Title: ILLUMINATED HANDLE BAR SWITCH WITH SMD BASED CONSTRUCTION

Abstract: An illumination assembly for an illuminated handle bar switch comprising SMD based illumination source, resistor, reflector, PCB for mounting illumination source, cover, and a rubber grommet that is completely sealed and has got protection against water, dust, and other contamination. The illumination assembly is robust enough to provide protection against vibration to soldering joints due to use of rubber grommet and also to withstand the vibration deriving from vehicle engine.
ILLUMINATED HANDLE BAR SWITCH WITH SMD BASED CONSTRUCTION

Field of invention
The present invention relates to handle bar switch module for two wheelers / three wheelers / all terrain vehicles, particularly, the present invention relates to an illuminated switch module, more particularly, the present invention relates to an illuminated handle bar switch module with symbols for motorcycle.

Background of the invention
Two wheeled or three wheeled vehicles include various electrical/electronic components that perform a variety of functions for smooth operation, safe driving and for providing indication to other riders while driving. Some of these functions include, Head lamp ON-OFF-Parking ON, Engine start, Engine kill, Dipper or High-Low, Turn Indicator with push cancel, Horn, Pass etc.

These functions are achieved by implementing control buttons mounted over control switches via battery in series. Conventionally, a module housing at least one control switch is mounted on a handle bar of the two wheeled or three wheeled vehicle. More particularly, the control switches for frequently used functions such as horn, dipper, blinker, turn indicator, etc are grouped together in the form of a first switching module (or alternatively referred to as left hand side switching module), which is mounted over left hand side of the handle bar. Similarly, control switches for less frequently used functions such as engine kill, engine start, head lamp ON-OFF, etc. are grouped together in the form of a second switching module (or alternatively referred to as right hand side switching module) mounted over right hand side of the handle bar.

Each of the switch modules can accommodate one or more control switches. The control switches can be contacting type switches or contact-less type switches. In other words, the control switches can be electrical or electronic switches.

Since, a switching module accommodate plurality of switches, each of which provides a different functionality, in order to enable the user of a vehicle to easily identify the functionality of a particular control switch, each control switch carries a unique symbol (also known as homologation symbols) indicating the function which will be performed by the activation of said switch. These symbols have now become standard symbols which
are recognized throughout the automotive industry. Figure l(a) represents a conventional left hand side switching module and figure l(b) represents a conventional right hand side switching module. As can be observed from figures l(a) and l(b), the symbol is disposed either adjacent to or over the respective control switch.

Conventionally, most of the symbols are either printed or pasted or paint filled or embossed over a surface of console or a control button of the control switch. However, the symbols present over the control switches are not visible to the rider while driving under insufficient illumination levels (such as during night time). Also, the aforesaid symbols become dull or eroded over a period of time due to cumulative effect of UV light, rain water, salt content in rain water, grease, oil, dust, other contamination, etc.

In few conventional two-wheeled vehicles, the symbols are printed over a plastic sheet that is pasted or glued over top surface of switch console. The sheet gets damaged and peeled off during extensive exterior use of product due to individual or combined effect of environment such as water, UV rays, dust etc.

Recent technical advancements have led to development of illuminated control switches by placing an illumination source below the symbol inside the handle bar switch module of two wheeled vehicles. In the conventional illuminated switches the illumination source does not provide uniform illumination. Also, the illumination source in the conventional switches is not protected against the vibrations, water, dust and other contamination resulting into small life of the illuminated switches and higher maintenance cost.

Further, the sets of illuminating source within control switches are controlled by the main control unit of the conventional two wheeler vehicle. Main control unit is generally placed below head lamp or below seat area of a two wheeler. This increases cost of wiring harness. This also increases the cost of illumination due to more wiring harness length, complex and bulky electronic control units with more number of parts, high cost of protection against water and dust to electronic control unit, ceases the scope for customization. As the number of parts is more, the chances for failure are also more. Therefore, there exists a need to develop an illuminated switch module which overcomes the afore-mentioned problems of conventional switches.
**Objects of the present invention**

The main object of the present invention is to provide an illuminated handle bar switch module for two wheeler vehicle or motorcycle.

Another object of the present invention is to provide an illumination sub-assembly for an illuminated handle bar switch module which provides uniform illumination of the symbol.

Yet another object of the present invention is to provide an illumination sub-assembly for an illuminated handle bar switch module which protects the illumination source from dust, water or other contamination and also withstand to the vibrations and protect electrical connections of illumination source.

Still another object of the present invention is to provide an illumination sub-assembly including SMD (surface mounted device) based illumination source.

Yet another object of the present invention is to provide an illuminated handle bar switch module which accommodates electronic control unit in the switch module itself that simplifies wire routing, reducing the length of wiring harness, comparatively less voltage drop, reducing number of water tight connectors between control unit and illumination source output.

One more object of the present invention is to provide a function symbol insert which us insert moulded in the switch module itself and where symbols are screen printed from inner side of the insert for enhancing the life of symbol from severe use of product in exterior environmental condition.

