Introduction to Static Protection Relays

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The term ***'static'*** implies that the relay has no moving parts. This is not strictly the case for a static relay, as the output contacts are still generally attracted armature relays. In a protection relay, the term 'static' refers to the absence of moving parts to create the relay characteristic.

The RSR-72 type relay for re-start and reacceleration is deigned to perform the automatic motor restarting, after control and protection device opening, as a consequence of a momentary line voltage interruption or drop-out.

Introduction of static relays began in the early 1960's. Their design is based on the use of analogue electronic devices instead of coils and magnets to create the relay characteristic. Early versions used discrete devices such as transistors and diodes in conjunction with resistors, capacitors, inductors, etc., but advances in electronics enabled the use of linear and digital integrated circuits in later versions for signal processing and implementation of logic functions.

While basic circuits may be common to a number of relays, the packaging was still essentially restricted to a ***single protection function per case***, while complex functions required several cases of hardware suitably interconnected. User programming was restricted to the basic functions of adjustment of relay characteristic curves.

They therefore can be viewed in simple terms as an analogue electronic replacement for electromechanical relays, with some additional flexibility in settings and some saving in space requirements. In some cases, relay burden is reduced, making for reduced CT/VT output requirements.

A number of design problems had to be solved with static relays. In particular, the relays generally require a ***reliable source of d.c. power*** and measures to prevent damage to vulnerable electronic circuits had to be devised. Substation environments are particularly hostile to electronic circuits due to electrical interference of various forms that are commonly found (e.g. switching operations and the effect of faults).

While it is possible to arrange for the d.c. supply to be generated from the measured quantities of the relay, this has the ***disadvantage*** of increasing the burden on the CT's or VT's, and there will be a minimum primary current or voltage below which the relay will not operate. This directly affects the possible sensitivity of the relay.

Figure 1 - Selection of static relays

So provision of an independent, highly reliable and secure source of relay power supply was an ***important consideration***.

To prevent maloperation or destruction of electronic devices during faults or switching operations, sensitive circuitry is housed in a shielded case to exclude common mode and radiated interference. The devices may also be sensitive to static charge, requiring special precautions during handling, as damage from this cause may not be immediately apparent, but become apparent later in the form of premature failure of the relay.

Therefore, radically different relay manufacturing facilities are required compared to electromechanical relays. Calibration and repair is no longer a task performed in the field without specialised equipment.

Figure 1 above shows examples of simple and complex static relays and ***Figure 2*** shows the circuit board for a simple static relay.

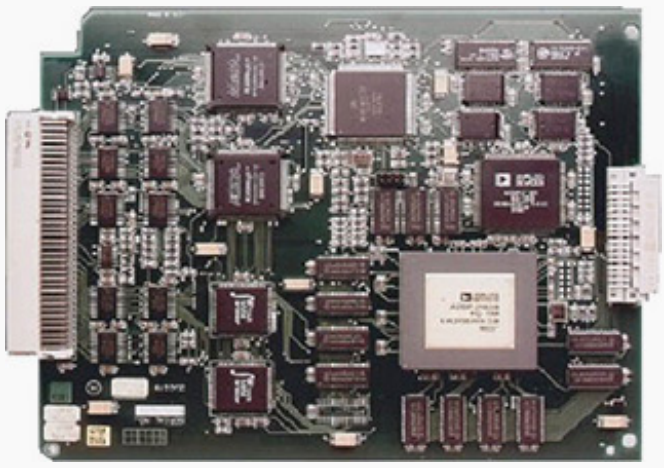

Figure 2 - Circuit board of static relay

Advantages of Static Relays

Static relays in general possess the following advantages:

1. Low burden on current and voltage transformers, since the operating power is. in many cases, from an auxiliary d.c. supply.
2. Absence of mechanical inertia and bouncing contacts, high resistance to shock and vibration.
3. Very fast operation and long life.
4. Low maintenance owing to the absence of moving parts and bearing friction.
5. Quick reset action and absence of overshoot.
6. Ease of providing amplification enables greater sensitivity.
7. Unconventional characteristics are possible – the basic building blocks of semiconductor circuitry permit a greater degree of sophistication in the shaping of operating characteristics, enabling the practical utilization of relays with operating characteristics more closely approaching the ideal requirements.
8. The low energy levels required in the measuring circuits permit miniaturization of the relay modules.

Resources: *Network Protection & Automation Guide – Areva; Power System Protection: Static Relays by T. S. Madhava Rao*

Source: http://electrical-engineering-portal.com/introduction-to-static-protection-relays