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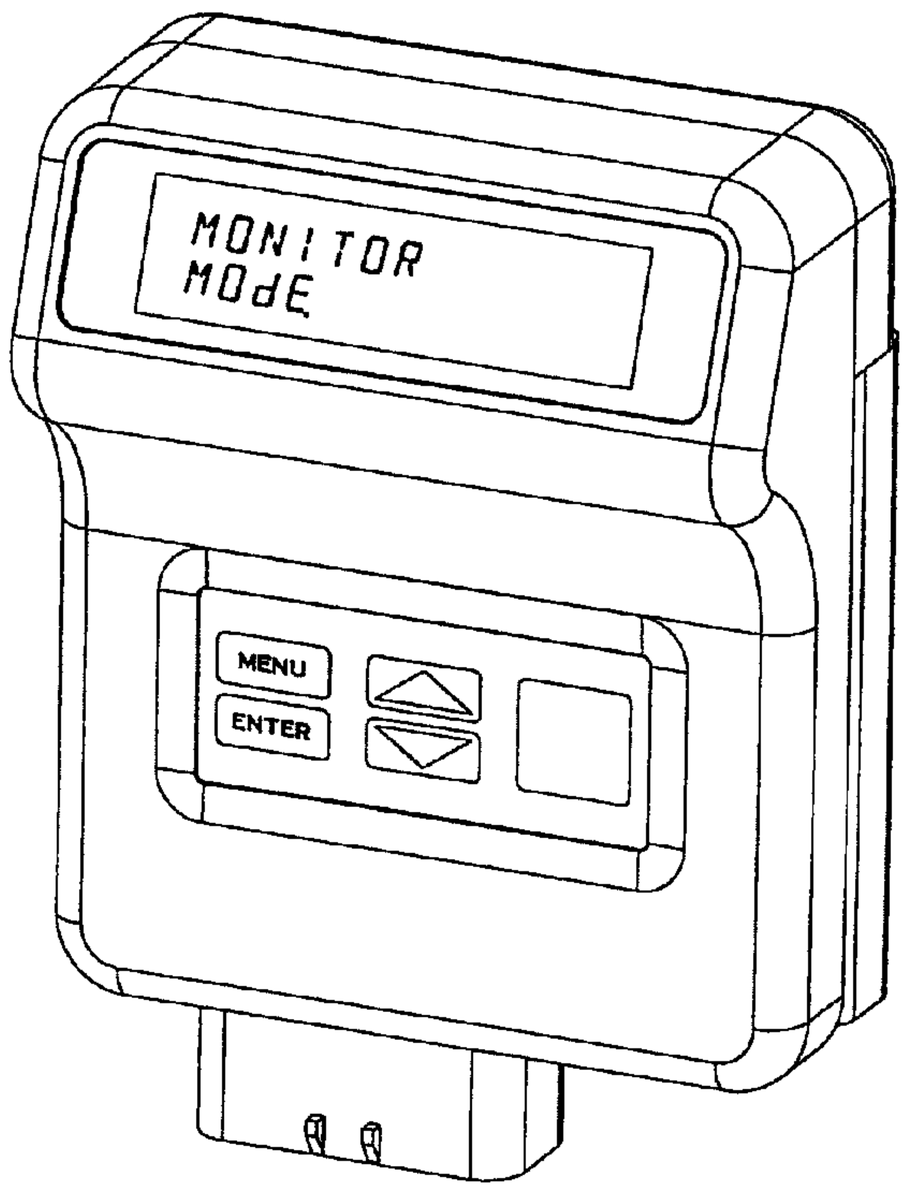
(54) Title: VEHICLE SPEED MONITORING SYSTEM II



(57) Abrégé/Abstract:
An apparatus is disclosed for monitoring vehicle speed and detecting episodes of vehicle speed in excess of predetermined speed thresholds and recording those episodes to a non-volatile memory system. The apparatus includes a first subsystem for mounting onto a vehicle to monitor and record vehicle speed related information. Second and third subsystems, intended for law enforcement or government appointed depots, are provided and are a manual handheld communication device and/or an automated radio frequency system for auditing the stored violations information recorded by the first subsystem.

ABSTRACT

An apparatus is disclosed for monitoring vehicle speed and detecting episodes of vehicle speed in excess of predetermined speed thresholds and recording those episodes to a non-volatile memory system. The apparatus includes a first subsystem for mounting onto a vehicle to monitor and record vehicle speed related information. Second and third subsystems, intended for law enforcement or government appointed depots, are provided and are a manual handheld communication device and/or an automated radio frequency system for auditing the stored violations information recorded by the first subsystem.

VEHICLE SPEED MONITORING SYSTEM II

The present invention relates to the field of vehicle speed monitoring. In particular, the present invention provides a system for continuously monitoring vehicle speed, and detecting violations of legal speed limits. The present invention also provides means for law enforcement personnel to access data from vehicles.

Currently, traffic law enforcement in most jurisdictions is a daunting task. There are simply too many vehicles on the road for a reasonably sized police force to monitor by direct observation. In the absence of strict monitoring of vehicular speed, there is a tendency for drivers to exceed legal speed limits. This is especially true for drivers of commercial vehicles, since the financial return in respect of a commercial vehicle such as a truck or bus will be directly dependent on the speed with which a driver can use it to perform tasks.

Vehicle speed monitoring by police forces has up to now been accomplished by direct observation of vehicles. This can be accomplished by radar scanning of the vehicle in motion, by timing the vehicle from point to point, or by tracking the vehicle in a second vehicle of known speed. There are also systems in some jurisdictions to alert police to fast moving vehicles. For instance, it is known to mount warning lamps on trucks, to light up when the vehicle is speeding. However, this only assists in the direct observation method of enforcement of speeding laws, since a law enforcement officer must actually observe the warning lamp, and then measure the speed of the vehicle.

The object of the present invention is to provide a complete closed loop system. This includes the in-vehicle speed monitoring system accompanied by peripheral network systems. The systems are for use by law enforcement personnel or government appointed depots. Violation data from individual vehicles are automatically uploaded to nationally distributed audit stations via radio frequency transmissions.

The system of the present invention also includes appropriate electronic and mechanical sensing and support devices, as will be discussed in following detail.

In a broad aspect, then, the present invention relates to an apparatus for monitoring vehicle speed and detecting episodes of vehicle speed in excess of a predetermined speed thresholds and recording those episodes to a non-volatile memory system. The apparatus includes: a first subsystem for mounting onto a vehicle to monitor and record vehicle speed related information. The second and third subsystems are intended for law enforcement or government appointed depots and are a manual handheld communication device and/or an automated radio frequency system for auditing the stored violations information recorded by said first subsystem.

Description

The vehicle speed monitoring system (VSM-II) of the present invention consists of three subsystems, the in-vehicle subsystem, the manual handheld communication device and support system and the automated peripheral network systems.

The in-vehicle subsystem consists of a main multifunction and display module, sensors, a GPS receiver, radio transceiver and interface devices, all interconnected by a custom prefabricated wire harness. The in-vehicle system is preferably installed into every commercial duty and/or official heavy vehicle.

The manual handheld communication device and support system allows for the review and auditing of the in-vehicle systems. This includes support equipment that allows for the routine maintenance of the in-vehicle system such as manual downloading of data, system checks and set up requirements. This also includes devices that support the collation of the distributed data to a central database within a particular jurisdiction or state.

The peripheral network support system is a bi-directional vehicle to land based communications system that allows for the automatic receipt and auditing of the in-vehicle systems via radio frequency transmissions. This includes support equipment that allows for the routine maintenance of the in-vehicle system such as automatic downloading of data, system checks. This also includes devices that support the collation of the distributed data to a central database within a particular jurisdiction or state.

Operating Description,

1. The vehicle is fitted with the system and initialised, consisting of a Central Multifunction Module (CMM) containing a integrated liquid crystal display module (LCD), and two accelerometers placed to the "X" and "Y" position relative to direction of travel, and a audible transducer and light emitting diode (LED) indicator, and a integrated global positioning receiver (GPS receiver) and a ignition disruption relay of which is installed in the drivers' area, along with the interconnecting harness and RF antennae and speed sensor and the radio frequency transceiver that are wired and installed into the vehicle.

2. During normal use of the vehicle, the speed sensor, (if required, since some vehicles may already be outfitted with varying types of speed sensor type technology, which may be usable with the CMM. Other vehicles may have capabilities of supplying a signal derived from and by an onboard Engine Controle Module (ECM) and can be connected through to the CMM), is constantly providing a signal representative of speed of the vehicle and the GPS is receiving data from the NAVSTAR satellites and is processed by the CMM and is continuously computing the position and speed of the vehicle

and direction. The CMM relies on stimuli from both the speed sensor and GPS peripherals for the purposes of deriving speed but does not require both for the purposes of establishing and episode of speeding.

3. When the CMM calculates that the vehicle has exceeded a pre-set speed limit, the speed data, the current date and time, and position of the vehicle is stored in non-volatile memory as a "Violation Data Record". This process then repeats at pre-set intervals if the vehicle maintains its overspeeding status.

4. At recurring time intervals, the stored Violation Data Records (if any) are placed in a queue and sent to receiving stations, peripheral network station(s), (PNS) via the on-board radio frequency transceiver. Only new and not previously sent records are transmitted. During the communication session, other data can be obtained and/or sent as event data pertaining to the status of the installation and tamper and/or diagnostic fault problems can also be transmitted to the receiving station. All data and files are then processed by the receiving station and distributed for internal processing accordingly.

