for generating the remote signals.

25. A vehicle security system according to claim 20 wherein said desired signal enabling means comprises:

a memory for storing a plurality of sets of signals for different vehicles; and

selecting means for selecting the desired set of signals from the plurality of different sets of signals for different vehicles.

26. A vehicle security system according to claim 25 wherein said selecting means comprises user selecting means for permitting a user to select the desired set of signals.

27. A vehicle security system according to claim 25 wherein said selecting means comprises bus determining means for determining the desired set of signals based upon signals on the data communications bus.

28. A vehicle security system according to claim 25 wherein said memory comprises device address memory means for storing a plurality of different sets of signals for different device addresses.

29. A vehicle security system according to claim 25 wherein said memory comprises protocol memory means for storing a plurality of different sets of signals for different protocols.

30. A vehicle security system according to claim 20 wherein said desired signal enabling means comprises bus learning means for learning the desired set of signals based upon signals on the data communications bus.

31. A vehicle security system according to claim 20 wherein said desired signal enabling means comprises download learning means for learning the desired set of signals from a downloading device.

32. A vehicle security system according to claim 31 wherein said downloading learning means comprises means for learning the desired set of signals from a computer temporarily connected thereto.

33. A vehicle security system according to claim 20 wherein said desired signal enabling means comprises protocol providing means for providing a protocol for the desired vehicle.

34. A vehicle security system according to claim 20 wherein said desired signal enabling means comprises device address providing means for providing device addresses for the desired vehicle.

35. A vehicle security system for a vehicle of a type including a data communications bus, said vehicle security system comprising:

a door lock control circuit and associated interface for interfacing to the data communications bus;

a security system controller and associated interface for interfacing to the data communications bus; and

desired signal enabling means for enabling said security system controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting said security system controller to communicate with said door lock control circuit.

36. A vehicle security system according to claim 35 further comprising a receiver connected to said security system controller; and wherein said security system controller selectively operates said door lock control circuit based upon remote signals received by said receiver.

37. A vehicle security system according to claim 36 further comprising a remote transmitter for generating the remote signals.

38. A vehicle security system according to claim 35 wherein said desired signal enabling means comprises:

a memory for storing a plurality of sets of signals for different vehicles; and

selecting means for selecting the desired set of signals from the plurality of different sets of signals for different vehicles.

39. A vehicle security system according to claim 38 wherein said selecting means comprises user selecting means for permitting a user to select the desired set of signals.

40. A vehicle security system according to claim 38 wherein said selecting means comprises bus determining means for determining the desired set of signals based upon signals on the data communications bus.

41. A vehicle security system according to claim 38 wherein said memory comprises device address memory means for storing a plurality of different sets of signals for different device addresses.

42. A vehicle security system according to claim 38 wherein said memory comprises protocol memory means for storing a plurality of different sets of signals for different protocols.

43. A vehicle security system according to claim 35 wherein said desired signal enabling means comprises bus learning means for learning the desired set of signals based upon signals on the data communications bus.

44. A vehicle security system according to claim 35 wherein said desired signal enabling means comprises download learning means for learning the desired set of signals from a downloading device.

45. A vehicle security system according to claim 44 wherein said downloading learning means comprises means for learning the desired set of signals from a computer temporarily connected thereto.

46. A vehicle security system according to claim 35 wherein said desired signal enabling means comprises protocol providing means for providing a protocol for the desired vehicle.

47. A vehicle security system according to claim 35 wherein said desired signal enabling means comprises device address providing means for providing device addresses for the desired vehicle.

48. A method for controlling a vehicle security function for a vehicle of a type including a data communications bus, and at least one security function control circuit and associated interface for interfacing to the data communications bus, the method comprising the steps of:

interfacing a security system controller to the data communications bus; and

enabling the security system controller to operate using a desired set of signals for a corresponding desired vehicle from a plurality of sets of signals for different vehicles for permitting the security system controller to communicate with the at least one security function control circuit.

49. A method according to claim 48 wherein the at least one vehicle function control circuit comprises an engine control circuit.

50. A method according to claim 49 wherein the engine control circuit comprises a starter control circuit.

51. A method according to claim 49 wherein the engine control circuit comprises at least one of an ignition and fuel control circuit.

52. A method according to claim 48 wherein the at least one vehicle function control circuit comprises a door lock control circuit.

53. A method according to claim 48 further comprising the steps of receiving remotely generated signals, and caus-

ing the security system controller to selectively operate the at least one security function control circuit based upon the received signals.

54. A method according to claim **48** wherein the step of enabling comprises the steps of:

storing in a memory a plurality of sets of signals for different vehicles; and

selecting the desired set of signals from the plurality of different sets of signals for different vehicles.

55. A method according to claim **54** wherein the step of selecting comprises permitting user selection of the desired set of signals.

56. A method according to claim **54** wherein the step of selecting comprises determining the-desired set of signals based upon signals on the data communications bus.

57. A method according to claim **54** wherein the step of storing in memory comprises storing a plurality of different sets of signals representative of different device addresses.

58. A method according to claim **54** wherein the step of storing in memory comprises storing a plurality of different sets of signals representative of different protocols.

59. A method according to claim **48** wherein the step of enabling comprises the step of learning the desired set of signals based upon signals on the data communications bus.

60. A method according to claim **48** wherein the step of enabling comprises the step of downloading the desired signals from a downloading device.

* * * * *

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(12) **United States Patent**
Flick

(10) **Patent No.: US 6,529,124 B2**
(45) **Date of Patent: *Mar. 4, 2003**

(54) **REMOTE VEHICLE FUNCTION CONTROL SYSTEM USING DATA BUS ADAPTOR CARTRIDGE AND ASSOCIATED METHODS**

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(73) Assignee: **Omega Patents, L.L.C.**, Douglasville, GA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 161 days.

This patent is subject to a terminal disclaimer.

(21) Appl. No.: **09/780,245**

(22) Filed: **Feb. 9, 2001**

(65) **Prior Publication Data**

US 2001/0029415 A1 Oct. 11, 2001

Related U.S. Application Data

(63) Continuation-in-part of application No. 09/583,257, filed on May 31, 2000, which is a continuation-in-part of application No. 09/382,245, filed on Aug. 25, 1999, now Pat. No. 6,275,147, which is a continuation of application No. 09/023,838, filed on Feb. 13, 1998, now Pat. No. 6,011,460, which is a continuation-in-part of application No. 08/701, 356, filed on Aug. 22, 1996, now Pat. No. 5,719,551.

(51) **Int. Cl.**[7] **B60R 25/10**

(52) **U.S. Cl.** **340/426**; 340/425.5; 340/531; 307/10.2; 180/287

(58) **Field of Search** 340/426, 427, 340/428, 429, 531, 532, 533, 539, 5.1, 5.2, 5.72, 825.69; 307/9.1, 10.1, 10.2, 10.5, 10.6; 439/34, 76.2, 212, 213, 620, 946

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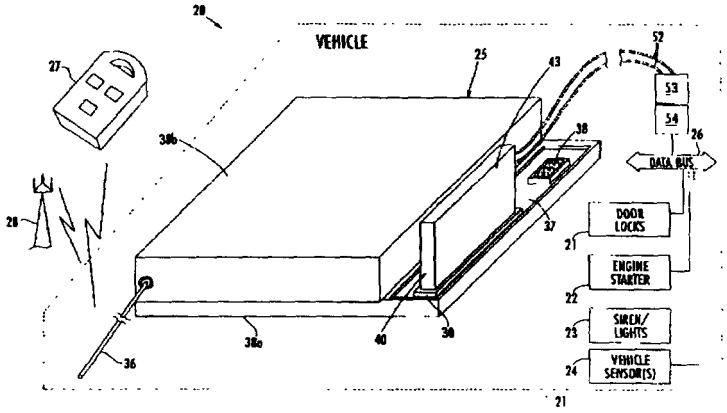
Primary Examiner—Toan Pham
(74) *Attorney, Agent, or Firm*—Allen, Dyer, Doppelt, Milbrath & Gilchrist, P.A.

(57) **ABSTRACT**

A vehicle system includes a remote function controller, and a data bus adaptor cartridge removably coupled to a data bus adaptor cartridge connector for permitting communications between control circuitry and at least one vehicle device over the data communications bus. The control circuitry may couple to the data bus adaptor cartridge through serial or parallel interfaces. The control circuitry may generate digital command codes, and the data bus adaptor cartridge may convert the digital command codes into data communications bus signals according to a desired protocol. The control circuitry may also read digital codes, and the data bus adaptor cartridge may convert data communications bus signals into digital codes according to a desired protocol for the control circuitry.