**Summary of the present invention**

The present invention provides an illuminated handle bar switch module with an illumination sub-assembly. The illumination sub-assembly comprising SMD (Surface Mount Devices) based illumination source, resistor, reflector, Printed Circuit Board (PCB) for mounting illumination source, cover, reflector, and a rubber grommet that is completely sealed and has got protection against water, dust, and other contamination.

Printed circuit board (PCB) with a small SMD based illumination source along with a resistor can be assembled over fully automatic PCB assembly line instead of manual assembly. SMD based illumination source along with resistor is mounted over pre-defined location on the PCB having soldering paste at pre-defined locations with the help of pick and place machine. The soldering paste is applied over PCB with the help of paste printing machine. At next stage, the assembled PCB is passed through reflow oven where paste is
melted at a pre-defined temperature & thus soldering is completed. This is followed by checking the quality of soldering with the help of optical inspection machine. The whole operation reduces the time of assembly of components over PCB drastically as compared to manual operation. Moreover, quality of soldering that is achieved through this automatic assembly line is very consistent and well defined.

After PCB assembly wire is soldered at both the input pad end of PCB that is performed offline, the whole PCB assembly along with wires is inserted into a reflector and is welded with plastic cover at the open end. The rubber grommet is plugged along with wires at the wire outlet hole. Thus, the complete assembly including illumination source and resistor over PCB, reflector, plastic cover, rubber grommet and wires is sealed.

Therefore, the present invention provides fully sealed illumination assembly for achieving enhanced life against water, dust, & other contamination. The size of the SMD based illumination source is small. According to an embodiment of the present invention the size of the SMD based illumination source is only 3 x 1.2 x 1 mm. Therefore, smaller packaging size SMD or other illuminating device can be placed directly over PCB inside the illumination assembly.

According to an embodiment of the present invention the illumination sub-assembly is placed directly below a function symbol insert for illuminating symbols disposed on the function symbol insert.

The shape and size of each illumination sub-assembly may differ from other illumination sub-assembly because size and shape of the function symbol insert varies which vary the size and shape of the reflector placed below respective function symbol insert. The size and shape of the illumination sub-assembly depend upon the shape and size of function symbol insert, packaging space available for illumination sub-assembly inside the respective switch and shape of left hand side switch module and right hand side switch module.

In an embodiment of the present invention, the illuminated handle bar switch module comprises one or more function symbol insert. In the function symbol insert the symbols are screen printed from the bottom side over transparent plastic sheet in black ink (first screen) followed by white ink (second screen) in first stage. Thereafter, these printed
symbols over sheet are cut to the desired layout and size followed by forming (operation) of each cut sheet as per the shape required in the first stage. These formed symbols over sheet are injection moulded to form function symbol insert in second stage. The said function symbol insert is further insert molded with switch module in third stage. The function symbol inserts are placed at desired location in the mould. These symbols do not erode and comparatively less faded during their extensive exterior use, as these symbols are printed from rear side of the sheet. Also, these symbols have got high life against severe environmental effect and do not get peeled off unlike conventional sticker printed homologation symbols or pad printed/paint filled/ embossed homologation symbols over switch console.

The present invention is robust enough to withstand the vibration deriving from vehicle engine and also provides protection against vibration to soldering joints due to use of rubber grommet which acts as a vibration dampener. The illuminated handle bar switch module of the present invention has enhanced life against water, dust and other contamination over soldering joints. Further, the present invention facilitates increased life span of symbols from the effects of UV rays, salt water, dust, sand and other contamination.

In an embodiment of the present invention, an electronic control unit (ECU) is accommodated inside the switch module. The ECU is configured to control the power supply to the PCB having SMD based illumination source. The electronic control unit is dedicated to control the illumination features of the illuminated switch module.

**Brief description of drawings**

Figures 1(a) and 1(b) conventional handle bar switch modules with symbols.

Figures 2(a) and 2(b) illustrates an exemplary view of illuminated handle bar switch module according to an embodiment of the present invention.

Figures 3(a) and 3(b) illustrate function symbol insert for the illuminated handle bar switch module according to an embodiment of the present invention.

Figure 4 shows placement of the function symbol Insert inside the switch module according to an embodiment of the present invention.

Figures 5(a) and 5(b) illustrate an exploded illumination sub-assembly (5) according to an embodiment of the present invention.
Figures 6 and 7 illustrate reflector and the PCB with SMD based LED according to an embodiment of the present invention.

Figures 8(a) and 8(b) illustrate assembled view of the illumination sub-assembly according to an embodiment of the present invention.

Figures 9(a) to (e) illustrate different shapes and sizes of illumination sub-assembly according to an embodiment of the present invention.

Figures 10 and 11 illustrate an illuminated handle bar switch module accommodating an electronic control unit according to an embodiment of the present invention.

Figures 12 to 15 illustrate cross-sectional views of the illuminated handle bar switch module in accordance with an embodiment of the present invention.

Figure 16 illustrates an assembled bottom view of illuminated left side handle bar switch module in accordance with an embodiment of the present invention.

