

VACUUM-TUBE
VOLTMETERS

VACUUM-TUBE VOLTMETERS

2ND EDITION

by
John F. Rider

Revised by
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and
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Dedicated to
MY MOTHER
The longer I knew her,
the better I loved her.

PREFACE TO SECOND EDITION

This, the second edition, reflects almost ten years of expanding use of the vacuum-tube voltmeter. While the basic theories underlying these devices have not changed much since the very early days, the needs of electronic circuits found in television, radar, electronic computers and other devices, have made great demands upon electronic means of measuring voltage and current. Pulse techniques have become general practice and the rapid determination of magnitudes is a daily need.

To provide the answer to these needs, vacuum-tube voltmeter circuitry has undergone many revisions and to make them effective, engineering brains have devised the vacuum-tube voltmeter probe—the means which enable quantitative determinations of voltage and current at frequencies far up in the hundreds of megacycles.

Conditions of operation have become critical in all sorts of electronic devices. High-resistance circuits are more commonplace than ever before. They satisfied the demands for greater and greater sensitivity, but came into being only after tube design improvements resulted in more improved evacuation processes. The measurement of voltage and current in such circuits dictated substantial modifications in vacuum-tube voltmeter design.

This book attempts to portray the changes made in vacuum-tube voltmeters during the last ten years. Every effort has been made to satisfy all segments of the electronic art—from the student through the maintenance man, to the engineer. This book attempts to deal with the principles of the various types of vacuum-tube voltmeters, their design, application, and even repair. To accomplish this goal, every type of instrument is discussed and substantially every commercial version which has made its appearance on the market is noted in detail, even to the presentation of the schematic wiring diagram.

Several individuals are identified with the second edition. Mr. Alfred W. Barber revised a goodly portion of the original text. Mr. Charles Tepfer of the John F. Rider staff did most of the editing and contributed greatly to the contents of numerous chapters, especially the chapters relating to probes, applications, and maintenance.

Special thanks are extended to the manufacturers represented in this edition for their cooperation in furnishing photographs and other data. Acknowledgments are accorded each by means of courtesy lines but we feel that special mention should be made, hence these comments.

Every effort was made to make this edition up to the minute. It is realized, of course, that no book can embrace every new device which is a part of an art, for the time on the presses may be a period when something new makes its appearance. It is hoped that this edition will contribute knowledge about vacuum-tube voltmeters to the hundreds of thousands of users of these devices.

JOHN F. RIDER

March 19, 1951

AUTHOR'S FOREWORD TO THE FIRST EDITION

The vacuum-tube voltmeter, since its inception in 1895, has developed into one of the most valuable aids to the electronic research worker. Originally used to measure high-frequency voltages in connection with laboratory operations, it now has developed into an extremely valuable r-f, a-f and d-c voltage measuring device for the engineer and the maintenance man and for indicating purposes in complete communicating systems.

This book on the vacuum-tube voltmeter is intended as a practical exposition of the numerous types of such measuring devices, with the direct intention of providing a source of information for the engineer, student and serviceman, so that if he desires to compare different types, establish their principles of operation or construct them, all the facts are available from one source.

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As is evident, a general understanding of the basic operation of the diode and triode types of tubes is taken for granted, although a brief review of each is furnished. This attitude is taken on the grounds that the man who works with vacuum-tube voltmeters is at least familiar with the vacuum tube. The beginner who is first learning elementary facts about radio theory, has no need for data on vacuum-tube voltmeters. At the same time, the use of equations relating to vacuum-tube voltmeter operation, such as are usually expected by the engineer, are also omitted because of the practical laboratory work that was done during the preparation of this text. The engineer who is interested in one certain type of vacuum-tube voltmeter, will find that type not only described, but presented in completed form with full constants for all of the components. Furthermore, since this is a practical book, rather than a theoretical book, there is no particular need for formulae.

As shown by the references and the bibliography, the text is a symposium of all the work which has been done in many countries upon vacuum-tube voltmeters. At the same time, however, original work also has been done, as attested by facts contained in this volume which are not available any place else.

In connection with the original laboratory work, we wish to express our gratitude to J. Avins who has done much research work upon vacuum-tube voltmeters, who has several valuable vacuum-tube voltmeter patents to his credit and under whose supervision the various finished units described in this volume were built. He was also greatly instrumental in the gathering of the numerous references contained in this book.

JOHN F. RIDER

February, 1941

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