รายการอ้างอิง

1. IEEE Recommended Practice for Master/Remote Supervisory Control and Data Acquisition (SCADA) Communications. IEEE Std 999-1992.

2. William L. Schweber. 1988. Data Communications international edition 1988. New York McGraw-Hill Book company.

3. MAXIM Data book, New Release 1996 Volume V.

4. Stuart A. Boyer. 1993. SCADA Supervisory Control and Data Acquisition., Iliad Engineering Inc. Instrument Society of America.

5. John D. Spragins. 1991. Telecommunications Protocols and Design. New York Addison-Wesley Publishing Company.

6. Shu Lin/Daniel J. Costello, Jr, 1983. Error Control Coding Fundamentals and Application. New Jersey. Prentice-Hall.

7. Uyless D. Black. 1987. Data Communications and Distributed Networks. New Jersey Prentice-Hall.

8. William J. Ackerman and Wayne R. Block. 1992. Understanding Supervisory Systems. IEEE. (October 1992) : 37-40

9. John D. McDonald. Developing and Defining Basic Scada System Concepts. IEEE. (1993)

10. J.A. Kischefsky and D.A. Down. Distributed Intelligence on Distribution SCADA System.

IEEE.

11. Brian Quartey and Donald Shaw. An Application of PLC's as RTU in SCADA Sy

IEEE. (1992) : 271-274

12. A.G. Bruce and R. Lee. A Framework for The Specification of SCADA Data Links.

IEEE. (1993) : 560-564

13. Peter Sweeney. 1991. Error Control Coding an Introduction. Hertfordshire. Prentice-Hall

14. ปรเมษฐ์ ประนยานันทน์ และปิยพงศ์ เผ่าวณิช. 2536. คู่มือและการประยุกต์ใช้งาน ไมโครคอนโทรลเลอร์ MCS-51. ซีเอ็ดยูเคชั่น.

15. Intouch Product Data Sheet. Wonderware Corporation (1997)

ภาคผนวก

ภาคผนวก ก.

ตารางของสมาชิกใน $GF(2^8)$

ERROR CORRECTION

BCH(255,239)