46 Claims, 6 Drawing Sheets



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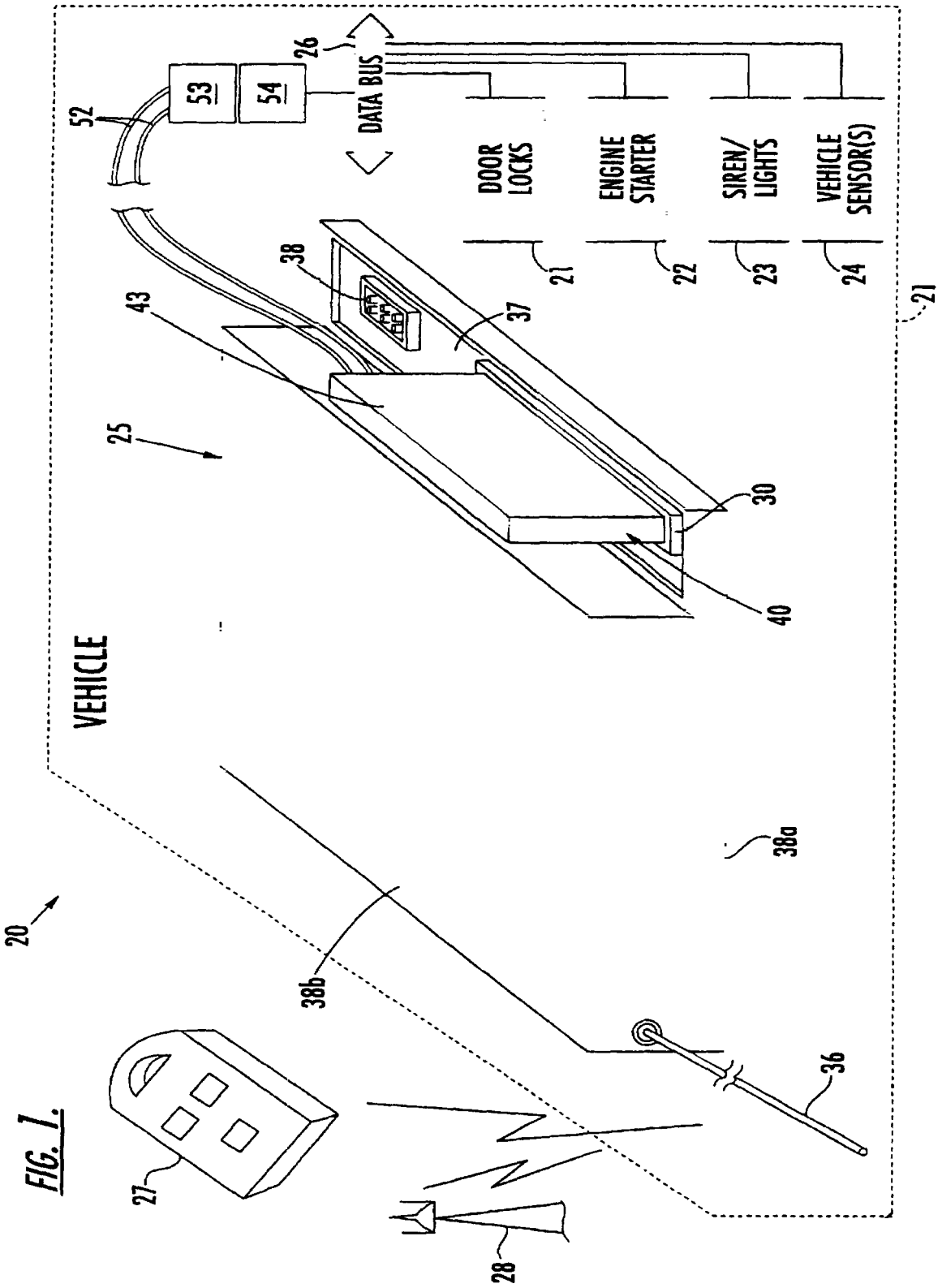
VEHICLE
20
21
25
26
DATA BUS
52
53
54
DOOR LOCKS
ENGINE STARTER
SIREN/ LIGHTS
VEHICLE SENSOR(S)
21
22
23
24
38
37
43
30
40
38a
38b
36
27
28

FIG. 1.

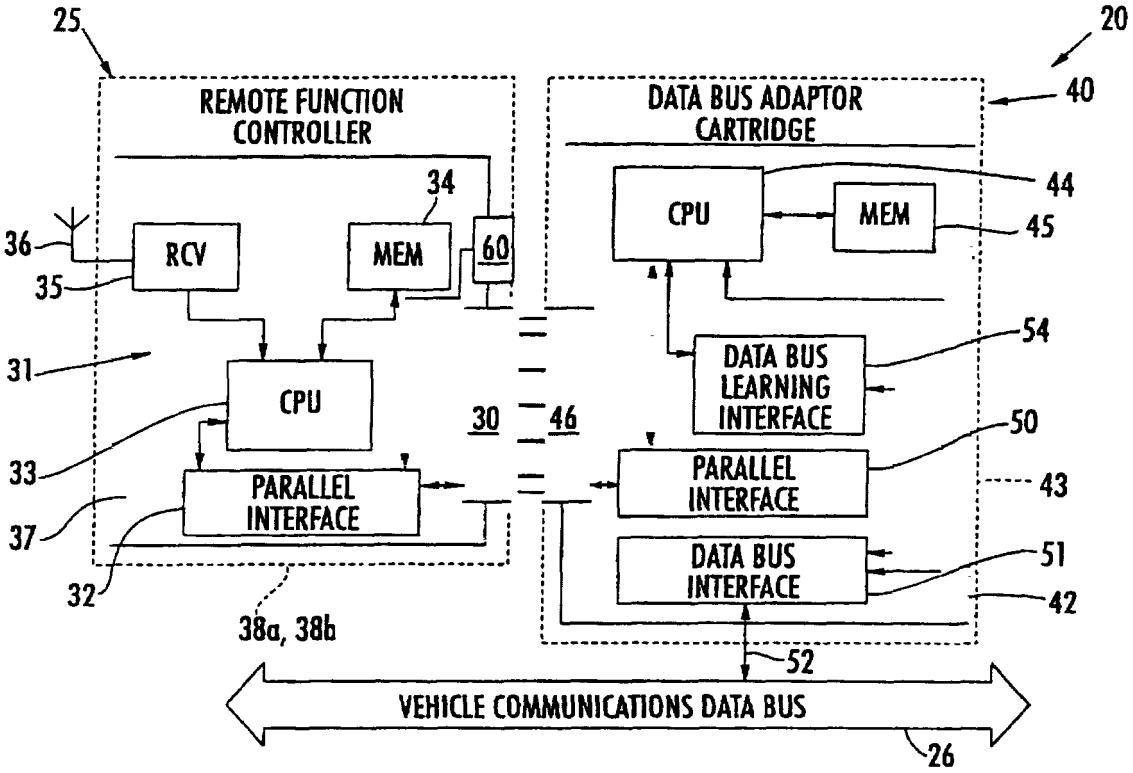
25
20
REMOTE FUNCTION CONTROLLER
DATA BUS ADAPTOR CARTRIDGE
40
34
44
CPU
MEM
45
36
RCV
MEM
60
35
54
DATA BUS LEARNING INTERFACE
31
CPU
30
46
50
PARALLEL INTERFACE
33
PARALLEL INTERFACE
43
37
DATA BUS INTERFACE
51
32
42
38a, 38b
52
VEHICLE COMMUNICATIONS DATA BUS
26

FIG. 2.

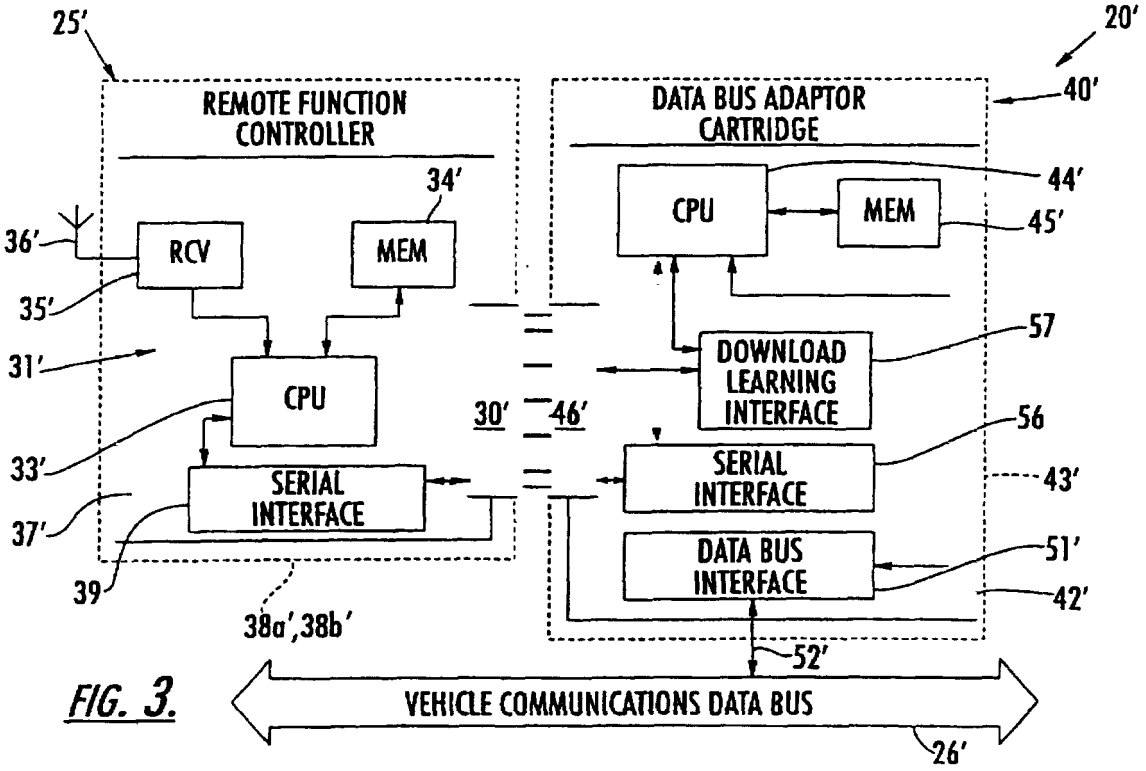
25'
20'
REMOTE FUNCTION CONTROLLER
DATA BUS ADAPTOR CARTRIDGE
40'
34'
44'
CPU
MEM
45'
36'
RCV
MEM
35'
57
DOWNLOAD LEARNING INTERFACE
31'
CPU
30'
46'
56
33'
SERIAL INTERFACE
SERIAL INTERFACE
43'
37'
DATA BUS INTERFACE
51'
39
42'
38a',38b'
52'
VEHICLE COMMUNICATIONS DATA BUS
26'

FIG. 3.

