

June 2011

What is a Solid-State Contactor?



We've spent a lot of time in previous editions discussing the technical aspects of solid state relays and their advantages over traditional switching solutions such as electromechanical relays and contactors. We've also spent some time talking about the applications for such products and the features / benefits that make solid state relays advantageous over EMRs and contactors when used within these applications. The conclusion we've reached, or have attempted to reach, is that both technologies have their place in the world; some applications are better suited for contactors, while many others are better suited for solid state relays.

Simple and succinct! Everything has a purpose in life.

But what about a solid state contactor?

Semantics

The differentiation between a relay and a contactor is a subject often debated in some engineering circles. At least, that is, in circles that don't have better things to do than debate such things. Never the less, the issue still remains; what makes a relay, specifically a solid state relay, a "relay", and what makes a contactor a "contactor"?

According to hyperspace's all-knowing repository of information (Wikipedia), a "contactor" is "...an electrically controlled switch used for switching a power circuit, similar to a relay except with higher current ratings", while a "relay" is simply "...an electrically operated switch". Therefore, it follows logically that solid state "relays" must be "relays" because they have lower current ratings than contactors. Both essentially perform the same function (opening and closing of an electrical circuit as a result of an external signal), but one is just bigger than the other. However, what if a panel is equipped with both a 10A "contactor" and a 50A solid state "relay"? Do the classifications for each suddenly change?

Some would definitely rebuke such a notion even if they accepted the premise that the size of the relay was irrelevant to its classification. This is simply because the term contactor, in their opinion, unequivocally implies the use of traditional electromechanical switching technology. Per their argument, since a "solid state relay" pretty much relies on "solid state" technology, it must therefore forever remain a "relay". This is a somewhat confusing position to take as for nearly 150 years (up until Crydom invented the Solid

State Relay in 1972 and their subsequent growth in the market) *all* relays utilised electromechanical switching technology. In fact, most relays on the market today are still electromechanical. So why is there such tolerance for the using the term “relay” with reference to solid state products and such resistance towards contaminating the terminology of the contactor world?

In most cases the answer is simply “comfort zone”, which takes us back to our circles. In other words, many engineers grew up with the belief that their big “bang and clang” electromechanical product was a contactor, while the little “click and clack” electromechanical product or solid state switch was simply a relay. This belief was further compounded by the fact that every manufacturer of solid state relays themselves called their products “relays”, and still do for the most part. However, If we eliminate the type of switching technology from the debate (solid state vs electromechanical), and agree to the fact that size is relative (solid state devices can and often do have higher current ratings than contactors), then we should be able to reasonably conclude that a solid state relay may also be classified as a solid state contactor. This may not sit well with the old-school engineering circle, which may also refute such a claim on the basis that there is a further differentiator in the designations due to the motor-load ratings commonly applied to contactors.

In this we believe they have a valid point. However, we also know that motor-load ratings can and are being applied to Crydom solid state relays, which effectively make them “solid state contactors” and, therefore, should end the debate.

But it probably won't!

In the end, we must only accept the fact that each and every manufacturer of such products may claim its own definition of the term, which may result in a confusing grey area. With regards to Crydom, our litmus test for whether or not the term “contactor” can be applied to a product is simply 1) is the product a multi-phase product or designed for use in a multi-phase system (three-phase or reversing contactor)?, and 2) does the product have documented and supported motor-load ratings? If the answer to both is “yes”, then it may be classified as a solid state contactor.

Note that we said it *may* be classified as a contactor. Some products, such as the 53TP and 53RV series three-phase and motor-reversing relays, are still classified as solid state relays even though they meet the litmus-test criteria established above for classification as solid state contactors. This has nothing to do with the operation of the products as they perform the exact same function of a solid state contactor. It is more of a historical classification, which is also influenced somewhat by target markets, applications, and commercial policies (part of the “confusing grey area”).

UL / IEC Classifications

We would be remiss if we excluded from our previous discussion the fact that UL and IEC standards have played a part in influencing market perception as to what is a contactor and what is a relay. From experience, many engineers referring to “IEC 60947 – Low-Voltage Switchgear and Controlgear” automatically think of electromechanical contactors. However, IEC 60947 does not define whether a

product is classified a contactor or a relay, nor does it restrict the classification of a product based upon the technology utilised to perform the switching function. Instead, IEC 60947 is broken down into parts that apply to specific types of low-voltage switchgear and controlgear. Manufacturers who want to submit their products for evaluation to IEC 60947 must determine which part is applicable to their product based on its intended use and the type of technology utilised..

For example, IEC 60947-4-1 applies to “Contactors and motor-starters – Electromechanical contactors and motor-starters”. As the title clearly states, only contactors utilising electromechanical switching technology can claim compliance to this part of the standard. But before any of our circles say “I told you so”, we jump to IEC 60947-4-2, which applies to “Contactors and motor-starters – AC Semiconductor motor-controllers and starters”, as well as IEC 60947-4-3 for “AC semiconductor controllers and contactors for non-motor loads”. So as we can see, the standard is perfectly willing to accept both electromechanical and solid state devices classified as a “contactor” and accommodates both by providing specific parts relative to their intended use and design.

UL508 on the other hand makes even less differentiation between whether a product is electromechanical or solid state and is applicable to both. However, as with IEC 60947 it does differentiate products by their intended use (Motor Controller or General Use Switch), but still steers clear from defining whether it is a relay and a contactor.

Crydom Solid State Contactors

Crydom offers two basic types of solid state contactors; AC three-phase switching and AC or DC motor-reversing. The DRA3P series AC three-phase contactors, as per our litmus test, have UL508 and IEC 60947-4-3 (AC51 up to 2.4A @ 510Vac) general-purpose resistive load ratings as well as IEC 60947-4-2 (AC53a up to 0.75kW @ 480Vac) motor-control ratings. Both zero-crossing (resistive loads) and random turn-on (motor loads) output versions are available, with internal overvoltage protection standard on all models.

The DRA3R series motor-reversing contactors have IEC 60947-4-2 AC53a motor-load ratings up to 1.5kW @ 480Vac and include a built-in interlock to protect the relay in the event of a simultaneous actuation of both the forward and reverse input signals. They also include internal MOVs and 1600V SCR die for reliable operation in harsh industrial environments. The DRA4D series DC “H-Bridge” motor-reversing contactors have 360W motor-load ratings at load voltages up to 180Vdc.

All Crydom solid state contactors offer the same advantages over traditional electromechanical products that our standard line of solid state relays provide, including;

- Life expectancy in excess 2 Million hours / 50 Million operations
- No moving parts, which eliminates switch-bounce and arcing
- No audible noise during switching
- Fast turn-on / turn-off time allows for accurate load control
- Zero-crossing capability to reduce surge currents

- Low-power input allows for the switching of high current loads with only a few mA of supply current
- High shock and vibration resistance
- Low cost of ownership over the life of the product

In addition to the DRA3 / DRA4 series contactors, Crydom is continually expanding the product line of solid state contactors to meet a wide variety of applications. For additional information please visit www.crydom.com.

Additional Information

[DRA Series Contactors – Press Release](#)

[DRA Series Contactors Brochure](#)

[DRA3P Series AC Contactors](#)

[DRA3R Series AC Motor-Reversing Contactors](#)

[DRA4D Series DC Motor-Reversing Contactors](#)

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