$G(x) = X^{16} + X^{14} + X^{13} + X^{11} + X^{10} + X^{9} + X^{8} + X^{6} + X^{5} + X + 1$

-	00000000	00		30	00000110	60	$\alpha^5+\alpha^6$
0	10000000	01	1	31	00000011	C0	$\alpha^6+\alpha^7$
1	01000000	02	α	32	10111001	9D	$1+\alpha^2+\alpha^3+\alpha^4+\alpha^7$
2	00100000	04	α^2	33	11100100	27	$1+\alpha+\alpha^2+\alpha^5$
3	00010000	08	α^3	34	01110010	4E	$\alpha+\alpha^2+\alpha^3+\alpha^6$
4	00001000	10	α^4	35	00111001	9C	$\alpha^2+\alpha^3+\alpha^4+\alpha^7$
5	00000100	20	α^5	36	10100100	25	$1+\alpha^2+\alpha^5$
6	00000010	40	α^6	37	01010010	4A	$\alpha+\alpha^3+\alpha^6$
7	00000001	80	α^7	38	00101001	94	$\alpha^2+\alpha^4+\alpha^7$
8	10111000	1D	$1+\alpha^2+\alpha^3+\alpha^4$	39	10101100	35	$1+\alpha^2+\alpha^4+\alpha^5$
9	01011100	3A	$\alpha+\alpha^3+\alpha^4+\alpha^5$	40	01010110	6A	$\alpha+\alpha^3+\alpha^5+\alpha^6$
10	00101110	74	$\alpha^2+\alpha^4+\alpha^5+\alpha^6$	41	00101011	D4	$\alpha^2+\alpha^4+\alpha^6+\alpha^7$
11	00010111	E8	$\alpha^3+\alpha^5+\alpha^6+\alpha^7$	42	10101101	B5	$1+\alpha^2+\alpha^4+\alpha^6+\alpha^7$
12	10110011	CD	$1+\alpha^2+\alpha^3+\alpha^6+\alpha^7$	43	11101110	77	$1+\alpha+\alpha^2+\alpha^4+\alpha^5+\alpha^6$
13	11100001	87	$1+\alpha^1+\alpha^2+\alpha^7$	44	01110111	EE	$\alpha+\alpha^2+\alpha^3+\alpha^5+\alpha^6+\alpha^7$
14	11001000	13	$1+\alpha^1+\alpha^4$	45	10000011	C1	$1+\alpha^6+\alpha^7$
15	01100100	26	$\alpha+\alpha^2+\alpha^5$	46	11111001	9F	$1+\alpha+\alpha^2+\alpha^3+\alpha^4+\alpha^7$
16	00110010	4C	$\alpha^2+\alpha^3+\alpha^6$	47	11000100	23	$1+\alpha+\alpha^5$
17	00011001	98	$\alpha^3+\alpha^4+\alpha^7$	48	01100010	46	$\alpha+\alpha^2+\alpha$
18	10110100	2D	$1+\alpha^2+\alpha^3+\alpha^5$	49	00110001	8C	$\alpha^2+\alpha^3+\alpha^7$
19	01011010	5A	$\alpha+\alpha^3+\alpha^4+\alpha^6$	50	10100000	05	$1+\alpha^2$
20	00101101	B4	$\alpha^2+\alpha^4+\alpha^5+\alpha^7$	51	01010000	0A	$\alpha+\alpha^3$
21	10101110	75	$1+\alpha^2+\alpha^4+\alpha^5+\alpha^6$	52	00101000	14	$\alpha^2+\alpha^4$
22	01010111	EA	$\alpha+\alpha^3+\alpha^5+\alpha^6+\alpha^7$	53	00010100	28	$\alpha^3+\alpha$
23	10010011	C9	$1+\alpha^3+\alpha^6+\alpha^7$	54	00001010	50	$\alpha^4+\alpha^6$
24	11110001	8F	$1+\alpha+\alpha^2+\alpha^3+\alpha^7$	55	00000101	A0	$\alpha^5+\alpha^7$
25	11000000	03	$1+\alpha$	56	10111010	5D	$1+\alpha^2+\alpha^3+$
26	01100000	06	$\alpha+\alpha^2$	57	01011101	BA	$\alpha+\alpha^3+\alpha^4+\alpha^5+\alpha^7$
27	00110000	0C	$\alpha^2+\alpha^3$	58	10010110	69	$1+\alpha^3+\alpha^5+\alpha^6$
28	00011000	18	$\alpha^3+\alpha^4$	59	01001011	D2	$\alpha+\alpha^4+\alpha^6+\alpha^7$
29	00001100	30	$\alpha^4+\alpha^5$				