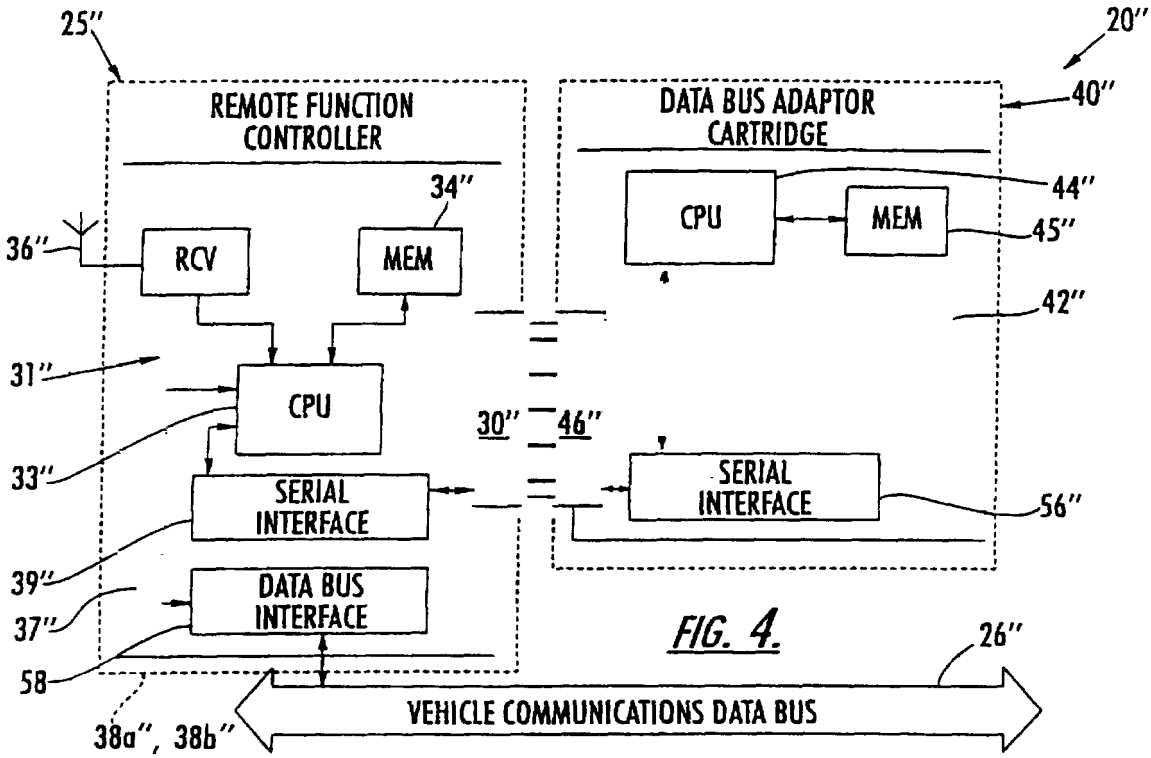

FIG. 4.

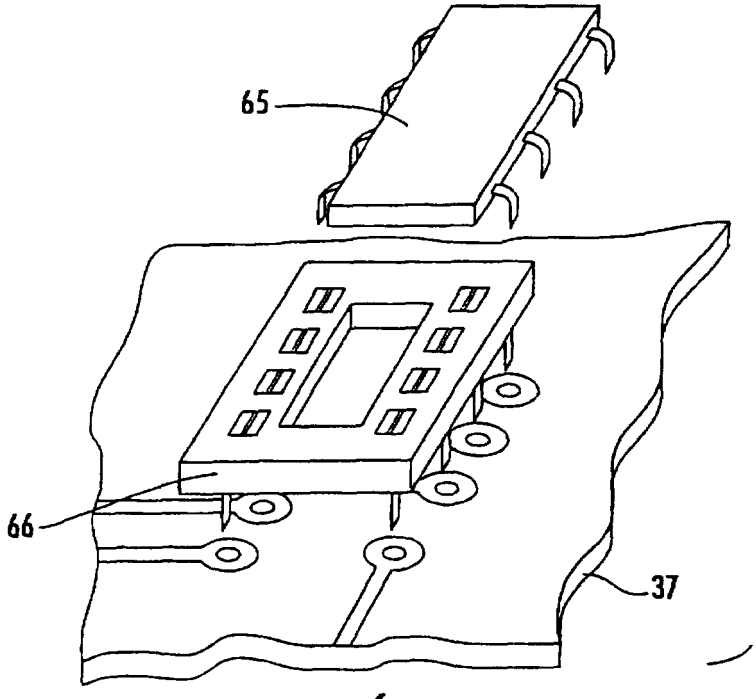

FIG. 6.

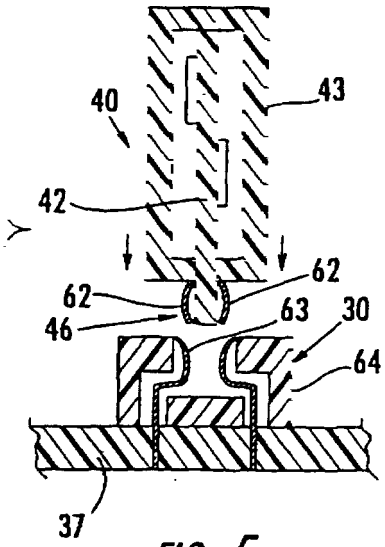

FIG. 5.

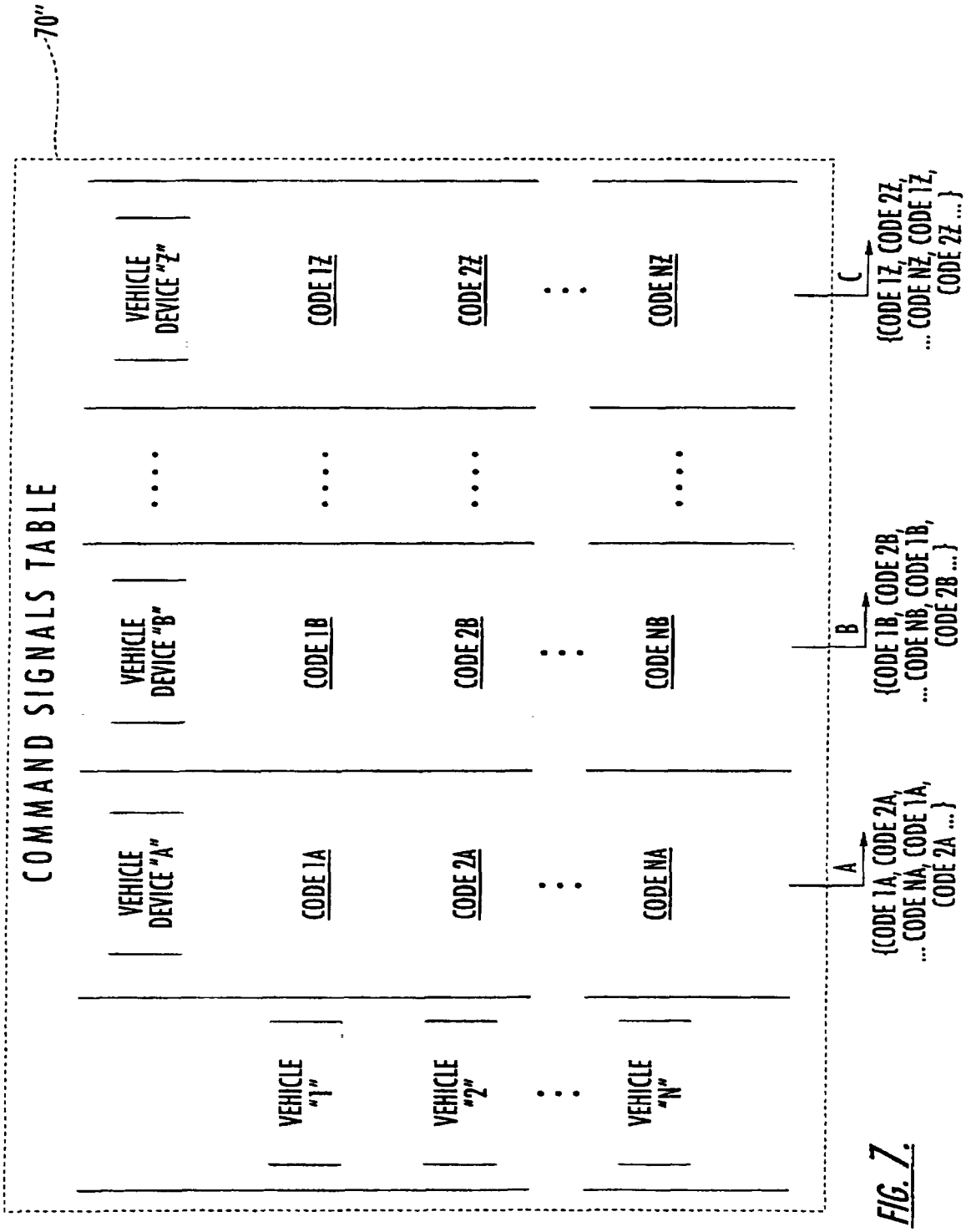
70"
COMMAND SIGNALS TABLE
VEHICLE "1"
VEHICLE "2"
VEHICLE "N"
VEHICLE DEVICE "A"
VEHICLE DEVICE "B"
VEHICLE DEVICE "Z"
CODE 1A
CODE 2A
CODE NA
CODE 1B
CODE 2B
CODE NB
CODE 1Z
CODE 2Z
CODE NZ
A
{CODE 1A, CODE 2A, ... CODE NA, CODE 1A, CODE 2A ...}
B
{CODE 1B, CODE 2B, ... CODE NB, CODE 1B, CODE 2B ...}
C
{CODE 1Z, CODE 2Z, ... CODE NZ, CODE 1Z, CODE 2Z ...}

FIG. 7.

