Part III Engineering Measurements

Figure III.1 A railroad transit from the Bausch & Lomb 1908 Catalog of Engineering Instruments. Much of North America was surveyed with such instruments, and the surveys continue to be used today. (Photo courtesy of American Artifacts)

Engineering decisions, whether in design, planning, scheduling, or fabrication, are often based on measured information. However, measurements are inherently inexact. The skill, science, and mathematics required to make precise measurements and interpret the effect of measurement uncertainty are a basic part of your engineering education. Part III of this book introduces you to the following topics:

Chapter 10 **Measurements and units:** This chapter reviews the unit systems used in Canadian engineering practice. The SI (Système Internationale or International System) units are emphasized, but other systems are also described.

Chapter 11 **Measurement error:** Measurement, as distinct from counting, is always a form of estimation and is therefore inexact. This chapter describes the sources of measurement uncertainty and gives rules for representing inexact quantities.

Chapter 12 **Error in derived quantities:** How does measurement uncertainty affect a quantity derived from measurements? This chapter shows how to calculate or estimate the uncertainty in a derived quantity as a function of measurement uncertainties.

Chapter 13 **Statistics:** Along with human factors, engineering is based on science; science is based on measurement, and modern measurement relies heavily on statistics. This brief introduction to basic statistics enables you to describe and compare sets of data using measures of central tendency (mean, mode, and median) and measures of dispersion (standard deviation and variance).

Chapter 14 **Gaussian law of errors:** Random errors, which are a fundamental component of measurement uncertainty, may often be described by the Gaussian probability distribution. This chapter defines the Gaussian distribution and shows how to use it to estimate errors and interpret data.