Or

4. When the number of accumulated "Violation Data Records", exceed a certain number, internal instructions to contact the (PNS), is initiated. The station is then sent the accumulated Violation Data Records, the temporary memory of the CMM is cleared and the communication event is closed. During the communications event data pertaining to the status of the installation and tamper and/or diagnostic fault problems also can be transmitted to the station.

5. The Violation Data records accumulated by the PNS are processed and sent to a central data collection base at the Ministry of Transportation or the Highway and Traffic Authority. There, applicable summons are generated and sent out, with the data directly added to the driver's records.

In drawings that illustrate parts, components and embodiments of the present invention:
Figure 1 is a perspective of a Central Multifunction Module, CMM;
Figure 2 is a perspective/schematic of Custom Wire Harness;
Figure 3 is a perspective of RF Transceiver Assembly and Antenna;
Figure 4 is a perspective of a Manual Remote Data Logger;
Figure 5 is a perspective of a RDL charge bay and communication interface port;
Figure 6 is a schematic of a typical example of the Peripheral Network Support system;
Figure 7 is a block diagram of the CMM;
Figure 8 is a block diagram of the RDL;
Figure 9 is a block diagram of the RDL support charge bay and communication interface;

Figure 10 is a block diagram of the CMI;
Figure 11 is a perspective/schematic of the CMM, Harness/Transceiver installation.

In-vehicle Subsystem,

The in-vehicle system of the present invention may be broken down into several parts, the central multifunction module, various sensors, the global positioning receiver, wire harnesses, radio frequency transceiver and various mounting and securing hardware components.

The Central Multifunction Module, (CMM details)

The CMM is based on a VLSI micro-controller circuit that contains the CMM system software. The micro-controller is of a "Flash Upgradeable" type and allows for routine program replacement and/or revisions. The CMM includes to the main assembly a LCD graphical visual indicator, audio alert transducer, visual LED indicator, power supply regulation and protection system, and real time clock (RTC) with back up battery, a non-volatile memory array and a infra-red transceiver system and two accelerometers and GPS receiver and ignition relay and system connectors.

A locking header connector is soldered and connected to the main board and when coupled with the wire harness allows electrical connection to the rest of the VSM-II in-vehicle system. The CMM includes a two pin connector that allows for the connection of an optional visual warning lamp as described as the forward facing beacon lamp.

The entire assembly is housed in an integrated plastic housing, various switches or buttons or user keypad switches etc., are placed to the designated location on the exterior of the housing and connected through to the internal circuit. The assembly has been designed to allow for placement into tight and restricting areas; however it is highly recommended the unit be mounted to the vertical surface of the instrument panel, and that, the front surface or face of the unit is to be placed in clear view of the driver.

The CMM is equipped with a user membrane switch array consisting of four labelled switch positions affixed to the face or first surface of the CMM assembly housing directly below the LCD area. The user switches have been provided as a user/owner aid tool allowing the accessibility of system information and on board diagnostics. By use of the switches and the following of user procedures of calling up of certain type information suffices as a useful diagnostic system aid interface.

The CMM is the visual and audio output device and data collection unit of the in-vehicle system as well as the main processing control centre. It allows for easy indication and viewing by the driver. The CMM

will, by means of the visual graphical and text based displays, indicate to the driver /operator his current speed violation status as well as other optional information such as directional information etc. The feature of direction is currently available from various GPS tracking systems in accepted known formats.

The audible alarm transducer is an integrated part of the assembly, which allows for unhindered sound dispersion when active. The volume of the alarm may be adjusted via the user keypad and menu selected item to accommodate passenger service in the case of buses running at night.

The CMM receives pulses from the speed sensor or vehicle ECM through connectivity of the wire harness and data from the GPS receiver. Embedded software analyses these pulses and signals and compares all of these continuously updated signals to preset internal values. From these computations, the controller decides if an over-speeding condition exists. If the state is over-speed, then the data and conditions, i.e., date, time (GMT) or (RTC) derived time stamp, speed, and position (LAT/LON) details etc., are written to integral non-volatile memory and an alarm triggered through the means of the display and audio alarms and LED visual pulsing are initiated by the system. If the vehicle is stationary and tampering is detected then the conditions: date, time, tamper code type, etc. are written to the integral non-volatile memory as a "Tamper Record". Selection and/or modification of appropriate software is considered a matter of choice for one skilled in the art. The software used by the applicant in an operational embodiment of the present invention is proprietary to Ardtech Technologies Inc.

The ignition relay is in place to open the starter circuit of the vehicle when installed and wired. The relay as mentioned is an integrated component of the CMM printed circuit board assembly. The purpose of the ignition relay is as follows: when a pre-set number of violations are attained unreported, the relay is energized open, inhibiting the starter circuit, in a preferred embodiment. The immobilized vehicle requires intervention by way of either the remote PNS via the RF communication system or that of a authority individual equipped with a manual handheld communication system named the Remote Data Logger, RDL, (later described).

At routine intervals a signal may be received via the RF transceiver (dependant on state of vehicle, i.e.: vehicle is running or not), requesting the CMM go online and exchange encrypted and compressed data format of the currently stored violations (if any) and or system problems with the peripheral network station(s). At specific intervals only when the vehicle is running the system will elect to establish a communication session with the peripheral network station(s), all relevant data contained to the CMM will be transmitted in an encrypted and compressed data format to the network station(s).

Manual downloading of the data is available through manual communication support equipment. The manual handheld communication system is known as the Remote Data Logger, RDL, (later described).

The Speed Sensor

The speed sensor detects the rotation of the drive shaft and converts these signals into electrical pulses. There is a wire and connector from either of the sinusoidal or digital pulse variations that is connected to the main harness. Optionally, this sensor can be deleted and the speed signal derived and processed from the OEM speedometer signals derived from the vehicles' electronic control module (ECM) where applicable.

The Global Positioning System Receiver and Antenna

The GPS receiver module receives position data on a constant basis while the vehicle is running. The GPS receiver is incorporated to the CMM assembly. The data is directly ported to the CMM micro-controller on demand. The GPS receiver antenna is mounted atop the vehicle roof for optimum performance. Power and signal connection to the antenna from the GPS receiver is via the main prefabricated wire harness.

The GPS receiver and antenna system are commercially available purchased application specific assemblies and may be patented to the respective companies under one or more patents and may be available from numerous suppliers. The receiver is capable at looking at several NAVSTAR satellites for good signal lock and position data. It is not a differential GPS unit, as the present application does not require a level of accuracy greater then one hundred meters. With Selective Availability, the signals have a stated accuracy of plus or minus 100 meters 95% of the time. The accuracy will automatically increase when the level of SA is turned to zero within the next nine years.

The GPS receiver is based on a multi channel capable chipsets, as an example, whilst only three channels are required for location determination, these receiver chipsets track upwards of twelve satellites, thus they make three more location determinations and then combine the four points for a more precise location determination if a twelve channel receiver were used. The minimum number of channels is eight for purposes of accuracy.

The RF Transceiver

The RF Transceiver is a sub-assembly module contained to its' own housing consisting of the necessary power supply and protection circuits and various RF and signal connectors. The system is connected through to the CMM via a custom wire harness assembly. The RF Transceiver is capable of receiving polling signals and porting the signal through to the CMM, the CMM is capable of initiating a communication session via the RF Transceiver on demand. When the CMM receives an audit instruction

it will output the information to the system in a secure data format and vice versa through the transceiver through to the PNS. The system can also be set to automatically upload the data when a number of violation records and/or tamper records reach a certain number.

Two Direction (X & Y) Accelerometers and the Waterfall Memory System,

Both "X" and "Y" direction relative to the direction of travel, are continuously monitored by the CMM. The purpose of the accelerometers is to detect large "G" force excursions, which are indicative of collisions or some other destructive mishap. The data output by the accelerometers is analysed by the CMM and is stored in non-volatile memory (NVM) for later retrieval. In a practical sense, in the event of a detected collision details of the events for the prior ten seconds are recorded to non-volatile memory allowing the possible reassembly of the data and reconstruction. The number of sensors and/or connections to the vehicle in addition to the accelerometers and GPS data are what are contained to the final ten seconds of waterfall memory.

The Waterfall Memory System is a continuously updated data length record stored to a non-volatile memory array and is duplicated for full redundancy. The data collection is based on a continuous rotating format known as a first in first out principal, (FIFO). Details of how the algorithms operate are specific to the respective documents and details contained to the copyrighted software of Ardtech Technologies Inc. Other memory systems may be employed, as will be clear to one skilled in the art.

The Main Harness

The main harness and its various extensions connect electrically the main CMM to sensors, the RF transceiver and GPS antennae, various vehicle wiring points and output devices. The CMM provides the needed power to all of the VSM-II in-vehicle attachments.

Various Hardware Components

The in-vehicle systems will be installed with various hardware components, screws, bolts, etc. Key components, such as the speed sensor and specific connector junctions of the wire harness, preferably have additional numbered security tags wired around the installed units to discourage unauthorised removal or tampering. Each tag may be branded with a unique serial number via a application crimping tool that imprints the installer's assigned identification number. Thus the security devices can be tracked and traced to the location and day of installation, along with the installer.

Automated Support, Peripheral Network Systems, Data Collection and Processing,

Sequential Polling Audit

The network system of the present invention is a system based on radio frequency transceiver stations evenly distributed within the jurisdiction of the enforcing mechanism. Each station contains the equipment, hardware and software necessary to broadcast the polling and audit signals to each vehicle on a rotational basis if necessary. The distributed stations are connected to a central base that will take the accumulated data and store it to a central database for later post processing collation and distribution.