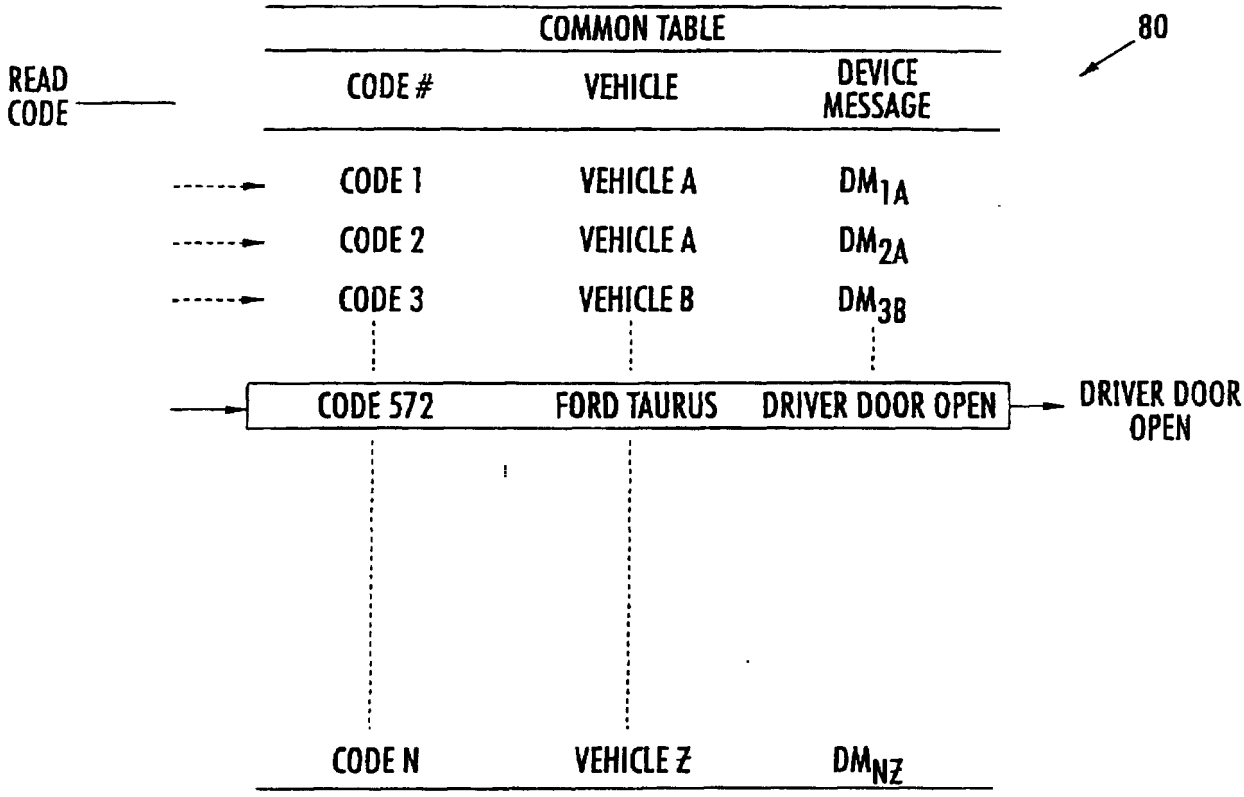
COMMON TABLE
80
READ CODE
CODE #
VEHICLE
DEVICE MESSAGE
CODE 1
VEHICLE A
DM1A
CODE 2
VEHICLE A
DM2A
CODE 3
VEHICLE B
DM3B
CODE 572
FORD TAURUS
DRIVER DOOR OPEN
DRIVER DOOR OPEN
CODE N
VEHICLE Z
DMNZ

FIG. 8.

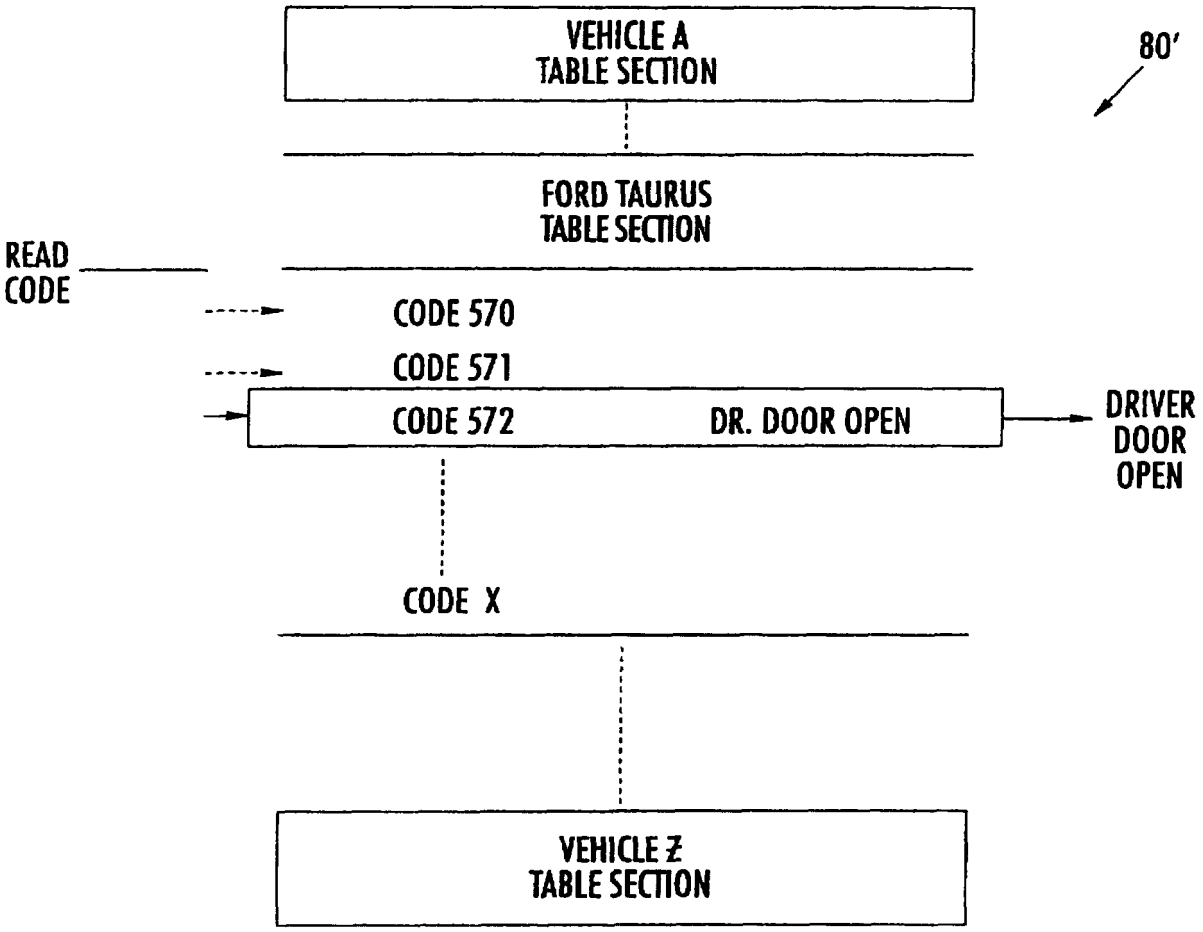
VEHICLE A
TABLE SECTION
80'
FORD TAURUS
TABLE SECTION
READ
CODE
CODE 570
CODE 571
CODE 572
DR. DOOR OPEN
DRIVER
DOOR
OPEN
CODE X
VEHICLE Z
TABLE SECTION

FIG. 9.

REMOTE VEHICLE FUNCTION CONTROL SYSTEM USING DATA BUS ADAPTOR CARTRIDGE AND ASSOCIATED METHODS

RELATED APPLICATIONS

The present application is a continuation-in-part of U.S. patent application Ser. No. 09/583,257 filed May 31, 2000, which in turn, is a continuation-in-part of U.S. patent application Ser. No. 09/382,245 filed Aug. 25, 1999, now U.S. Pat. No. 6,275,147 which in turn, is a continuation of U.S. Pat. Ser. No. 09/023,838 filed Feb. 13, 1998 now U.S. Pat. No. 6,011,460, which in turn, is a continuation-in-part of U.S. patent application Ser. No. 08/701,356 filed Aug. 22, 1996, now U.S. Pat. No. 5,719,551.

FIELD OF THE INVENTION

This application is related to the field of control systems and, more particularly, to a remote control system and related methods for vehicles.

BACKGROUND OF THE INVENTION

Vehicle security systems are widely used to deter vehicle theft, prevent theft of valuables from a vehicle, deter vandalism, and to protect vehicle owners and occupants. A typical automobile security system, for example, includes a central processor or controller connected to a plurality of vehicle sensors. The sensors, for example, may detect opening of the trunk, hood, doors, windows, and also movement of the vehicle or within the vehicle. Ultrasonic and microwave motion detectors, vibration sensors, sound discriminators, differential pressure sensors, and switches may be used as sensors. In addition, radar sensors may be used to monitor the area proximate the vehicle.

The controller typically operates to give an alarm indication in the event of triggering of a vehicle sensor. The alarm indication may typically be a flashing of the lights and/or the sounding of the vehicle horn or a siren. In addition, the vehicle fuel supply and/or ignition power may be selectively disabled based upon an alarm condition.