Figure 17 describes a cross-sectional view of illuminated left side handle bar switch module according to an embodiment of the present invention.

Figure 18 illustrates a handle bar of a motorcycle with illuminated handle bar switch module according to an embodiment of the present invention.

**Detailed description of the present invention**

Accordingly, the present invention provides an illuminated handle bar switch module for motorcycle, said switch module comprising:

- at least one control switch for operating functions of one or more accessories of the motorcycle; said control switch is configured to connect a power source to the accessory of the motorcycle;

- at least one function symbol insert comprising at least one symbol indicative of the function performed by the said control switch;

- at least one illumination sub-assembly comprises:
  - a reflector comprising a top surface, a bottom surface and side surfaces located adjacent to the said top surface and the bottom surface so as to define a cavity; said top surface comprising at least one light transmitting portion;
  - a printed circuit board (PCB) is accommodated in the cavity and comprises a surface mounted illumination source; the PCB is accommodated in the cavity so that the said at least one light transmitting surface receive light emitted by the said illumination source;
the bottom surface of the reflector is provided with a bore for extending out connecting wires soldered to PCB; a closure plug disposed in the bore for closing the bore and the said closure plug comprises apertures for projecting therethrough connecting wires for making electrical connections of the said PCB with the power source.

said at least one illumination sub-assembly located so that the top surface is disposed directly below the said function symbol insert thereby illuminating the symbol disposed on the said insert by light beam transmitted through the light transmitting portion.

In an embodiment of the present invention the said function symbol insert is mounted in the switch module by means selected from pasting, hot sealing, fastening and ultrasonic welding.

In another embodiment of the present invention the said at least one function symbol insert is mounted in the switch module by means of insert moulding.

In still another embodiment of the present invention the said at least one function symbol insert comprises a sheet on which the symbol is screen printed.

In yet another embodiment of the present invention the said at least one symbol is disposed on a surface of the said sheet of the function symbol insert which remains inside the switch module.

In a further embodiment of the present invention the cavity of the reflector has an open end disposed on the side surface of the reflector for receiving the PCB.

In a further more embodiment of the present invention the open end is closed by a cover which is detachably secured to the reflector.

In another embodiment of the present invention the reflector is provided with raceways extending from the open end of the cavity and disposed on two opposing side surfaces for slidably receiving the said PCB.

In still another embodiment of the present invention the surface mounted illumination source is a light emitting diode (LED).
In a further embodiment of the present invention the reflector comprises one or more light reflecting surfaces which are located so as to reflect and guide the light beam, received from the illumination source, to the said at least one light transmitting portion which transmits the light beam.

In another embodiment of the present invention the top surface comprises two light transmitting portions for illuminating two symbols disposed on the function symbol insert.

In still another embodiment of the present invention the said closure plug is a rubber grommet.

In yet another embodiment of the present invention the said rubber grommet is threaded with corresponding threads provided in the bore.

In a further embodiment of the present invention said illumination sub-assembly comprises: a connecting arm for connecting the said illumination sub-assembly in the switch module with the help of fastening means.

In a further more embodiment of the present invention the reflector comprises at least one projection provided with a connecting arm having a hole for inserting a fastener and interior of the switch module is provided with threaded plug for cooperating with the fastener thereby connecting the illumination sub-assembly with the interior of the switch module.

In another embodiment of the present invention the connecting wires extending from the illumination sub-assembly is coupled with an electronic control unit (RCU) accommodated inside the switch module for connecting the PCB and the illumination source with the power source.

In still another embodiment of the present invention the said ECU comprises a printed circuit board mounted with plurality of resistors, one or more capacitor and an integrated circuit for providing the voltage drop and current conditioning.

In yet another embodiment of the present invention the ECU is housed in a receptacle inside the switch module.
An embodiment of the present invention provides an illumination sub-assembly for illuminated switch module, said illumination sub-assembly comprising:
a reflector comprising a top surface, a bottom surface and side surfaces located adjacent to the said top surface and the bottom surface so as to define a cavity; said top surface comprising at least one light transmitting portion;
a printed circuit board (PCB) is accommodated in the cavity and comprises a surface mounted illumination source; the PCB is accommodated in the cavity so that the said at least one light transmitting surface receive light emitted by the said illumination source;
the bottom surface of the reflector is provided with a bore for extending out connecting wires soldered to PCB;
a closure plug disposed in the bore for closing the bore and the said closure plug comprises apertures for projecting therethrough connecting wires for making electrical connections of the said PCB with the power source.

