

# **How to Make a Side-stand Cutout Switch – Neutral/Gear Operated**

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## **TOOLS / EQUIPMENT REQUIRED:**

**Soldering iron and flux cored solder wire**

**Wire cutters/strippers**

**Multi-meter**

**Lengths of wire (black, red, yellow and grey) – suitable for low current draw (thickness 25AWG)**

**Wiring schematic of your machine's harness** (useful but not essential)

**An NPN transistor suitable for switching applications** (I used a Phillips Semiconductors BC337 transistor in a TO-92 package available from Jaycar electronics for \$0.36)

**A NAND gate logic control integrated circuit chip** (I used a Texas Instruments CMOS CD4011 chip available from Jaycar electronics for \$0.85)

## **OPTIONAL EQUIPMENT**

**Various sizes of shrink wrap** (to encase the wiring and soldered joints)

**Epoxy/Araldite to encase the soldered chip** (to prevent shorts and to protect the circuit)

**Zip ties** (to ensure a clean installation on the wiring harness)

## **BASIC DISCUSSION OF SWITCH CIRCUIT:**

This switch is intended for use with those Ducati machines that have the basic sidestand switch where the engine can only be started with the sidestand up. This electronic switch will allow you to start and warm up the bike on the sidestand but will cut the engine if you put it into gear with the sidestand down.

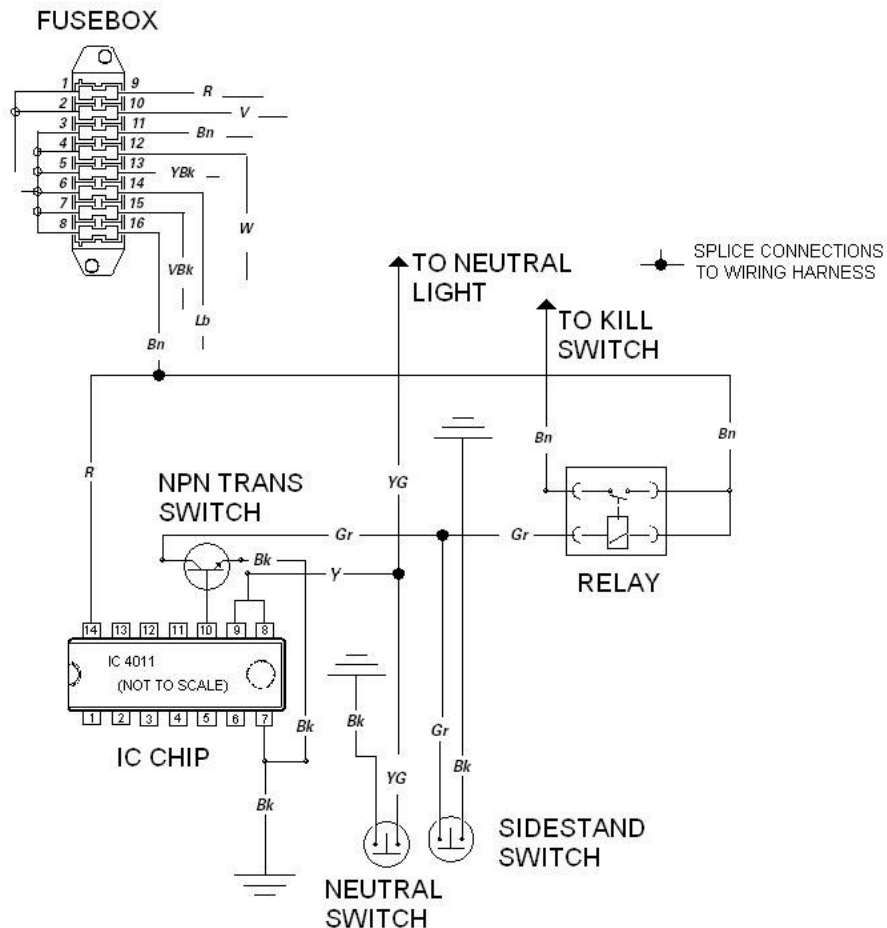
The switch is a very simple circuit and operates on the sidestand relay box with the neutral warning light switch as the sensor. In the stock configuration, the sidestand relay (an electro-magnetic switch) is closed when the sidestand is up and completes the circuit to the engine kill switch. When the stand is put down, the relay is opened and opens the kill switch circuit, thus cutting the engine.