A typical security system also includes a receiver associated with the controller that cooperates with one or more remote transmitters typically carried by the user as disclosed, for example, in U.S. Pat. No. 4,383,242 to Sassover et al. and U.S. Pat. No. 5,146,215 to Drori. The remote transmitter may be used to arm and disarm the vehicle security system or provide other remote control features from a predetermined range away from the vehicle. Also related to remote control of a vehicle function U.S. Pat. No. 5,252,966 to Lambropoulous et al. discloses a remote keyless entry system for a vehicle. The keyless entry system permits the user to remotely open the vehicle doors or open the vehicle trunk using a small handheld transmitter.

Unfortunately, the majority of vehicle security systems need to be directly connected by wires to individual vehicle devices, such as the vehicle horn or door switches of the vehicle. In other words, a conventional vehicle security system is hardwired to various vehicle components, typically by splicing into vehicle wiring harnesses or via interposing T-harnesses and connectors. The number of electrical devices in a vehicle has increased so that the size and complexity of wiring harnesses has also increased. For example, the steering wheel may include horn switches, an airbag, turn-signal and headlight switches, wiper controls, cruise control switches, ignition wiring, an emergency flasher switch, and/or radio controls. Likewise, a door of a vehicle, for example, may include window controls, locks, outside mirror switches, and/or door-panel light switches.

In response to the increased wiring complexity and costs, vehicle manufacturers have begun attempts to reduce the amount of wiring within vehicles to reduce weight, reduce wire routing problems, decrease costs, and reduce complications which may arise when troubleshooting the electrical system. For example, some manufacturers have adopted multiplexing schemes to reduce cables to three or four wires and to simplify the exchange of data among the various onboard electronic systems as disclosed, for example, in "The Thick and Thin of Car Cabling" by Thompson appearing in the IEEE Spectrum, February 1996, pp. 42–45.

Implementing multiplexing concepts in vehicles in a cost-effective and reliable manner may not be easy. Successful implementation, for example, may require the development of low or error-free communications in what can be harsh vehicle environments. With multiplexing technology, the various electronic modules or devices may be linked by a single signal wire in a bus also containing a power wire, and one or more ground wires. Digital messages are communicated to all modules over the data communications bus. Each message may have one or more addresses associated with it so that the devices can recognize which messages to ignore and which messages to respond to or read.

The Thompson article describes a number of multiplexed networks for vehicles. In particular, the Grand Cherokee made by Chrysler is described as having five multiplex nodes or controllers: the engine controller, the temperature controller, the airbag controller, the theft alarm, and the overhead console. Other nodes for different vehicles may include a transmission controller, a trip computer, an instrument cluster controller, an antilock braking controller, an active suspension controller, and a body controller for devices in the passenger compartment.

A number of patent references are also directed to digital or multiplex communications networks or circuits, such as may be used in a vehicle. For example, U.S. Pat. No. 4,538,262 Sinniger et al. discloses a multiplex bus system including a master control unit and a plurality of receiver-transmitter units connected thereto. Similarly, U.S. Pat. No. 4,055,772 to Leung discloses a power bus in a vehicle controlled by a low current digitally coded communications system. Other references disclosing various vehicle multiplex control systems include, for example, U.S. Pat. No. 4,760,275 to Sato et al.; U.S. Pat. No. 4,697,092 to Roggendorf et al.; and U.S. Pat. No. 4,792,783 to Burgess et al.

Several standards have been proposed for vehicle multiplex networks including, for example, the Society of Automotive Engineers "Surface Vehicle Standard, Class B Data Communications Network Interface", SAE J1850, July 1995. Another report by the SAE is the "Surface Vehicle Information Report, Chrysler Sensor and Control (CSC) Bus Multiplexing Network for Class 'A' Applications", SAE J2058, July 1990. Many other networks are also being implemented or proposed for communications between vehicle devices and nodes or controllers.

Unfortunately, conventional vehicle control systems, such as aftermarket vehicle security systems, are for hardwired connection to vehicle devices and are not readily adaptable to a vehicle including a data communications bus. Moreover, a vehicle security system if adapted for a communications bus and devices for one particular model, model year, and manufacturer, may not be compatible with any other models, model years, or manufacturers. Other systems for the control of vehicle functions may also suffer from such shortcomings.

SUMMARY OF THE INVENTION

In view of the foregoing background, it is therefore an object of the invention to provide a vehicle remote function control system, such as for a vehicle including a data communications bus, which can be readily interfaced to the data communications bus.

This and other objects, features and advantages in accordance with the present invention are provided by a system including a remote function controller comprising a data bus adaptor cartridge connector, and control circuitry coupled thereto, and a data bus adaptor cartridge removably coupled to the data bus adaptor cartridge connector. The data bus adaptor cartridge is for permitting communications between the control circuitry and at least one vehicle device over the data communications bus. The adaptor cartridge may provide compatibility with a number of different vehicle types, for example.

The control circuitry may further comprise a serial interface, and the data bus adaptor cartridge may comprise a serial interface to be coupled to the control circuitry. In other embodiments, the control circuitry may comprise a parallel interface, and the data bus adaptor cartridge may comprise a parallel interface.

The control circuitry may generate digital command codes. In these embodiments, the data bus adaptor cartridge converts the digital command codes into data communications bus signals according to a desired protocol. The desired protocol may be based upon at least one of a desired signal level, a desired signal modulation scheme, and a desired communication rate.

The control circuitry may also generate at least one set of digital command codes comprising at least one working command signal and at least one non-working command signal for a given vehicle to thereby provide command compatibility with a plurality of different vehicles. The control circuitry may also read digital codes, and the data bus adaptor cartridge may convert data communications bus signals into digital codes according to a desired protocol for the control circuitry. Again, the desired protocol may be based upon at least one of a desired signal level, a desired signal modulation scheme, and a desired communication rate.

The control circuitry may be for storing a set of device codes for a given vehicle device for a plurality of different vehicles, for reading a device code from the data communications bus, and for determining a match between a read device code and the stored device codes to thereby provide reading compatibility with a plurality of different vehicles.

The data bus adaptor cartridge may comprise a memory, and a download learning interface for storing in the memory at least one of vehicle device codes and a desired protocol for a given vehicle from a downloading device. In other words, the data bus adaptor cartridge may be downloaded with the vehicle specific digital codes and/or protocol. Alternately, the data bus adaptor cartridge comprises a data bus learning circuit for learning at least one of vehicle device codes and a desired protocol for a given vehicle from signals carried on the data bus.

The data bus adaptor cartridge may include at least one first electrical conductor. The data bus adaptor cartridge connector may also comprise at least one second electrical conductor for engaging the at least one first electrical conductor of the data bus adaptor cartridge. In addition, the remote function controller may further comprise a circuit board carrying the data bus adaptor cartridge connector and the control circuitry.

At least one remote transmitter may be provided for operating the security controller. In these embodiments, the control circuitry may comprise a receiver and a processor connected thereto. The remote function controller may comprise at least one of a security controller, a remote keyless entry controller, and a remote start controller.

In another embodiment, the data bus adaptor device may comprise at least one integrated circuit. Accordingly, the connector may be an integrated circuit socket.

A method aspect of the invention is for permitting a remote function controller comprising control circuitry to operate in a vehicle including a data communications bus connecting a plurality of vehicle devices. The method may include coupling a data bus adaptor cartridge connector to the control circuitry, and removably coupling a data bus adaptor cartridge to the data bus adaptor cartridge connector. This may be done to permit communications between the control circuitry and at least one vehicle device over the data communications bus.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic block diagram of a vehicle remote control system in accordance with the invention.

FIG. **2** is a more detailed schematic block diagram of the remote function controller and data bus adaptor cartridge as shown in FIG. **1**.

FIG. **3** is a more detailed schematic block diagram of another embodiment of a remote function controller and data bus adaptor cartridge in accordance with the invention.

FIG. **4** is a more detailed schematic block diagram of yet another embodiment of a remote function controller and data bus adaptor cartridge in accordance with the invention.

FIG. **5** is a schematic cross-sectional view of the data bus adaptor cartridge and associated connector as shown in FIG. **1**.

FIG. **6** is an exploded perspective view of an embodiment of a data bus adaptor device in the form of an integrated circuit, an integrated circuit socket, and a corresponding circuit board portion of the remote function controller data bus in accordance with another embodiment of the present invention.

FIG. **7** is a schematic diagram illustrating processing of command signals by the remote function controller of FIG. **1**.

FIG. **8** is a schematic diagram illustrating processing of a code read from the data communications bus in accordance with an embodiment of the remote function controller of FIG. **1**.

FIG. **9** is a schematic diagram illustrating processing of a code read from the data communications bus in accordance with another embodiment of the remote function controller of FIG. **1**.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The present invention will now be described more fully hereinafter with reference to the accompanying drawings in which preferred embodiments of the invention are shown. This invention may, however, be embodied in many different forms and should not be construed as limited to the illustrated embodiments set forth herein. Rather, these embodiments are provided so that this disclosure will be thorough and complete, and will fully convey the scope of the invention to those skilled in the art. Like numbers refer to

like elements throughout. Prime and double prime notation are used in alternate embodiments to indicate similar elements.

Referring initially to FIGS. **1** and **2**, a control system **20** for a vehicle **21** is now described. The control system **20** includes a remote function controller **25** connected to a data communications bus **26** in the vehicle **21**. The data communications bus **26** may be any of several types, such as compatible with the J1850 or CAN standards, or other type of bus as will be appreciated by those skilled in the art.

The system **20** also includes a data bus adaptor cartridge connector **30**, and control circuitry **31** coupled thereto, and a data bus adaptor cartridge **40** removably coupled to the data bus adaptor cartridge connector. The data bus adaptor cartridge **40** is for permitting communications between the control circuitry **31** and at least one vehicle device over the data communications bus **26**.

