SEQUENCER INSTRUCTIONS

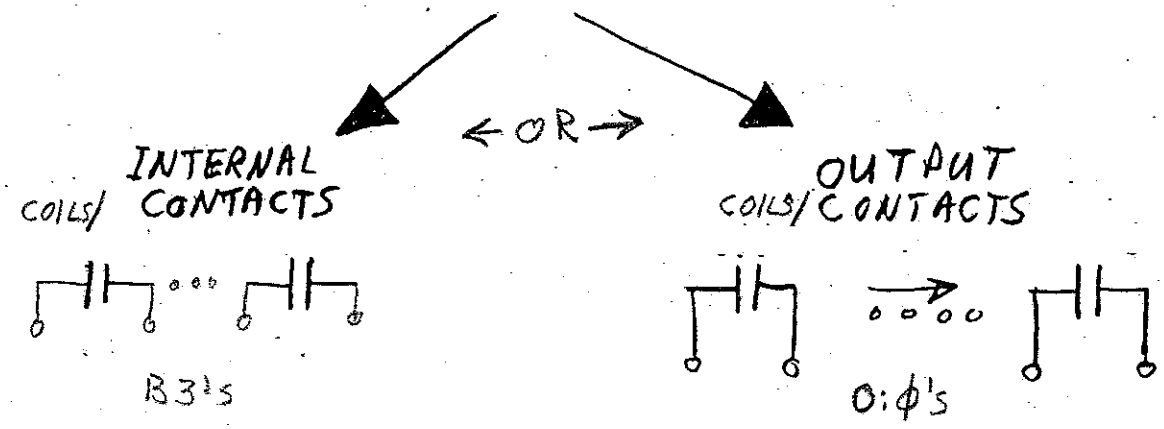
SEQUENCER OUTPUT — SQO

—(SQO)—

—(R)—

↑ STEP RESET

—(SQO)—



- SEQUENCER DATA "1" = ON, "0" = OFF } STEP DATA

- UNUSED CONTACTS ARE DISABLED BY "O" OR ⊗ (NOT USED)
- CONTACTS TO BE USED ARE ENABLED BY "1"

↓

MASK DATA

Basic Operation – Sequencer Output

The SQO instruction can control the ON/OFF status, addresses for up to 100 steps. It can be time-driven or event-driven. With time-driven sequencers, each step functions similar to timer instructions, involving an AC value and a programmed PR value (*dwell time*). In the same way, the event-driven sequencer functions similar to the counter instruction.

Time-Driven SQO:

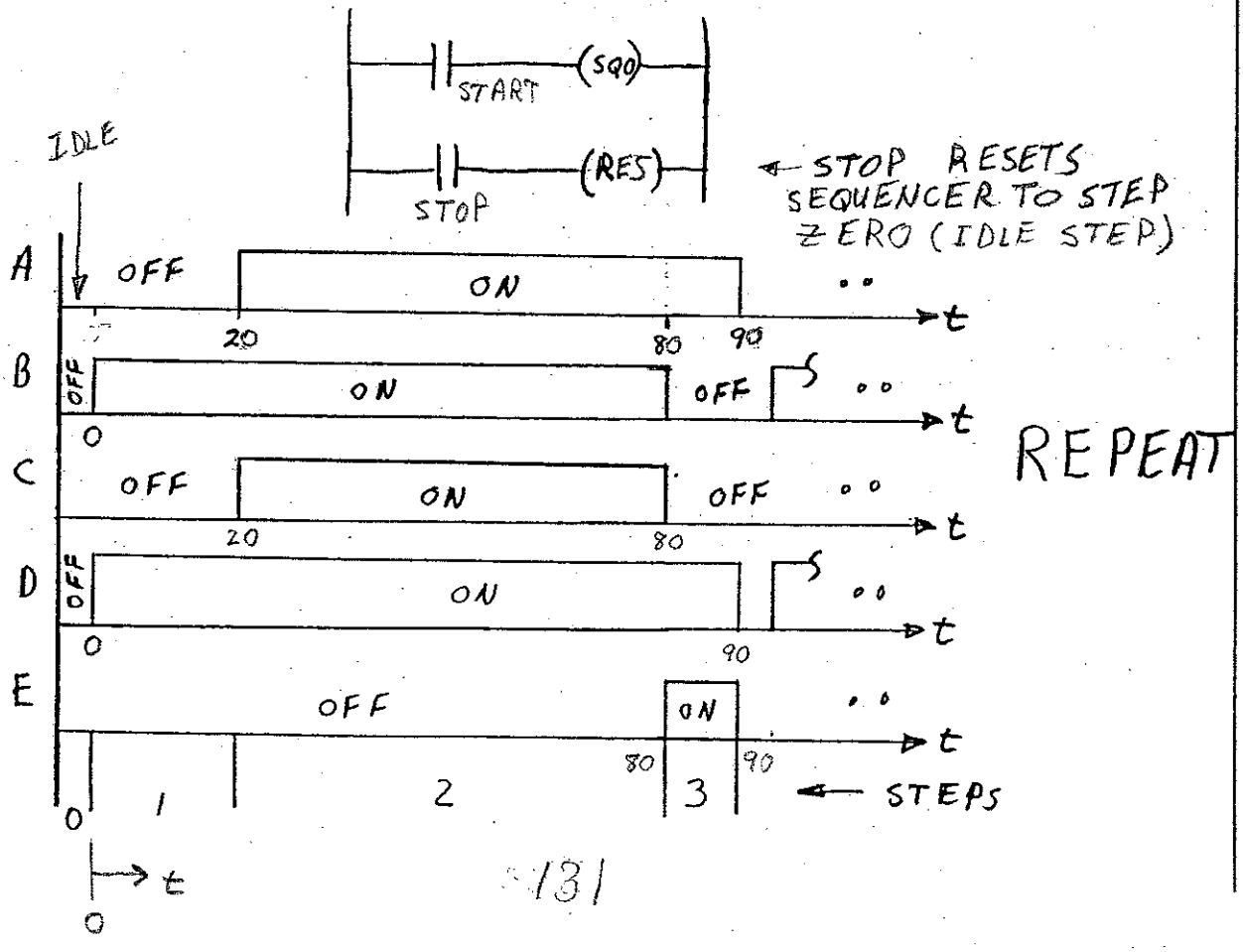
IDLE STEP (STOP MODE) → REPEAT

Step	Bit Addresses (Data Entry: ON = 1, OFF = 0)					Dwell Time (PR Value)
	A	B	C	D	E	
0	OFF	OFF	OFF	OFF	OFF	1
1	OFF	ON	OFF	ON	OFF	20 seconds
2	ON	ON	ON	ON	OFF	60 seconds
3	ON	OFF	OFF	ON	ON	10 seconds

← PULSE WIDTH PER STEP

Beginning at step 0: With rung conditions FALSE, the SQO instruction is waiting on step 0. Bit addresses A thru E are OFF in accordance with data for step 0. When the SQO instruction goes TRUE:

Then step 1 begins; bit addresses B and D go ON. After 20 seconds, step 2 begins; bit addresses A and C go ON. After 60 seconds, step 3 begins; bit addresses B and C go OFF, E goes ON. After 10 seconds, a completion bit is set ON and the cycle repeats with step 1.



