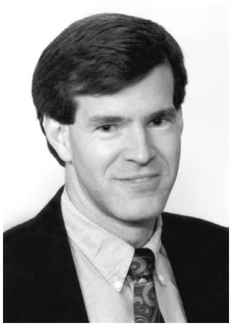

by John J. Shea

Electronic Devices on Discrete Components for Industrial and Power Engineering

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Electronics is being used for many power control and switching applications. More and more sophisticated but sensitive devices, such as microcontrollers and integrated circuits, are incorporated into many modern day semiconductor devices. However, because of the low voltages used in such devices, reliability becomes an issue, especially for critical process controlled by potentially sensitive electronics. Microcontrollers allow the inclusion of many new features. However, microcontrollers can be very susceptible to EMI and power transients, and may not be highly reliable, especially in harsh industrial environments. Also, there is the threat of man-made EMI (electromagnetic weapons) which can be used to cause electronic failure. Generally, if the microcontroller in a system fails, the entire system fails. Another factor to consider is the degree of sophistication required to implement microcontrol, e.g., surface mount components, power supply support, PC board fabrication, memory, software, and firmware considerations. All this requires considerable resources. Such a huge amount of work may not be realistic for those who may need only one or two circuits for use in the lab or plant.

The author adopts the approach of using only discrete devices for switching and control of distribution-level voltages. This book shows how devices such as high-voltage transistors, thyristors, and miniature vacuum and high-power gas-filled reed switches can be used to build simple and reliable switching devices for industrial automation applications, as an alternative to microcontrollers and other sensitive electronics. The author presents dozens of realizable circuits that can easily be made in a laboratory without sophisticated equipment. The circuits are mainly relay protective devices, and automation devices, which use only discrete components, free from the disadvantages of complex microcontrollers and microelectronics (but of course without the benefits).

The book consists of seven chapters and a number of appendices containing reference data on various discrete components. The first three chapters describe the operating principles of the discrete components used in subsequent chapters, including thyristors, transistors, dinisters, reed switches, and high-voltage reed relays. The fourth chapter describes circuits mainly used for switching and protection at distribution level voltages. The examples involve 220 to 250 Vac systems, but the circuits can be easily scaled to virtually any distribution voltage level (i.e. 120 Vac, 208 Vac, 480 Vac, etc.). Details cover switching devices, timers, logic elements, elements sensitive to overcurrents, overvoltages, regulators, and stabilizers used in control equipment in industrial plants. The final three chapters describe industrial applications based on discrete components and circuits, with many of the circuits being useful in power electronics, power switching, and electromechanical applications. Examples are a simple soft-start contactor, HV pulse generator, arc-arresting circuit, HV reed relay controllers for lasers, microwave ovens, radar systems, overcurrent protective relay, circuit breaker, and HV indicators for switchgear.

This is an interesting book for those who need to build these types of devices for laboratory or one-off use. It gives many useful and interesting circuits for controlling and switching high-power distribution level voltages. The appendices contain a summary data sheet on many high-voltage (200 to 4000 V) semiconductor devices (transistors, thyristors, IGBT's, triacs, diacs, FETs, and various types of reed relays), making the appendix a convenient reference for hard-to-find components. Those who like to tinker in the lab with high-power switching and protective type devices will find this book very interesting and a worthwhile purchase.