The present invention also provides, a handle bar with an illuminated left hand side switch module and an illuminated right hand side module for motor cycle; each of the said left hand side switch module and the right hand side module comprising:
at least one control switch for operating functions of one or more accessories of the motorcycle; said control switch is configured to connect a power source to the accessory of the motorcycle;
at least one function symbol insert comprising at least one symbol indicative of the function performed by the said control switch;
at least one illumination sub-assembly comprises:
a reflector comprising a top surface, a bottom surface and side surfaces located adjacent to the said top surface and the bottom surface so as to define a cavity; said top surface comprising at least one light transmitting portion;
a printed circuit board (PCB) is accommodated in the cavity and comprises a surface mounted illumination source; the PCB is accommodated in the cavity so that the said at least one light transmitting surface receive light emitted by the said illumination source;
the bottom surface of the reflector is provided with a bore for extending out connecting wires soldered to PCB;
a closure plug disposed in the bore for closing the bore and the said closure plug comprises apertures for projecting therethrough connecting wires for making electrical connections of the said PCB with the power source.

said at least one illumination sub-assembly located so that the top surface is disposed directly below the said function symbol insert thereby illuminating the symbol disposed on the said insert by light beam transmitted through the light transmitting portion;

an electronic control unit (ECU) received in a receptacle which is disposed in the said left hand side switch module or in the right hand side module; said ECU is configured to connect a power supply to the PCB;

said electronic control unit of one switch module is coupled with the illumination source of the other side of the switch module by one or more water tight connector.

The present invention is described with reference to the figures and specific embodiments; this description is not meant to be construed in a limiting sense. Various alternate embodiments of the invention will become apparent to persons skilled in the art upon reference to the description of the invention. It is therefore contemplated that such alternative embodiments form part of the present invention.

Figures 2(a) and 2(b) illustrate an exemplary view of the illuminated handle bar switch module according to an embodiment of the present invention. The switch module shown in figure 2(a) is left hand side switch module of the motorcycle. The switch module shown in figure 2(b) is right hand side switch module of the motorcycle.

The illuminated handle bar switch module has at least one function symbol insert comprising at least one symbol which is indicative of the functions performed by the control switch. As shown in figures 2(a) and 2(b) the illuminated handle bar switch module (1) has function symbol inserts (2) comprising illuminated symbols (3) such as dipper, blinker, horn in left hand side switch module and engine kill, main, start in right hand side switch module. As shown in figures 2(a) and 2(b), the function symbol inserts are disposed adjacent to the respective control switches (4). As can be clearly understood, the switch module can be provided with one or more control switches (4). Similarly, the number of function symbol inserts (2) can be one or more. As can be observed from figures 2(a) and 2(b), for each control switch (4) a separate function symbol insert (2) can
be provided which is located adjacent to the control switch (4). The number of symbols (3) on the function symbol insert can be one or more than one and the number of symbols can be determined according to the requirement. For example, the function symbol insert respective of the blinker comprises two symbols, the function symbol insert respective of the horn comprises one symbol and the function symbol insert respective of the headlight comprises three symbols.

The function symbol insert can be a sheet which has one or more symbols printed or embossed over the said sheet. The said insert can be mounted on the switch module by pasting, hot sealing, fastening or ultrasonic welding or by any other suitable method. In an embodiment of the present invention the function symbol insert comprises a sheet on which the symbol is screen printed. The said function symbol insert is mounted on the switch module by insert molding such that the surface of the sheet on which the symbol is screen printed remains inside the switch module. It can be clearly understood that such function symbol insert can be prepared by taking a transparent sheet on which the symbol is screen printed and then coating the said sheet with black paint while masking the portion of the sheet on which symbol is to be formed. Therefore, the light impinges on such function symbol insert, it is transmitted only through the portion on which the symbol is screen printed.

Figures 3(a) and 3(b) illustrate function symbol insert (2) for the illuminated handle bar switch module (1) according to an embodiment of the present invention.

As shown in figures 3(a) and 3(b), the symbols (3) are screen printed over transparent plastic sheet from the rear side with black ink printing followed by white ink printing. Portions comprising symbol or set of symbols are cut from the said sheet to desired shape and size followed by a forming operation. The said formed symbol over sheet is moulded to form function symbol Insert. As can be clearly understood, different function symbol inserts have different shapes and sizes such as symbol insert for blinker, dipper, horn, main or light, engine kill, and ignition start, etc.

Figure 4 shows that the function symbol Insert (2) is placed inside the injection mould at desired location during injection moulding process so as to form a switch module (1).
As can be clearly understood, the symbols do not get affected by the environmental factors such as water, dust, shower, salt or UV radiations as symbols are screen printed on a surface the function symbol inserts which remains inside the switch module rather than top surface of the function symbol insert.

The symbols are backlit or illuminated with help of an illumination sub-assembly and enhance the aesthetic value of the handle bar control switch during insufficient illumination levels in environment. Therefore, locating the buttons or control switches becomes easier while driving.

In an embodiment of the present invention, the illuminated handle bar switch module comprises one or more illumination sub-assembly.

Figures 5(a) and 5(b) illustrate an exploded illumination sub-assembly (5) according to an embodiment of the present invention. As shown in figures 5(a) and 5(b), the illumination sub assembly comprising a reflector (6) accommodating a printed circuit board (7) having a SMD based illumination source (8). Figures 6 and 7 illustrate the reflector (6) and the printed circuit board (7) with SMD based illumination source (8) according to an embodiment of the present invention.

