Data Conversion

Acknowledgements: Developed by Ui Luu and Manny Griego, Faculty of Glendale Community College, Glendale, Arizona.

Time Required: 1 hour

Equipment & Tools

- Internet connection
- Standard browsing (web surfing) capabilities

Team or Individual: This is a team activity. Teams should be no more than four people and each team member is responsible for finding one ADC and one DAC for comparisons. Team members can work together for table and flow chart design and specifications.

Learning Objectives

1. Create a table to set digital-to-analog values to control fan speeds for a feedback control circuit.
2. Create a table to list temperature input, resistance, analog inputs, and analog-to-digital values.
3. Design or draw a flow chart for a temperature monitor & DC fan speed control program, showing input control points in degree C (° C) with associated analog-to-digital values and output control in digital-to-analog counts and associated speed set points in RPM.
4. Use manufacturers data sheets to compare advantages and disadvantages of different digital-to-analog and analog-to-digital converters.

Performance and Task Procedures Overview

- Review the information presented in the Introduction below.
- Create tables to provide control data points.
- Design or draw a flow chart for a control program showing input and output control points.
- Use the Internet to research 24 bit ADCs and DACs.
- Summarize your findings

Deliverables

- Completed tables
- Flow chart
- Summary of Internet findings

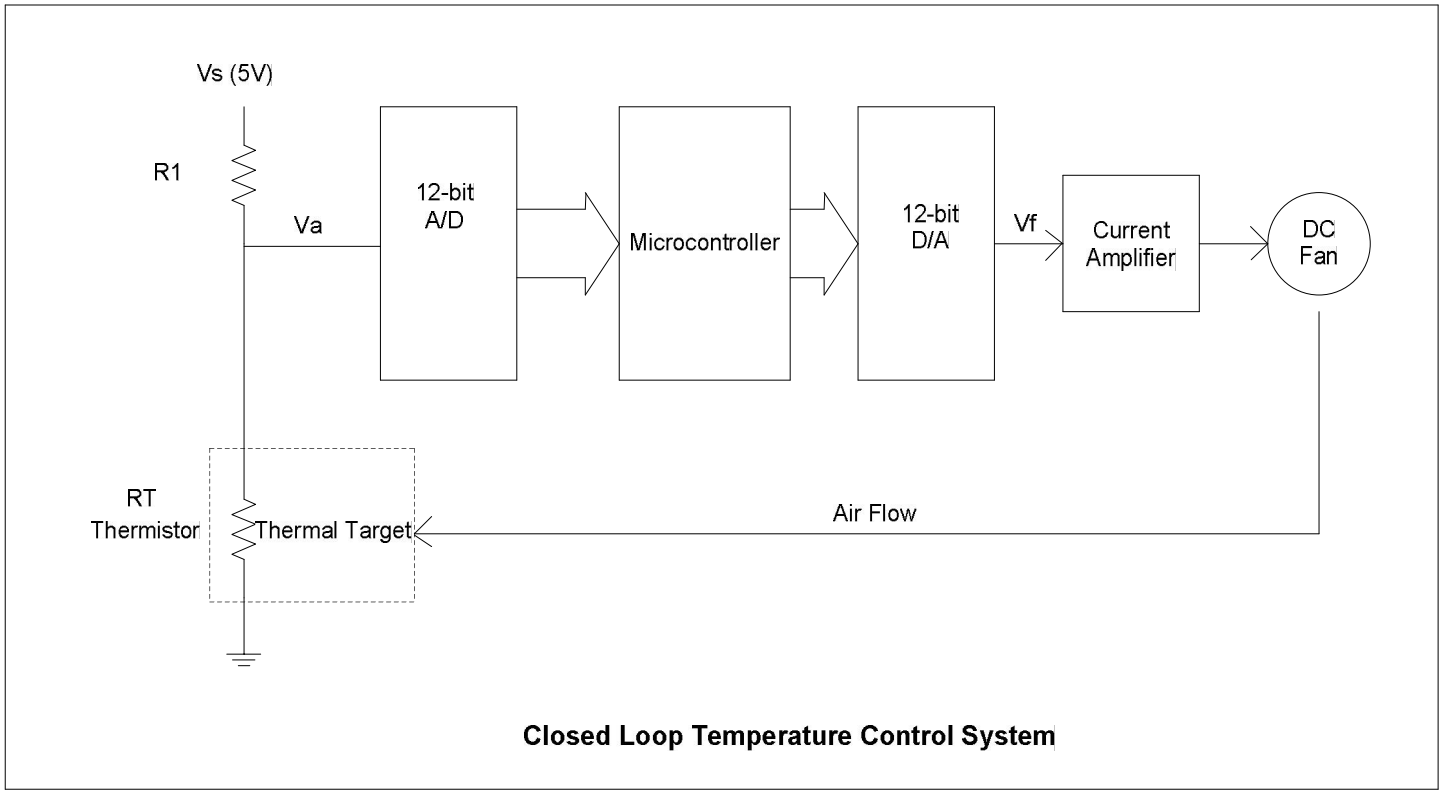
Scoring or Grading Criteria: The decision to grade students on their deliverables is left to the instructor.

Introduction

Data acquisition is the term used to describe the gathering of relevant data, recording it, storing it, displaying it, and processing it to get useful information about a system. Some examples are collecting data in an automated manufacturing factory to monitor assembly or in a chemical plant to monitor the process. Other examples include monitoring test data from an airplane, rocket, satellite, or weather station.

Most of the data comes from sensors that detect changes in physical characteristics such as temperature, pressure, stress, flow rate, physical position, speed of shaft rotation, and other conditions. The sensor data is then digitized and transmitted to the system where it is then stored, processed, analyzed, and finally displayed.

In a closed loop control system used in this drill down, a thermal target is monitored by a thermistor: as the temperature changes, the thermistor resistance changes. The monitor system recognizes the temperature by reading the analog-to-digital input. A DC fan is implemented to provide airflow to cool off the target. The fan speed / air flow rate is controlled by output of D/A converter. If the temperature is too warm, the fan speed increases to provide higher air flow. As the temperature decreases, the fan speed decreases. (Full scale input for the ADC is 5 V; full scale output for the DAC is 12 V.)



Closed Loop Temperature Control System

Drill Down Procedure

1. Use the following data and the drawing above for determining the specifications for your tables.

R1 = 1000 Ohm

Table A: Thermistor Characteristics

Temperature (° C)	RT (Ohm)
25	1000
30	955
35	909
40	864
45	818
50	773
60	682
70	591

Table B: DC Fan characteristics

Voltage (V)	Speed (RPM)
6	2000
7	2333
8	2667
9	3000
10	3333
11	3667
12	4000

Table C: Temperature control profile with speed set points

Target Temperature (° C)	Fan Speed (RPM)
< 45	2000
45 to 60	3000
60 to 70	3500
> 70	4000

2. Create a table to show the temperature input vs. analog-to-digital values.

3. Create a table to show digital-to-analog input vs. fan speed.

4. Design or draw a flow chart to monitor the input temperature and provide output control to achieve the temperature profile vs. fan speed as indicated in Table C. Show input and output control points.
   a. Input should include temperature and analog-to-digital counts.
   b. Output should include fan speed and digital-to-analog counts.

5. Use an Internet search engine such as Google or Yahoo to search for 24 bit ADC and DAC from four different manufacturers.

6. Summarize your findings in a matrix from showing relevant design specifications. Focus on trade-offs between resolution and speed. List at least three other applications associated with the target devices.