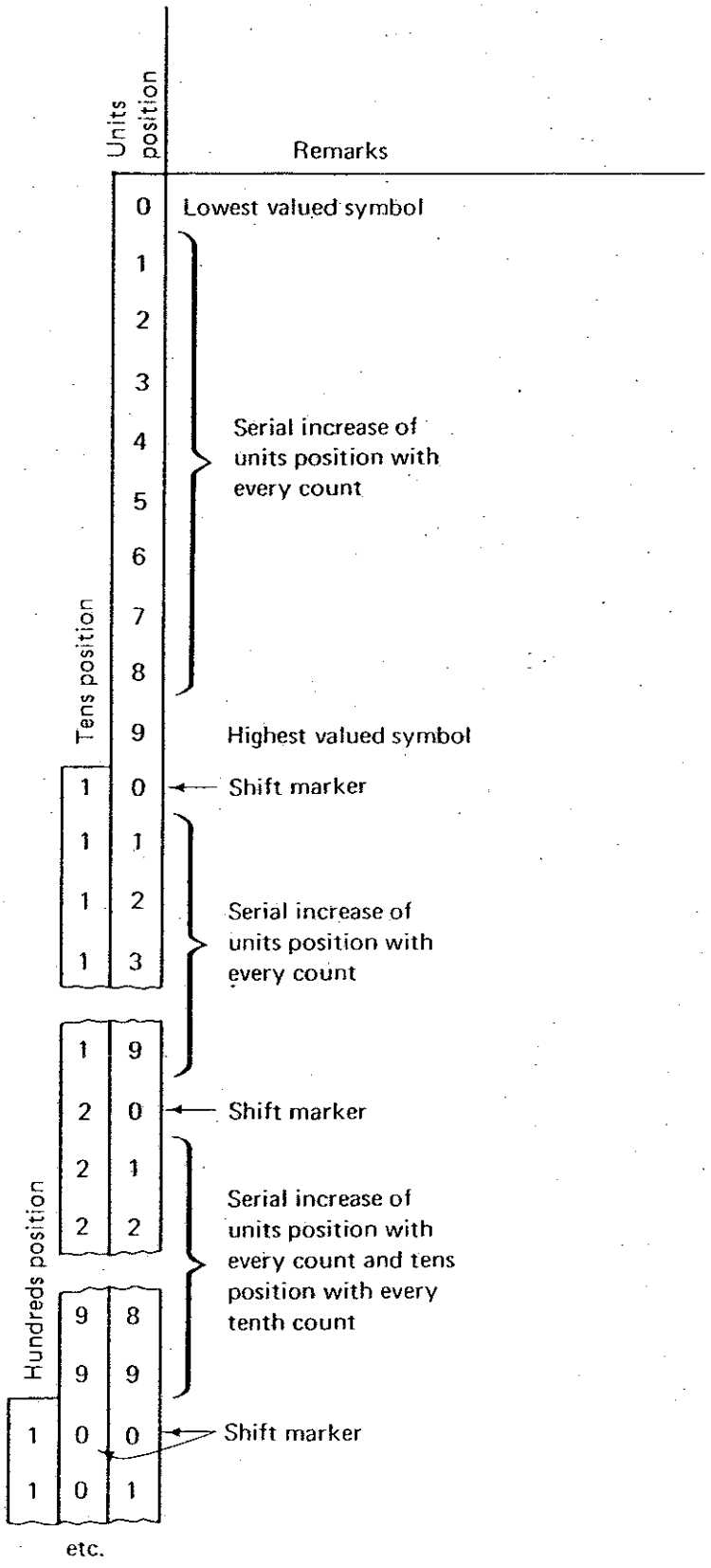


Figure 2-1 Decimal counting concepts

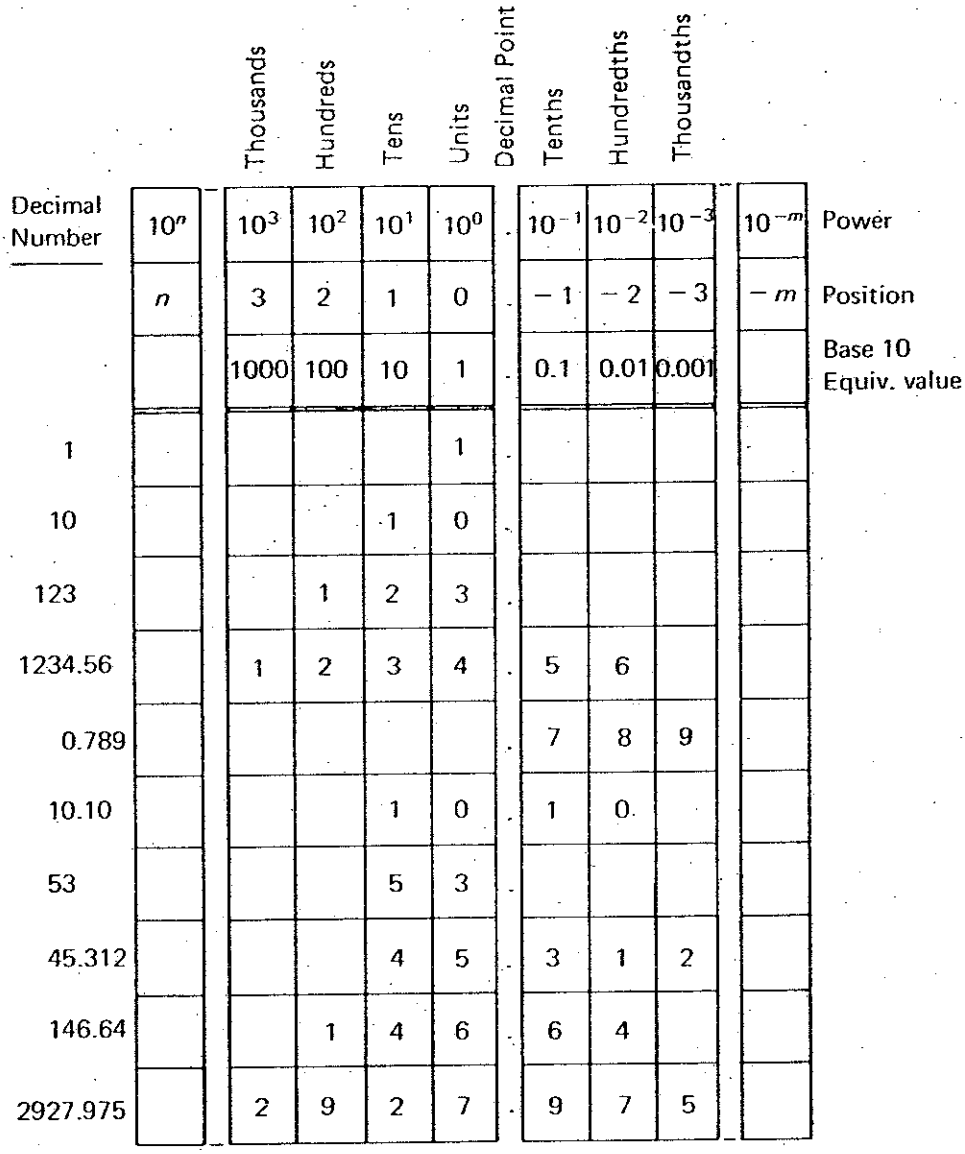


Figure 2-2 Representation of decimal numbers

Decimal	*Binary*	*Comments*
0	0000	Identical
1	0001	Identical
2	0010	Shift to the left required
3	0011	A 2 and a 1 makes 3
4	0100	Another shift to left required
5	0101	A 4 and a 1 makes 5
6	0110	A 4 and a 2 makes 6
7	0111	A 4 and a 2 and a 1 makes 7
8	1000	Another shift to left required
9	1001	An 8 and a 1 makes 9
10	1010	An 8 and a 2 makes 10
11	1011	An 8 and a 2 and a 1 makes 11
12	1100	An 8 and a 4 makes 12
13	1101	An 8 and a 4 and a 1 makes 13
14	1110	An 8 and a 4 and a 2 makes 14
15	1111	An 8 and a 4 and a 2 and a 1 makes 15

