Relays – For BMW Motorcycles

-> Is that relay necessary?

By Ron Schmidt

We often get the opportunity to help our customers add electrical items to their motorcycles. Jeff asked me some interesting questions just the other day about relays. Why do we need them? What exactly do they do? Why do we use multiple relays sometimes?

He mentioned that less than 100 years ago, he installed a set of Lucas Flamethrower driving lights on a 1959 MGA. He said he just ran a wire from the positive side of the battery, through a toggle switch on the dash, then to the lights. Everything worked. Switch on, lights on. Switch off, lights off. Simple.

We could wire the same lights on a new BMW (well, if you could actually find a working set of Flamethrowers!) the same way and they would work just fine. Electricity really hasn't change much, even in Jeff's lifetime.

Here are a few reasons why we would not be inclined to wire them that way:

The switch would have to be large enough physically to handle a couple hundred watts. That size looked fine on a dash of an old English sports car, but would be an eyesore on a motorcycle.

If little Johnny next door found that big switch and flipped it to the on position, the lights would come on even with the ignition key off. The owner of the motorcycle would come out to find a dead battery. Little Johnny's life might be in jeopardy. Nothing good would come of this scenario.

The Flamethrowers would not turn off when the high beam was turned to low beam. So the oncoming cars would be blinded for extra time until the low beam switch and the Flamethrower switch were both turned off. This requires an extra step, and more importantly, an increase in the amount of time that the rider is thinking about turning lights off instead of thinking about where he is going. Unsafe.

Relays are what we use to eliminate the above problems, as well as to allow us to work around the CAN (Controlled Area Network, AKA Can't Add Nothin') systems on the new BMWs.

The same scenarios could apply to any item that uses a lot of current. Lights and heated clothing fall into this category. However, even items that run with a very small amount of current, such as GPS or radar detector units, can benefit from a relay if you want to turn them on or off in conjunction with some other event, such as only wanting them to work only with the ignition on. For the duration of this discussion, we will call whatever the item that needs to be switched a consumer.

The simplest relay is nothing more than an electrically operated switch. Most have a small electromagnet that, when energized, moves a larger contact switch to control another circuit. The small electromagnet requires very little current to trigger it. The larger contacts that are switched to complete the other circuit handle all current that the consumer needs.

To further simplify the relay, we'll break it into its two main components. We will call the first part, the electromagnet side, the relay coil. We will call the second part, which carries the current for the consumer, the controlled switch. These are my terms, so if you are an electrical engineer, please feel free to call each side whatever you like when you are presenting your seminar.

The relay coil requires very little current to do its job of pulling the contacts of the controlled switch together. The relay coil has two terminals. One will be grounded; the other needs a 12VDC power source to operate it. This allows us to use small switches or even other circuits that already exist on the motorcycle to operate them. If we use the 12VDC source from the high beam of Jeff's old car, the Flamethrowers would come on any time the high beams were on, and

turn off when the high beams turned off. If he wanted to have the high beams on without the Flamethrowers, we could install a microswitch in series between the high beam and the relay coil. Then he could have both on or just the high beams by turning the microswitch off.

The low current needs of the relay coil are also useful in allowing us to "fool" the CAN. Every circuit on the CAN has to have some + and – allowances. The relay can be added into the protected CAN circuits and generally not trip them. If the CAN circuit is too sensitive for a normal relay, we can use special, extremely low current electronic relays that will not trip the CAN, and have that relay trigger a larger relay to supply current to the consumers. We will not be defeated!

The controlled switch part of the relay handles the current needs of the consumer. In its most basic form, the controlled switch is nothing more than an on or off (circuit closed or circuit open) device. This kind of relay is commonly used to turn a consumer on or off in conjunction with another event, such as only when the ignition is on. This is called a single pole, single throw (SPST) switch. It has two terminals. One is a supply, generally through a fuse directly to the positive side of the battery. The other terminal is the switched side that, when on, supplies current from the supply to the consumer.

Another version of the controlled switch side of the relay, called a double pole, single throw (DPST) or a change-over switch, allows us to turn one consumer on when another is turned off. It has three terminals. One is a supply, generally through a fuse directly to the positive side of the battery. The other two take turns: when one is on, the other is off and vise-versa. An example for the use of this kind of relay is on bikes with more than one set of additional lights. On my GS I have a set of fog lights and a set of monster, illegal, wonderful rally lights. I use an SPST relay, triggered by the ignition switch, to supply the current to the supply side of a DPST relay controlled switch. The DPST relay coil is triggered from the high beam. When the high beam is on, one of the two controlled switch terminals has power, the other is off. When the low beam is turned on, the two terminals reverse. One terminal supplies current to the monster lights, the other supplies current to the fog lights. Additionally, there is a micro switch in series between the triggering sides of the relays. So, with the key off, none of the lights come on. With the key on, lights on low beam, only the fog lights come on, or I can choose to turn them off with the micro switch. With key on, fog light micro switch on, high beam on and monster light micro switch off, the fog lights stay on with the high beams. With key on, high beams on, and the monster light micro switch on, the monster lights are on but the fog lights go off. This is helpful, because once the monster lights are on, the fog lights are just a current draw with no benefit, similar to turning a flashlight on midday at White Sands National Monument. It also adds a cool feature. If everything is turned on and I use the high beam flasher it cycles the fog and Monster lights sequentially. I can tell you that in LA rush hour traffic this will cause the traffic to spread like the Red Sea. It might also get me thrown in jail.

Relays come in a variety of sizes and shapes physically. They are also "sized" electrically as needed to handle the current requirements of the consumer. Be aware that from one brand to the next the physical location of the terminals may not be the same, so you must know the schematic of the relay you are going to use. Sometimes Bosch and Hella relays, both made in Germany, have the same size terminals and will plug into the same pigtail blocks, but will not operate the same or perhaps at all. Or at worst they might allow all the smoke to escape from the wire, which is a very bad thing. So be careful.