Referring to figures 5(a), 5(b), 6 and 7, the reflector (6) comprises a top surface (9), a bottom surface (10) and side surfaces (11) so as to define a cavity (12). The top surface (9) of the reflector (6) comprises at least one light transmitting portion. More than one light transmitting portion can be disposed on the top surface (9) of the reflector. Alternatively, the complete top surface (9) can be formed as light transmitting portion. The reflector (6) is made up of a suitable transparent material and a coating of opaque material can be provided on interior of top, bottom and side surface while masking desired portion of the top surface (9) to as to make one or more light transmitting portions. The cavity (12) has a closed end (13) and an open end (14) which is disposed on one of the side surface (11) of the reflector (6) for receiving the PCB. The said open end (14) can be closed by means of a cover (15) detachably attached to the reflector. Alternatively, the cover (15) which is detachable attached with the reflector (6) form one of the side surface (11) of the reflector. Thus, detachment of the cover (15) from the reflector (6) creates the open end (14) which is used for receiving the PCB inside the cavity. The reflector (6) comprises two raceways
(16) located extends from the open end (14) to the closed end, and disposed on two opposing side surfaces of the reflector.

As shown in figures 5(a) and 6, the bottom surface (10) of the reflector (6) comprises a bore (17) for making electrical connections of the PCB with the power source. The bore (17) can be used for extending out connecting wires (18) soldered to the PCB. The bore (17) is closed with the help of a closure plug (19). The closure plug (19) comprises apertures (20) for extending out the connecting wires (18) soldered to PCB. As shown in figure 5(a) and 5(b), the closure plug (19) has threads (21) for engaging with corresponding threads provided in the bore (17) of the reflector. In an embodiment of the present invention the closure plug (19) is made of a rubber or the closure plug (19) is a rubber grommet.

Figure 7 shows a printed circuit board (PCB) (7) with SMD based illumination source. In an embodiment of the present invention the illumination source (8) is a light emitting diode (LED). The SMD based LED along with resistor is surface mounted over PCB on fully automatic PCB assembly line. SMDs are placed by pick and place machine at pre-defined locations having soldering paste over PCB. Solder paste is applied with the help of paste printing machine over PCB. Once the components are placed at the pre-defined locations over PCB, they are passed through re-flow oven at pre-set temperature where solder paste is melted and applied at connecting points of PCB. This is followed by optical quality inspection over PCB line and the sub-assembly is unloaded finally. The input wires or connecting wires (18) are connected or soldered to the said PCB (offline).

The rubber grommet closes the bore (17) so as to prevent entry of water, dust, oil, grease or other contamination inside the reflector (6) or over PCB. Finally, the whole sub-assembly is sealed by closing the open end (14) of the cavity (12) through the cover (15) at the open end (14) of reflector. The said cover (15) can be connected with transparent reflector.

Figures 8(a) and 8(b) illustrate assembled view of the illumination sub-assembly according to an embodiment of the present invention. As can be observed from figures 8(a) and 8(b), the PCB is received in the reflector (6) so that the light transmitting portion of the top surface (9) receives light emitted from the illumination source. The illumination sub-
assembly is located so that the top surface (9) of the reflector (6) is placed directly below the function symbol insert thereby illuminating the symbol disposed on the insert. The reflecting may be provided with one or more reflecting surfaces or surfaces of the reflector (6) can be coated with light reflecting material so as to guide the light beam to the light transmitting portion of the top surface. As shown in figure 8(a) and 8(b), a connecting arm for connecting the said illumination sub-assembly in the switch module with the help of fastening means.

A separate illumination sub-assembly is provided for function symbol insert. The said sub-assembly is placed below the respective function symbol insert inside switch console. Reflector construction, reflector’s top surface construction, PCB size, will vary from one illumination sub-assembly to other illumination sub-assembly depending upon packaging space available inside switch console and shape of the reflector. Therefore, the shape and size of the reflector depends upon surface area of function symbol insert below which the illumination sub-assembly is to be located, packaging space available for illumination sub-assembly, distance between light source and surface to be illuminated. Therefore the shape and size of reflector for dipper, blinker, horn, start, main or light, ignition start, engine kill, etc may vary from one another.

Figures 9(a) to (e) illustrate different shapes and sizes of illumination sub-assembly placed directly below the respective function symbol inserts.

According to an embodiment of the present invention, an electronic control unit (ECU) (22) is accommodated in the switch module. The ECU is disposed in the path of current flow from the power supply to the PCB with SMD based illumination source. In an embodiment of the present invention the current flows from the power supply to the PCB with SMD based illumination source (8) via ECU (22) when the head lamp is switched on. However, a separate switch can be provided for switching on the power supply to the illumination sub-assembly. The electronic control unit provides various protections to the illumination sub-assembly against surge currents and transient voltage, reverse polarity and battery drainage.

Figure 10 shows an illuminated handle bar switch module accommodating an electronic control unit according to an embodiment of the present invention. The placement of the
electronic control unit inside the switch module saves the length of wiring harness and also reduces the number of water tight connectors. The placement of the electronic control unit (ECU) (22) within the switch module simplifies wire routing and also reduces it length thereby saving the overall cost of the system.