Figure 2-3 Binary counting table

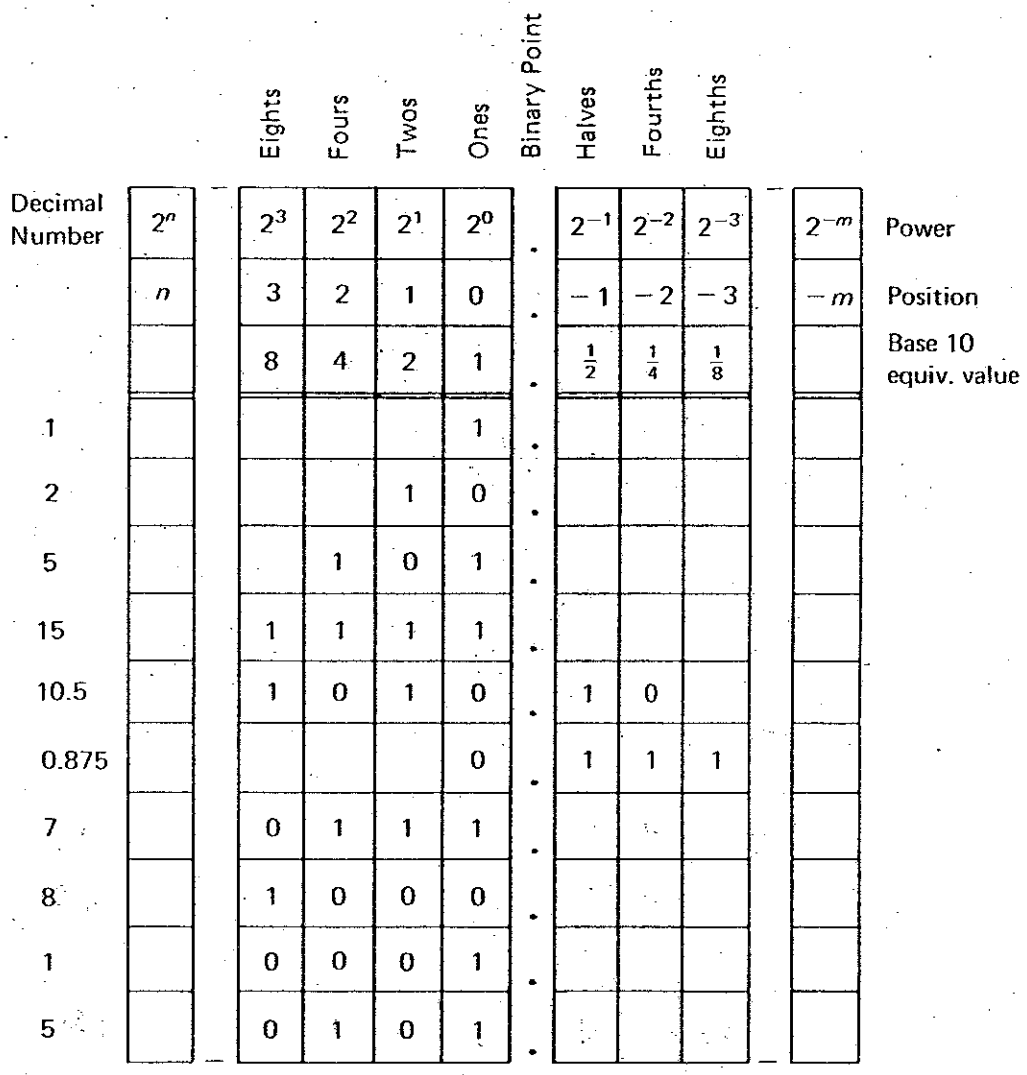


Figure 2-4 Representation of binary numbers

BINARY COUNTING CONCEPTS

DECIMAL #		16s	8s	4s	2s	UNITS	REMARKS
0						0	LOWEST VALUED SYMBOL
1						1	HIGHEST VALUED SYMBOL
2					1	0	← SHIFT MARKER
3					1	1	2+1=3
4				1	0	0	← SHIFT MARKER (2)
5				1	0	1	4+1=5
6				1	1	0	4+2=6
7				1	1	1	4+2+1=7
8			1	0	0	0	← SHIFT MARKER (3)
9			1	0	0	1	8+1=9
10	A		1	0	1	0	8+2=10
11	B		1	0	1	1	8+2+1=11
12	C		1	1	0	0	8+4=12
13	D		1	1	0	1	8+4+1=13
14	E		1	1	1	0	8+4+2=14
15	F	16s	1	1	1	1	8+4+2+1=15
16		1	0	0	0	0	← SHIFT MARKER (4)
17		1	0	0	0	1	
18		1	0	0	1	0	

POSITION

0 TO 255 IN DECIMAL, HEXADECIMAL, AND BINARY

0	0	00000000	48	30	00110000	96	60	01100000
1	1	00000001	49	31	00110001	97	61	01100001
2	2	00000010	50	32	00110010	98	62	01100010
3	3	00000011	51	33	00110011	99	63	01100011
4	4	00000100	52	34	00110100	100	64	01100100
5	5	00000101	53	35	00110101	101	65	01100101
6	6	00000110	54	36	00110110	102	66	01100110
7	7	00000111	55	37	00110111	103	67	01100111
8	8	00001000	56	38	00111000	104	68	01101000
9	9	00001001	57	39	00111001	105	69	01101001
10	A	00001010	58	3A	00111010	106	6A	01101010
11	B	00001011	59	3B	00111011	107	6B	01101011
12	C	00001100	60	3C	00111100	108	6C	01101100
13	D	00001101	61	3D	00111101	109	6D	01101101
14	E	00001110	62	3E	00111110	110	6E	01101110
15	F	00001111	63	3F	00111111	111	6F	01101111
16	10	00010000	64	40	01000000	112	70	01110000
17	11	00010001	65	41	01000001	113	71	01110001
18	12	00010010	66	42	01000010	114	72	01110010
19	13	00010011	67	43	01000011	115	73	01110011
20	14	00010100	68	44	01000100	116	74	01110100
21	15	00010101	69	45	01000101	117	75	01110101
22	16	00010110	70	46	01000110	118	76	01110110
23	17	00010111	71	47	01000111	119	77	01110111
24	18	00011000	72	48	01001000	120	78	01111000
25	19	00011001	73	49	01001001	121	79	01111001
26	1A	00011010	74	4A	01001010	122	7A	01111010
27	1B	00011011	75	4B	01001011	123	7B	01111011
28	1C	00011100	76	4C	01001100	124	7C	01111100
29	1D	00011101	77	4D	01001101	125	7D	01111101
30	1E	00011110	78	4E	01001110	126	7E	01111110
31	1F	00011111	79	4F	01001111	127	7F	01111111
32	20	00100000	80	50	01010000	128	80	10000000
33	21	00100001	81	51	01010001	129	81	10000001