The at least one vehicle device may include one or more of vehicle door locks **21**, an engine starter **22**, and a siren or lights **23** as schematically illustrated. One or more sensing devices **24** may also be connected to the data communications bus **26**. These types of vehicle devices **21–24** may directly connected to the data communications bus **26** or may be connected to communicate over the bus via another intervening vehicle controller module as will be appreciated by those skilled in the art. Other similar devices may also be connected to the data communications bus **26**, and those of skill in the art will recognize that the system **20** of the present invention can communicate with such other devices as well.

The control circuitry **31** may include a parallel interface **32** for interfacing to a corresponding parallel interface **41** in the data bus adaptor cartridge **40**. The control circuitry **31** also illustratively includes a processor or CPU **33**, a memory **34** connected to the CPU, and a receiver **35** connected to the CPU. In other embodiments, the memory **34** may be incorporated in the CPU. An antenna **36** in the form of a wire as shown in FIG. **1** may be connected to the receiver **35**. The control circuitry **31** may be in the form of integrated circuits and/or discrete circuit components mounted on a printed circuit board **37** as will be appreciated by those skilled in the art.

The remote function controller **25** may also include lower and upper housing shells **38***a*, **38***b* assembled together and enclosing most or all of the circuit board **37**. As shown in FIG. **1**, for example, an end portion of the circuit board **37** may be exposed to permit the data bus adaptor cartridge **40** to be received in the connector **30** which is carried by this exposed end portion.

A second connector **60** is also shown in the illustrated embodiment, and this connector may be used to interface to a device not connected to the data communications bus **26**. For example, this second connector **60** could permit coupling to an indicator LED, or other similar device. Of course, in other embodiments, this second connector **60** is not needed.

The data bus adaptor cartridge **40** may also include its own circuit board **42** which carries one or more integrated and/or discrete electronic components. The cartridge **42** may also include its own housing shell **43**, although this may not be needed in other embodiments as will be explained in greater detail below.

The data bus adaptor cartridge **40** may include a processor or CPU **44**, and a memory **45** connected thereto. Also the cartridge **40** includes a connector portion **46** which mates with the data bus adaptor connector **30** carried by the remote function controller **25**. The illustrated cartridge **40** also includes a parallel interface **50** which cooperates with the parallel interface **32** of the remote function controller **25** to permit the exchange of signals therewith.

The data bus adaptor cartridge **40** also illustratively includes a data bus interface **51**. This interface **51** sends and receives signals from the data communications bus **26** at the proper signal levels, modulation scheme, and/or data rates as will be appreciated by those skilled in the art. The signals are illustratively carried by wires **52** which terminate at a connector **53**. This connector **53** is illustratively connected to the data bus connector **54**.

The receiver **36** may receive signals from a small handheld transmitter **27** and/or from a fixed remote transmitter **28** as will be appreciated by those skilled in the art. The remote transmitter may also be a geostationary or moving satellite in other embodiments. The remote transmitter **27**, **28** sends signals to the system **20** to cause various operations at the vehicle. For example, the remote. function controller **25** may be for a security system and the user may wish to switch between armed and disarmed modes. The remote function controller **25** may also be for remote keyless entry in which case the transmitter signals relate to locking and unlocking the vehicle doors. The remote function controller **25** may also be for remote starting the vehicle engine in which case the signals relate to starting the engine as will be appreciated by those skilled in the art. As will also be understood by those skilled in the art, other remote functions and combinations of remote functions are contemplated by the present invention.

The remote transmitter **27** may be a small portable unit including a housing, function control switches carried by the housing, a battery within the housing, and the associated transmitter circuitry. This type of remote handheld transmitter is commonly used in conventional vehicle security systems, remote start systems, and remote keyless entry systems. The communications from the remote transmitter **27** to the receiver **35** at the vehicle **21** is typically a direct radio frequency link, that is, there is no intervening communications links. However, in other embodiments, the remote transmitter **27** may indirectly communicate with the receiver **35** via other communications infrastructure, such as via satellite, or cellular communications, via the public switched telephone network (PSTN) and/or over the world wide web or Internet, as will be appreciated by those skilled in the art.

The remote transmitter **27** may also be a passive transponder type device, that takes power from an associated transponder reader as will be appreciated by those skilled in the art, and automatically transmits a signal to the reader. For example, the transponder may be of the type carried in conjunction with the vehicle keys, or may be embedded in the key as will be readily appreciated by those skilled in the art.

The data bus adaptor cartridge **40** also illustratively includes data bus learning circuitry **54** for learning at least one of desired codes or a desired protocol from signals on the data bus **26**. Although this data bus learning circuitry **54** is shown separate from the CPU **44**, in other embodiments, all or a part of this circuitry may be included with the CPU as will be appreciated by those skilled in the art. The desired protocol may be based upon at least one of a desired signal level, a desired signal modulation scheme, and a desired communication rate. In other words, the data bus learning interface **54** may monitor signals on the data bus **26** and thereby learn the proper protocol. Extending this concept,

the data bus learning interface may also permit learning of circuit codes to operate certain devices as will be explained in greater detail below.

In some embodiments, the control circuitry **31** of the remote function controller **25** may generate digital command codes. In these embodiments, the data bus adaptor cartridge **40** converts the digital command codes into data communications bus signals according to a desired protocol. The desired protocol may be based upon at least one of a desired signal level, a desired signal modulation scheme, and a desired communication rate.

The control circuitry **21** may also generate at least one set of digital command codes comprising at least one working command signal and at least one non-working command signal for a given vehicle to thereby provide command compatibility with a plurality of different vehicles. The control circuitry **21** may also read digital codes, and the data bus adaptor cartridge **40** may convert data communications bus signals into digital codes according to a desired protocol for the control circuitry. Again, the desired protocol may be based upon at least one of a desired signal level, a desired signal modulation scheme, and a desired communication rate.

The control circuitry **31** may be for storing a set of device codes for a given vehicle device for a plurality of different vehicles, for reading a device code from the data communications bus **26**, and for determining a match between a read device code and the stored device codes to thereby provide reading compatibility with a plurality of different vehicles. The reading and sending of digital codes will be discussed in greater detail below.

Turning now additionally to FIG. **3**, another embodiment of the remote function controller **25'** and data bus adaptor cartridge **40'** are now described, and wherein prime notation is used to indicate similar elements to the first embodiment described above with reference to FIGS. **1** and **2**. In this illustrated embodiment, the remote function controller **25'** includes a serial interface **39**, and the data bus adaptor cartridge **40'** comprises a corresponding serial interface **56** to be coupled to the serial interface of the remote function controller.

This second embodiment of the remote function controller **25'** and data bus adaptor cartridge **40'** also differs in that the data bus adaptor cartridge illustratively includes a download learning interface **57** for learning desired codes and/or a desired protocol from a downloading device. For example, the cartridge **40'** could be temporarily connected to a computer to received the desired codes or protocol for a given vehicle as will be appreciated by those skilled in the art.

The connector **46'** could be used for the download learning or another connector, not shown, may be used. Although the download learning interface **57** is shown as a separate circuit portion, it could be implemented in whole or in part in the CPU **44'** as will be appreciated by those skilled in the art. This circuitry defines the download learning means of the adaptor cartridge **40**. Of course, the downloading computer could have, in turn, already downloaded or be in the process of downloading the information from the Internet, for example. Other types of downloading are also contemplated by the invention.

The other components of FIG. **3** are similar to those in FIG. **2** and are indicated with prime notation. These other similar elements need no further discussion herein.

Referring now briefly to FIG. **4**, yet another embodiment of a remote function controller **25"** and data bus adaptor cartridge **40"** are now described. Double prime notation is used to indicate similar elements in this embodiment. In this embodiment, the data bus interface **58** is provided in the remote function controller **25"** rather than the data bus adaptor cartridge **40"**. In this embodiment, the data bus adaptor cartridge **40"** cooperates with the remote function controller **25"** to communicate over the data bus **26"**; however, the data bus interface **58** is carried by the circuit board **37"** of the remote function controller.

Referring now to FIGS. **5** and **6**, two different plug-in or connector arrangements in accordance with the invention are now described. As shown in FIG. **5**, the data bus adaptor cartridge **40** may include a housing **43** which carries the circuit board **42**. The circuit board **42** may include an end portion which extends outwardly beyond the lower end of the housing as shown in the illustrated embodiment. Electrical conductors **62** may be carried by this protruding circuit board portion defining the connector **46** and which engages corresponding conductors **63** carried by a body portion **64** of the connector **30**. The connector body portion **64** is mounted to the adjacent circuit board **37** of the remote function controller **25**. Of course this arrangement could be reversed and many other types of removable electrical connection are contemplated by the present invention.

As shown in FIG. **6**, for example, the data bus adaptor circuitry or cartridge may in the form of a single integrated circuit **65** which is removably mounted to the circuit board **37** via an integrated circuit socket **66** as will be appreciated by those skilled in the art. In other embodiments, similar removable cartridge configurations are also possible as will also be appreciated by those skilled in the art.

As will be readily appreciated by those skilled in the art, the vehicle **21** includes a number of electrical/electronic devices that can be controlled and/or the status thereof read via the data communications bus **26**. The vehicle devices connected to the data bus **26** may be considered to be relatively simple devices, such as sensors, or more complicated devices with some internal processing, such as may generally be considered as controllers.

The remote function controller **25** may provide multi-vehicle compatibility in one or both directions of communications via the data communications bus **26**. Referring now additionally to FIG. **7**, the drive or generation of signals on the data bus portion of communication is now further described. In this embodiment, the remote function controller **25** includes memory **34** for the command signals.