In an embodiment of the present invention the electronic control unit (ECU) (22) comprises a printed circuit board (PCB) mounted with plurality of resistors, one or more capacitor and an integrated circuit for providing the voltage drop and current conditioning. The ECU (22) has a PCB including placement of electrical and/or electronic components over both sides of PCB. These components include but not limited to one integrated circuit for dropping the input voltage from 12 volts to 3 volts or as desired by the illumination sub-assembly. One or more capacitor is mounted over PCB at input end as well as output end for filtering the spikes generated while running the vehicle. This protects the circuit from surge current and transient voltage current. On other side of PCB, one or more resistors are placed in series (one for each SMD based LED) for stepping down the current i.e. from amperes to milli-amperes. At least one pad has been defined over PCB as an output to the illumination sub-assembly or SMD based LED. The number of pads can be increased or decreased depending upon the numbers of illumination sub-assembly. The output wires from the illumination sub-assembly can be directly soldered to these pads.

In an embodiment of the present invention, the present invention, the electronic control unit is a dedicated electronic control unit which controls the illumination feature only. The electronic control unit is smaller in size and accommodated inside the switch module. Figure 10 illustrates an exemplary view of packaging of the electronic control unit in the switch module according to an embodiment of the present invention. As shown in figure 10, the switch module comprises a receptacle (23) for receiving the electronic control unit. As shown in figure 10, the receptacle (23) has an open end (24) and a closed end (25). The ECU (22) is received from the open end of the receptacle. As can be noticed from figure 10, the receptacle (23) is a box type structure with rectangular side walls. Two guides (26) are provided on two opposing side walls so that the ECU (22) is received in the receptacle (23) slidably. The raceways extend from the open end to the closed end. The open end of the receptacle (23) is used for routing the wires making electrical connections of the ECU (22) with LED and power supply. As can be observed from figure 11, wiring harness making electrical connections is extending through the open end of the receptacle. The
open end of the receptacle (23) can be closed by potting of epoxy resins and/ or sealants. The open end of the receptacle (23) can also be closed by a cover and rubber grommet which is disposed between the cover and the open end. The cover and the open end can be provided with apertures for extending wiring harnesses.

In an embodiment of the present invention, the said ECU (22) is slided inside the receptacle (23) and wires are routed outside from the open end of the receptacle. This is followed by potting with epoxy or sealant over ECU (22) inside the receptacle. Potting prevents the entry of water, dust, UV radiations or other contamination inside ECU (22). Potting also protects the said ECU (22) from the effect of vibrations derived out of engine vehicle.

Figure 11 illustrates assembly of the electronic control unit with receptacle inside the switch module according to an embodiment of the present invention. As shown in figures 10 and 11, interior of the switch module is constructed so as to accommodate the receptacle. The receptacle and the interior of the switch module can be provided with means for connecting the receptacle with the interior of the switch module.

As shown in figure 11, wires emerging out of electronic control unit are routed to the respective LED. Both the left hand side switch module and the right hand side switch module is provided with separate electronic control units which are mounted inside the respective switch modules. However, a single ECU can be used for controlling the illumination of both left hand side and the right hand side switch module. Said ECU can be mounted either in the right hand side switch module or in the left hand side switch module. The LEDs on the other side of control switch receives input current from the same ECU via water tight connector. This saves the length of the wiring harness and number of water tight connectors between both switches.

Figure 12 shows a cross-sectional view of switch module assembly upper left side with illumination sub assembly and function symbol insert in accordance with an embodiment of the present invention. As shown in figure 12, dipper function symbol insert (27) and blinker function symbol insert (-28) are insert moulded with the upper half of the switch module. The blinker illumination sub-assembly (29), dipper illumination sub-assembly (30) is mounted directly below the respective function symbol insert with upper switch
module via fasteners. Dipper control switch, pass control switch and horn control switch are packaged with the upper half of the left hand side switch module.

Figure 13 shows a cross-sectional view of lower half of left side switch module with illumination sub-assembly and function symbol insert in accordance with an embodiment of the present invention. Horn function symbol insert (31) is insert moulded with the lower half of the switch module. Horn illumination sub-assembly (32) is mounted directly below the function symbol insert (31) within lower half of the switch module via fasteners. Horn control switch and blinker control switch are packaged within the lower half of the left hand side switch module.

Figure 14 shows a cross-sectional view of the upper half of right side switch module with light (33) and engine kill (34) illumination sub-assembly and their respective function symbol insert (35, 36) in accordance with an embodiment of the present invention.

Figure 15 shows a cross-sectional view of the lower half of the right side switch module with start illumination sub-assembly (37) and the function symbol Insert (38). This illustration also shows the packaging of electronic control unit (22, 23) inside switch console lower of right hand side switch assembly.