60	10011101	B9	$1+\alpha^3+\alpha^4+\alpha^5+\alpha^7$	91	11000101	A3	$1+\alpha+\alpha^5+\alpha^7$
61	11110110	6F	$1+\alpha+\alpha^2+\alpha^3+\alpha^5+\alpha^6$	92	11011010	5B	$1+\alpha+\alpha^3+\alpha^4+\alpha^6$
62	01111011	DE	$\alpha+\alpha^2+\alpha^3+\alpha^4+\alpha^6+\alpha^7$	93	01101101	B6	$\alpha+\alpha^2+\alpha^4+\alpha^5+\alpha^7$
63	10000101	A1	$1+\alpha^5+\alpha^7$	94	10001110	71	$1+\alpha^4+\alpha^5+\alpha^6$
64	11111010	5F	$1+\alpha+\alpha^2+\alpha^3+\alpha^4+\alpha^6$	95	01000111	E2	$\alpha+\alpha^5+\alpha^6+\alpha^7$
65	01111101	BE	$\alpha+\alpha^2+\alpha^3+\alpha^4+\alpha^5+\alpha^7$	96	10011011	D9	$1+\alpha^3+\alpha^4+\alpha^6+\alpha^7$
66	10000110	61	$1+\alpha^5+\alpha^6$	97	11110101	AF	$1+\alpha+\alpha^2+\alpha^3+\alpha^5+\alpha^7$
67	01000011	C2	$\alpha+\alpha^6+\alpha^7$	98	11000010	43	$1+\alpha+\alpha^6$
68	10011001	99	$1+\alpha^3+\alpha^4+\alpha^7$	99	01100001	86	$\alpha+\alpha^2+\alpha^7$
69	11110100	2F	$1+\alpha+\alpha^2+\alpha^3+\alpha^5$	100	10001000	11	$1+\alpha^4$
70	01111010	5E	$\alpha+\alpha^2+\alpha^3+\alpha^4+\alpha^6$	101	01000100	22	$\alpha+\alpha^5$
71	00111101	BC	$\alpha^2+\alpha^3+\alpha^4+\alpha^5+\alpha^7$	102	00100010	44	$\alpha^2+\alpha^6$
72	10100110	65	$1+\alpha^2+\alpha^5+\alpha^6$	103	00010001	88	$\alpha^3+\alpha^7$
73	01010011	CA	$\alpha+\alpha^3+\alpha^6+\alpha^7$	104	10110000	0D	$1+\alpha^2+\alpha^3$
74	10010001	89	$1+\alpha^3+\alpha^7$	105	01011000	1A	$\alpha+\alpha^3+\alpha^4$
75	11110000	0F	$1+\alpha+\alpha^2+\alpha^3$	106	00101100	34	$\alpha^2+\alpha^4+\alpha^5$
76	01111000	1E	$\alpha+\alpha^2+\alpha^3+\alpha^4$	107	00010110	68	$\alpha^3+\alpha^5+\alpha^6$
77	00111100	3C	$\alpha^2+\alpha^3+\alpha^4+\alpha^5$	108	00001011	D0	$\alpha^4+\alpha^6+\alpha^7$