When polling is initiated by the PNS, the polling signals are automatically generated in a next number sequence type algorithm. The sequential queue of ID numbers one unique number per vehicle registration is assigned at time of initialisation and commissioning of the in vehicle system. The system communicates with the particular vehicle to obtain the particulars if any and sequentially moves to the next available number in sequence or other. If no communication is established with a particular vehicle it is thought to be not operating or is out of range, details of which of failed communication attempt is stored for later reassessment, after which the next number is selected and polled accordingly.

The data received from each vehicle is processed and sent to the central database. Part of the data processing involves automatically generating traffic violation summons and issuing the same.

Automatic Vehicle Self Audit

The PNS of the present invention is a system of radio frequency transceiver stations evenly distributed within the jurisdiction of the enforcing mechanism. Each station contains the equipment, hardware and software necessary to receive and transmit signals bi-directionally to and from each vehicle. The collected data from the vehicles is processed and sent to the central database. Part of the data processing involves automatically generating traffic violation summons and issuing the same.

The self-audit signals are automatically generated from each vehicle. The communication session is initiated by the CMM when the accumulated number of violations, exceed a set number. If a communication session can not be established and the number of stored violations exceed the permissible number then the ignition relay will be energized by the CMM preventing the vehicle from starting until such time a communication session can be established and the violation data is successfully received by peripheral network stations after which the relay is de-energized and the vehicle is permitted to start. The data received from each vehicle is processed and sent to the central database.

Part of the data processing involves automatically generating traffic violation summons and issuing the same.

Communication, Peripheral Network System Capabilities

The peripheral network communications to each vehicle will include data streams that will contain the base function of over-speeding details and position and vehicle identification (ID) statistics and details but may also be used to diagnose the system for any malfunctions and/or tampers. This will also allow the updating of the operating system (OS) software and settings if necessary.

The radio frequency transceiver equipment is capable of being composed of several type radio frequency technologies, one example is that of a low earth orbit (LEO) satellite system others are and/or a GSM or AMP or Digital Cellular based system and respective supporting land based equipment that allow two-way communications to each vehicle. The selected RF communication equipment will be dependant on local restrictions and/or support capabilities of the various systems.

In addition to the base functionality there is a potential to offer the user/owner by means of a support service bureau or a back office infra structure network some optional value added features as well as the base over speeding function and collision reconstruction and running diagnostics of the vehicle. An example of these features may be directions to a destination via charting capabilities, cargo tracking, voice communication with the driver, etc. The possibilities will be obvious to those familiar with the intelligent transportation systems (ITS) industries. Fleet operators can determine online the status of a vehicle by either through a direct modem connection or the Internet to the central database network.

The Handheld Support Apparatus, (Manual Equipment)

The Remote Data Logger

Manual downloading of information from the in-vehicle system is accomplished via a handheld remote data logger unit, (RDL). The violation data can be copied from the CMM non-volatile memory array into the hand held unit via the integrated infra-red transceiver. The handheld unit also has the capability to rewrite the flash memory of the CMM with updated feature enabled software. This also allows the updating of software through extended operation support capabilities and settings if necessary.

The RDL is a manual device and is used primarily by those authorized individuals, i.e.: police officers and/or government authorized personnel. The RDL is a compact portable unit that contains the

necessary hardware and software compatible with that of the system described as the in vehicle CMM system.

The RDL is powered by a rechargeable battery cell array that periodically requires conditioning and recharging by a charge system. The charge system is contained to the mating docking bay charge system the RDL is placed to on a routine basis when not in use.

Data collected by the RDL is contained to the within the non-volatile memory array and contains all records for each of the individual communication sessions undertaken by the user. These data records are further transferred to the host support system via the RDL docking charge bay system which is connected through by means of a serial peripheral communication port to a standard personal desktop computer installed with custom application software. The data files are further post processed and transferred to the central database via conventional phone line modem and support hardware and software.

Calibration Systems (Optional)

The in-vehicle system is calibrated to the true road speed of the vehicle via data from the GPS system. This system has the virtue of not needing a dedicated calibration procedure performed. The system can also be set during installation by tailoring the CMM to accept the speedometer pulses supplied by the vehicle manufacturer to the speedometer instrument.

If a manual calibration is preferred, this will be accomplished with the use of a calibration system. These systems can be either a stationary dynamometer system or a portable calibration system both means require the inter-connection of the calibrator interface unit.

There may be one of two types of calibration systems. The stationary system is based on a rolling drum type of dynamometer and the second system is based on a type of non-contact microwave sensor that senses the distance travelled by the vehicle over the ground. Both systems output a set number of pulses per unit of distance travelled. Thus, the faster the vehicle travels the greater number of pulses. The pulse data output signal is connected to the calibration interface unit and is processed accordingly. Other types of dynamic and static calibration will be obvious to those skilled in the art.

The Calibration Module Interface (CMI)

The CMI is a simplified interface device that interfaces the in-vehicle system to the calibration system during a manual calibration. It is connected to the calibration dynamometer through a wire harness and

to the CMM via infrared communication signals. The pulse signal received from the dynamometer system, either being stationary or portable is compared to pre-set programmed values accordingly. When the vehicle has achieved the set calibration velocity, the calibration interface unit outputs a signal to the CMM. At that instance, the CMM stores into its non-volatile memory as configuration and parameter data.

Visual and audio alarms in the calibrator indicate to the calibration technician the status of the calibrator and VSM-II. The calibrator is equipped with a talk-through adapter that allows monitoring of the calibration activity through a laptop computer.

The In-Vehicle System, (Variations),

The Speed Sensor, (Active Sensor)

Vehicles that are not equipped with electronically driven speedometers, or that cannot be adapted to because of non-standard signal formats, are necessary to be equipped with speed sensor of type.

The speed sensor is a transducer that is installed between the transmission drive pinion gear and the speedometer cable of the vehicle. Various sensor types are accommodated, sinusoidal or square wave output. The connected transducer has a built in rotary encoder that outputs a set frequency or pulses per revolution and allows for direct passthrough mechanical connection of the speedometer cable. Since the revolution of the drive pinion shaft is directly coupled to the drive shaft of the vehicle, the output of the sensor is directly proportional to the ground speed of the vehicle. The sensor does not have any ratio adapters built in, it is straight through, and thus the speedometer performance remains unchanged. The sensors have wires that are terminated in a weatherproof connector accordingly. Depending upon the sensor's signal output and power requirements, the terminated wires are installed into appropriate connector positions allowing simple connection in the field of the common wire harness assembly.

The connector locks into its corresponding mating connector on the speed sensor extension harness and forms a water, grease, and dust proof connection.

The speed sensor is installed at the pinion drive gear of the transmission of the vehicle. Various adapter drive tips, as will be a matter of choice to one skilled in the art, allow the sensor to be driven by a variety of different transmission drive configurations.

A select number of vehicle configurations do not allow the installation of the speed sensor directly to the transmission speedometer drive output. This may be because the drive configuration is too specialised and generic adapters are not available, or the speedometer method of attachment is not the same as

standard heavy vehicle convention. There may also not be enough physical room to install the sensor its supplied configuration. These cases require special procedures and adapter hardware in order to install a speed sensor to the vehicle.

The sensor is mounted and a security tag is placed around points of the sensor, which makes removal the sensor apparent.

Speed Sensor Extension Harness

The speed sensor extension harness electrically connects the speed sensor to the central harness. It is a fabricated four-conductor wire harness assembly consisting of 18AWG stranded tinned copper wire, cut to a specified length. The wire is rated for harsh environment and has a temperature rating of -20°C to +105°C accordingly.

Usually the speed sensor port is located near the back of the transmission; the harness extension must reach from the under dash location of the CMM unit back down the undercarriage of the vehicle to the rear transmission area, (for most passenger buses).

Visible Warning Lamp, (Forward Facing Beacon Lamp, Optional)

The optional visible warning lamp is made of a high power pre-focused array of light emitting diodes and/or incandescent lamp positioned in the focal point of a parabolic reflector. The assembly is housed inside weatherproof housing assembly and is equipped with a amber coloured lens. The luminance power of the array and/or lamp is such that when projected through the lens, it is highly visible when viewed on-axis in noon sunlight. The intensity however is not high enough to make the light blinding or highly distracting when viewed at night or in a dark environment.

There is a day/night ambient light detector built into the CMM, which regulates the level of brightness per detected ambient light.

The optional visible warning lamp is outfitted with a custom wire harness assembly and connector. The connector is connected to the option lamp port located to the base of the CMM unit. The mounting of the unit is to the exterior cab roof. The GPS and transceiver antennae can be made integral to the case housing or top of the light, thus decreasing the number of appliances that must be affixed to the cab top. Appropriate mounting hardware is provided.

The extension leads from the CMM pass under the instrument panel and up the "A" pillar, and across to the connection port of the visual warning lamp. Both ends of the wire harness assembly are fitted with moulded over strain relief bushings. The base of the lamp is fixed to the cab top with mechanical fasteners, and is weather sealed with a compressible gasket.

Optional features.