Figure 16 illustrates an assembled bottom view of illuminated left side handle bar switch module in accordance with an embodiment of the present invention. It can be clearly observed from figure 16 that how various parts are packaged together inside upper half of the switch module. As shown in figure 16, blinker illumination sub-assembly is packaged within the switch module and dipper illumination sub-assembly is packaged along with dipper control switch. The pass control switch is also packaged within but the module does not have pass illumination sub-assembly because pass function symbol insert lies on back side while driving and is not visible to the rider.

Figure 17 describes a cross-sectional view of illuminated left side handle bar switch module. As shown in figure 17, the illuminated handle bar switch module includes dipper illumination sub-assembly, blinker illumination sub assembly, horn illumination sub assembly and their respective homologation symbol Insert moulded at pre-defined location within the switch module in upper half and in lower half. The said switch module also includes a dipper control switch, a blinker control switch, a horn control switch and a pass
control switch. All sub-assemblies are packaged inside switch module in upper and lower halves including wire routing. Both upper and lower halves of the switch module is fastened together with the help of mounting screws.

Figure 18 illustrates a handle bar of a motorcycle with illuminated handle bar switch module according to an embodiment of the present invention. As shown in figure 14, the left hand side (39) switch module has function symbol inserts for dipper, blinker, horn and the right hand side (40) switch module has function symbol inserts Engine kill, Main, start. An ECU is provided on right hand side switch module (40). A female water tight connector (41) which is connecting with a male water tight connector (42) of left hand side control switch provides connections of LEDs of the left hand side switch module.

The illumination sub-assembly of the present invention provides uniform light distribution over entire function symbol insert. The PCB with SMD based LED assembled inside the reflector is completely sealed- and prevents the entry of water, dust, sand, grease, oil or other contamination which reduces the life of the product drastically when subjected to severe exterior environmental condition.

Moreover, the present invention is robust enough to withstand high vibrations deriving out of engine vehicle. The rubber grommet not only prevents contamination due to entry of water but also acts as vibration dampener and protects the soldering points of wire connecting over PCB.

**Some of the advantages of the present invention are as follows:**

a) The present invention provides illuminated handle bar switch module which meets the performance expectations of the end user and is economical to the manufacturer.

b) The robust design prevents the entry of water, dust, oil, grease or other contamination inside illumination sub-assembly that results in enhancing the life of illumination below respective homologation symbols.

c) The illumination sub-assembly protects soldering joints from vibration thereby prevents SMD based LED to get de-soldered during service life.

d) The function symbol insert prevents homologation symbol from fading, eroding, decolorizations, peeling off.
e) Illuminated symbols are visible to rider during night time and thus help the rider to easily locate the switch buttons.

f) Reflector assembly also helps in protecting light leakage from the sides of switch & knob.

g) The present invention enhances the aesthetic value of the handle bar switch left hand side and right hand side of two-wheeler.

h) Different colors of symbols are possible in day as well as night.

i) In the daytime, different color symbol is achieved by pre-defined color of screen printing where as for night application, different color symbol is obtained by changing the color of SMD based LED or by using bi-polar SMD based LED.
We Claim:

1. An illuminated handle bar switch module for motorcycle, said switch module comprising:
   at least one control switch for operating functions of one or more accessories of the motorcycle; said control switch is configured to connect a power source to the accessory of the motorcycle;
   at least one function symbol insert comprising at least one symbol indicative of the function performed by the said control switch;
   at least one illumination sub-assembly comprises:
      a reflector comprising a top surface, a bottom surface and side surfaces located adjacent to the said top surface and the bottom surface so as to define a cavity; said top surface comprising at least one light transmitting portion;
      a printed circuit board (PCB) is accommodated in the cavity and comprises a surface mounted illumination source; the PCB is accommodated in the cavity so that the said at least one light transmitting surface receive light emitted by the said illumination source;
      the bottom surface of the reflector is provided with a bore for extending out connecting wires soldered to PCB;
      a closure plug disposed in the bore for closing the bore and the said closure plug comprises apertures for projecting therethrough connecting wires for making electrical connections of the said PCB with the power source.
   said at least one illumination sub-assembly located so that the top surface is disposed directly below the said function symbol insert thereby illuminating the symbol disposed on the said insert by light beam transmitted through the light transmitting portion.

2. A switch module as claimed in claim 1. wherein the said function symbol insert is mounted in the switch module by means selected from pasting, hot sealing, fastening and ultrasonic welding.
3. A switch module as claimed in claim 1, wherein the said at least one function symbol insert is mounted in the switch module by means of insert moulding.

4. A switch module as claimed in any of the preceding claims, wherein the said at least one function symbol insert comprises a sheet on which the symbol is screen printed.

5. A switch module as claimed in claims 3 and 4, wherein the said at least one symbol is disposed on a surface of the said sheet of the function symbol insert which remains inside the switch module.

6. A switch module as claimed in any of the preceding claims, wherein the cavity of the reflector has an open end disposed on the side surface of the reflector for receiving the PCB.

7. A switch module as claimed in claim 6, wherein the open end is closed by a cover which is detachably secured to the reflector.