78	00011110	78	$\alpha^3+\alpha^4+\alpha^5+\alpha^6$	109	10111101	BD	$1+\alpha^2+\alpha^3+\alpha^4+\alpha^5+\alpha^7$
79	00001111	F0	$\alpha^4+\alpha^5+\alpha^6+\alpha^7$	110	11100110	67	$1+\alpha+\alpha^2+\alpha^5+\alpha^6$
80	10111111	FD	$1+\alpha^2+\alpha^3+\alpha^4+\alpha^5+\alpha^6+\alpha^7$	111	01110011	CE	$\alpha+\alpha^2+\alpha^3+\alpha^6+\alpha^7$
81	11100111	E7	$1+\alpha+\alpha^2+\alpha^5+\alpha^6+\alpha^7$	112	10000001	81	$1+\alpha^7$
82	11001011	D3	$1+\alpha+\alpha^4+\alpha^6+\alpha^7$	113	11111000	1F	$1+\alpha+\alpha^2+\alpha^3+\alpha^4$
83	11011101	BB	$1+\alpha+\alpha^3+\alpha^4+\alpha^5+\alpha^7$	114	01111100	3E	$\alpha+\alpha^2+\alpha^3+\alpha^4+\alpha^5$
84	11010110	6B	$1+\alpha+\alpha^3+\alpha^5+\alpha^6$	115	00111110	7C	$\alpha^2+\alpha^3+\alpha^4+\alpha^5+\alpha^6$
85	01101011	D6	$\alpha+\alpha^2+\alpha^4+\alpha^6+\alpha^7$	116	00011111	F8	$\alpha^3+\alpha^4+\alpha^5+\alpha^6+\alpha^7$
86	10001101	B1	$1+\alpha^4+\alpha^5+\alpha^7$	117	10110111	ED	$1+\alpha^2+\alpha^3+\alpha^5+\alpha^6+\alpha^7$
87	11111110	7F	$1+\alpha+\alpha^2+\alpha^3+\alpha^4+\alpha^5+\alpha^6$	118	11100011	C7	$1+\alpha+\alpha^2+\alpha^3+\alpha^6+\alpha^7$
88	01111111	FE	$\alpha+\alpha^2+\alpha^3+\alpha^4+\alpha^5+\alpha^6+\alpha^7$	119	11001001	93	$1+\alpha+\alpha^4+\alpha^7$
89	10000111	E1	$1+\alpha^5+\alpha^6+\alpha^7$	120	11011100	3B	$1+\alpha+\alpha^3+\alpha^4+\alpha^5$
90	11111011	DF	$1+\alpha+\alpha^2+\alpha^3+\alpha^4+\alpha^6+\alpha^7$	121	01101110	76	$\alpha+\alpha^2+\alpha^4+\alpha^5+\alpha^6$
				122	00110111	EC	$\alpha^2+\alpha^3+\alpha^5+\alpha^6+\alpha^7$
				123	10100011	C5	$1+\alpha^2+\alpha^6+\alpha^7$
				124	11101001	97	$1+\alpha+\alpha^2+\alpha^4+\alpha^7$
				125	11001100	33	$1+\alpha+\alpha^4+\alpha^5$
				126	01100110	66	$\alpha+\alpha^2+\alpha^5+\alpha^6$