The devices connected to the data communications bus **26** may include a siren or lights **23** or other alarm indicator. The vehicle devices may also include one or more door lock actuators **21** as would be likely used by a security system or remote keyless entry system, for example, as would be readily appreciated by those skilled in the art. For a remote start system, one or more remote engine starting devices **22** may be connected to the data communications bus **26**. Such a remote starting device **22** may be a starter relay, for example, controlled by signals from the data communications bus. The remote starting device **22** could also be a device or circuit to bypass an engine immobilizer circuit as will be appreciated by those skilled in the art.

The vehicle device to which signals are to be sent by the remote function controller **25** may also include another controller, such as an engine management controller, not shown. The engine management controller could be sent signals such as to prevent or enable starting for security or remote start applications as will be appreciated by those skilled in the art.

In accordance with this aspect of the invention, the remote function controller **25** preferably generates at least one set of

command signals on the data communications bus **26** for the at least one vehicle device. The at least one set of command signals preferably comprises at least one working command signal and at least one non-working command signal for a given vehicle to thereby provide compatibility with the plurality of different vehicles. In other words, multiple signals or codes can be generated on the data communications bus **26**, and only that code for the given vehicle and device will cause an operation or response from the vehicle device.

This provides for a relatively simple and straightforward approach to interface or cooperate with a vehicle having a data communications bus **26**, and wherein the controller **25** is advantageously compatible with a number of different vehicles. Since typically it may be desired to interface to a plurality of vehicle devices, the remote function controller **25** may generate a respective set of command signals for each of the vehicle devices.

Such multi-vehicle compatibility provided by the controller **25** is especially advantageous in after-market systems, such as for security, remote keyless entry, or remote starting for example. The ability to interface through the data communications bus **26** also significantly reduces the wiring complexity needed to interface to the associated vehicle devices.

The remote function controller **25** may sequentially generate the different command signals (working and non-working) for an intended vehicle device. To ensure effective communications even in the presence of noise, for example, the multi-vehicle compatible controller **25** may generate the set of command signals a plurality of times, such as, for example, two to five times. The need to effectively communicate should be balanced against possible traffic congestion on the data bus **26** as will be appreciated by those skilled in the art.

Referring now more specifically to the diagram of FIG. **7**, the operation of an embodiment of the remote function controller **25** is further described. The controller **25** may operate by arranging in the memory **34** a common table **70** as shown. The CPU **33** upon determining that an action needs to be performed, such as unlocking the driver's door, for example, would identify the appropriate column from the table **70** from among the columns labeled "vehicle device A" to "vehicle device Z". For example, the appropriate column may be "vehicle device B", in which case the CPU would then read the memory locations in this column to generate on the bus **26** the appropriate set of codes to lock the driver's door for each of the N vehicles with which the multi-vehicle compatible controller **25'** is compatible. Of course, only one of the codes would be a working code, and the other codes would cause no vehicle function to be performed. For example, if vehicle "**2**" was the vehicle, only the code **2B** would cause the driver's door to unlock.

The actual coded signals would be compatible with the particular data communications bus **26** as will be appreciated by those skilled in the art. The codes may be binary codes, which for convenience can be represented more simply by corresponding hexadecimal codes as would also be appreciated by those skilled in the art. For example, for an unlock all vehicle doors to be commanded in a 1995 Jeep Grand Cherokee, the code may be 03868004, for a 2000 Jeep Grand Cherokee, the code may be 0422A00400. As will be readily appreciated by those skilled in the art, such codes can be obtained from the manufacturers directly, or may be read from the data bus **26** using any one of a number of commercially available diagnostic tools for reading the data bus, for example.

The set of command signals may be repeated as mentioned above, and as schematically illustrated at the lower portion of the table **70**. Of course, the memory **34** may store the actual codes, but may also store data enabling generation of the set of command signals by the CPU **33**. This may be particularly so where certain portions of the code, e.g. preamble, or some other portion, are common across either multiple vehicles, and/or over multiple vehicle devices.

The number of vehicles and number of devices to be controlled using the remote function controller **25** can both be relatively large to cover a substantial portion of the vehicle marketplace. Alternatively, the multiple command signal concept may also be advantageously used to provide compatibility for as few as two vehicles, and even a single vehicle device.

In those embodiments, where the remote function controller **25** provides multi-vehicle code compatibility for command signals to be transmitted on the data communications bus **26**, the data bus adaptor cartridge **40** provides compatibility with different vehicle protocols. The protocol may be in terms of one or more of signal level, modulation scheme, or transmission rate, for example. Of course, in other embodiments, this multi-vehicle code compatibility could be provided in the data bus adaptor cartridge **40** as will be appreciated by those skilled in the art.

Turning now to FIGS. **8** and **9**, the other direction of communication is now described. In particular, the reverse direction or reading of signals from the data communications bus **26** is now described. Many of the components are the same as those described above, and, hence, need no further description. The CPU **33** is connected to the memory **34** which now serves as the code look-up memory. The data bus **26** also connects one or more of vehicle sensors **24** such as for security, remote starting or keyless entry, for example, to the remote function controller **25**.

The compatibility to read a code and determine the message or content thereof for a vehicle device from among a plurality of vehicles can be used alone or in combination with the compatibility for writing or generating signals on the bus described above. More particularly, the remote function controller **25** may be for storing a set of device codes for a given vehicle device for a plurality of different vehicles, for reading a device code from the data communications bus **26**, and for determining a match between a read device code and the stored device codes to thereby provide compatibility with a plurality of different vehicles. Such an arrangement provides for a relatively simple and straightforward approach to interface with a vehicle having a data communications bus **26**.

As noted briefly above, the remote function controller **25** may include the code look-up memory **34** for the stored device codes, and a processor or CPU **33** cooperating with the memory for determining the match between the read device code and the stored device codes. The at least one vehicle device may include a plurality of vehicle devices, and, accordingly, the memory **34** of the controller **25** preferably stores a respective set of device codes for each of the plurality of vehicle devices.

Referring now more specifically to FIG. **8**, the look-up table feature of the remote function controller **25** is now described. A common table **80** may be created which contains a column for the vehicle codes in some predefined sequence, such as in a numerical order beginning with a first code, Code 1, and ending with a last code, Code N, as illustrated. The central column in the illustrated embodiment includes the corresponding vehicle identification with the

vehicles extending from a first vehicle, Vehicle A, to a last vehicle, Vehicle Z. The number of codes and vehicles may be selected so that a given remote function controller **25** is useable across an economically large number of vehicles as will be appreciated by those skilled in the art.

The last or rightmost column in the illustrated table **80** is the device data or message corresponding to the associated vehicle and code. These device messages extend from a first message, DM_{1A}, to a last device message, DM_{NZ}. The messages may be of many different types, such as driver door open or closed, hood open or closed, shock sensor triggered, brake pressure indicated, gearshift selector in Park, etc. as will be appreciated by those skilled in the art.

By way of example, the common table **80** includes a blocked row schematically illustrating a match for a Code **572**. This code is for a Ford Taurus and indicates that the driver's door is open. This type of data may be useful in any of the illustrated implementations including vehicle security, remote keyless entry, or remote starting. The CPU **33** would read the code on the data bus **26** and compare the code against the stored codes to determine a match. The CPU **33** is likely to buffer some or all of a code when received to subsequently be compared using the table **80** as will be understood by those skilled in the art. In other embodiments, individual bits or blocks thereof may be compared as they are received.

An alternate embodiment of a common table **80'** is now explained with reference to FIG. **9**. In this case the overall or common table **80'** may be considered parsed or divided into a plurality of vehicle table sections. The first table section is for vehicle A, and the last for vehicle Z in the illustrated embodiment. This embodiment also illustrates the driver door for the Ford Taurus as being matched from the read signal from the data communications bus **26**. What is of interest in this embodiment, is that upon initial set-up or an initial learning period, only the codes for the learned vehicle need then later be compared to the read code. Accordingly, a time savings may be realized.

Those of skill in the art will recognize that the tables **80** and **80'** of FIGS. **8** and **9** are exemplary illustrations from among many possible configurations of look-up tables that may be used in accordance with the present invention. Other configurations are also contemplated by the present invention.

Since it may also be desirable to re-install the remote function controller **25** in another vehicle, the controller may be reset and another vehicle learned or configured during an initial set-up. This concept is generally described as an embodiment of a desired signal enabling function or feature in related parent U.S. patent application Ser. No. 09/382,245 filed Aug. 25, 1999, which in turn, is a continuation of U.S. Pat. No. 6,011,460, which in turn, is a continuation-in-part of U.S. Pat. No. 5,719,551, and the disclosure of each of which are incorporated herein by reference in its entirety.

In those embodiments, where the remote function controller **25** provides multi-vehicle code compatibility for reading signals from the data communications bus **26**, the data bus adaptor cartridge **40** provides compatibility with different vehicle protocols. The protocol may be in terms of one or more of signal level, modulation scheme, or transmission rate, for example. Of course, in other embodiments, this multi-vehicle code reading compatibility could be provided in the data bus adaptor cartridge **40** as will be appreciated by those skilled in the art.

A method aspect of the invention is for permitting a remote function controller **25** comprising control circuitry **31** to operate in a vehicle **21** including a data communications bus **26** connecting a plurality of vehicle devices **21–24**. The method may include coupling a data bus adaptor cartridge connector **30** to the control circuitry **31**, and removably coupling a data bus adaptor cartridge **40** to the data bus adaptor cartridge connector. This may be done to permit communications between the control circuitry and at least one vehicle device over the data communications bus.

