

Instrumentation Symbols

Process control systems and instrumentation can be described in several ways. Flowsheets show the process equipment, instruments, and control systems, as well as interconnections, such as piping and electrical and pneumatic transmission lines. More detailed flowsheets are referred to as *pipng and instrumentation diagrams (P&IDs)*. They include additional information, such as valve characteristics, piping details (e.g., pipe sizes and fittings), and miscellaneous information, such as drains, vents, and sampling lines. Both types of diagrams are widely used in the process industries.

In order for flowsheets and P&IDs to be understood by people with different job responsibilities such as plant designers, process engineers, instrumentation specialists, and vendors, it is useful to use standardized symbols and conventions on the flowsheets. Standards concerning instrumentation symbols and flowsheet conventions have been developed by technical societies, such as the International Society of Automation (ISA). However, individual companies often use different or additional symbols for particular processes.

Figure I.1 lists some common instrument symbols and line designations. Instruments are usually shown as a circle with a letter designation and a number. The controller

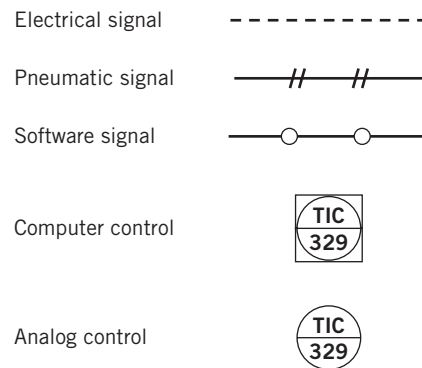


Figure I.1. Line and instrument symbols.

shown in Figure I.1 is a temperature-indicating controller (TIC). The square around the circle indicates that it is implemented via digital control. The *I* designation (for indicating) is an anachronism, because the vast majority of current analog and digital controllers display the measured value of the controlled variable. (Many decades ago, some controllers did not.) Each instrument in a control loop (e.g., sensor, control valve, controller) has the same identifying number, which is referred to as the tag number. Thus, in Figure I.1, the TIC is the temperature controller for control loop #329.

Figure I.2 shows alternative representations of a pressure control loop (Lipták, 2003). The simpler version would be used when the control strategy and its implementation are the main concerns. The more detailed version shows piping and instrumentation details. An example of a more complicated flowsheet is shown in Figure I.3 for a distillation column control strategy. In addition to the instrumentation and controllers, it includes special control calculations involving multiplication, addition, and subtraction.

Additional information concerning instrumentation symbols and flowsheets is available from ISA (1992) and the Instrument Engineer's Handbook (Lipták, 2003).

Table I.1 Some common letter symbols for instrumentation diagrams

Letter	Used as First Letter	Used as Succeeding Letters
A	Analysis	Alarm
C		Control
F	Flow rate	
G	User's choice	
H		High
I	Current	Indicate
J	Power	
L	Level	
P	Pressure	
R		Record
S	Speed	Switch
T	Temperature	

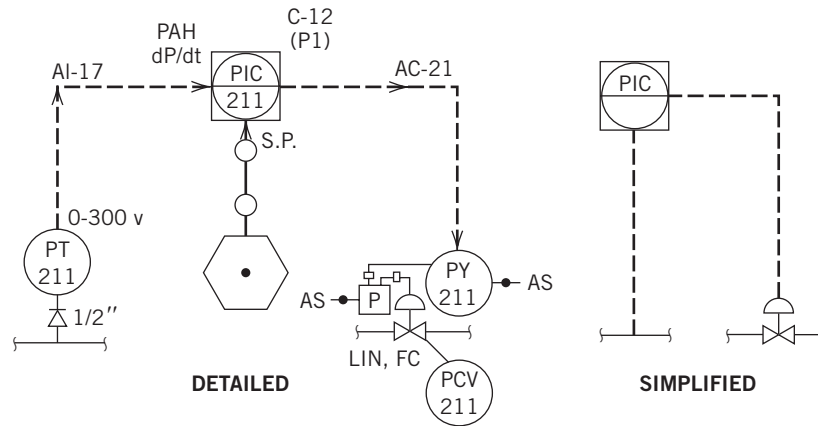


Figure I.2. Alternative representations of a pressure control loop:
Left: Detailed Right: Simplified for a process flow sheet (Liptak, 2003).

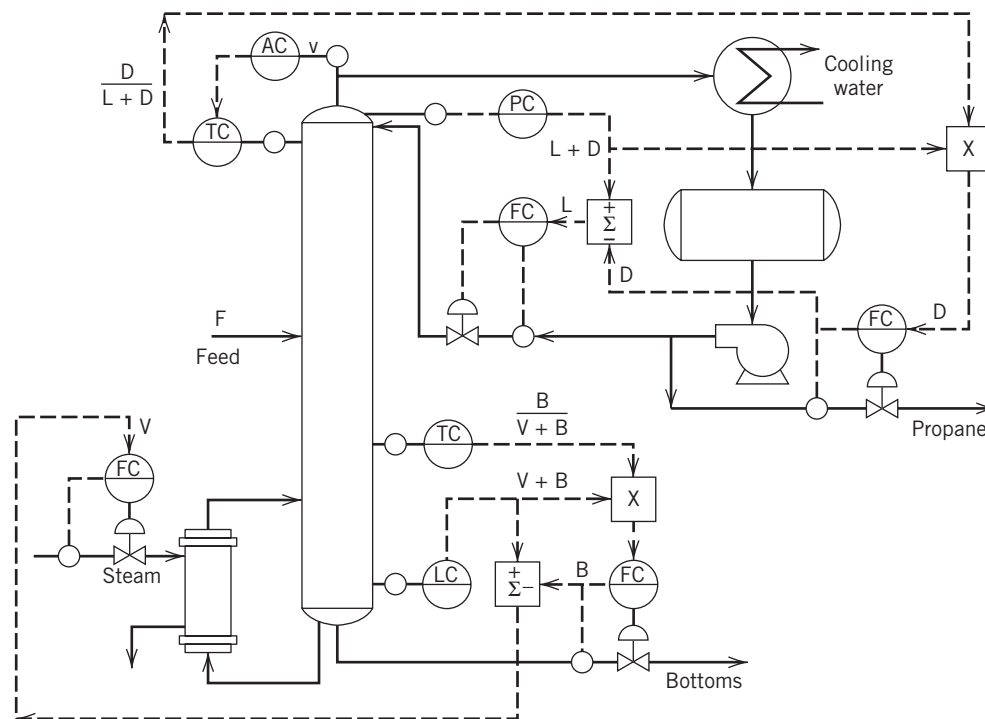


Figure I.3 A depropanizer control system (Perry et al., 2008).

REFERENCES

- Instrumentation Symbols and Identification, Standard ISA-5.1-1984 (R1992)*, International Society of Automation (ISA), Research Triangle Park, NC (1992).
- Lipták, B. (Ed.), *Instrument Engineers' Handbook, 4th ed., Vol. I, Process Measurement and Analysis*, Radnor, PA, 2003.

- Perry, R. H. and D. W. Green (ed.), *Chemical Engineers' Handbook, 8th ed., Section 8, Process Control*, McGraw-Hill, NY, 2008.