

Learn LabVIEW™ 2010 / 2011 Fast

A Primer for
Automatic Data
Acquisition



Douglas Stamps, Ph.D.

Visit the following websites to learn more about this book:



[amazon.com](https://www.amazon.com)

[BARNES & NOBLE](https://www.barnesandnoble.com)

[Google books](https://books.google.com)

Table of Contents

Preface		iv
Part 1 Introduction to LabVIEW		1
Chapter 1 LabVIEW for Data Acquisition		3
1.1	What is Automatic Data Acquisition?	3
1.2	What is LabVIEW?	6
1.3	The LabVIEW Environment	6
1.3.1	Starting LabVIEW	7
1.3.2	Front Panel and Block Diagram	7
1.3.3	Pulldown Menus and Keyboard Shortcuts	8
1.3.4	Toolbars	9
1.3.5	Palettes	11
1.4	An Experiential Introduction to LabVIEW	15
1.4.1	Case Structures	17
1.4.2	Data Acquisition: The DAQ Assistant	20
1.4.3	Writing to a Measurement File	25
1.4.4	Timing VIs for Control of VI Execution	29
1.4.5	While Loop	30
1.4.6	Waveform Chart	34
1.4.7	Waveform Graph	37
1.4.8	Data Types	39
1.4.9	Converting Dynamic Data	43
1.4.10	Controlling While Loop Execution	47
1.4.11	Good Housekeeping Tips: Cleaning up the Block Diagram	49
1.4.12	Starting the Finite Measurements Case of the Example VI	49
1.4.13	For Loop	53
1.4.14	Local Variables	56
1.4.15	Documenting VIs	60
1.4.16	Good Housekeeping Tips: Organizing the Front Panel	62
1.4.17	Running and Debugging a VI	64
1.5	LabVIEW Example VIs	69

Part 2 Data Acquisition: LabVIEW Configuration Approach 73

Chapter 2	Analog Signal Measurement and Generation	75
2.1	Analog Signal Basics	75
2.1.1	Signal Measurement System	75
2.1.2	Signal Resolution	77
2.1.3	Signal Sampling Rate	78
2.2	Finite Analog Input using Buffers, Hardware Timing, and Triggering	82
2.2.1	Hardware Timing	82
2.2.2	Buffers	83
2.2.3	Triggers	83
2.2.4	Skill-Development Problem: Finite Analog Input Example VI using Hardware Timing, Buffering, and Triggering	84
2.3	Continuous Analog Input using Hardware Timing, Circular Buffers, and Triggers	95
2.3.1.	Circular Buffer	96
2.3.2.	Skill-Development Problem: Continuous Analog Input Example VI using Hardware Timing, Circular Buffering, and Triggering	97
2.4	Continuous Analog Output using Software Timing	109
2.4.1	Introduction to Analog Output	109
2.4.2	Skill-Development Problem: Non-Buffered, Software-Timed, Continuous Analog Output Example VI	109
2.5	Finite Analog Output using Buffers and Hardware Timing	124
2.6	Continuous Analog Output using Circular Buffers and Hardware Timing	140
2.7	Learn by Doing	156
2.7.1	Proficiency-Development Problem: General Purpose Analog Input	157
2.7.2	Proficiency-Development Problem: Thermocouple Input	164
2.7.3	Proficiency-Development Problem: Strain Gage Input	173
2.7.4	Proficiency-Development Problem: Signal Conditioning Using Filters	188
2.7.5	Proficiency-Development Problem: Analog PID Compensator	201

Chapter 3	Digital Signal Measurement and Generation	215
3.1	Digital Signal Basics	215
3.2	Continuous Digital I/O with Software Timing	216
3.3	Learn by Doing	231
3.3.1	Proficiency-Development Problem: Digital Input/Digital Output Control	231
3.3.2	Proficiency-Development Problem: Analog Input/Digital Output Control with Minimum and Maximum Set Points	239
3.3.3	Proficiency-Development Problem: Stepper Motor Control	248
3.3.4	Proficiency-Development Problem: Keypad Scanning	258
Chapter 4	Counters	269
4.1	Counter Basics	269
4.2	Counter Input	271
4.2.1	Introduction to Counter Input Applications	271
4.2.2	Skill-Development Problem: Continuous Measurement of a Digital Pulse Train's Period	275
4.3	Counter Output	284
4.3.1	Introduction to Counter Output Applications	284
4.3.2	Skill-Development Problem: Pulse Train Generation and Pulse Width Modulation	285
4.4	Learn by Doing	296
4.4.1	Proficiency-Development Problem: Inductive Proximity Sensor/Metal Detector	296
4.4.2	Proficiency-Development Problem: Simple Engine Dynamometer Simulation	300
Index		309