Other features relating to vehicle control systems are disclosed in copending patent applications entitled "REMOTE START SYSTEM FOR A VEHICLE HAVING A DATA COMMUNICATIONS BUS AND RELATED METHODS" Ser. No. 09/583,333 and "MULTI-VEHICLE COMPATIBLE CONTROL SYSTEM FOR READING FROM A DATA BUS AND ASSOCIATED METHODS" Ser. No. 09/583,257, the entire disclosures of which are incorporated herein by reference.

Many modifications and other embodiments of the invention will come to the mind of one skilled in the art having the benefit of the teachings presented in the foregoing descriptions and the associated drawings. Accordingly, it is understood that the invention is not to be limited to the illustrated embodiments disclosed, and that other modifications and embodiments are intended to be included within the spirit and scope of the appended claims.

That which is claimed is:

1. A system for a vehicle including a data communications bus connecting a plurality of vehicle devices, the system comprising:

a remote function controller comprising a data bus adaptor cartridge connector, and control circuitry coupled thereto; and

a data bus adaptor cartridge removably coupled to said data bus adaptor cartridge connector for permitting communications between said control circuitry and at least one vehicle device over the data communications bus.

2. A system according to claim **1** wherein said control circuitry further comprises a serial interface, and wherein said data bus adaptor cartridge comprises a serial interface coupled to the serial interface of said control circuitry.

3. A system according to claim **1** wherein said control circuitry further comprises a parallel interface, and wherein said data bus adaptor cartridge comprises a parallel interface coupled to the parallel interface of said control circuitry.

4. A system according to claim **1** wherein said control circuitry generates digital command codes; and wherein said data bus adaptor cartridge converts the digital command codes into data communications bus signals according to a desired protocol.

5. A system according to claim **4** wherein the desired protocol is based upon at least one of a desired signal level, a desired signal modulation scheme, and a desired communication rate.

6. A system according to claim **4** wherein said control circuitry generates at least one set of digital command codes comprising at least one working command signal and at least one non-working command signal for a given vehicle to thereby provide command compatibility with a plurality of different vehicles.

7. A system according to claim **1** wherein said control circuitry reads digital codes; and wherein said data bus adaptor cartridge converts data communications bus signals into digital codes according to a desired protocol for said control circuitry.

8. A system according to claim **7** wherein the desired protocol is based upon at least one of a desired signal level, a desired signal modulation scheme, and a desired communication rate.

9. A system according to claim 7 wherein said control circuitry is for storing a set of device codes for a given vehicle device for a plurality of different vehicles, for reading a device code from the data communications bus, and for determining a match between a read device code and the stored device codes to thereby provide reading compatibility with a plurality of different vehicles.

10. A system according to claim 1 wherein said data bus adaptor cartridge comprises:

a memory; and

a download learning interface for storing in said memory at least one of vehicle device codes and a desired protocol for a given vehicle from a downloading device.

11. A system according to claim 1 wherein said data bus adaptor cartridge comprises a data bus learning circuit for learning at least one of vehicle device codes and a desired protocol for a given vehicle from signals carried on the data bus.

12. A system according to claim 1 wherein said data bus adaptor cartridge includes at least one first electrical conductor; and wherein said data bus adaptor cartridge connector comprises at least one second electrical conductor for engaging said at least one first electrical conductor of said data bus adaptor cartridge.

13. A system according to claim 1 wherein said remote function controller further comprises a circuit board carrying said data bus adaptor cartridge connector and said control circuitry.

14. A system according to claim 1 further comprising at least one remote transmitter for operating said security controller; and wherein said control circuitry comprises a receiver and a processor connected thereto.

15. A system according to claim 1 wherein said remote function controller comprises at least one of a security controller, a remote keyless entry controller, and a remote start controller.

16. A system for a vehicle including a data communications bus connecting a plurality of vehicle devices, the system comprising:

a remote function controller comprising circuit board, a data bus adaptor cartridge connector carried by said circuit board, and control circuitry carried by said circuit board and coupled to said data bus adaptor cartridge connector, said control circuitry comprising a serial interface; and

a data bus adaptor cartridge removably coupled to said data bus adaptor cartridge connector for permitting communications between said control circuitry and at least one vehicle device over the data communications bus, said data bus adaptor cartridge comprising a serial interface for communication with said serial interface of said controller.

17. A system according to claim 16 wherein said control circuitry generates digital command codes; and wherein said data bus adaptor cartridge converts the digital command codes into data communications bus signals according to a desired protocol.

18. A system according to claim 17 wherein the desired protocol is based upon at least one of a desired signal level, a desired signal modulation scheme, and a desired communication rate.

19. A system according to claim 17 wherein said control circuitry generates at least one set of digital command codes comprising at least one working command signal and at least one non-working command signal for a given vehicle to thereby provide command compatibility with a plurality of different vehicles.

20. A system according to claim 16 wherein said control circuitry reads digital codes; and wherein said data bus adaptor cartridge converts data communications bus signals into digital codes according to a desired protocol for said control circuitry.

21. A system according to claim 20 wherein the desired protocol is based upon at least one of a desired signal level, a desired signal modulation scheme, and a desired communication rate.

22. A system according to claim 20 wherein said control circuitry is for storing a set of device codes for a given vehicle device for a plurality of different vehicles, for reading a device code from the data communications bus, and for determining a match between a read device code and the stored device codes to thereby provide reading compatibility with a plurality of different vehicles.

23. A system according to claim 16 wherein said data bus adaptor cartridge comprises:

a memory; and

a download learning interface for storing in said memory at least one of vehicle device codes and a desired protocol for a given vehicle from a downloading device.

24. A system according to claim 16 wherein said data bus adaptor cartridge comprises a data bus learning circuit for learning at least one of vehicle device codes and a desired protocol for a given vehicle from signals carried on the data bus.

25. A system according to claim 16 further comprising at least one remote transmitter for operating said control circuitry; and wherein said control circuitry comprises a receiver and a processor connected thereto.

26. A system according to claim 16 wherein said remote function controller comprises at least one of a security controller, a remote keyless entry controller, and a remote start controller.

27. A system for a vehicle including a data communications bus connecting a plurality of vehicle devices, the system comprising:

a remote function controller comprising a data bus adaptor cartridge connector and control circuitry coupled thereto; and

a data bus adaptor cartridge removably coupled to said data bus adaptor cartridge connector for permitting communications between said control circuitry and at least one vehicle device over the data communications bus, said data bus adaptor cartridge comprising

a memory, and

download learning means for storing in said memory at least one of vehicle device codes and a desired protocol for a given vehicle from a downloading device.

28. A system according to claim 27 wherein said data bus adaptor cartridge includes at least one first electrical conductor; and wherein said data bus adaptor cartridge connector comprises at least one second electrical conductor for engaging said at least one first electrical conductor of said data bus adaptor cartridge.

29. A system according to claim 27 further comprising at least one remote transmitter for operating said control circuitry; and wherein said control circuitry comprises a receiver and a processor connected thereto.

30. A system according to claim 27 wherein said remote function controller comprises at least one of a security controller, a remote keyless entry controller, and a remote start controller.

31. A system for a vehicle including a data communications bus connecting a plurality of vehicle devices, the system comprising:

a remote function controller comprising a data bus adaptor device connector, and control circuitry coupled thereto; and

a data bus adaptor device removably coupled to said data bus adaptor device connector for permitting communications between said control circuitry and at least one vehicle device over the data communications bus.

32. A system according to claim **31** wherein said data bus adaptor device comprises a cartridge including a housing and circuitry contained therein.

33. A system according to claim **31** wherein said data bus adaptor device comprises at least one integrated circuit.

34. A system according to claim **33** wherein said data bus adaptor device connector comprises at least one integrated circuit socket.

35. A method for permitting a remote function controller comprising control circuitry to operate in a vehicle including a data communications bus connecting a plurality of vehicle devices, the method comprising:

coupling a data bus adaptor cartridge connector to the control circuitry; and

removably coupling a data bus adaptor cartridge to the data bus adaptor cartridge connector for permitting communications between the control circuitry and at least one vehicle device over the data communications bus.

36. A method according to claim **35** wherein the control circuitry further comprises a serial interface, and wherein the data bus adaptor cartridge comprises a serial interface for coupling to the serial interface of the control circuitry.

37. A method according to claim **35** wherein the control circuitry further comprises a parallel interface, and wherein the data bus adaptor cartridge comprises a parallel interface for coupling to the parallel interface of the control circuitry.

38. A method according to claim **35** wherein the control circuitry generates digital command codes; and wherein the data bus adaptor cartridge converts the digital command codes into data communications bus signals according to a desired protocol.

39. A method according to claim **38** wherein the desired protocol is based upon at least one of a desired signal level, a desired signal modulation scheme, and a desired communication rate.

40. A method according to claim **35** wherein the control circuitry reads digital codes; and wherein the data bus adaptor cartridge converts data communications bus signals into digital codes according to a desired protocol for the control circuitry.

41. A method according to claim **40** wherein the desired protocol is based upon at least one of a desired signal level, a desired signal modulation scheme, and a desired communication rate.

42. A method according to claim **35** wherein the remote function controller comprises at least one of a security controller, a remote keyless entry controller, and a remote start controller.

43. A method for permitting a remote function controller comprising control circuitry to operate in a vehicle including a data communications bus connecting a plurality of vehicle devices, the method comprising:

coupling a data bus adaptor device to the control circuitry; and

removably coupling a data bus adaptor device to the data bus adaptor device connector for permitting communications between the control circuitry and at least one vehicle device over the data communications bus.

44. A method according to claim **43** wherein the data bus adaptor device comprises a cartridge including a housing and circuitry contained therein.

45. A method according to claim **43** wherein the data bus adaptor device comprises at least one integrated circuit.

46. A method according to claim **45** wherein the data bus adaptor device connector comprises at least one integrated circuit socket.

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