This modification runs a sensor wire from the neutral warning light switch to the integrated circuit (IC) chip which then makes a decision on whether the engine is in gear or not. If the engine is not in gear the chip sends a signal to the transistor switch which completes a parallel circuit to the sidestand relay thus energizing the relay and completing the kill switch circuit. If the engine is put in gear, the IC senses the voltage at the neutral warning light wire and sends a signal to the transistor to open the parallel relay circuit and thus opens the kill switch circuit which cuts the engine. The time taken for this process of events to occur is essentially immediate.

## BASIC CIRCUIT SCHEMATIC

The figure below shows the basic layout of the switch circuit in relation to the wiring diagram of a 2001 model 996 biposto. However, the circuit would be similar for other models which have the sidestand switch and relay. The basic geometry is, power, ground, neutral signal and relay parallel circuit.

**Wire color coding**  
**W-Y** White-Yellow  
**P** Pink  
**W** White  
**Y-G** Yellow-Green  
**G** Green  
**R-G** Red-Green  
**W-R** White-Red  
**W-G** White-Green  
**V-Bk** Violet-Black  
**Y** Yellow  
**W-Bk** White-Black  
**Bn** Brown  
**G-W** Green-White  
**W-Bn** White-Brown  
**R-Bk** Red-Black  
**R-B** Red-Blue  
**GR-R** Grey-Red  
**R** Red  
**Bn-W** Brown-White  
**B-Bk** Blue-Black  
**Y-Bk** Yellow-Black  
**GR** Grey  
**V-W** Violet-White  
**Lb** Light blue  
**Bk** Black  
**Y-B** Yellow-Blue  
**Bn-G** Brown-Green  
**G-Gr** Green-Grey  
**O-G** Orange-Green  
**Gr-Y** Grey-Yellow



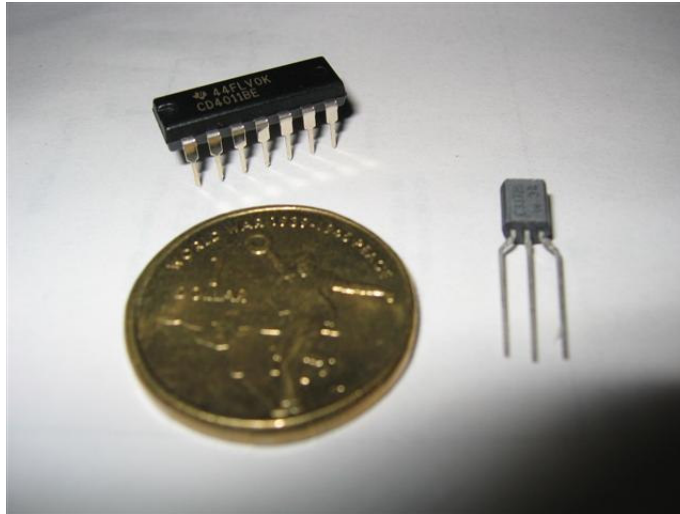
**Figure 1: Switch Wiring Schematic**

## SWITCH MANUFACTURE

Prepare your materials and switch on the soldering iron. Allow the iron to achieve stable temperature prior to attempting work. The IC and transistor can be damaged by excessive heat. Typical safe applications of the soldering iron to the joint are about 5 seconds. Tin the wires with a small amount of solder prior to bringing the parts to be jointed together. Hold the joint together and apply heat and allow the solder to be drawn into the joint. Remove the iron and allow the joint to cool without movement.

The physical size of the switch is fairly small. The legs of the transistor can be bent and soldered directly to the applicable legs of the IC. Solder the applicable wires directly to the legs of the IC and manipulate them so that they are lined up and exit from one end of the chip in a neat and parallel manner. The remaining legs of the IC which are not used can be cut off. Take care not to apply so much solder such that shorts within the circuit may occur.

