

Contents

Preface	vi
Foreward	xiii
How to Read This Text	xv
1. Getting Started	1
1.1 Getting Started with BasicX Programming	1
1.2 Create the Working Directory	4
1.3 A Note to Users Running BasicX on Networked Computers	5
1.4 Establish a COMmunications Link	5
1.5 Take it for a Test Drive	8
2. Screen Output	17
2.1 Is This Thing On? (Revisited)	17
2.2 Debug.Print	18
2.3 Concatenating Strings	23
2.4 Some Final Details	26
3. LEDs and Delays	33
3.1 An Enlightening Program	33
3.2 Don't Delay! <i>Oh, Wait.</i> Do Delay!	37
3.3 Lines to Code Before I Sleep	40
3.4 Review	40
4. Computer Arithmetic	43
4.1 Introduction	43
4.2 Just an Expensive Calculator?	43
4.3 Other Arithmetic Operators	45
4.4 Scientific Notation	46
4.5 Dividing by Zero	46
4.6 Type Mismatch: Comparing Apples and Oranges	47
4.7 A Few Concerns Concerning Negative Notation	48
4.8 Integer Division	48
4.9 Exponentiation	49
4.10 Finding Roots	51
4.11 Order of Operations	54
4.12 Review of the BX-24 Mathematical Operations	56
5. Variables, Constants, and Data Types	67
5.1 Data Types	67
5.2 Give Your BX-24 Its Own Identity	69
5.3 That's Why They Call It Const, Dude	72
5.4 A Quick Recap	74
5.5 Revisiting Old Examples	74
5.6 So, Why Bother with Variables?	76
5.7 Self Test Bonanza	78

6. Data Type Conversions and Numerical Rounding	81
6.1 Data Type Conversions	81
6.2 Numerical Rounding	86
6.3 Review	92
7. Advanced Computer Mathematics	97
7.1 More Math? Aw, Do We Have To?	97
7.2 Absolute Value	98
7.3 Base-e Exponential Functions	98
7.4 Logarithms	100
7.5 Three Trigonometric Functions: Sin, Cos, and Tan	103
7.6 The Inverse Trigonometric Functions: Sin^{-1} , Cos^{-1} , and Tan^{-1}	108
8. For-To-Next Loops	117
8.1 Going in Circles	117
8.2 For-To-Next Loop Examples	117
8.3 Some Practical Problems	126
9. Do-Loops	135
9.1 Still Going in Circles	135
9.2 Population Growth Studies: A Two-Model Approach	142
9.3 Some Practical Problems	145
9.4 Review	153
10. BX-24 Clock Works	159
10.1 Do I have Time for This?	159
10.2 Setting the Clock	159
10.3 How Fast Is Fast?	162
10.4 Does Anyone Have the Time?	165
10.5 The Timer Function	168
11. Introduction to Servomotor Programming	171
11.1 Welcome to Servo Programming	171
11.2 What Are Servos?	171
11.3 Building the Mouse	172
11.4 BX-24 and RAMB Pins	175
11.5 Color Conventions	176
11.6 RAMB Power	177
11.7 Powering Up the Servos	178
11.8 Pulse Widths – The Servo's Heartbeat	179
11.9 Servo Operation	180
11.10 Let's Do the Hokey-Pokey!	184
11.11 Do the Cha-Cha!	187
11.12 To Everything Turn, Turn, Turn	189
11.13 It Keeps Going, and Going, and Going, ...	192
11.14 Troubleshooting and Final Comments	193
12. Subprograms: Procedures and Functions	197
12.1 Introduction to Subprograms	197
12.2 Two Simple Procedures	197
12.3 Global Constants	200
12.4 Global Variables	201
12.5 Pass the Arguments, Please	203
12.6 Procedure Examples	205
12.7 Easy Robot Motion	208

12.8	Calibration Celebration	212	
12.9	Functions	215	
12.10	Review	217	
13.	Advanced Servo Operations		223
13.1	Moving Forward	223	
13.2	A Short Review	223	
13.3	Speed Control: Pulse Width Modulation	225	
13.4	Center Your Mouse	225	
13.5	Test the Center Position Values	228	
13.6	Precision Linear Motion	229	
13.7	Precision Turning	235	
13.8	Precision Calibration	236	
13.9	Put the Calibration to Work	240	
13.10	Use Caution When Working With Unmodified Servos	242	
14.	The Random Number Generator		245
14.1	To Seed Or Not To Seed?	245	
14.2	Using the Random Number Generator	246	
14.3	Rnd Applications and Other Cool Stuff	249	
15.	If-Then and Select Case Logic Statements		257
15.1	Teaching a Machine to Think	257	
15.2	A Real-World If-Then Statement	257	
15.3	Computer-World If-Then Statements	258	
15.4	If-Then Examples	259	
15.5	Motion Logic	273	
15.6	Select Case Logic Statements	274	
15.7	Select Case Demonstrations	274	
15.8	Review	278	
15.9	You Made It!	278	
16.	Using an Infrared Range Finder		283
16.1	A Look under the Ranger's Hood	283	
16.2	Mounting the Infrared Ranger to the Mouse	285	
16.3	Powering up the Ranger	286	
16.4	Putting the Ranger to Work	287	
16.5	IR Cool, You Are Cool	288	
16.6	Not Your Average IR Ranger	289	
16.7	Continuous Sensor Values	292	
16.8	Range Limitations of the Sharp GP2D12 Ranger	294	
16.9	Fitting a Curve to the GP2D12 Sensor Data	296	
16.10	Making the GP2D12 a True Range Finder	298	
16.11	Two Practical Applications	299	
16.12	Automaton Realized	303	
17.	Environment Sensing Using Voltage Dividers		307
17.1	A Little Terminology	307	
17.2	Resistors	308	
17.3	Voltage Divider Basics	310	
17.4	<i>Qualitative</i> Analysis of Digital Output from the VDB	311	
17.5	<i>Quantitative</i> VDB Analysis – Part 1: Converting Digital Back To Analog	318	
17.6	<i>Quantitative</i> VDB Analysis – Part 2: The Physics Behind the VDB	318	
17.7	<i>Quantitative</i> VDB Analysis – Part 3: Thermistor Calibrations	320	
17.8	<i>Quantitative</i> VDB Analysis – Part 4: Putting It Together with Code	321	

Appendices

A	Handling and Care of Nickel-Metal Hydride (Ni-MH) Batteries	327
B	Multiple Users Running BasicX on a Network	331
C	Reserved Keywords	337
D	Controlling the Piezo Buzzer and Audio Transducer	339
E	Servo Comparisons and Physical Limitations	347
F	Limitations of the Sharp GP2D12 Infrared Sensor	349
G	Unmodified Servos: Gripper and Turret Mount Applications	353

Index

359

The book at a glance:

