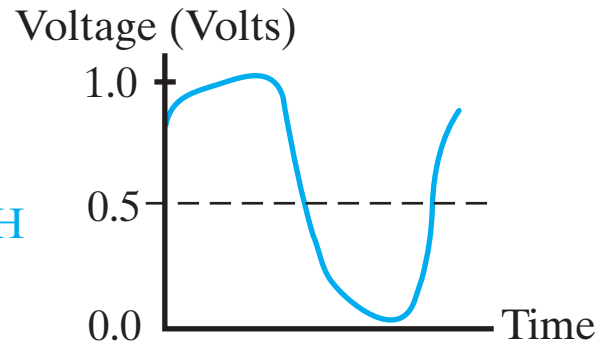
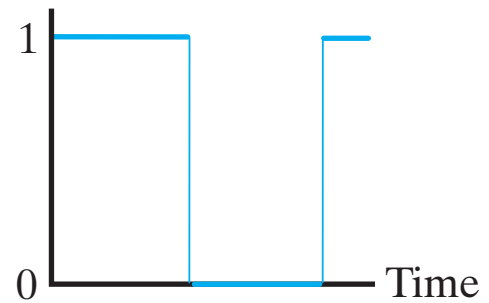


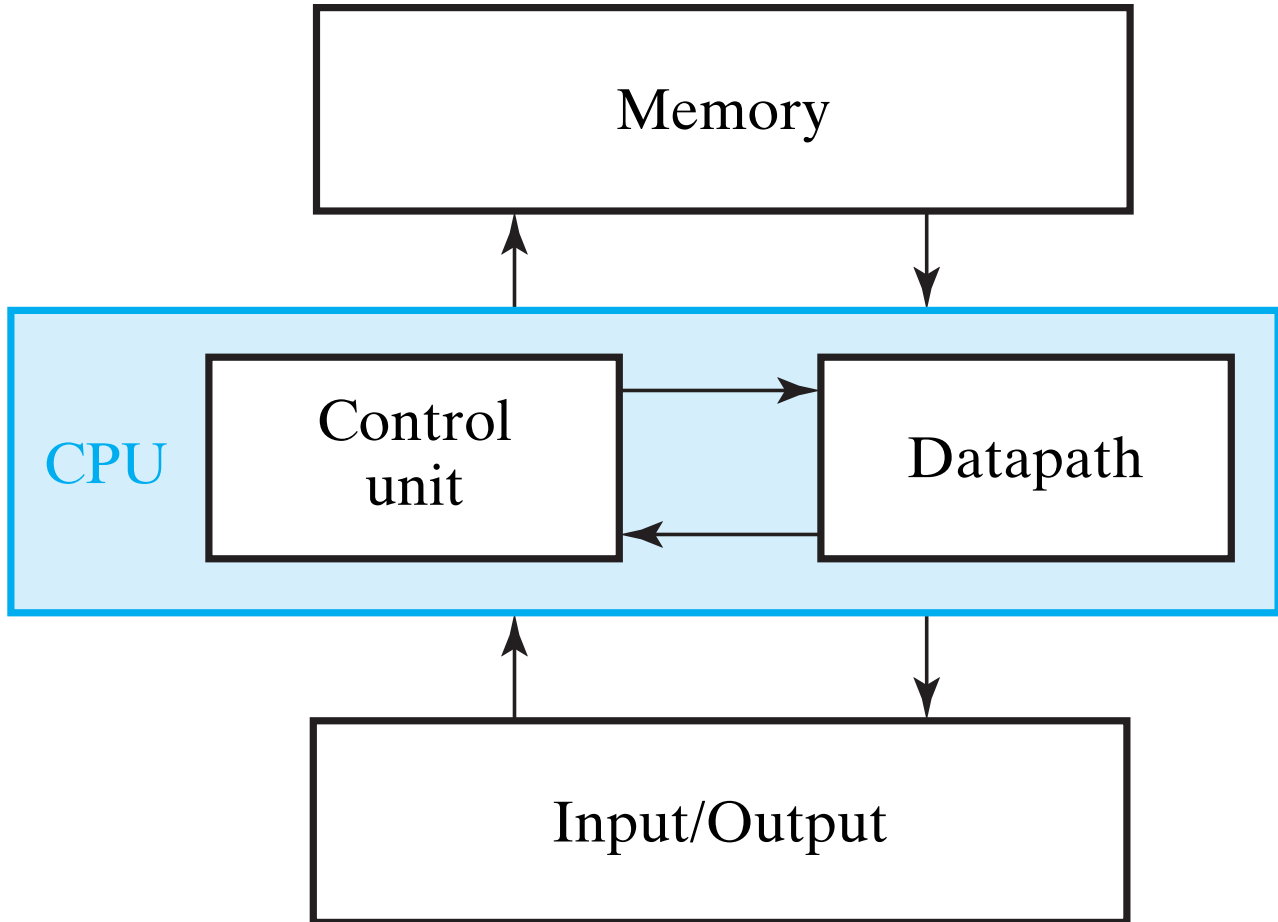
(a) Example voltage ranges



(b) Time-dependent Voltage

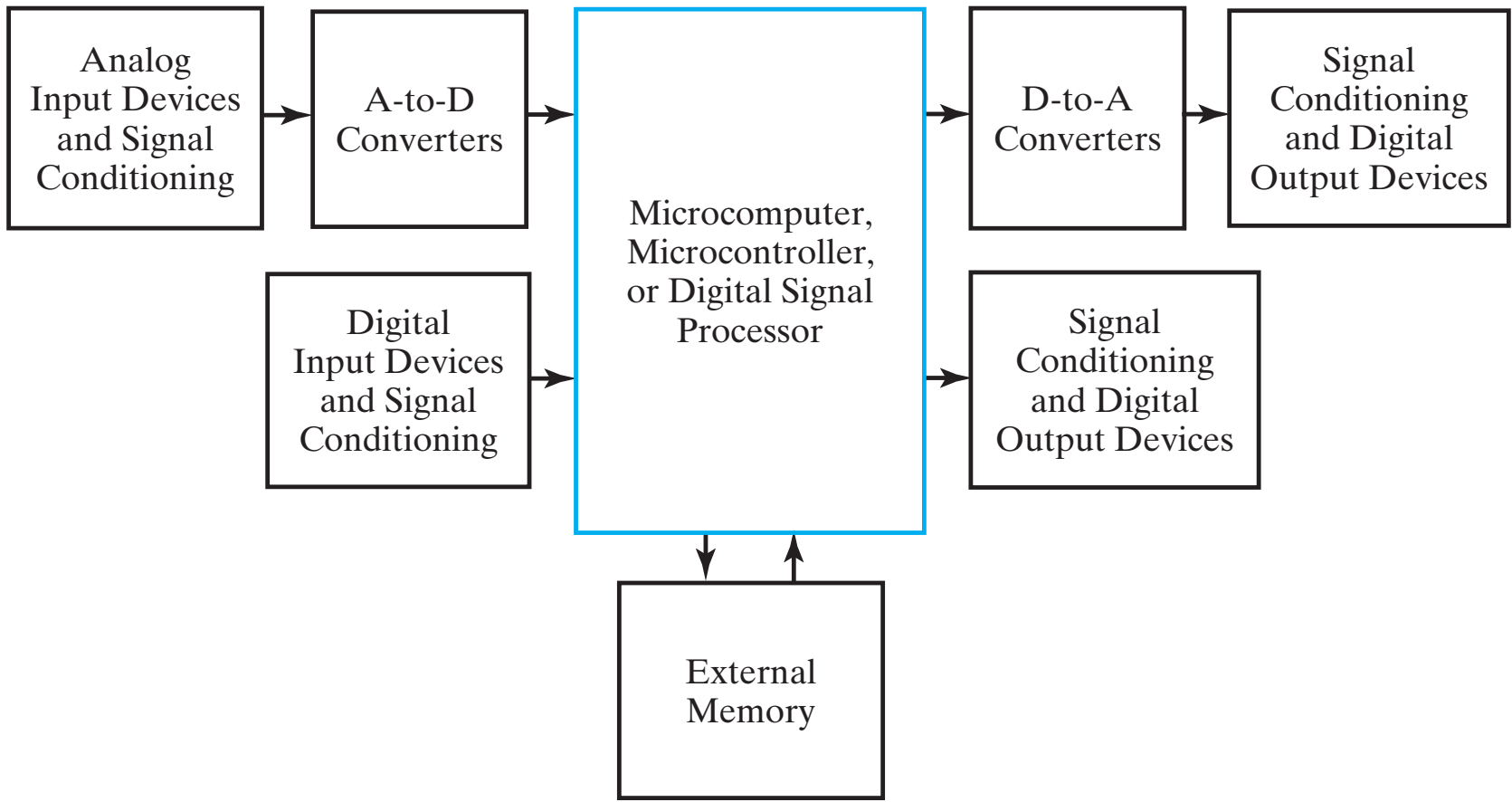


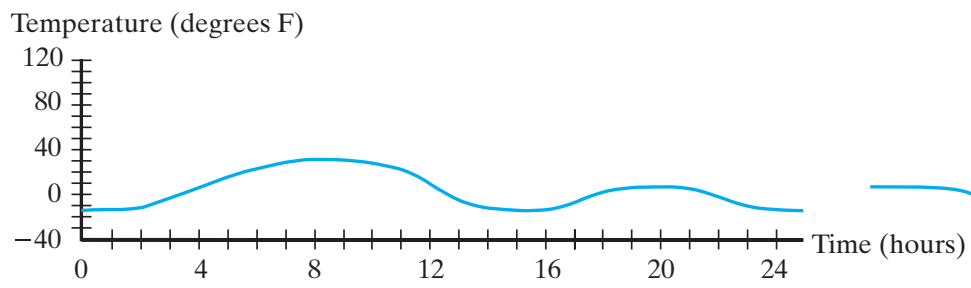
(c) Binary model of time-dependent voltage



□ **TABLE 1-1**  
**Embedded System Examples**

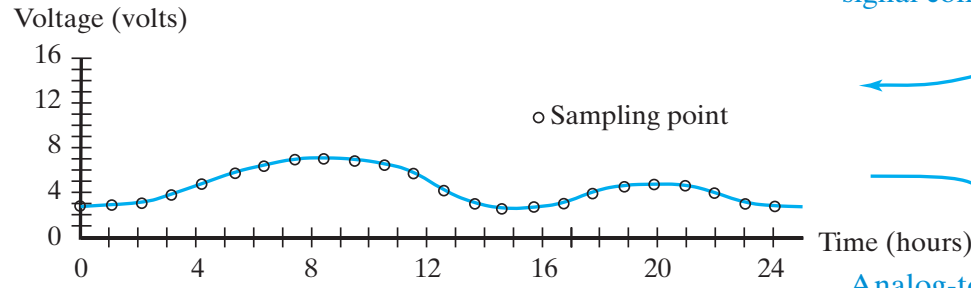
Application Area	Product
Banking, commerce and manufacturing	Copiers, FAX machines, UPC scanners, vending machines, automatic teller machines, automated warehouses, industrial robots
Communication	Cell phones, routers, satellites
Games and toys	Video games, handheld games, talking stuffed toys
Home appliances	Digital alarm clocks, conventional and microwave ovens, dishwashers
Media	CD players, DVD players, flat panel TVs, Digital cameras, digital video cameras
Medical equipment	Pacemakers, incubators, magnetic resonance imaging
Personal	Digital watches, MP3 players, personal digital assistants
Transportation and navigation	Electronic engine controls, traffic light controllers, aircraft flight controls, global positioning systems





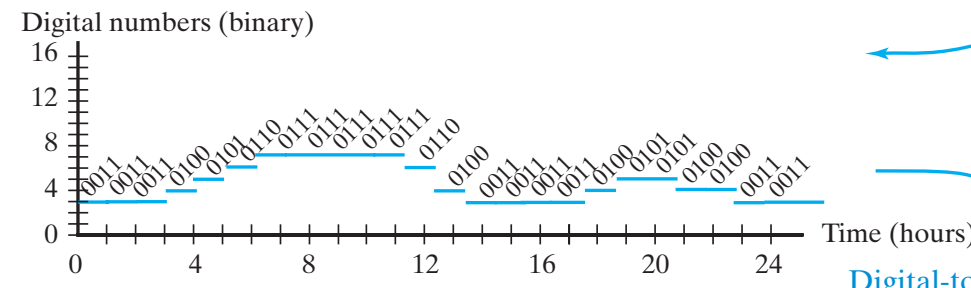
(a) Analog temperature

Sensor and signal conditioning



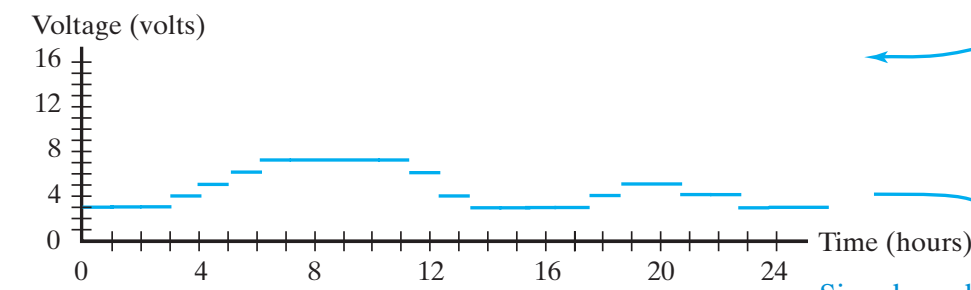
(b) Continuous (analog) voltage

Analog-to-Digital (A/D) conversion



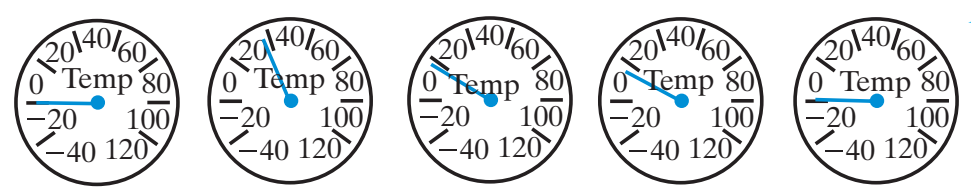
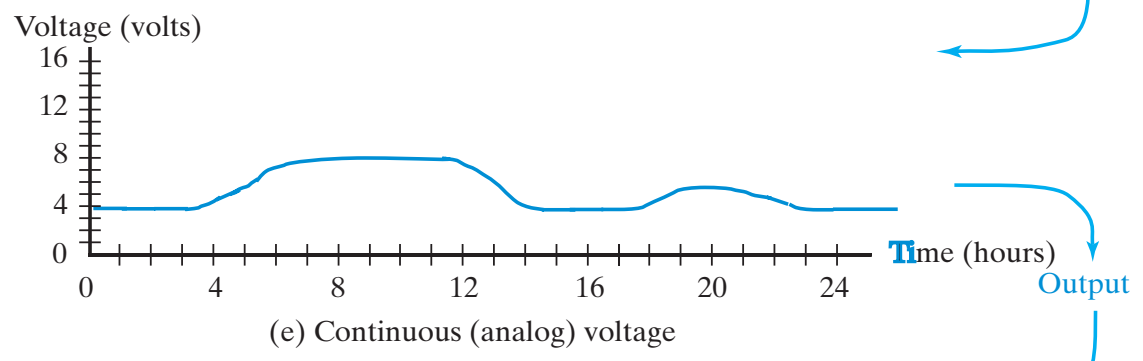
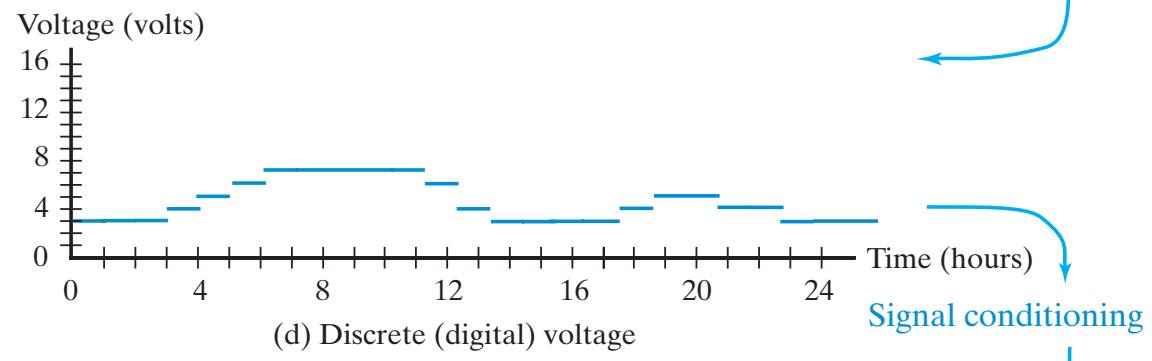
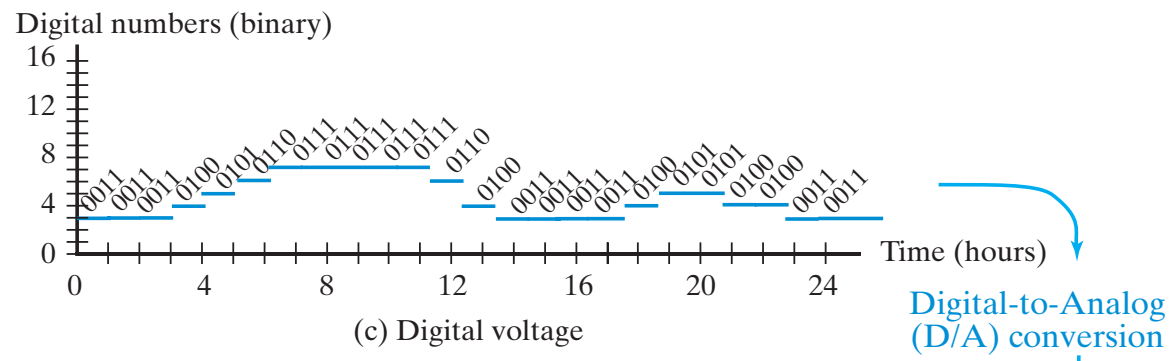
(c) Digital voltage

Digital-to-Analog (D/A) conversion



(d) Discrete (digital) voltage

Signal conditioning



## □ TABLE 1-2 Powers of Two

<b>n</b>	<b>2<sup>n</sup></b>	<b>n</b>	<b>2<sup>n</sup></b>	<b>n</b>	<b>2<sup>n</sup></b>
0	1	8	256	16	65,536
1	2	9	512	17	131,072
2	4	10	1,024	18	262,144
3	8	11	2,048	19	524,288
4	16	12	4,096	20	1,048,576
5	32	13	8,192	21	2,097,152
6	64	14	16,384	22	4,194,304
7	128	15	32,768	23	8,388,608

**□ TABLE 1-3**  
**Numbers with Different Bases**

<b>Decimal (base 10)</b>	<b>Binary (base 2)</b>	<b>Octal (base 8)</b>	<b>Hexadecimal (base 16)</b>
00	0000	00	0
01	0001	01	1
02	0010	02	2
03	0011	03	3
04	0100	04	4
05	0101	05	5
06	0110	06	6
07	0111	07	7
08	1000	10	8
09	1001	11	9
10	1010	12	A
11	1011	13	B
12	1100	14	C
13	1101	15	D
14	1110	16	E
15	1111	17	F

□ **TABLE 1-4**  
**Binary-Coded Decimal (BCD)**

---

<b>Decimal Symbol</b>	<b>BCD Digit</b>
0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001

---

**TABLE 1-5**  
**American Standard Code for Information Interchange (ASCII)**

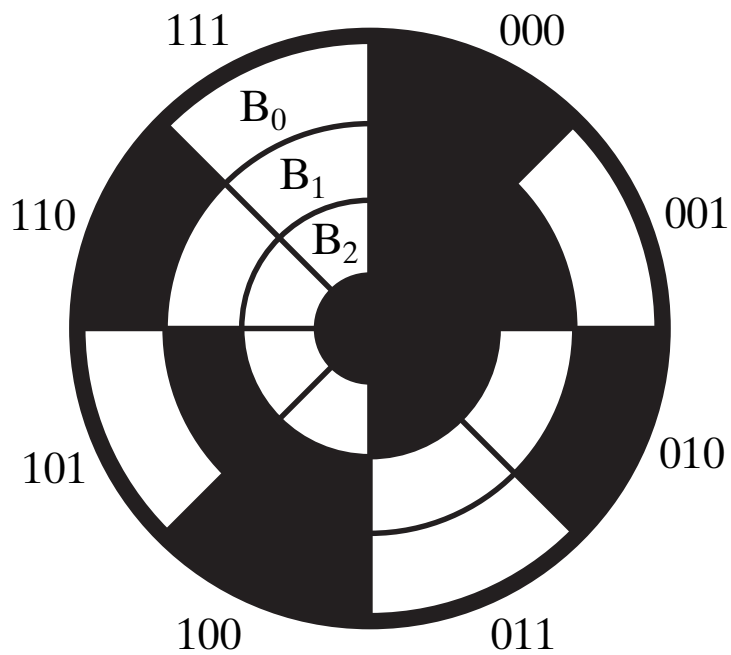
<b>B<sub>4</sub>B<sub>3</sub>B<sub>2</sub>B<sub>1</sub></b>	<b>B<sub>7</sub>B<sub>6</sub>B<sub>5</sub></b>							
	<b>000</b>	<b>001</b>	<b>010</b>	<b>011</b>	<b>100</b>	<b>101</b>	<b>110</b>	<b>111</b>
0000	NULL	DLE	SP	0	@	P	`	p
0001	SOH	DC1	!	1	A	Q	a	q
0010	STX	DC2	"	2	B	R	b	r
0011	ETX	DC3	#	3	C	S	c	s
0100	EOT	DC4	\$	4	D	T	d	t
0101	ENQ	NAK	%	5	E	U	e	u
0110	ACK	SYN	&	6	F	V	f	v
0111	BEL	ETB	'	7	G	W	g	w
1000	BS	CAN	(	8	H	X	h	x
1001	HT	EM	)	9	I	Y	i	y
1010	LF	SUB	*	:	J	Z	j	z
1011	VT	ESC	+	;	K	[	k	{
1100	FF	FS	,	<	L	\	l	
1101	CR	GS	-	=	M	]	m	}
1110	SO	RS	.	>	N	^	n	~
1111	SI	US	/	?	O	_	o	DEL

