

# Cascade Control

## CHAPTER

# 14

### 14.1 ■ INTRODUCTION

Cascade control is one of the most successful methods for enhancing single-loop control performance. It can dramatically improve the performance of control strategies, reducing both the maximum deviation and the integral error for disturbance responses. Since the calculations required are simple, cascade control can be implemented with a wide variety of analog and digital equipment. This combination of ease of implementation and potentially large control performance improvement has led to the widespread application of cascade control for many decades. In this chapter, cascade control is fully explained with special emphasis placed on clear guidelines that, when followed, ensure that the cascade method is properly designed and is employed only where appropriate.

As explained in the introduction to this part, single-loop enhancements take advantage of extra information to improve on the performance of the PID feedback control system. Cascade uses an additional measurement of a process variable to assist in the control system. The selection of this extra measurement, which is based on information about the most common disturbances and about the process dynamic responses, is critical to the success of the cascade controller. Therefore, insight into the process operation and dynamics is essential for proper cascade control design.

The basic concepts of cascade control are presented in the next section. Subsequent sections provide concise explanations of the design criteria, performance expectations, tuning methods, and implementation issues. All of the methods and