Which Power Controllers are Best for Your Application

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INTRODUCTION

One of the toughest chores when specifying an SCR Power Control (SCR) is determining which options are required or best suited for the application. Sometimes it's obvious; however understanding the application, load element type and available options will make the selection easier.

Keep in mind, although some options can be used with either zero-fired or phase-fired SCRs, most are used with phase-firing. For example, a current limit is normally used with phase-firing. Although some SCR manufacturers provide current limits for zero-fired equipment, understanding how a current limit operates tells the engineer whether or not this makes sense (see RMS Current Limit).

The following list provides a brief description of how the option operates, lists typical applications and is followed with the numbers 1 and/or 3 and the letters ZF and/or PF indicating the number of phases and whether it is to be used on zero- or phase-fired SCR Power Controls.

OVER-TEMPERATURE THERMOSTATS "NO or NC" – These are bi-metal snap thermostats that open or close when the heatsink's temperature exceeds it's maximum operating temperature. Underwriters laboratories require thermostats on any SCR Power Controller that has active cooling such as fans or water. HDR provides a thermostat as standard equipment starting at 90 amperes. You need to specify N.O. or N.C. when ordering a SCR Power Controller. If you do not, you will receive N.O. thermostats. (1,3,Z,P)

FUSE KIT "FK" – HDR's ZF1,2,3 and PF1s rated 15, 25, 40 and 70 amperes do not include a fuse as standard equipment. Fuses are available in kit form for mounting by the user. The kit includes a fuse block and the correct number of fuses of the proper rating. HDR provides semi-conductor fuses, not slow-blow as some SCR manufacturers. The semi-conductor fuse is clearly the proper choice based upon its operating characteristics.

TRANSFORMER KIT "TX" – HDR's ZF1,2,3 and PF1s rated 15, 25, 40 and 70 amperes require 24 VAC control power with the exception of the ZF1 and ZF2 "-C" models which are self powered by the 4-20ma command signal. The transformer provides only the control power on zero-fired models. However, on the PF1 it not only provides control power but also the essential zero-crossing signal necessary to synchronize the firing of the SCRs. Because it provides the synchronizing information, its primary winding must be connected to the same source that the PF1 is controlling. (1,3,Z,P)

LUG KIT "LG" – Pressure type lugs such as ILSCO or Burndy are standard equipment on HDR's SCR Power Controls rated 15 through 225 amperes. HDR found that most users of SCRs above 225 amperes prefer compression crimp-on lugs as compared to the pressure type. For this reason, lugs can be provided as an option on units rated 350 amperes and higher. (1,3,Z,P)

RMS CURRENT LIMIT "CL" – HDR's current limit is RMS current sensing: not average current as some manufactures provide. This is important since the RMS value of the current is the heating value. Current Limits are generally used if the load's resistance is likely to change with temperature or time such as Silicon Carbide. The current limit sets or clamps the maximum RMS current available from the SCR Power Control. It also includes an over-current trip (see Over-Current Trip). The current limit is adjustable from 35 to 125% of the SCR's current rating. (1,3,P)

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RMS CURRENT REGULATION "CR" – Our current regulator is RMS current sensing. The "CR" option will limit the maximum current similar to the current limit and will hold the RMS current constant based upon the command signals level regardless of load resistance changes or line voltage fluctuations. In addition, the RMS output current will be linear to the command signal input. The most common application is controlling load elements like molybdenum disilicide. Because this element's resistance is nearly zero when cold, it is important to regulate the RMS current until the element comes up to temperature. The adjustment range is 35 to 125% of the units rating. It includes an Over-Current Trip (see Over-Current Trip). (1,3,P)

OVER-CURRENT TRIP "OC" – HDR's over-current trip is peak current sensing. This is important since the instantaneous peak current can damage a SCR. The "OC" will shutdown the SCR within a half-cycle of AC current, usually quick enough to protect the SCR. It includes an auto/man reset that allows the user to select automatic or manual reset after an alarm. In the automatic mode, the circuit will automatically reset and continue operating. If the fault is still present, it will trip again and continue resetting until the fault has cleared. This is especially useful if the application has frequent faults that clear. In the manual mode, a local or remote reset pushbutton must be pressed or complete removal of power to the SCR Power Control is required to reset. A "form C" relay output is available for alarming or shutdown. The adjustment range is 100 to 300% of the unit's current rating. HDR does not recommend using the "OC" trip as "electronic fuses" to replace the semi-conductor fuse except in special instances. (1,3,P)

POWER REGULATION "PR" – The power regulation option monitors true power to regulate the SCR's output. It uses output voltage, current, conduction angle, phase-shift and power factor to compute the power. The "PR" option sets a limit on available power from the SCR Power Controller. It will hold the output power constant regardless of load resistance changes or line voltage fluctuations based upon the command signal's level. It also provides output power that is linear to the command signal. The most common use is controlling silicon carbide elements. The adjustment range is 35 to 125% of the units rating. It includes a RMS current limit and has a 0-5Vdc output that is proportional to load power. (1,3,P)

LOAD FAILURE ALARM "LF" – This option monitors the load voltage and current, calculates load resistance and provides a relay output if the load resistance changes. This is especially useful with loads made of several series-parallel connected load elements. (1,Z,P)

LOAD UNBALANCE ALARM "UB" – The unbalance alarm monitors and compares the current in each of the three phases. If the current deviates more than the setpoint allows, an alarm relay is actuated. The 3 phase sensing can be intentionally offset if the load has an intentional unbalance. (3,Z,P)

SCR FAILURE ALARM "SF" – This option monitors the voltage drop across each of the SCRs. Since most SCRs fail shorted (zero voltage drop), this is the most accurate method to detect a failed SCR. A relay output is provided. This method should not be confused with the method of comparing the SCR Power Control's output current to the input command signal and providing a relay output if output current is present with no input command signal. (3,Z,P)

VOLTAGE, CURRENT, POWER or RESISTANCE REGULATION "VIPR" – Pronounced Viper, this circuit allows the user to manually select the regulation mode. The voltage, current and power modes operate similar to those already described. The resistance mode monitors the load voltage and current, calculates the resistance for any given command signal and provides a feedback

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signal to the SCR. Especially useful in laboratories whose requirements change frequently and for direct electrode glass melting. Maintaining a constant glass resistance ensures a constant and even glass temperature. The adjustment range is 35 to 125% of the unit's rating. An RMS current limit is included. (1,P)

While each of the previously mentioned HDR options are included in the SCR Power Controls model number as a suffix, the following options are included as a prefix.

WATER-COOLING "W" – Most of HDR's power controls can be built with water cooled heatsinks. The advantage is the heat loss associated with the SCR is removed via water. This is especially useful if you must maintain a sealed enclosure such as a NEMA 12. This option is not UL, cUL or CE approved. (1,3,Z,P)

DC OUTPUT "DC" – On single-phase SCR Power Controllers this is available as DCPF1 and used mainly as Saturable Core Reactor drivers or for vibratory feeder control. The output voltage is 90% of the input RMS voltage. Most current ratings of HDR's PF3 can be converted to DC output. The DC output voltage on a 3-phase unit will be 1.35 times the input line-to-line RMS voltage. (1,3,P)

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