34	22	00100010	82	52	01010010	130	82	10000010
35	23	00100011	83	53	01010011	131	83	10000011
36	24	00100100	84	54	01010100	132	84	10000100
37	25	00100101	85	55	01010101	133	85	10000101
38	26	00100110	86	56	01010110	134	86	10000110
39	27	00100111	87	57	01010111	135	87	10000111
40	28	00101000	88	58	01011000	136	88	10001000
41	29	00101001	89	59	01011001	137	89	10001001
42	2A	00101010	90	5A	01011010	138	8A	10001010
43	2B	00101011	91	5B	01011011	139	8B	10001011
44	2C	00101100	92	5C	01011100	140	8C	10001100
45	2D	00101101	93	5D	01011101	141	8D	10001101
46	2E	00101110	94	5E	01011110	142	8E	10001110
47	2F	00101111	95	5F	01011111	143	8F	10001111

0 TO 255 IN DECIMAL, HEXADECIMAL, AND BINARY

144	90	10010000
145	91	10010001
146	92	10010010
147	93	10010011
148	94	10010100
149	95	10010101
150	96	10010110
151	97	10010111
152	98	10011000
153	99	10011001
154	9A	10011010
155	9B	10011011
156	9C	10011100
157	9D	10011101
158	9E	10011110
159	9F	10011111

160	A0	10100000
161	A1	10100001
162	A2	10100010
163	A3	10100011
164	A4	10100100
165	A5	10100101
166	A6	10100110
167	A7	10100111
168	A8	10101000
169	A9	10101001
170	AA	10101010
171	AB	10101011
172	AC	10101100
173	AD	10101101
174	AE	10101110
175	AF	10101111

176	B0	10110000
177	B1	10110001
178	B2	10110010
179	B3	10110011
180	B4	10110100
181	B5	10110101
182	B6	10110110
183	B7	10110111
184	B8	10111000
185	B9	10111001
186	BA	10111010
187	BB	10111011
188	BC	10111100
189	BD	10111101
190	BE	10111110
191	BF	10111111

192	C0	11000000
193	C1	11000001
194	C2	11000010
195	C3	11000011
196	C4	11000100
197	C5	11000101
198	C6	11000110
199	C7	11000111
200	C8	11001000
201	C9	11001001
202	CA	11001010
203	CB	11001011
204	CC	11001100
205	CD	11001101
206	CE	11001110
207	CF	11001111

208	D0	11010000
209	D1	11010001
210	D2	11010010
211	D3	11010011
212	D4	11010100
213	D5	11010101
214	D6	11010110
215	D7	11010111
216	D8	11011000
217	D9	11011001
218	DA	11011010
219	DB	11011011
220	DC	11011100
221	DD	11011101
222	DE	11011110
223	DF	11011111

224	E0	11100000
225	E1	11100001
226	E2	11100010
227	E3	11100011
228	E4	11100100
229	E5	11100101
230	E6	11100110
231	E7	11100111
232	E8	11101000
233	E9	11101001
234	EA	11101010
235	EB	11101011
236	EC	11101100
237	ED	11101101
238	EE	11101110
239	EF	11101111