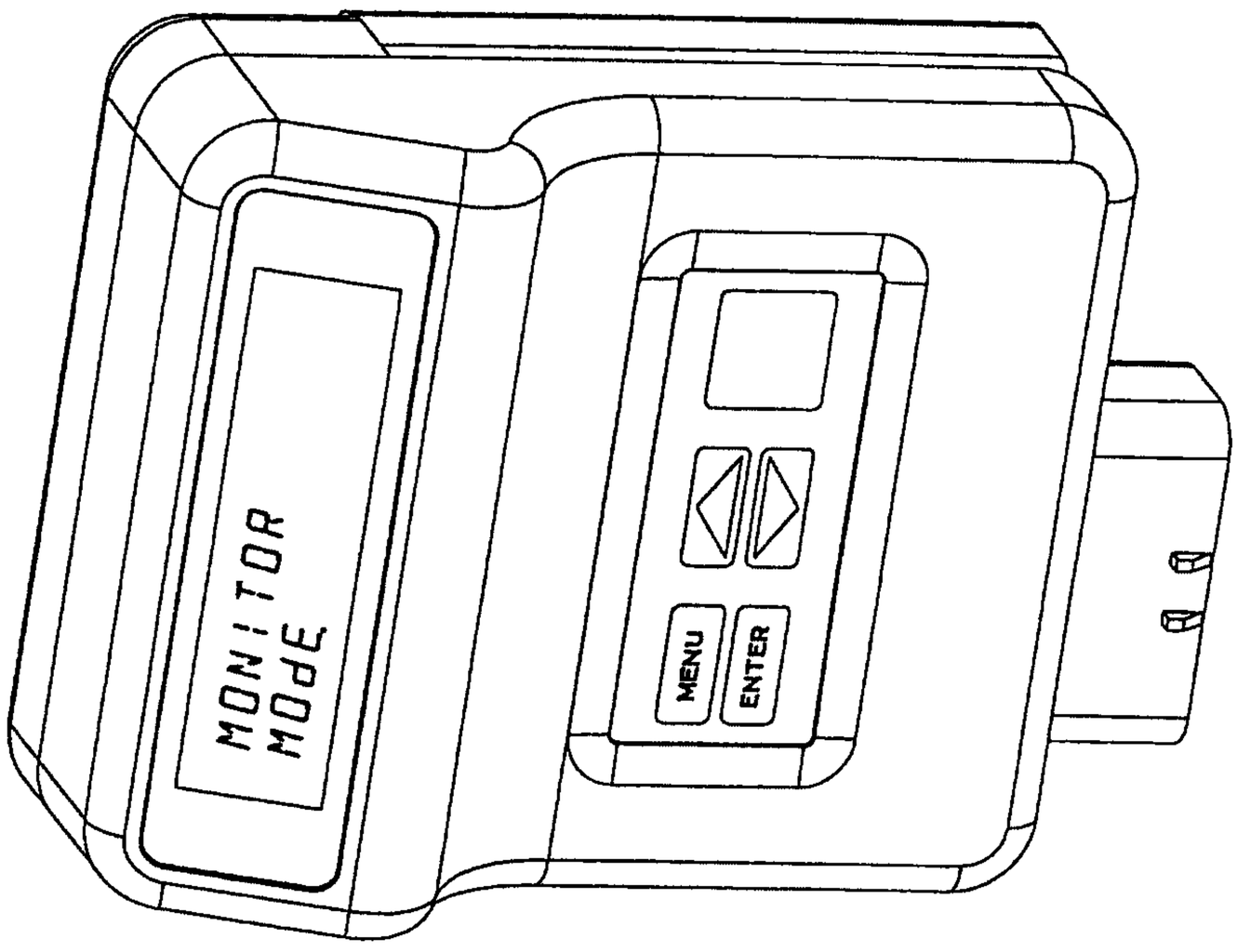
Obviously, the combination of location, speed, and two-way radio communication allows a plethora of value add features to be incorporated into the core device to augment its potential marketability. These features may be added will little or a medium amount of additional software and auxiliary equipment. For instance, the addition of a Micropower Impulse Radar module to the front of the vehicle can be used to detect impending accidents, and immediately instruct the CMM to record a continuous stream of data for accident insurance purposes in addition to the onboard accelerometers.

Another example is that of a load sensing system installed to attached trailers of which are connected through to the utility bus of the CMM trough the wire harness. The addition of the system allows for data collection of dynamic loading on vehicle and which the relevant data can be forwarded via the bi-directional communication support system to the appropriate authority or vehicle owner.

THE EMBODIMENTS OF THE INVENTION IN WHICH AN EXCLUSIVE PROPERTY OR PRIVILEGE IS CLAIMED ARE DEFINED AS FOLLOWS:

1. An apparatus for monitoring vehicle speed and detecting episodes of vehicle speed in excess of predetermined speed thresholds and recording those episodes to a non-volatile memory system, including a first subsystem for mounting onto a vehicle to monitor and record vehicle speed related information, second, and third subsystems, intended for law enforcement or government appointed depots comprising a manual handheld communication device and/or an automated radio frequency system for auditing the stored violations information recorded by said first subsystem.

