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# **Engine Combustion: Pressure Measurement and Analysis**

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### **Library of Congress Cataloging-in-Publication Data**

Rogers, David (David R.)

Engine combustion : pressure measurement and analysis / David R. Rogers.  
p. cm.

Includes bibliographical references and index.

ISBN 978-0-7680-1963-6

1. Automobiles—Motors—Cylinders. 2. Automobiles—Motors—Combustion. 3. Pressure—Measurement. I. Title.

TL214.C93R64 2010

629.25—dc22 2010021607

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Website: <http://books.sae.org>

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**ISBN 978-0-7680-1963-6**

**DOI 10.4271/R-388**

**SAE Order No. R-388**

**Printed in USA**

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# Introduction

Indicator, or combustion pressure measurements, used to be the preserve of “experts” only. But, due to the general decrease in the cost of the measurement technology, and the increasing complexity of the task of developing an internal combustion engine—including optimising all the available parameters—combustion pressure measurement is no longer an exclusive task. Today, it is much more likely that test cell operators, technicians, and engineers will be required to have a clear understanding of the measurement procedure and the equipment involved.

The idea behind this book is to provide the inexperienced technical person, trying for perhaps the first time to understand combustion pressure measurements, a source of basic information and guidance on what equipment is available and how to use it in various common applications. The book has been developed as a handbook, to be used as an initial source of information and then, perhaps, to be consulted regularly as a reminder during daily work, or to point the reader to other good sources of information on the subject. This book is not offered as a detailed thesis on the subject of engine combustion and thermodynamics; there are many excellent sources of information available to supplement the information in this book, that will enable readers to develop their knowledge further on the topic of combustion and how to measure, understand, and optimise it.

There is much tribal knowledge in a specialized environment, and best practice, gained from experience, is often shared among users and operators of combustion measurement equipment. This book is an attempt to bring together some of this knowledge and combine it with suggested pathways to further, more detailed information. This should enable readers to go from understanding first principles, to using equipment, gaining experience, and finally to being able to confidently purchase equipment of the correct price and performance for their needs.

The important points to consider with respect to combustion measurements are that this equipment is relatively expensive and sensitive, so that a correct understanding is a prerequisite for an efficient measurement process. It is important always to bear in mind that the only thing produced by combustion measurement is data. If this data is in any way inaccurate, considerable time and money can be wasted. Therefore, familiarity with the measurement system and its efficient operation is essential. In addition, combustion measurements typically create large data files—and while the cost of storing data is relatively low, the time needed to reduce or mine this data, to get the important information from it, can be considerable and should not be overlooked. Data can, of course, be reduced, but it is important to understand the compromises in each stage of reduction, and, if possible, to maintain reversibility and traceability so that if it should be necessary to go backward, post-reduction, deeper into the detail of the raw data, that can still be possible.

I would like to thank the companies who have supported me in this project by providing and sharing details of their equipment, systems, and technologies for combustion pressure

measurement. I am very grateful to them for this. In particular, I would like to thank Sandra Gildemeister of AVL List GmbH for her ongoing assistance throughout the project.

David R Rogers, 2010

**Companies who have provided support and information:**

AVL List GmbH ([www.avl.com](http://www.avl.com))

Kistler Instruments ([www.kistler.com](http://www.kistler.com))

d2t ([www.d2t.com](http://www.d2t.com))

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