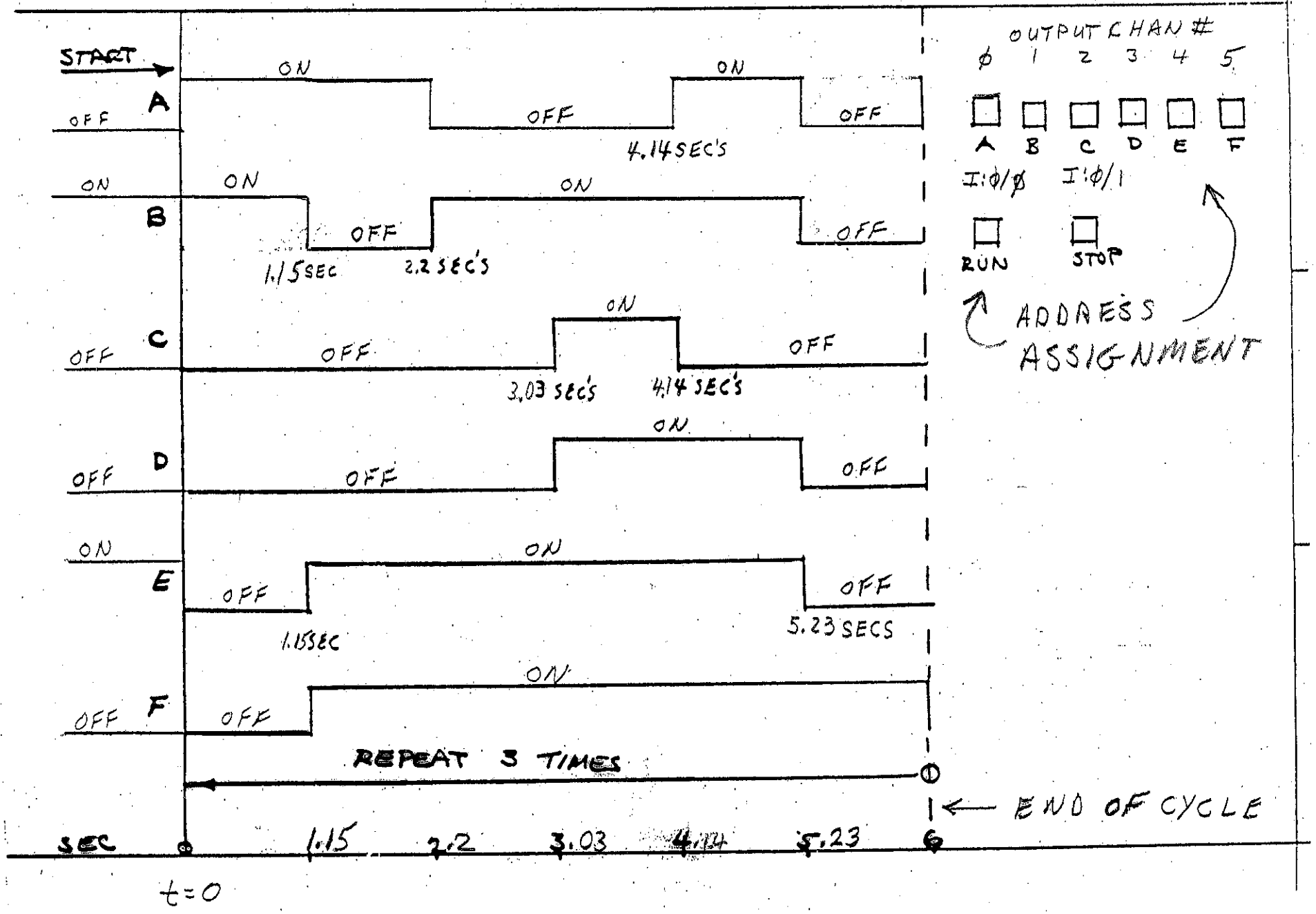
240	F0	11110000
241	F1	11110001
242	F2	11110010
243	F3	11110011
244	F4	11110100
245	F5	11110101
246	F6	11110110
247	F7	11110111
248	F8	11111000
249	F9	11111001
250	FA	11111010
251	FB	11111011
252	FC	11111100
253	FD	11111101
254	FE	11111110
255	FF	11111111