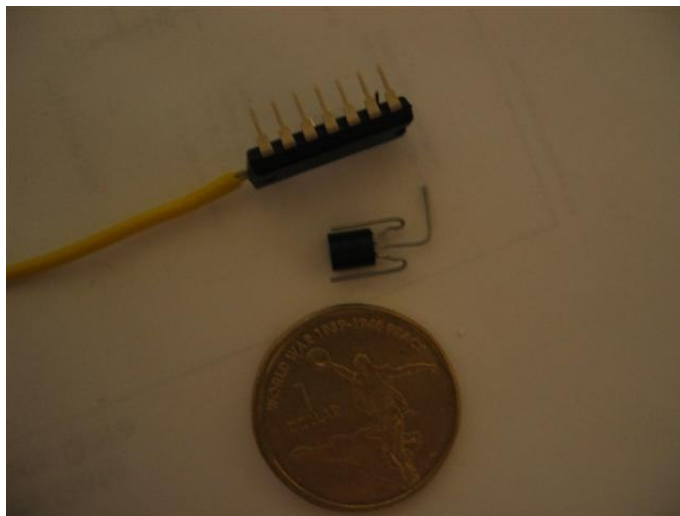
Figures 2 through 5 show the sequential steps in the manufacture of the switch circuit.



**Figure 2: CMOS 4011 IC Chip and BC337 NPN Transistor**

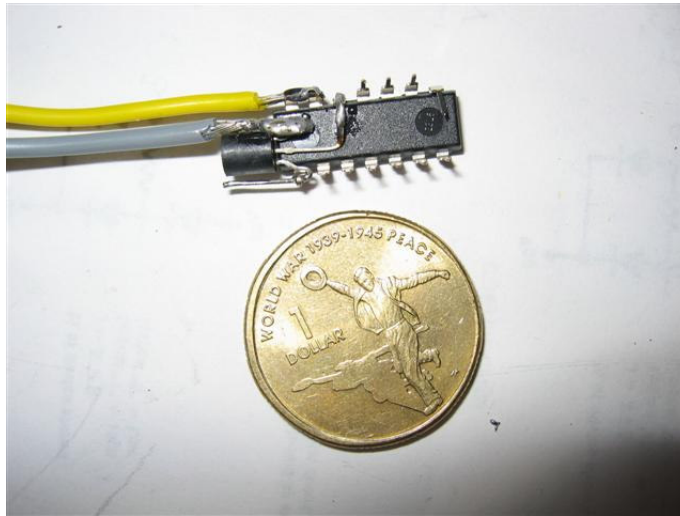
Lay the chip upside down and begin by soldering the yellow wire to pins 8 and 9 of the chip (refer Figure 3) Take care to note the correct pins of the chip by placing it face up resting on it's pins with the semi-circle indent on the left, pin 1 is directly below the indent and the pins are numbered sequentially in an anti-clockwise direction about the chip.

Next, bend the pins of the transistor as shown in Figure 3. Note that the lower pin as shown in the figure is hooked over pin 7 (the ground connection) and the center pin is bent 90 degrees and soldered to pin 10 of the chip.



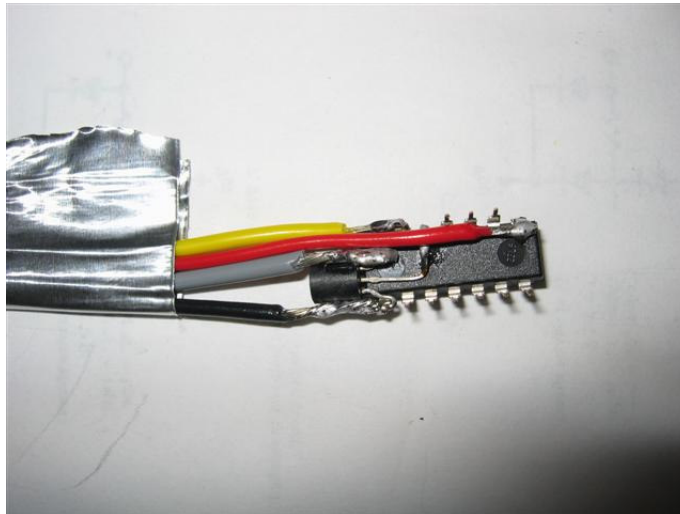
**Figure 3: Neutral Wire and forming of Transistor Pins**

Next, solder the grey wire (the relay short circuit wire) to the upper pin of the transistor taking care not to bridge the transistor pins with solder. Figure 4 shows the transistor soldered to the chip.