8. A switch module as claimed in any of the preceding claims, wherein the reflector is provided with raceways extending from the open end of the cavity and disposed on two opposing side surfaces for slidably receiving the said PCB.

9. A switch module as claimed in any of the preceding claims, wherein the surface mounted illumination source is a light emitting diode (LED).

10. A switch module as claimed in any of the preceding claims, wherein the reflector comprises one or more light reflecting surfaces which are located so as to reflect and guide the light beam, received from the illumination source, to the said at least one light transmitting portion which transmits the light beam.

11. A switch module as claimed in any of the preceding claims, wherein the top surface comprises two light transmitting portions for illuminating two symbols disposed on the function symbol insert.

12. A switch module as claimed in any of the preceding claims, wherein the said closure plug is a rubber grommet.
13. A switch module as claimed in claim 12, wherein the said rubber grommet is threaded with corresponding threads provided in the bore.

14. A switch module as claimed in any of the preceding claims, wherein said illumination sub-assembly comprises: a connecting arm for connecting the said illumination sub-assembly in the switch module with the help of fastening means.

15. A switch module as claimed in any of the preceding claims, wherein the reflector comprises at least one projection provided with a connecting arm having a hole for inserting a fastener and interior of the switch module is provided with threaded plug for cooperating with the fastener thereby connecting the illumination sub-assembly with the interior of the switch module.

16. A switch module as claimed in any of the preceding claims, wherein the connecting wires extending from the illumination sub-assembly is coupled with an electronic control unit (ECU) accommodated inside the switch module for connecting the PCB and the illumination source with the power source.

17. A switch module as claimed in claim 18, wherein the said ECU comprises a printed circuit board mounted with plurality of resistors, one or more capacitor and an integrated circuit for providing the voltage drop and current conditioning.

18. A switch module as claimed in claims 17 and 18, wherein the ECU is housed in a receptacle inside the switch module.

19. An illumination sub-assembly for illuminated switch module, said illumination sub-assembly comprising:
   a reflector comprising a top surface, a bottom surface and side surfaces located adjacent to the said top surface and the bottom surface so as to define a cavity; said top surface comprising at least one light transmitting portion;
   a printed circuit board (PCB) is accommodated in the cavity and comprises a surface mounted illumination source; the PCB is accommodated in the cavity so that the said at least one light transmitting surface receive light emitted by the said illumination source;
the bottom surface of the reflector is provided with a bore for extending out connecting wires soldered to PCB;
a closure plug disposed in the bore for closing the bore and the said closure plug comprises apertures for projecting therethrough connecting wires for making electrical connections of the said PCB with the power source.

20. A handle bar with an illuminated left hand side switch module and an illuminated right hand side module for motor cycle; each of the said left hand side switch module and the right hand side module comprising:
at least one control switch for operating functions of one or more accessories of the motorcycle; said control switch is configured to connect a power source to the accessory of the motorcycle;
at least one function symbol insert comprising at least one symbol indicative of the function performed by the said control switch;
at least one illumination sub-assembly comprises:
a reflector comprising a top surface, a bottom surface and side surfaces located adjacent to the said top surface and the bottom surface so as to define a cavity; said top surface comprising at least one light transmitting portion;
a printed circuit board (PCB) is accommodated in the cavity and comprises a surface mounted illumination source; the PCB is accommodated in the cavity so that the said at least one light transmitting surface receive light emitted by the said illumination source;
the bottom surface of the reflector is provided with a bore for extending out connecting wires soldered to PCB;
a closure plug disposed in the bore for closing the bore and the said closure plug comprises apertures for projecting therethrough connecting wires for making electrical connections of the said PCB with the power source,
said at least one illumination sub-assembly located so that the top surface is disposed directly below the said function symbol insert thereby illuminating the symbol disposed on the said insert by light beam transmitted through the light transmitting portion;
an electronic control unit (ECU) received in a receptacle which is disposed in the
said left hand side switch module or in the right hand side module; said ECU is
configured to connect a power supply to the PCB;
said electronic control unit of one switch module is coupled with the illumination
source of the other side of the switch module by one or more water tight connector.
A. **CLASSIFICATION OF SUBJECT MATTER**

   Int. Cl.  
   B62J 6/16 (2006.0) B60Q 3/00 (2006.0)

According to International Patent Classification (IPC) or to both national classification and IPC

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**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPDOC, WPI: keywords: illuminate, backlight, light, switch, button, toggle, handle, steering, motorcycle, motorbike, scooter, moped, symbol, graphic, marking, indicia or text, PCB, circuit

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**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
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<tr>
<td>A</td>
<td>WO 02/064419 A3 (McALLISTER DESIGNS, INC.) 22 August 2002</td>
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<tr>
<td></td>
<td>Abstract and figures 3-5</td>
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<td>A</td>
<td>US 6204752 B1 (KISHIMOTO) 20 March 2001</td>
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<td>Abstract and figures 8-10</td>
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Date of the actual completion of the international search: 13 July 2010

Date of mailing of the international search report: 20 October 2010

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Due to data integration issues this family listing may not include 10 digit Australian applications filed since May 2001.