

CONTENTS

For the detailed contents of any subsection, consult the title page of that subsection. The alphabetical index follows Section 13.

	PAGE
<i>Contributors</i>	v
<i>Foreword</i>	xi
<i>Preface</i>	xiii
<i>Acknowledgments</i>	xvii
Sec. I—INTRODUCTION	
Instrumentation Defined	1-2
Standards of Measurement	1-6
Sec. 2—TEMPERATURE MEASUREMENT	
Thermocouples.	2-5
Radiation and Optical Pyrometry	2-21
Resistance Thermometry.	2-47
Thermistors as Primary Temperature Elements	2-60
Filled-system Thermometers.	2-68
Other Temperature-measuring Methods	2-85
Sec. 3—PRESSURE MEASUREMENT	
Mechanical Pressure Elements	3-4
Strain Gages and Other Electrical Pressure Transducers.	3-30
High-vacuum Measurement	3-64
Sec. 4—FLOW MEASUREMENT	
Head Flow Meters.	4-5
Area Flow Meters	4-57
Positivedisplacement Meters	4-76
Weirs and Flumes for Flow Measurement in Open Channels	4-82
Mass and Magnetic Flow Meters	4-86
Sec. 5—LIQUID-LEVEL MEASUREMENT	
Liquid-level Detectors.	5-3
Solids-level Detectors	5-55
Sec. &CHEMICAL-COMPOSITION MEASUREMENT	
Chemical Composition	6-11
Chemical Composition—Instrumental Techniques for Its Determination.	6-20

Emission Spectrometry	6-25
Ultraviolet-absorption Method of Analysis	6-46
Infrared Analysis	6-67
Determination of Chemical Composition by Measurement of Reaction Product	6-84
pH and pH-measuring Systems	6-96
Solution Potential Measurements (Oxidation-Reduction)	6-122
Mass Spectrometry	6-135
Analytical Methods Employing X Rays	6-143
Electrical-conductivity Measurements	6-159
Oxygen Analyzers	6-173
Thermal-conductivity Gas Analysis.	6-186
Polarography	6-197
Analysis by Fractional Distillation	2-203
Chemical Oscillometry	6-205
Nuclear Magnetic Resonance and Electron Paramagnetic Resonance Spectroscopy.	6-211
Sec. 7—OTHER PROCESS MEASUREMENTS	
Industrial Weighers	7-8
Tachometers, Governors, Air-velocity Meters, and Accelerometers.	7-40
Density and Specific-gravity Measurement.	7-54
Psychrometers, Hygrometers, and Dew-point Meters.	7-60
Viscosity and Consistency	7-73
Viscosity-measuring Devices	7-85
Consistency-measuring Devices	7-96
Photometric Variables.	7-111
Photometric Instruments.	7-129
Moisture-measuring Instruments	7-150
Sec. 8—MEASURING INSTRUMENTS—INDICATING AND RECORDING	
Indicating and Recording Means	8-7
Scanning Instruments—Control and Information Systems	8-34
Graphic Instrumentation.	8-48
Electric Telemetering	8-57
Dynamic Factors in Pneumatic Transmission	8-74
Galvanometers and Other Moving-coil Instruments	8-77
Potentiometers.	8-89
Self-balancing Electrical Instruments	8-107
Electrical Bridge Instruments	8-118
Sec. %—AUTOMATIC CONTROLLERS	
Pneumatic Controllers	9-5
Hydraulic Controllers.	9-35
Electric Controllers	9-48
Timers and Program Controllers.	9-78
Automatic Ratio Controllers.	9-106

Sec. 10—FINAL CONTROL ELEMENTS

Control-valve Bodies	10-5
Control-valve Actuators	10-30
Electric Actuators	10-44
Internal-pilot Piston-operated Regulating Valves.	10-58
Control-valve Sizing	10-69
Control-valve Characteristics	10-77
Controlled-volume Pumps	10-92

Sec. 11—PRINCIPLES OF AUTOMATIC CONTROL

Fundamentals of Automatic Process Control	11-4
Mathematical Techniques for Solving Automatic Control Problems	11-41

Sec. 12—REFERENCE DATA

Electrochemical Data.	12-2
Flow Data	12-13
Instrumental Flow-plan Symbols	12-32
Humidity Data	12-44
Physical Properties	12-48
Pressure Data	12-60
Temperature Data.	12-63
Control-valve Data	12-89

Sec. 13—GLOSSARY OF TERMS 13-1

Index follows Section 13.