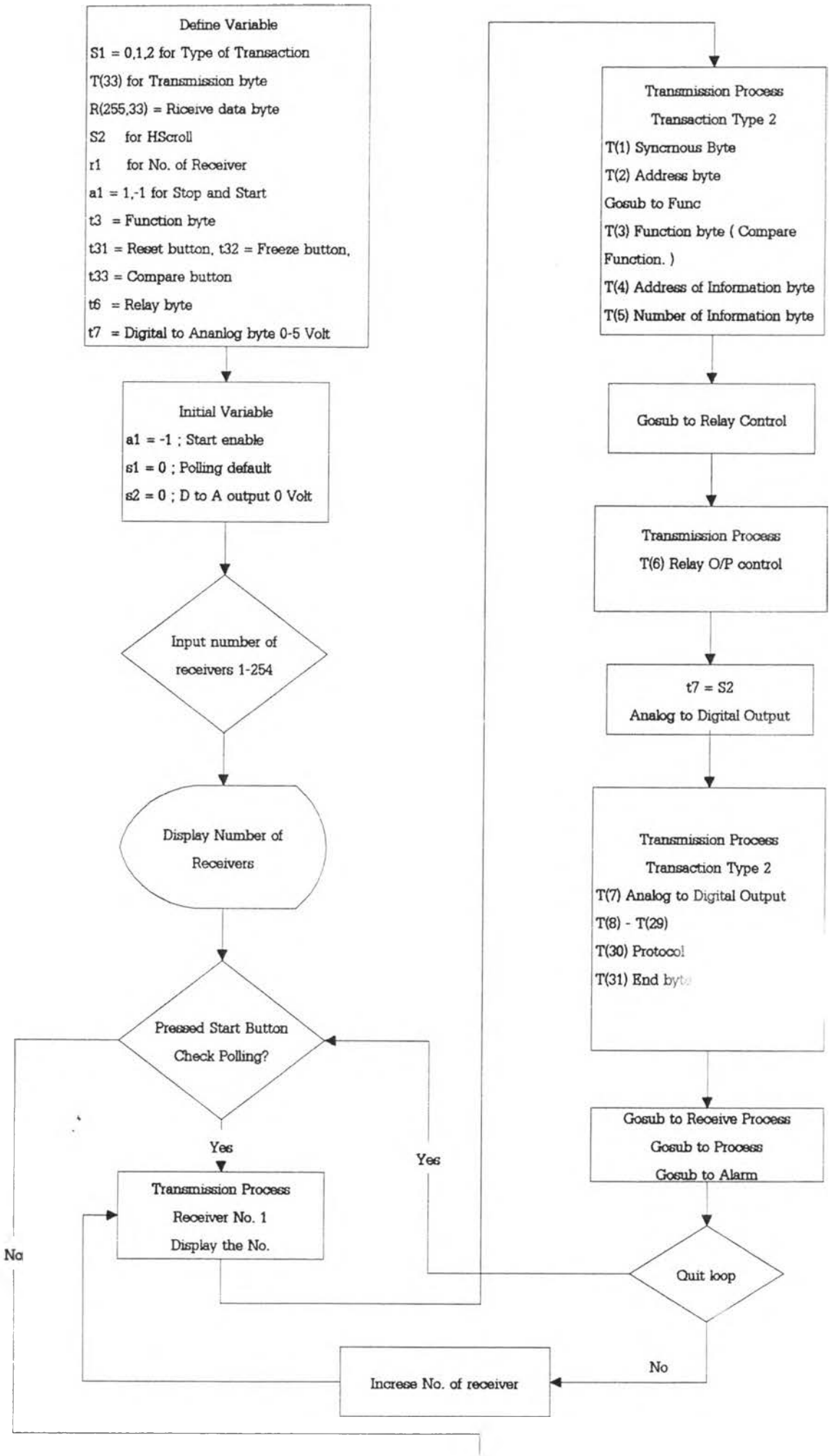
127	00110011	CC	$\alpha^2+\alpha^3+\alpha^6+\alpha^7$	161	10001011	D1	$1+\alpha^4+\alpha^6+\alpha^7$
128	10100001	85	$1+\alpha^2+\alpha^7$	162	11111101	BF	$1+\alpha+\alpha^2+\alpha^3+\alpha^4+\alpha^5+\alpha^7$
129	11101000	17	$1+\alpha+\alpha^2+\alpha^4$	163	11000110	63	$1+\alpha+\alpha^5+\alpha^6$
130	01110100	2E	$\alpha+\alpha^2+\alpha^3+\alpha^5$	164	01100011	C6	$\alpha+\alpha^2+\alpha^6+\alpha^7$
131	00111010	5C	$\alpha^2+\alpha^3+\alpha^4+\alpha^6$	165	10001001	91	$1+\alpha^4+\alpha^7$
132	00011101	B8	$\alpha^3+\alpha^4+\alpha^5+\alpha^7$	166	11111100	3F	$1+\alpha+\alpha^2+\alpha^3+\alpha^4+\alpha^5$
133	10110110	6D	$1+\alpha^2+\alpha^3+\alpha^5+\alpha^6$	167	01111110	7E	$\alpha+\alpha^2+\alpha^3+\alpha^4+\alpha^5+\alpha^6$
134	01011011	DA	$\alpha+\alpha^3+\alpha^4+\alpha^6+\alpha^7$	168	00111111	FC	$\alpha^2+\alpha^3+\alpha^4+\alpha^5+\alpha^6+\alpha^7$
135	10010101	A9	$1+\alpha^3+\alpha^5+\alpha^7$	169	10100111	E5	$1+\alpha^2+\alpha^5+\alpha^6+\alpha^7$
136	11110010	4F	$1+\alpha+\alpha^2+\alpha^3+\alpha^6$	170	11101011	D7	$1+\alpha+\alpha^2+\alpha^4+\alpha^6+\alpha^7$
137	01111001	9E	$\alpha+\alpha^2+\alpha^3+\alpha^4+\alpha^7$	171	11001101	B3	$1+\alpha+\alpha^4+\alpha^5+\alpha^7$
138	10000100	21	$1+\alpha^5$	172	11011110	7B	$1+\alpha+\alpha^3+\alpha^4+\alpha^5+\alpha^6$
139	01000010	42	$\alpha+\alpha^6$	173	01101111	F6	$\alpha+\alpha^2+\alpha^4+\alpha^5+\alpha^6+\alpha^7$
140	00100001	84	$\alpha^2+\alpha^7$	174	10001111	F1	$1+\alpha^4+\alpha^5+\alpha^6+\alpha^7$
141	10101000	15	$1+\alpha^2+\alpha^4$	175	11111111	FF	$1+\alpha+\alpha^2+\alpha^3+\alpha^4+\alpha^5+\alpha^6+\alpha^7$
142	01010100	2A	$\alpha+\alpha^3+\alpha^5$	176	11000111	E3	$1+\alpha+\alpha^5+\alpha^6+\alpha^7$