132.6

PLC TIME DRIVEN SEQUENCER

SAMPLE TIMING DIAGRAM

SAMPLE 1 of 3



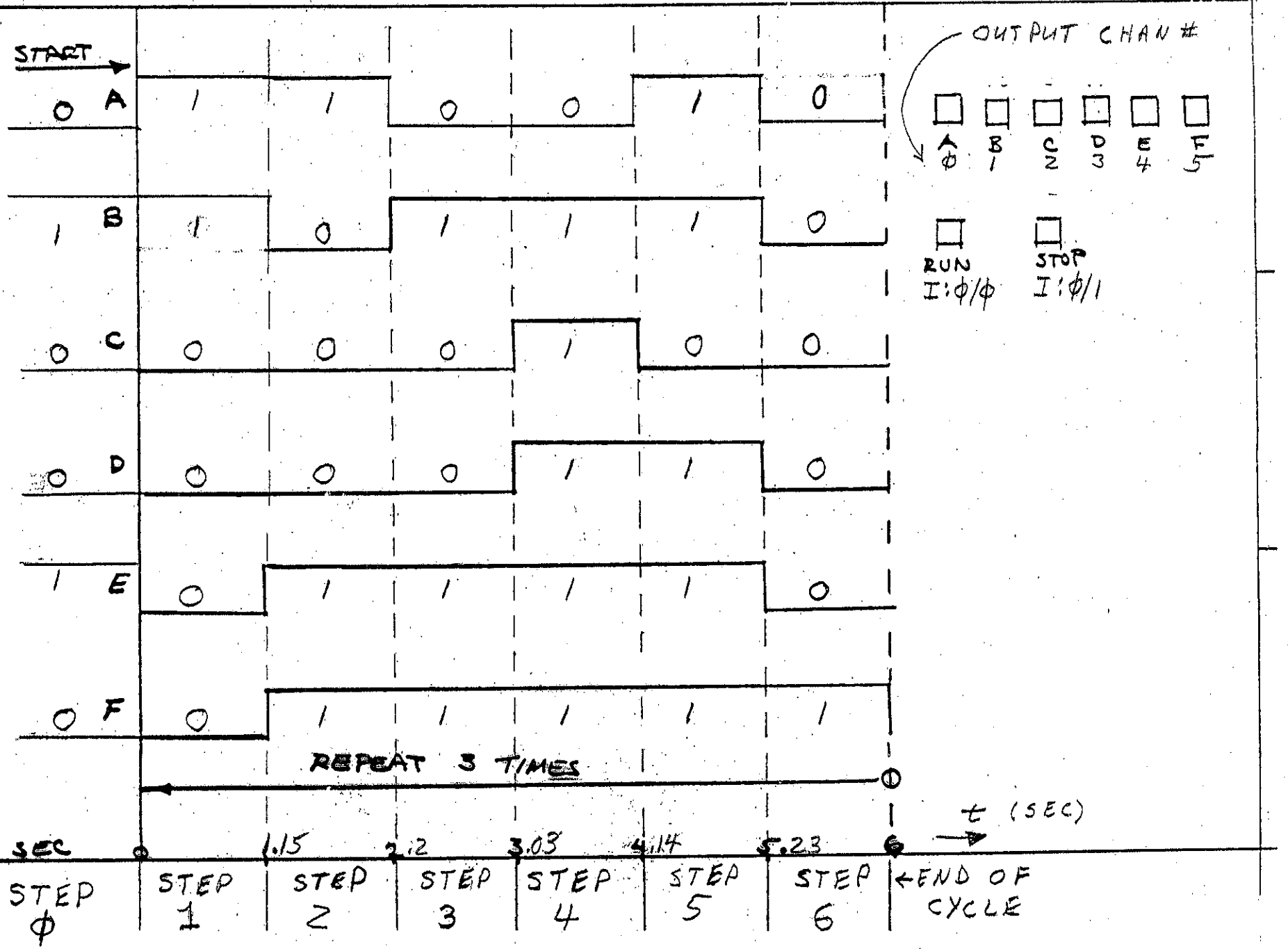
133.0

PLC TIME DRIVEN SEQUENCER

SAMPLE TIMING DIAGRAM

22-141 50 SHEETS
22-142 100 SHEETS
22-144 200 SHEETS

SAMPLE
2 of 3



1331

FILENAME: SEQRDEMOØ1

LENTGH = 6

SEQUENCER INSTRUCTION DATA FORM

TIME BASE = .01 SECS.

*MASK DATA SEQUENCER #1

BIT ADDRESS DATA									PROGRAM CODE		WORD FILE	PRESET VALUES (DWELL TIME)	WORD FILE
O:Ø/CHAN#	B				A				Data B	Data A	N7:		N7:
Bit Addresses →	7	6	5	4	3	2	1	Ø					
* Mask Data →	0	0	1	1	1	1	1	1	3	F			
Step Data → 0			0	1	0	0	1	0	1	2	Ø	1	40
1			0	0	0	0	1	1	0	3	1	115	41
2			1	1	0	0	0	1	3	1	2	105	42
3			1	1	0	0	1	0	3	2	3	83	43
4			1	1	1	1	1	0	3	E	4	111	44
5			1	1	1	0	1	1	3	B	5	109	45
6			1	0	0	0	0	0	2	0	6	77	46
7											7		47
8											8		48
9											9		49
10											10		50
11											11		51
12											12		52
13											13		53
14											14		54
15											15		55
16											16		56
17											17		57
18											18		58
19											19		59
20											20		60

Program Codes

Bit Address Data	Program Code
0000	0
0001	1
0010	2
0011	3
0100	4
0101	5
0110	6
0111	7
1000	8
1001	9
1010	A
1011	B
1100	C
1101	D
1110	E
1111	F

Example - For data 0001 1111, enter code 1 for Data B, and code F for Data A.
Thus: 0001 1111
1 F

133.2

>Time Driven Sequencer With Output[s] Controlled By The SQO Instruction<
>>Initialize The System Control Internal Relay[B3/1] To The !UnLatch!
**State Upon Entry To The Run Mode<<
==>>Programmer: Wayne Cordwell 11.03.2002
==========>>Program History: Revised Seqr01 Developed On MPS/ABMICRO..
==========>>DOS Version.

0000
First Pass
S:1/15
>OffLatch<
B3/1

>>Start-Up Rung Via PB At Input Channel# 0<<

0001
>Start-UP<
I:0/0
>Internal Start<
B3/0

1761-Micro

>>>Jump To Subroutine To Execute START/HOLD/CONTINUE Master/Slave Toggle Latches Via B3/0<<<

0002
>Goto<
Start/Hold/Continue

>>>System Timer{Master Oscillator} With Pause Mode<<<

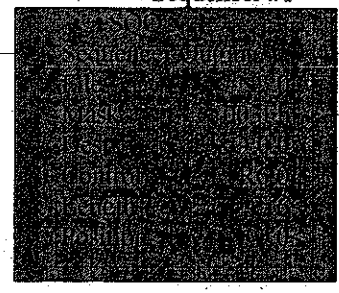
0003
>MasterStart And<
>RTOEnable<
B3/1
>Master Hold<
B3/4
>>System Timer<<

>>Start Seqencers: Seqr#1 Controls Outputs ON/OFF Status. Seqr#2 Controls Outputs Dwell Time[ON/OFF Time Slot]
>>>Word Files N7:0,1,2.....N7:39 Control Output ON/OFF Status For Each Step.
>>>Word Files N7:40,1,2.....N7:79 Control Output Dwell Time For Each Step.