FIG. 1



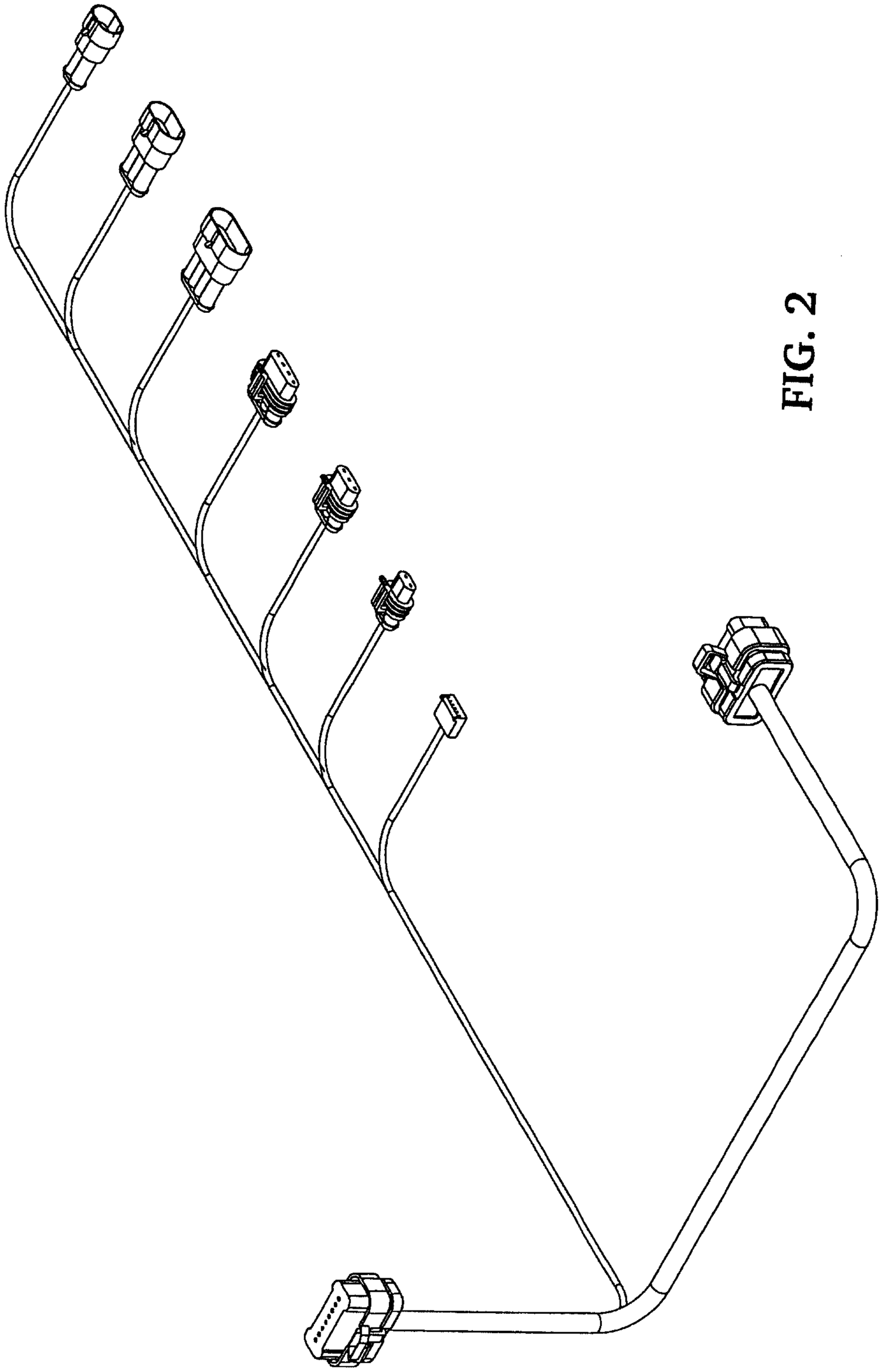


FIG. 2

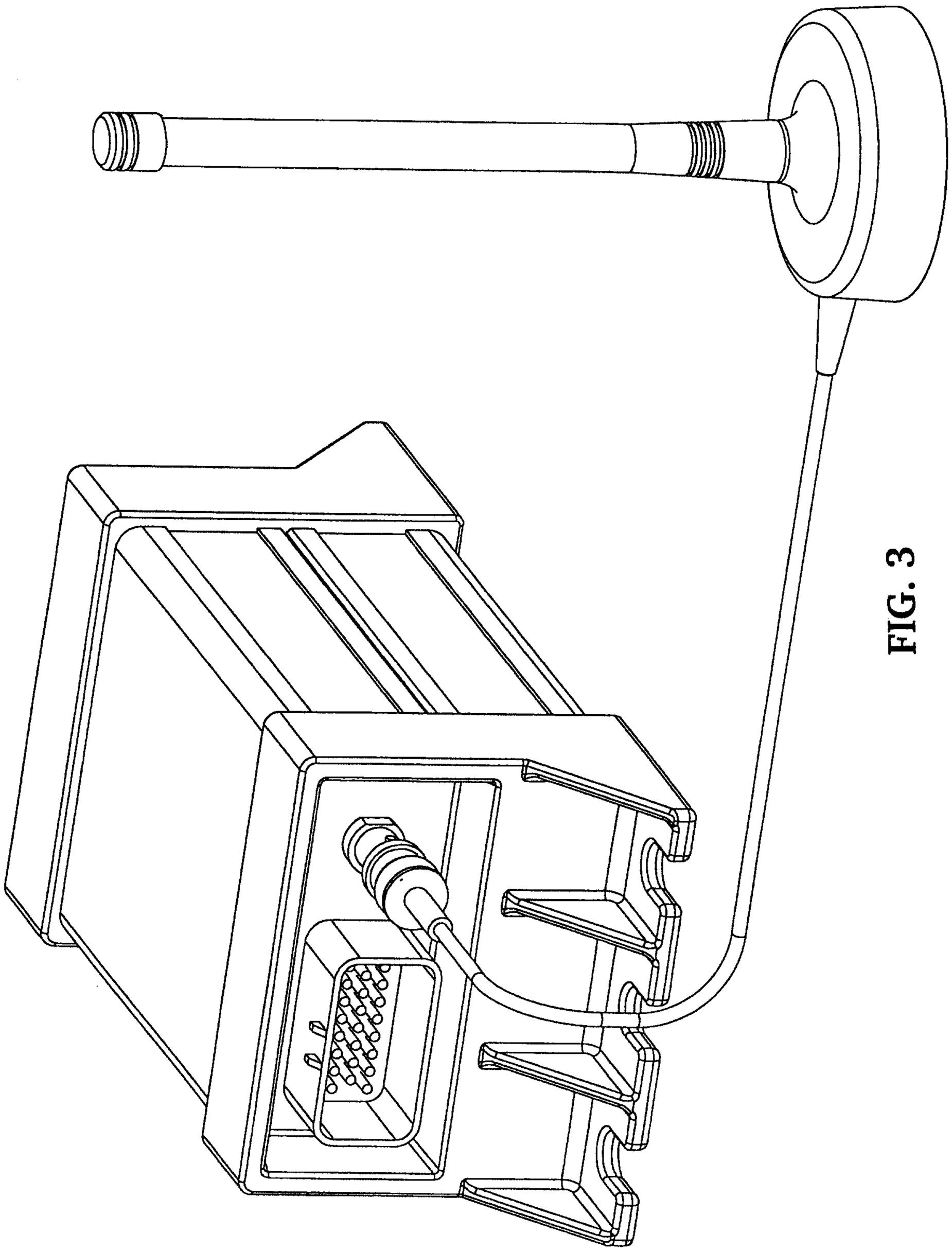


FIG. 3

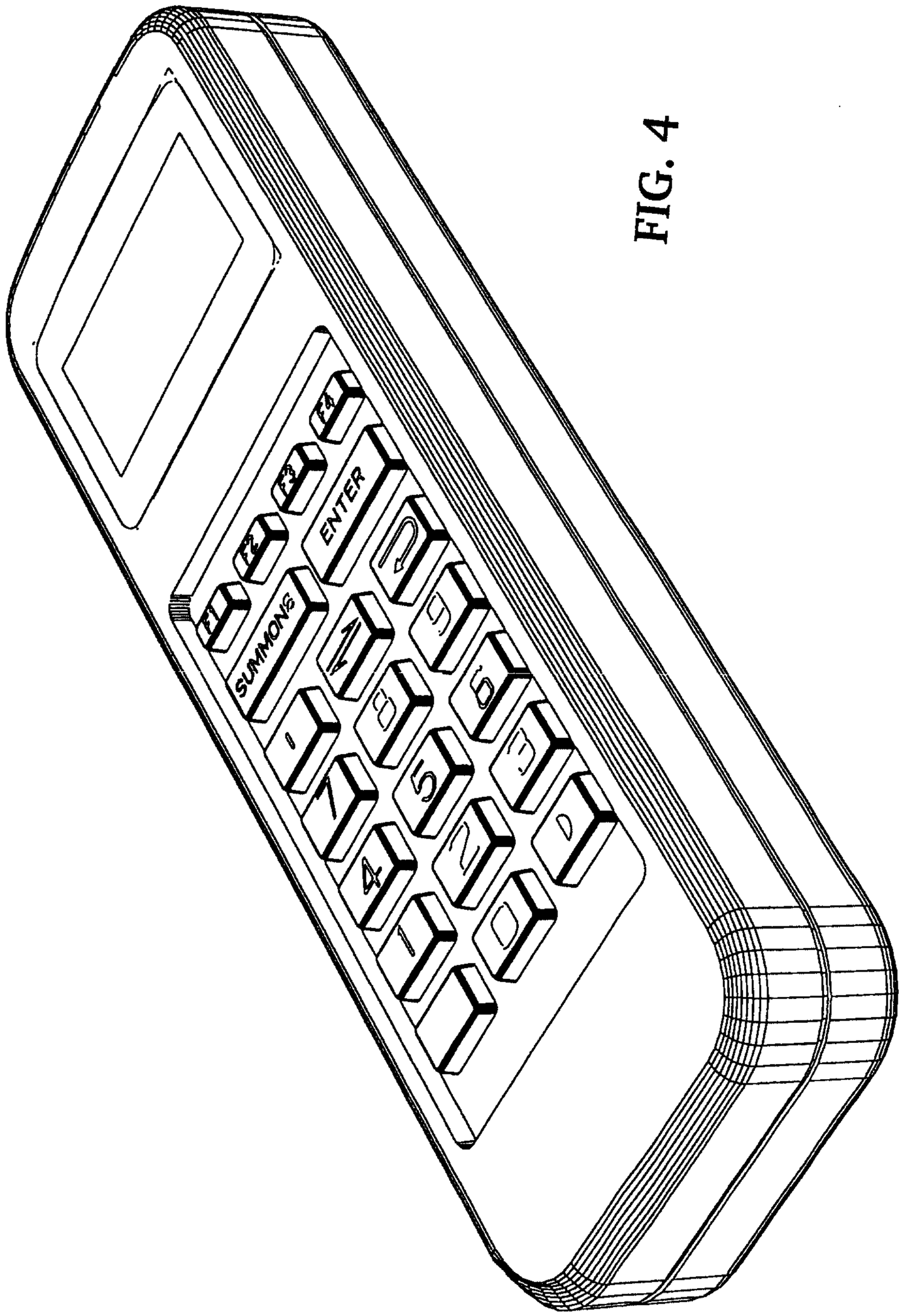
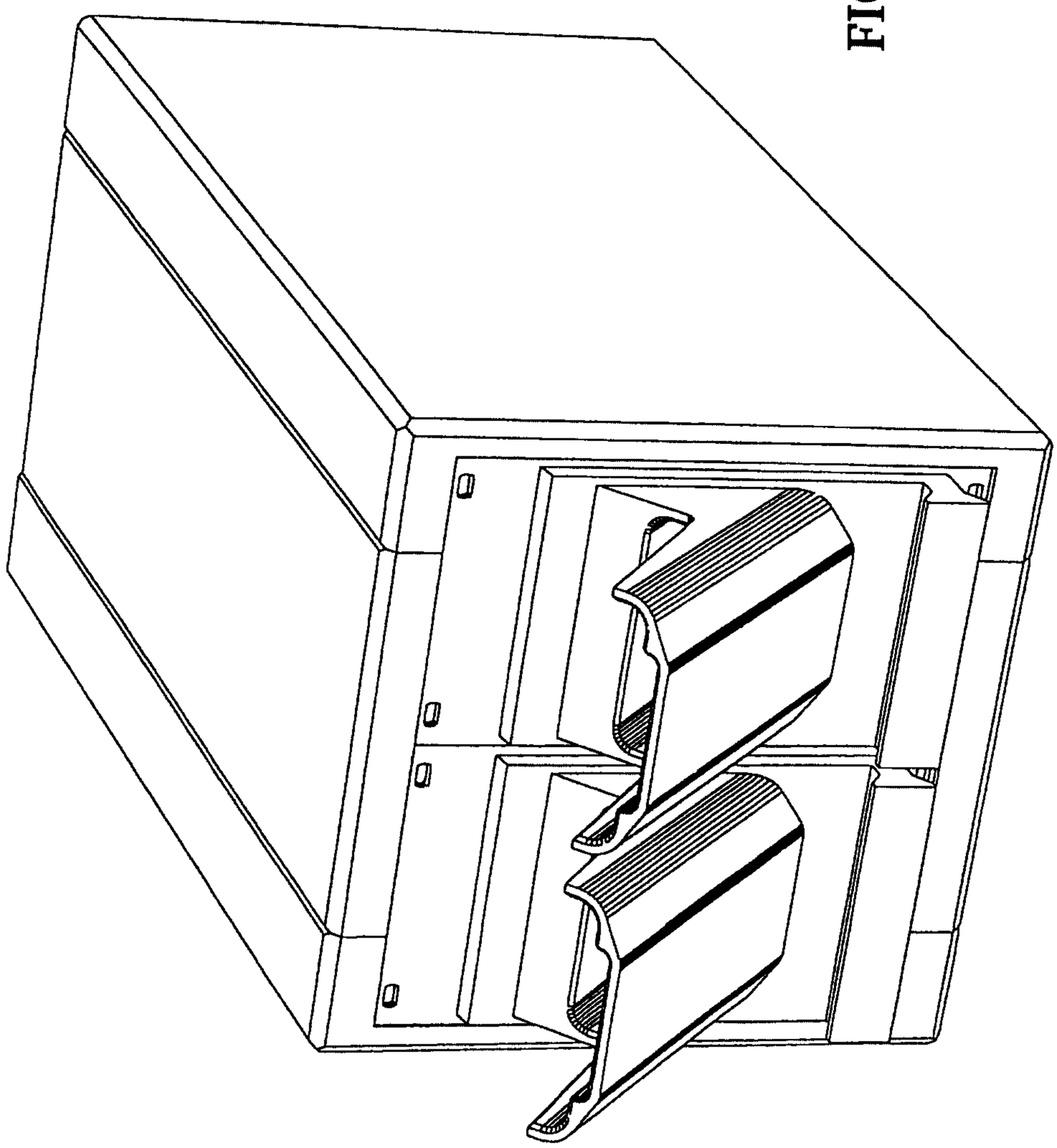