#### Control Characters

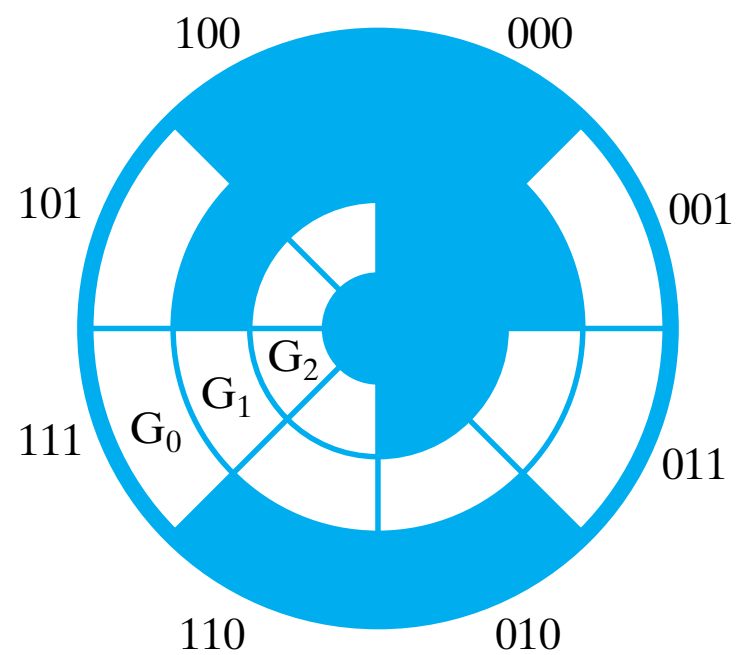
NULL	NULL	DLE	Data link escape
SOH	Start of heading	DC1	Device control 1
STX	Start of text	DC2	Device control 2
ETX	End of text	DC3	Device control 3
EOT	End of transmission	DC4	Device control 4
ENQ	Enquiry	NAK	Negative acknowledge
ACK	Acknowledge	SYN	Synchronous idle
BEL	Bell	ETB	End of transmission block
BS	Backspace	CAN	Cancel
HT	Horizontal tab	EM	End of medium
LF	Line feed	SUB	Substitute
VT	Vertical tab	ESC	Escape
FF	Form feed	FS	File separator
CR	Carriage return	GS	Group separator
SO	Shift out	RS	Record separator
SI	Shift in	US	Unit separator
SP	Space	DEL	Delete

□ **TABLE 1-6**  
**Gray Code**

<b>Binary Code</b>	<b>Bit Changes</b>	<b>Gray Code</b>	<b>Bit Changes</b>
000	1	000	1
001	2	001	1
010	1	011	1
011	3	010	1
100	1	110	1
101	2	111	1
110	1	101	1
111	3	100	1
000		000	



(a) Binary Code for Positions 0 through 7



(b) Gray Code for Positions 0 through 7