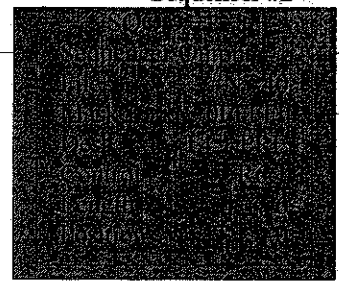
0004

>End Of Cycle:
[1] RTO-Reset
[2] CTU Ups A Count
At End Of Sequence
T4:1/DN

>Sequencer #1<



>Sequencer #2<



0005

>>Count The Number Of Sequencer Cycles<<

>Sequencer #2<
R6:1/DN

>End Of Cycle:
[1] RTO-Reset
[2] CTU Ups A Count
At End Of Sequence
T4:1/DN

>Sequencer #2<
Cycles Counter<

0006

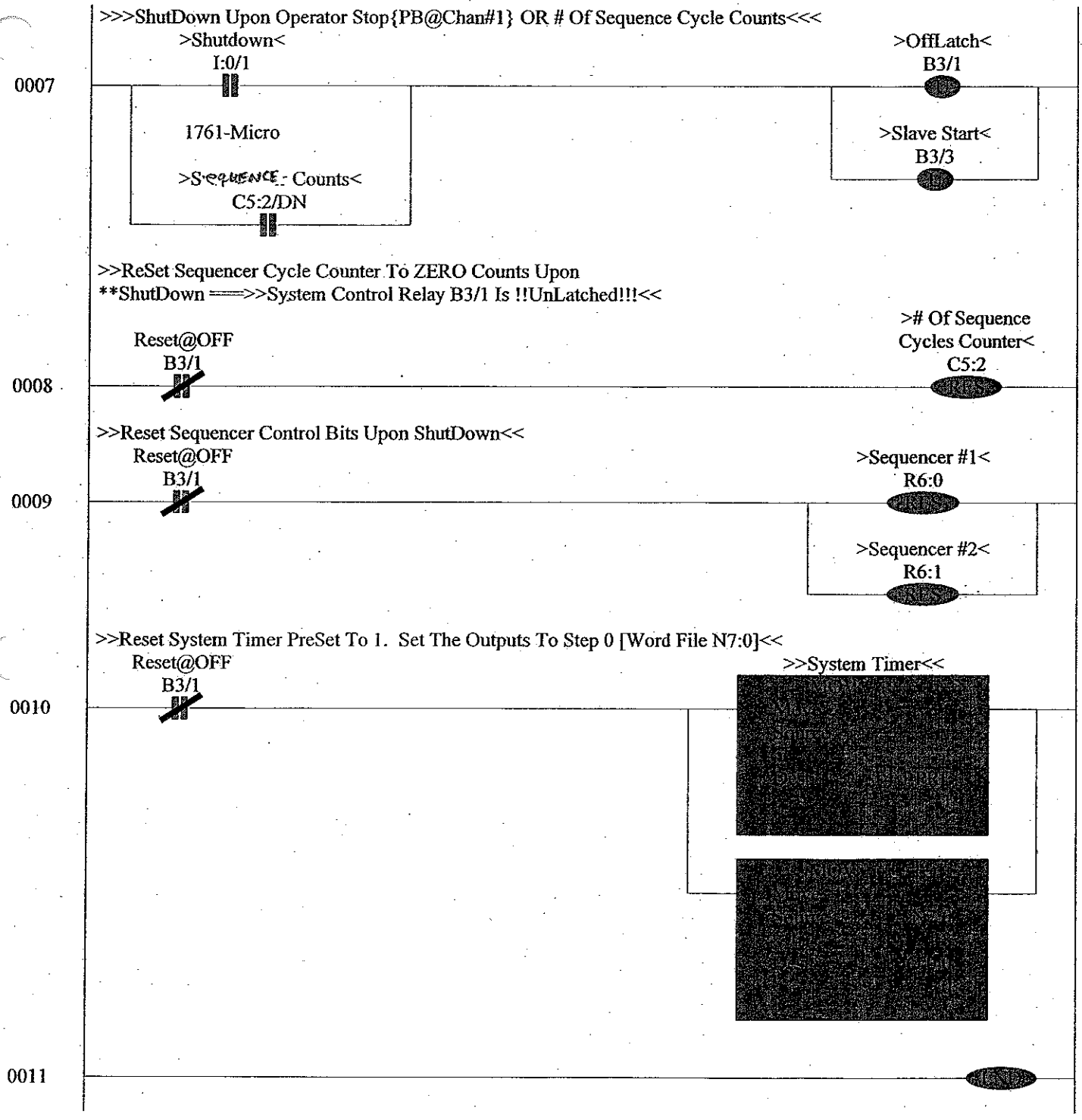
>>>Reset{For Start Of The Next Cycle}/ShutDown Of The System Timer<<<