FIG. 4

FIG. 5



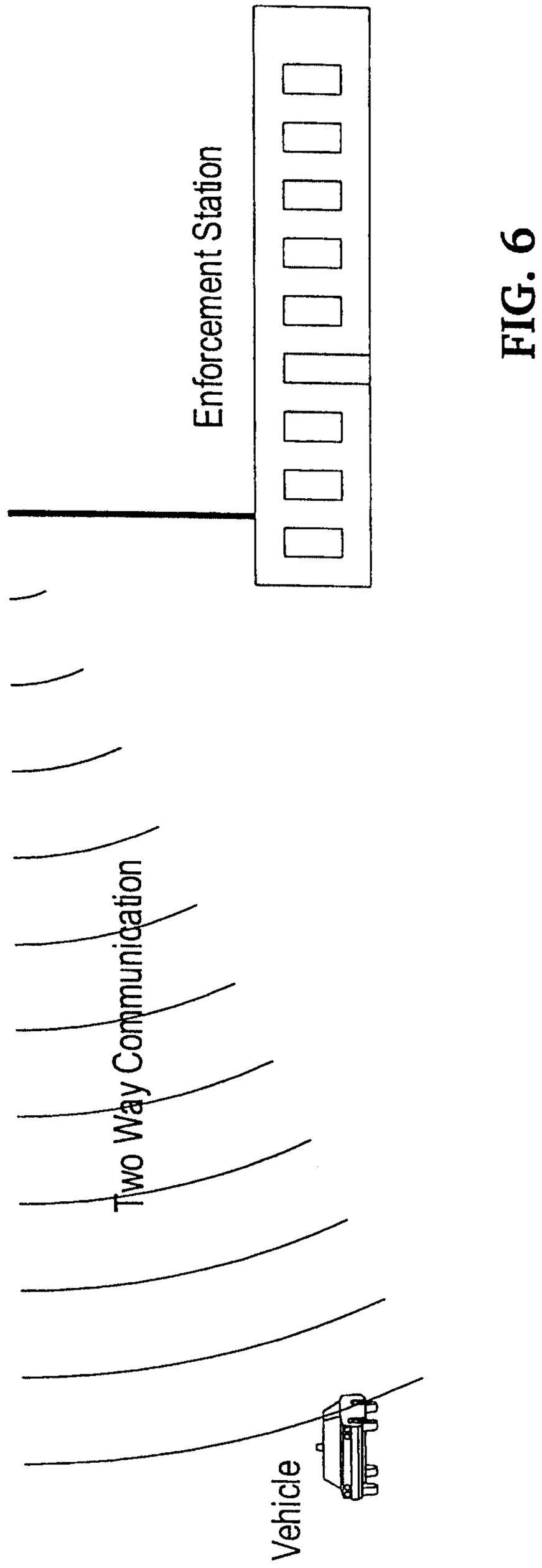


FIG. 6

FIG. 7

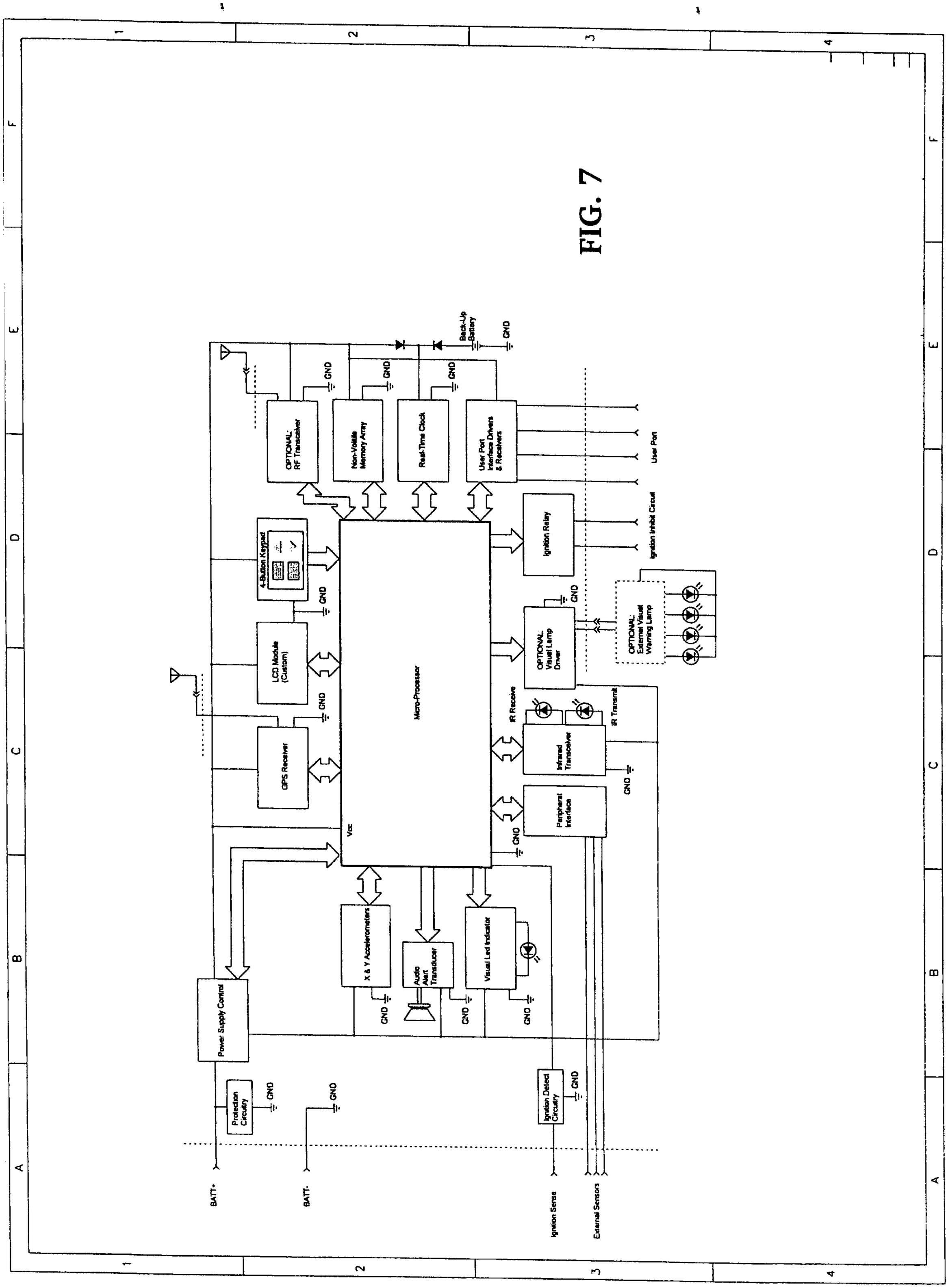

Back-Up Battery
GND
OPTIONAL: RF Transceiver
Non-Volatile Memory Array
Real-Time Clock
User Port Interface Drivers & Receivers
User Port
4-Button Keypad
Ignition Relay
Ignition Inhibit Circuit
LCD Module (Custom)
OPTIONAL: Visual Lamp Driver
OPTIONAL: External Visual Warning Lamp
Micro-Processor
IR Receive
IR Transmit
Infrared Transceiver
GPS Receiver
Peripheral Interface
Vcc
X & Y Accelerometers
Audio Alert Transducer
Visual Led Indicator
Power Supply Control
Protection Circuitry
Ignition Detect Circuitry
BATT+
BATT-
Ignition Sense
External Sensors

