Contents

Preface to the Fourth Editioni		
A. The Ba	sics	
Chapter	1	
The Si	x Steps of HVAC DDC System Design	
1.1	Understanding the Basics	
1.2	A Simple HVAC DDC System	
1.3	DDC Signals	
1.4	The Six Steps of HVAC DDC System Design	
1.5	What Is ASHRAE?	
Chapter :	2	
	Controllers	
2.1	DDC Controllers	
2.2	Uninterruptable Power Supply	
2.3	Operator Machine Interface	
2.4	Smart Sensors	
2.5	Smart Actuators	
2.6	DDC Communication via LAN Trunk	
2.7	Smart Graphics	
2.8	Types of DDC Controllers	
2.9	Application-Specific Controllers	
2.10	General-Purpose Controllers	
2.11	Programmable Logic Controllers	
2.12	Supervisory Control and Data Acquisition	
2.13	Distributed Control Systems	
2.14	The Difference Between DDC, PLC, SCADA, and DCS	
2.15	DDC Wireless Technology	
2.16	Wireless Systems Applications	
Chapter :	3	
	asics of HVAC Controls	
3.1	The Most Commonly Used HVAC Control Systems	
3.2	Control Actions	
3.3	Six Types of Control Actions	

3.4	Fuzzy Logic	
3.5	Control Loop	
3.6	Example 1: Control Loop	
3.7	Closed-Loop vs. Open-Loop	
•	68	
	DDC, LEED, and Commissioning	
	Leadership in Energy and Environmental Design and DDC	
	Commissioning and DDC	
	Energy Efficiency and Sustainability Standards	
	Integrated Project Delivery for Controls	
4.5	Building Information Modeling	
B. DDC No	etworking	
Chapter 5	580	
DDC Sy	ystem Architecture	
5.1	Data Communication Between DDC Controllers	
5.2	The Open System Interconnection Reference Model	
	Network	
	Protocol	
	DDC Topologies and Network Layers	
	Network Access Method	
	Local Area Network Standards	
	Physical Layer Standards	
	Physical Media	
	Practical Scenarios	
	Example 1: DDC System Architecture	
5.12	Example 2: DDC System Architecture	
Chapter 6	5102	
ASHRA	E BACnet	
6.1	HVAC DDC Systems	
6.2	What Is BACnet?	
6.3	The Evolution of BACnet	
6.4	BACnet/SC (Secure Connect)	
6.5	BACnet/IP Broadcast Management Device	
6.6	BACnet Application Layer	
6.7	BACnet Objects	
6.8	BACnet Services	

6.9	BACnet Network Layer
6.10	BACnet Data Link Layer
6.11	BACnet Physical Layer
6.12	BACnet Protocol Implementation Conformance Standard
6.13	BACnet Interoperability Building Block
6.14	Native BACnet
6.15	BACnet Testing Laboratories
6.16	Benefits of Closed, Proprietary Systems
6.17	BACnet Gateway
•	119
Open S	Systems and LonWorks Platform
7.1	What Is LonWorks?
7.2	How Does LonWorks Work?
7.3	LonTalk Protocol
	Neuron Chip
7.5	LonWorks Standard Network Variable Types
7.6	LonWorks Standard Configuration Parameter Types
7.7	LonWorks Transceivers
7.8	LonWorks Routers
7.9	LonWorks Network Services
7.10	LonWorks Networking Media
7.11	LonMaker for Windows
7.12	What Is LonMark?
•	
	ervices and the Niagara Platform
	What Are Web Services?
	The Niagara Platform
8.3	How Does the Niagara Platform Work?
8.4	The Smart Grid
8.5	Demand Response
8.6	Cloud Computing
8.7	Analytics
8.8	Fault Detection and Diagnostics
8.9	HVAC DDC and Artificial Intelligence
8.10	HVAC DDC and Cyber Security
8.11	Energy Dashboard
8.12	Energy Dashboard Classification

C. Hybrid DDC Systems

Chapter 9	148
Pneum	atic Control and DDC
9.1	The Basics of Pneumatic Controls
9.2	Compressed Air System
9.3	How to Size an Air Compressor
9.4	Example 1: Air Compressor Sizing
9.5	Example 2: Heat Vent Control – Pneumatic
9.6	Example 3: Fan Coil Unit Control – Pneumatic and DDC
9.7	Example 4: Air Handling Unit Control – Pneumatic and DDC
Chapter 1	0166
Electric	c Control and DDC
10.1	Alternating Current vs. Direct Current
10.2	Variable Frequency Drive
10.3	Harmonic Distortion
10.4	Motors: Electronically Commutated vs. Permanent Split Capacitor
10.5	Variable Frequency Drive or No Variable Frequency Drive?
10.6	Basic Electrical Control Components
10.7	Example 1: Supply Fan Control
10.8	Example 2: Multiple Electric Functions – Electric Control
10.9	Example 3: Three-Phase Fan Coil Unit Control – Electric and DDC
10.10	Example 4: Single-Phase Fan Coil Control – Electric and DDC
10.11	Example 5: Duct Smoke Detector
D. Contro	l Components
•	1
	l Valves
	Control Valves
11.2	Flow Characteristics of Control Valves
11.3	Location of Control Valves
11.4	Mixing and Diverting Three-way Control Valves
11.5	Two-way vs. Three-way Control Valves
11.6	Selection of Modulating Control Valves
11.7	How to Size Control Valves
11.8	Example 1: Control Valve Selection
11.9	Example 2: Control Valve Selection

Chapter 1	2		
Contro	l Dampers		
12.1	Control Dampers		
12.2	Control Damper Flow Characteristics		
12.3	Parallel Blade vs. Opposed Blade		
12.4	Rule-of-Thumb Check for Control Damper Sizing		
12.5	Example 1: Control Damper Selection		
12.6	Damper Leakage		
12.7	Rule-of-Thumb Check for Control Damper Actuator Sizing		
12.8	Example 2: Control Damper Actuator Selection		
12.9	Example 3: Mixing Box CFM and Temperature Calculation		
Chapter 1	3		
Electro	nic Sensors		
13.1	Temperature Sensors		
13.2	Humidity Sensors		
13.3	Pressure Sensors		
13.4	Flow Meters		
E. Practica	al Scenarios		
Chapter 1	4243		
•	al Examples of Chilled Water System Control		
14.1	Example 1: Chilled Water System with a Chiller and a Pump		
	Example 2: Chilled Water System with Parallel Pumping		
	Example 3: Chilled Water System with Primary-Secondary Loop		
	Example 4: Variable Primary Chilled Water System		
	Controlling Various Types of Chillers		
	Water-Cooled Versus Air-Cooled Chillers		
14.7	Heat Recovery Chillers		
14.8	DDC, VFD, and Direct LAN Connection for Chillers		
14.9	DDC and Chilled Water Buffer Tanks		
14.10	How to Control Chillers and Low-Load Conditions		
17.10	now to control chillers and low load conditions		
Chapter 1	5		
Practic	Practical Examples of Condenser Water Control Systems		
15.1	Example 1: Condenser Water Control, Single Cooling Tower		
15.2	Example 2: Condenser Water Control, Multiple Cooling Towers		
15.3	Cooling Towers Water Consumption		

Practical E 16.1 Ex 16.2 Ex	
Practical E 17.1 Ex	
F. Specifying	g DDC
HVAC DDC 18.1 Cc 18.2 Dr 18.3 Sp 18.4 Me	
Glossary References	