>End Of Cycle:
[1] RTO-Reset
[2] CTU Ups A Count
At End Of Sequence
T4:1/DN

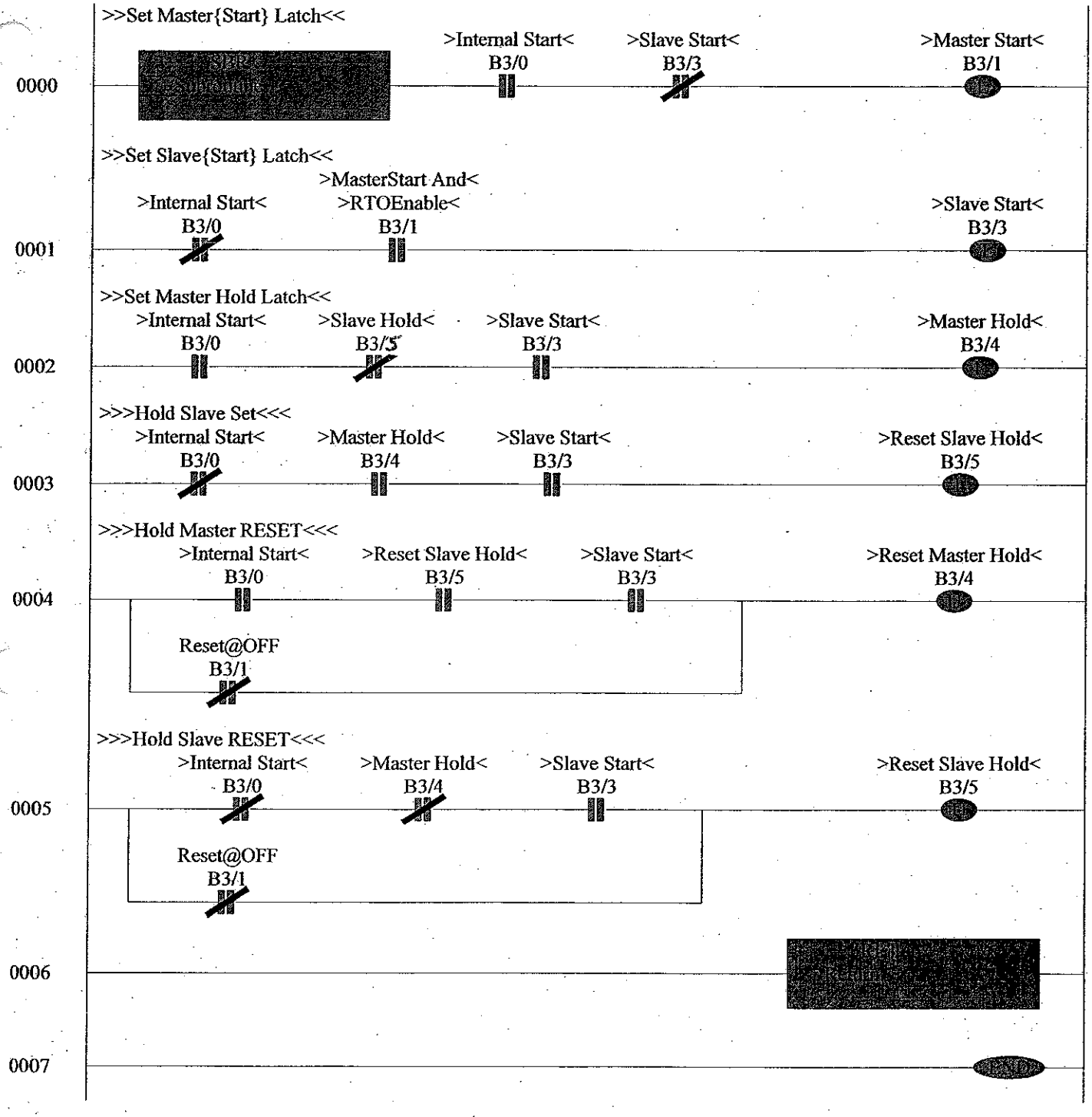
Reset@OFF
B3/1

>>System Timer<<
T4:1

LAD 2 - SEQR_OUTPT - Sequencer Output Control By SQO Instruction --- Total Rungs in File = 12



133.5


>>Set Master{Start} Latch<<
>Internal Start<
B3/0
>Slave Start<
B3/3
>Master Start<
B3/1
0000
>>Set Slave{Start} Latch<<
>MasterStart And<
>Internal Start<
B3/0
>RTOEnable<
B3/1
>Slave Start<
B3/3
0001
>>Set Master Hold Latch<<
>Internal Start<
B3/0
>Slave Hold<
B3/5
>Slave Start<
B3/3
>Master Hold<
B3/4
0002
>>>Hold Slave Set<<<
>Internal Start<
B3/0
>Master Hold<
B3/4
>Slave Start<
B3/3
>Reset Slave Hold<
B3/5
0003
>>>Hold Master RESET<<<
>Internal Start<
B3/0
>Reset Slave Hold<
B3/5
>Slave Start<
B3/3
>Reset Master Hold<
B3/4
Reset@OFF
B3/1
0004
>>>Hold Slave RESET<<<
>Internal Start<
B3/0
>Master Hold<
B3/4
>Slave Start<
B3/3
>Reset Slave Hold<
B3/5
Reset@OFF
B3/1
0005
0006
0007

SEQRDEMO01.RSS

Data File N7 (hex) ← ON/OFF DATA

Offset	0	1	2	3	4	5	6	7	8	9
N7:0	12	3	31	32	3E	3B	20	0	0	0
N7:10	0	0	0	0	0	0	0	0	0	0
N7:20	0	0	0	0	0	0	0	0	0	0
N7:30	0	0	0	0	0	0	0	0	0	0
N7:40	1	73	69	53	6F	6D	4D	0	0	0
N7:50	0	0	0	0	0	0	0	0	0	0
N7:60	0	0	0	0	0	0	0	0	0	0
N7:70	0	0	0	0	0	0	0	0	0	0
N7:80	0	0	0	0	0	0	0	0	0	0
N7:90	0	0	0	0	0	0	0	0	0	0
N7:100	0	0	0	0	0					

← ON/OFF N7:0 → N7:6

(Radix Hex/BCD)

133.7

SEQRDEMO01.RSS

Data File N7 (dec) ← DWELL TIME DATA

Offset	0	1	2	3	4	5	6	7	8	9
N7:0	18	3	49	50	62	59	32	0	0	0
N7:10	0	0	0	0	0	0	0	0	0	0
N7:20	0	0	0	0	0	0	0	0	0	0
N7:30	0	0	0	0	0	0	0			
N7:40	1	115	105	83	111	109	77			
N7:50	0	0	0	0	0	0	0			
N7:60	0	0	0	0	0	0	0	0	0	0
N7:70	0	0	0	0	0	0	0	0	0	0
N7:80	0	0	0	0	0	0	0	0	0	0
N7:90	0	0	0	0	0	0	0	0	0	0
N7:100	0	0	0	0	0					

(Radix Decimal)

DWELL TIME N7:46 ↓ N7:46

Check list for the time driven sequencer using the SQO function

[ ] Be sure sequencer #1 and #2 have the same length.

[ ] Each sequencer must have a unique control file [R6]

[ ] Reserve word files N7:0 up to and including N7:39 for the On/Off data. Use Hexadecimal Radix when entering these values. Note N7: {Last Value Address}; Is the Length. For Example if N7:21 is the last value of On/Off data, then length equals 21. *Sequencer #1*

[ ] Reserve word files N7:40 up to and including N7:79 for the dwell time data. Use decimal radix when entering these values. The number of On/Off values must equal the number of dwell time values. *Sequencer #2*

[ ] Mask data for Sequencer #1 must not be greater than 3F (Hexadecimal) when using the 1761-L16 BWA Allen-Bradley Micro-Logix Controller. A program fault will occur if the mask data is greater than 3F (Hexadecimal).

[ ] Mask data for Sequencer #1 must not be greater than FFF (Hexadecimal) when using the 1761-L32 BWA Allen-Bradley Micro-Logix Controller. A program fault will occur if the mask data is greater than FFF (Hexadecimal)

[ ] Besides having a hard copy (print report) of the ladder diagrams, you should print the N7 (word files) in decimal and hexadecimal radix. Your instructor will show you how to do this via the "report options".

[ ] Step zero is the "Idle Step", outputs are "On" or "Off" according to the program; PLC is in the run mode but the sequencer program is in the stop (Shut Down) mode.

[ ] The time base of T4:1 must have the same time base units for the corresponding data in N7:40 to N7:79 (max) word file. A time base = 0.01 is hundred's of seconds, therefore N7 data of 115 is 1.15 seconds.

[ ] Use Seqrodem001 as a "boiler plate" to build future programs. Note C5:2 is the number of sequencer cycles counter. It's preset controls the number of cycles the programs executes before shutdown. If C5:2 is disabled (can't count) then the Auto Repeat Mode Results.