FIG. 8

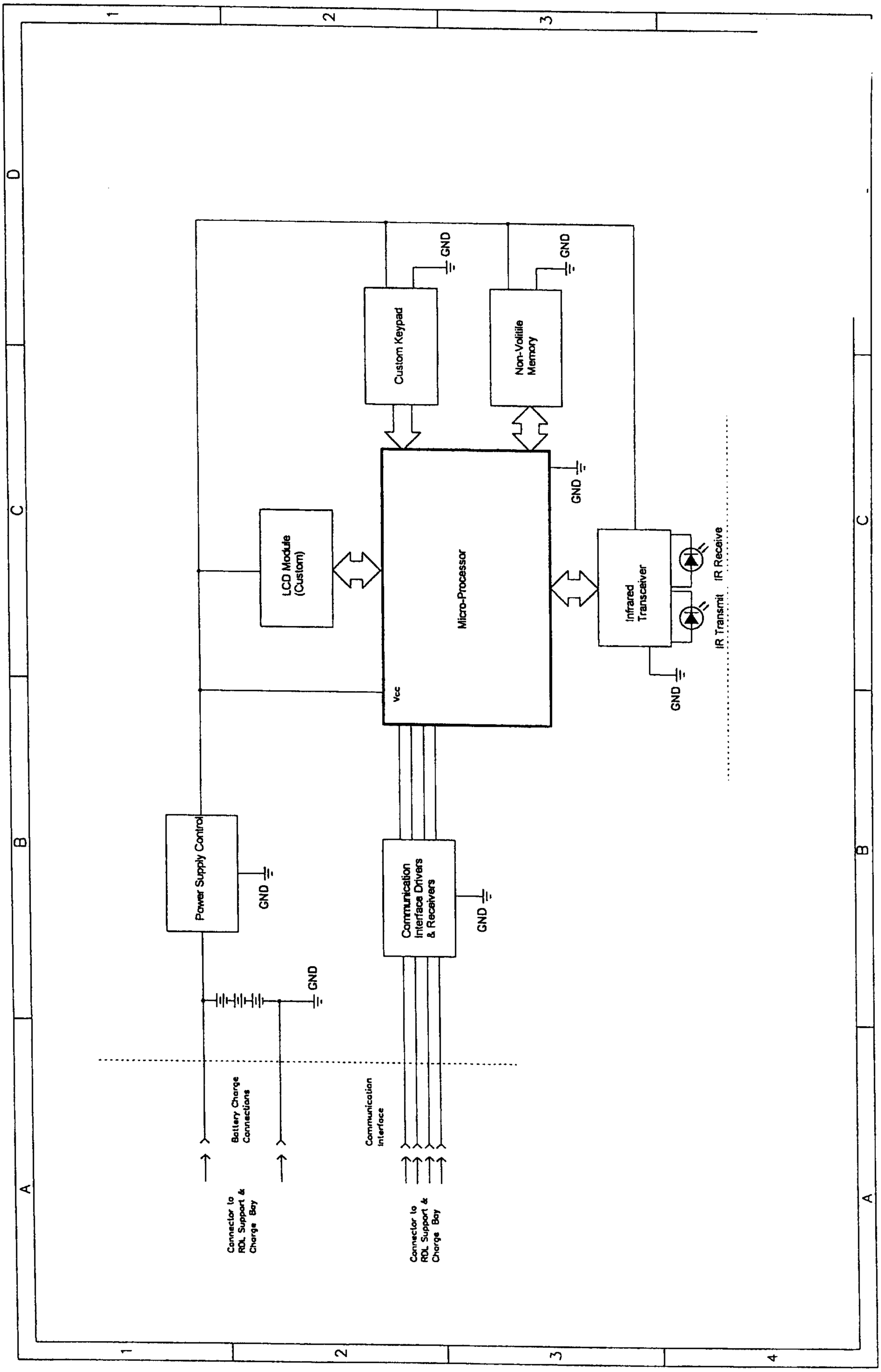

1
2
3
D
C
B
A
GND
GND
Custom Keypad
Non-Volitile Memory
GND
LCD Module (Custom)
Micro-Processor
Vcc
Infrared Transceiver
GND
IR Transmit
IR Receive
Power Supply Control
GND
Communication Interface Drivers & Receivers
GND
GND
Battery Charge Connections
Communication Interface
Connector to RDL Support & Charge Bay
Connector to RDL Support & Charge Bay
1
2
3
4

FIG. 9

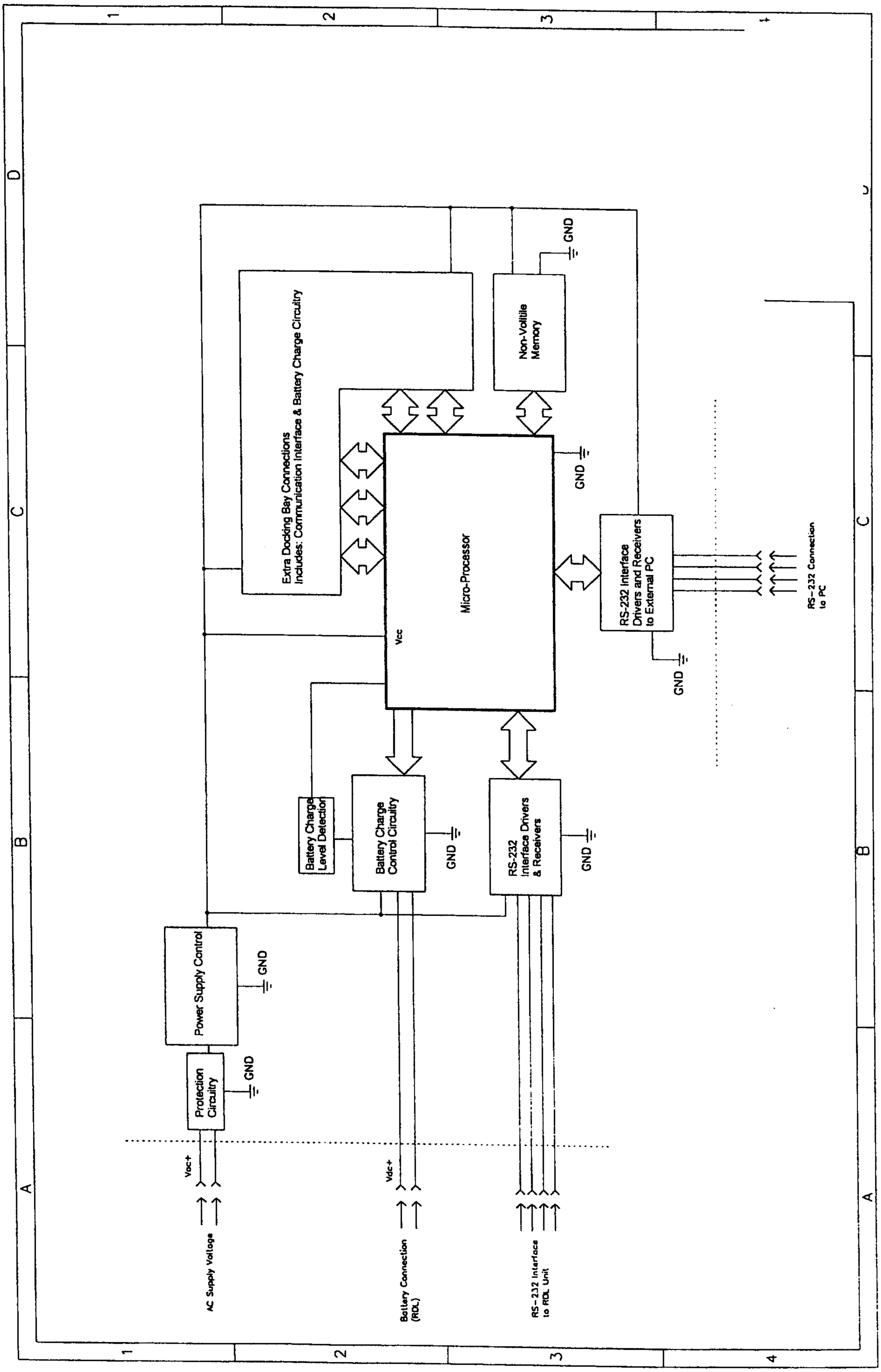
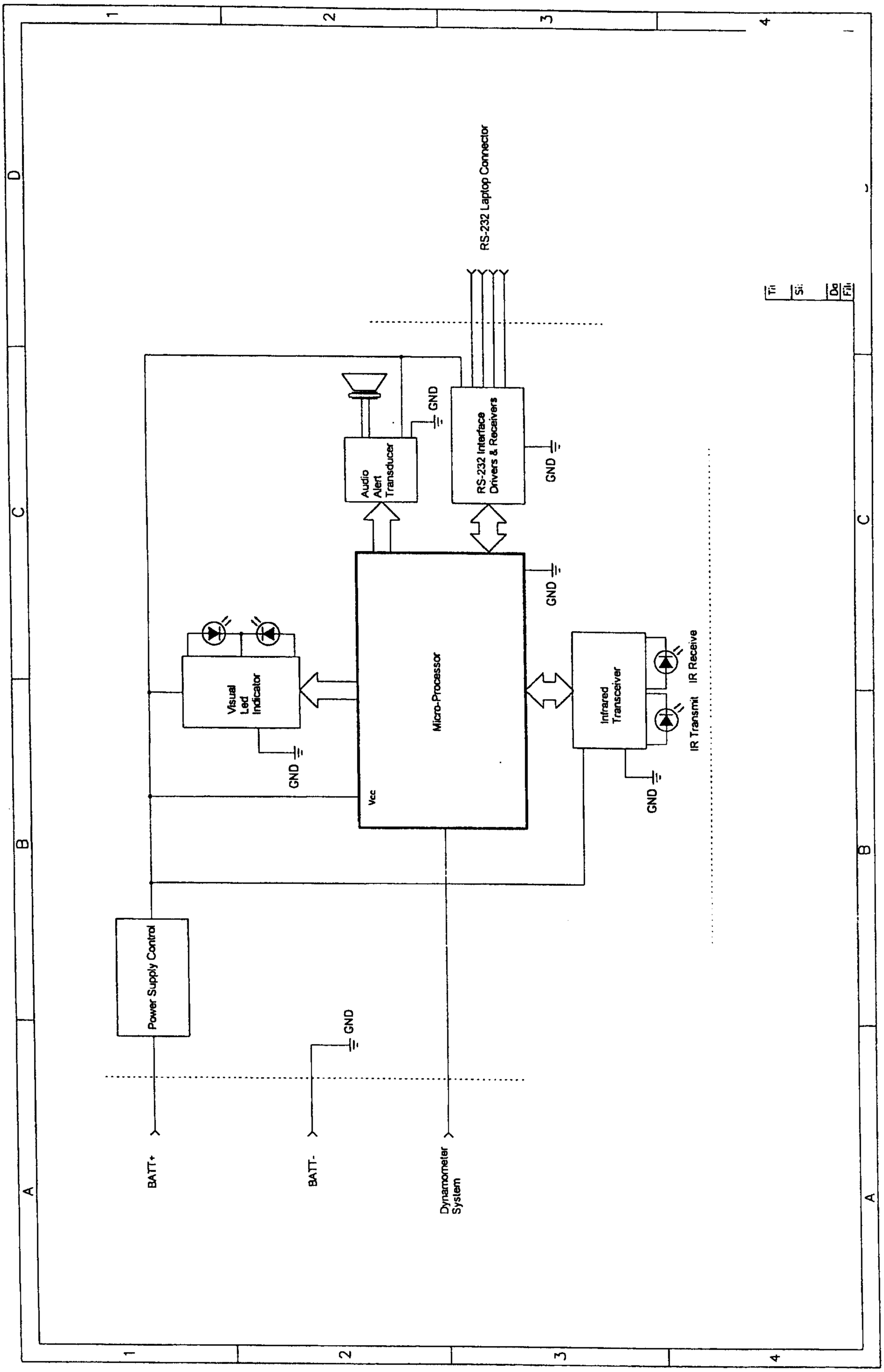