**Figure 4: Jointing of Transistor and Relay wire**

Next, solder the black wire (the ground wire) to the lower pin of the transistor and then solder the red power wire to pin 14 of the chip. Place the wire as shown in Figure 5 and bend the pin 14 over the wire and solder in place.



**Figure 5: Completion of Switch Manufacture**

At this stage the circuit is complete. To avoid shorts within the circuit, the unused pins of the chip should be cut from the chip. To protect the switch from damage due to moisture ingress or mishandling I recommend that it is placed in a length of heat shrink wrap and subsequently filled with epoxy (araldite glue) and allowed to cure to full hardness. Figure 6 below shows the completed switch ready for installation on the bike. However, prior to encapsulating the circuit in the heat shrink and epoxy you should test the switch for correct function with a trial fit on the bike or by using a power supply (between 3 and 15 volts and a multi-meter. Correct operation is as follows:

Connect the red wire to the positive terminal of the power supply and the black wire to the negative terminal of the power supply. Connect a multi-meter set to read electrical resistance on the 0 to 200 ohm scale between the grey and black wires, with the yellow wire left disconnected the resistance should read low i.e. less than 10 ohms. This indicates that the transistor switch is closed, allowing current to pass through the sidestand relay. Now connect the yellow wire to the positive terminal of the power supply and read the resistance. The

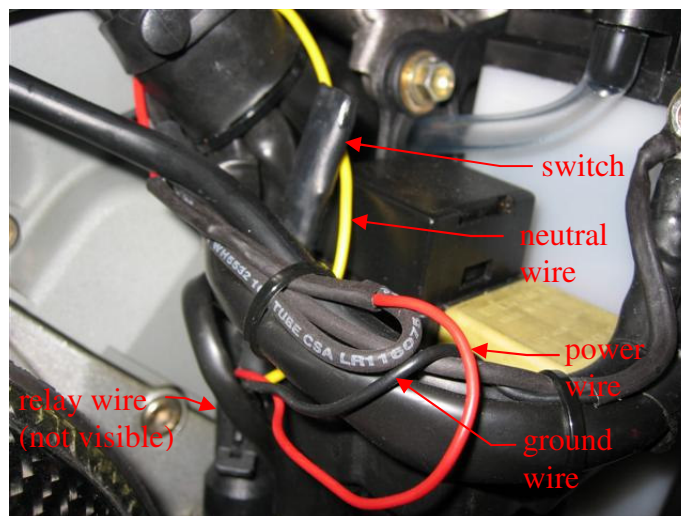
reading should be infinite indicating that the transistor switch has opened thus preventing current from passing through the sidestand relay.



**Figure 6: Completed Side Stand Switch**

At this stage the switch is ready to be installed on the wiring harness of the bike. Refer to Figure 1 above for the wiring schematic. Position the switch on the bike in a suitable location away from significant heat sources. Identify the correct lengths for each of the four wires and trim to suit. Connect the red wire to the connector 16 terminal of the fusebox. I simply soldered the wire to the side of the connector. The power should pass through the fusebox for two reasons; a. so that the switch will only be operating while ignition is switched on and b. if there is a short failure within the switch the wiring harness will be protected by the fuse.

Connect the black wire to an adjacent grounding wire or simply attached an eye connector and bolt the wire to the negative terminal of the battery. Connect the grey wire to the grey wire of the sidestand relay by soldering the wire to the connector. If you cannot remove the connector from the housing or there is insufficient room to solder, cut the wire and make a 3 way joint. Ensure that you clean the joint after soldering to prevent sharp edges and envelope the joint in a length of heat shrink wrap. Lastly, solder the yellow wire to the neutral switch wire. Follow the neutral switch wiring from the switch at the rear right side of the engine to the connector, cut the yellow/green wire just after the connector and make a 3 way joint similar to that used for the grey wire. Clean up the wires by manipulating and holding in place with zip ties. Figure 7 shows the installed switch on my 2001 996.



**Figure 7: Complete Switch Installed on Bike**

Hope you enjoy.

Kind Regards,