Fundamentals of Industrial Control

C. L. Albert,
D. A. Coggan, Editors

Practical Guides for Measurement and Control

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Instrument Society of America

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About This Series

This volume is part of the Practical Guide Series developed and published by the Instrument Society of America (ISA).

The Practical Guides were conceived because of a shortage of published material in the field of measurement and control that bridges the gap between theory and actual industrial practice. Many books in the field have catered to the needs of technical students, who need to be oriented to basic control theory and concepts, or college-level readers, who are interested in engineering mainly from a classroom perspective. There are handbooks for practicing engineers that cover measurement and control, but these handbooks often devote only a chapter or two to topics that merit more attention. Within the Practical Guides Series, separate volumes address each of the important topics and give them comprehensive, book-length treatments. Each book in the series can be understood and used by technical students, sales engineers, sales personnel, and managers, and relied upon by those who have "real-life" industrial concerns such as correct application, safety, installation, and maintenance.

Another unique feature of the Practical Guides is the stress placed on the actual experience of measurement and control practitioners. The Practical Guides are overseen by three Series Editors and one Series Technical Editor, who have extensive experience in measurement and control. The Series Editors guide the Volume Editors, who have been selected for their specific expertise in the volume topics and who bring together numerous Contributing Writers with even more specialized knowledge.

The Practical Guides capture the hard-earned experience of the writers and, by employing examples and recording anecdotal observations, make that experience as applicable for the reader as possible. Case studies, either hypothetical or based on real case histories, are used to illustrate typical situations and show how good planning and practical applications made the difference between success and failure. Some of this information has never been documented before.

This volume is designed to be at home in a library, in a classroom, or on the plant floor. The comfortable reading style, large pages, and frequent illustrations will contribute to ease of use. The page design uses graphics to "call out" some of the major points of the text, such as crucial safety checks and important examples. Each Practical Guide gathers widely scattered information in a single text, with bibliographies directing the reader to other sources.

Providing editorial guidance for the Practical Guides Series are some of the most distinguished names in the field of measurement and control.

Paul W. Murrill, Ph. D., Series Editor

Paul W. Murrill has authored or co-authored ten textbooks and over 70 articles on process control, computers, and mathematical models. Formerly Chancellor of Louisiana State University, he currently serves as Special Advisor to the Chairman of the Board of the Gulf States Utilities, after having served as chairman and CEO of the company for five years.

Thomas M. Stout, Ph. D., Series Editor

Thomas M. Stout is the author or co-author of more than 125 technical papers and holds four patents as co-inventor of computer and process controls. Dr. Stout is a pioneer in the application of computers in process control, particularly in petroleum refining.

Robert H. Zielske, Series Editor

Robert H. Zielske is Chief Instrument Engineer for Georgia Pacific Corporation, where he oversees design, testing, installation, and start-up of new facilities and major expansions. During his 40-year career, he has worked in design and applications engineering, marketing and sales, and training.

John W. Bernard, Series Technical Editor

John W. Bernard has worked on the leading edge of industrial automation systems for 35 years. He has extensive experience in process management and research. Among his many achievements is installing the first digital computers for direct process control. Bernard has written numerous papers on computer control and systems engineering and has been deeply involved in standards activities.

Call for Participation

The major purpose of this series is to collect in one volume most of the existing practical knowledge about specific measurement and control subjects.

Additional material for inclusion in subsequent updates of this volume is most welcome.

If you wish to contribute any helpful hints, case studies, or other material, please contact:

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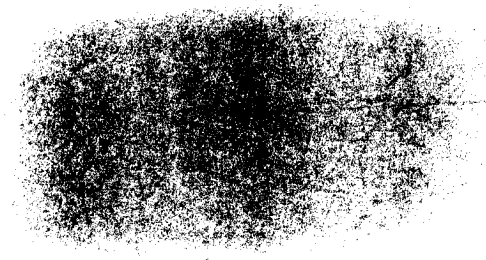

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Preface

Readers will wonder how a book on fundamentals can be published when there already seems to be so much similar material on the market. This one truly is different. As the introductory volume to the entire Practical Guide Series, it was written in the PGS spirit—with emphasis on the practical. This isn't always easy to do when dealing with fundamental concepts. The contributors to this book have succeeded, however, in finding the right balance between requisite theory and recommended application.

Another way in which this book is different is that it has a proven track record. Before becoming the introductory volume to the Practical Guide Series, it was used in a preliminary version as reference notes for an introductory course in process instrumentation given at McGill University in Montréal. This course has run continuously for 40 years, and the lecturers have always been practitioners. Their backgrounds have rubbed off on the course presentations and—fortunately—in this book.

Finally, this book was written by a dedicated group of professionals who, with the exception of one person, are all members of the Montréal chapter of ISA. Their enthusiasm was a major factor in assembling all the material needed to produce the words as they are printed here. The reader will undoubtedly be affected by this contagious enthusiasm.

Donald A. Coggan
Charles Albert
Montréal, Québec
July, 1992

About the Volume Editors

Donald A. Coggan, author of ISA's book and accompanying software, *Preparing for Instrumentation Technician Evaluation*, is an independent consulting engineer. He is owner and principal engineer of a consulting engineering firm specializing in control and automation systems. He is also the founder of Lab-Experts, which offers specialized engineering services for the control of laboratory ventilation systems. From 1981 to 1988, he carried on his varied consulting business activities under the umbrella company, Coggan Consulting Corporation.

Born and raised in Winnipeg, Manitoba, Mr. Coggan later moved to Montréal where he obtained his Bachelor of Electrical Engineering degree from McGill University. Before starting up his own consulting engineering business at the end of 1980, Mr. Coggan had previously worked for Johnson Controls and MCC Powers in positions of increasing responsibility. In addition, he was a part-time instructor from 1972 to 1986 at Vanier College where he taught courses in instrumentation, HVAC controls, energy conservation, and computer-aided drafting.

Mr. Coggan is the author of over 60 articles and technical papers, which he has presented throughout North America and in Europe and Asia. As founder and Editor-in-Chief of *Gaining Control*, his own technical publications company serving the control and automation industry, he has written a number of technical reports and software programs.

An avid reader and amateur health buff, Mr. Coggan lives in Outremont, Québec, with his wife, Huguette, and children, Rebecca, Christopher, and Melanie.

Charles Albert is a former president of the Montréal Section of ISA. He has been a member of the Executive Committee as well as a very active member of the Education Committee.

Mr. Albert has also carried out many functions at an international level out of ISA's head office in Research Triangle Park in North Carolina. These include participation in the Executive Committee on Education and the Computer Division. He has also played an active role as Official Delegate of the Montréal Section to international meetings and conferences in Canada, in the United States, and abroad.

Mr. Albert is employed by Canadian Pacific Forest Products where he is Senior Process Automation Engineer with Corporate Engineering Group.

Contributors

Biographies of each of the following contributors are included at the end of their respective chapter(s).

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