1
2
3
4
D
C
B
A
GND
Non-Volitile Memory
Extra Docking Bay Connections
Includes: Communication Interface & Battery Charge Circuitry
GND
Micro-Processor
Vcc
RS-232 Interface Drivers to External PC
GND
RS-232 Connection to PC
Battery Charge Level Detection
Battery Charge Control Circuitry
GND
RS-232 Interface Drivers & Receivers
GND
Power Supply Control
GND
Protection Circuitry
GND
Vac+
AC Supply Voltage
Vdc+
Battery Connection (RDL)
RS-232 Interface to RDL Unit

FIG. 10


RS-232 Laptop Connector
Audio Alert Transducer
GND
RS-232 Interface Drivers & Receivers
GND
GND
Visual Led Indicator
GND
Micro-Processor
Vcc
Infrared Transceiver
IR Transmit
IR Receive
GND
Power Supply Control
GND
BATT+
BATT-
Dynamometer System

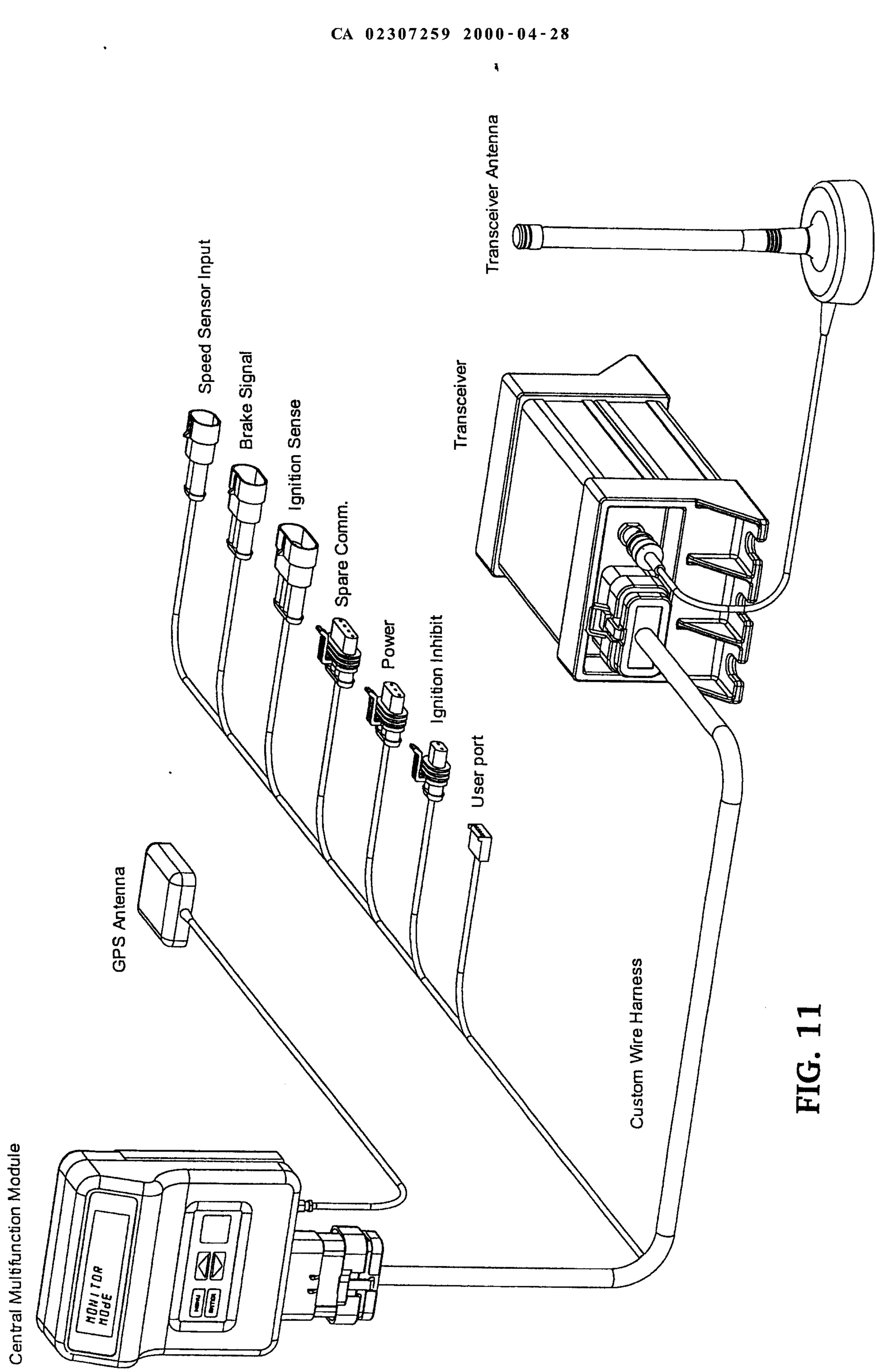
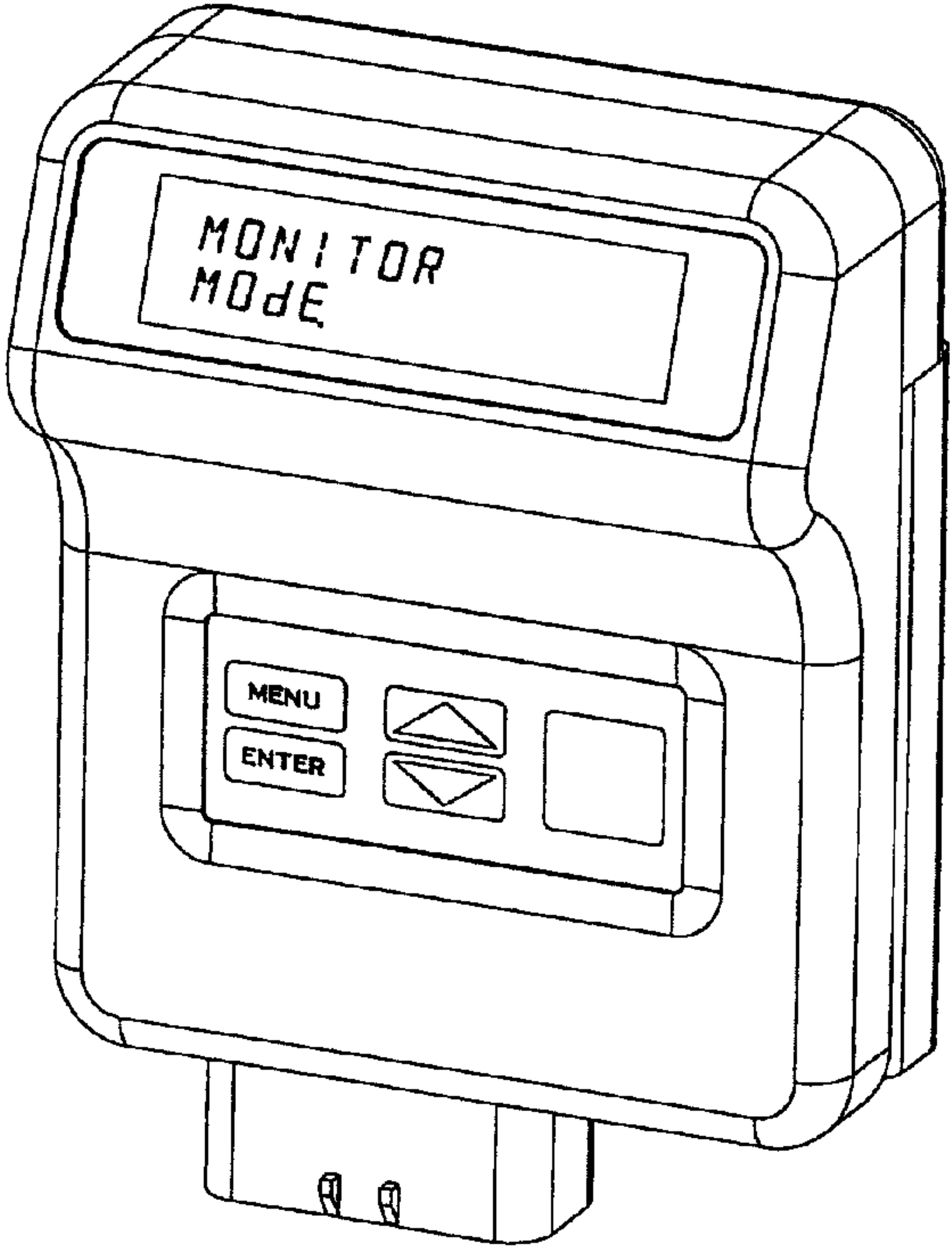

Transceiver Antenna
Transceiver
Speed Sensor Input
Brake Signal
Ignition Sense
Spare Comm.
Power
Ignition Inhibit
User port
GPS Antenna
Custom Wire Harness
Central Multifunction Module
MONITOR MODE

FIG. 11


MONITOR
MODE
MENU
ENTER