143	00101010	54	$\alpha^2+\alpha^4+\alpha^6$	177	11011011	DB	$1+\alpha+\alpha^3+\alpha^4+\alpha^6+\alpha^7$
144	00010101	A8	$\alpha^3+\alpha^5+\alpha^7$	178	11010101	AB	$1+\alpha+\alpha^3+\alpha^5+\alpha^7$
145	10110010	4D	$1+\alpha^2+\alpha^3+\alpha^6$	179	11010010	4B	$1+\alpha+\alpha^3+\alpha^6$
146	01011001	9A	$\alpha+\alpha^3+\alpha^4+\alpha^7$	180	01101001	96	$\alpha+\alpha^2+\alpha^4+\alpha^7$
147	10010100	29	$1+\alpha^3+\alpha^5$	181	10001100	31	$1+\alpha^4+\alpha^5$
148	01001010	52	$\alpha+\alpha^4+\alpha^6$	182	01000110	62	$\alpha+\alpha^5+\alpha^6$
149	00100101	A4	$\alpha^2+\alpha^5+\alpha^7$	183	00100011	C4	$\alpha^2+\alpha^6+\alpha^7$
150	10101010	55	$1+\alpha^2+\alpha^4+\alpha^6$	184	10101001	95	$1+\alpha^2+\alpha^4+\alpha^7$
151	01010101	AA	$\alpha+\alpha^3+\alpha^5+\alpha^7$	185	11101100	37	$1+\alpha+\alpha^2+\alpha^3$
152	10010010	49	$1+\alpha^3+\alpha^6$	186	01110110	6E	$\alpha+\alpha^2+\alpha^3+\alpha^5+\alpha^6$
153	01001001	92	$\alpha+\alpha^4+\alpha^7$	187	00111011	DC	$\alpha^2+\alpha^3+\alpha^4+\alpha^6+\alpha^7$
154	10011100	39	$1+\alpha^3+\alpha^4+\alpha^5$	188	10100101	A5	$1+\alpha^2+\alpha^5+\alpha^7$
155	01001110	72	$\alpha+\alpha^4+\alpha^5+\alpha^6$	189	11101010	57	$1+\alpha+\alpha^2+\alpha^4+\alpha^6$
156	00100111	E4	$\alpha^2+\alpha^5+\alpha^6+\alpha^7$	190	01110101	AE	$\alpha+\alpha^2+\alpha^3+\alpha^5+\alpha^7$
157	10101011	D5	$1+\alpha^2+\alpha^4+\alpha^6+\alpha^7$	191	10000010	41	$1+\alpha^6$
158	11101101	B7	$1+\alpha+\alpha^2+\alpha^4+\alpha^5+\alpha^7$	192	01000001	82	$\alpha+\alpha^7$
159	11001110	73	$1+\alpha+\alpha^4+\alpha^5+\alpha^6$	193	10011000	19	$1+\alpha^3+\alpha^4$
160	01100111	E6	$\alpha+\alpha^2+\alpha^5+\alpha^6+\alpha^7$	194	01001100	32	$\alpha+\alpha^4+\alpha^5$
				195	00100110	64	$\alpha^2+\alpha^5+\alpha^6$
				196	00010011	C8	$\alpha^3+\alpha^6+\alpha^7$

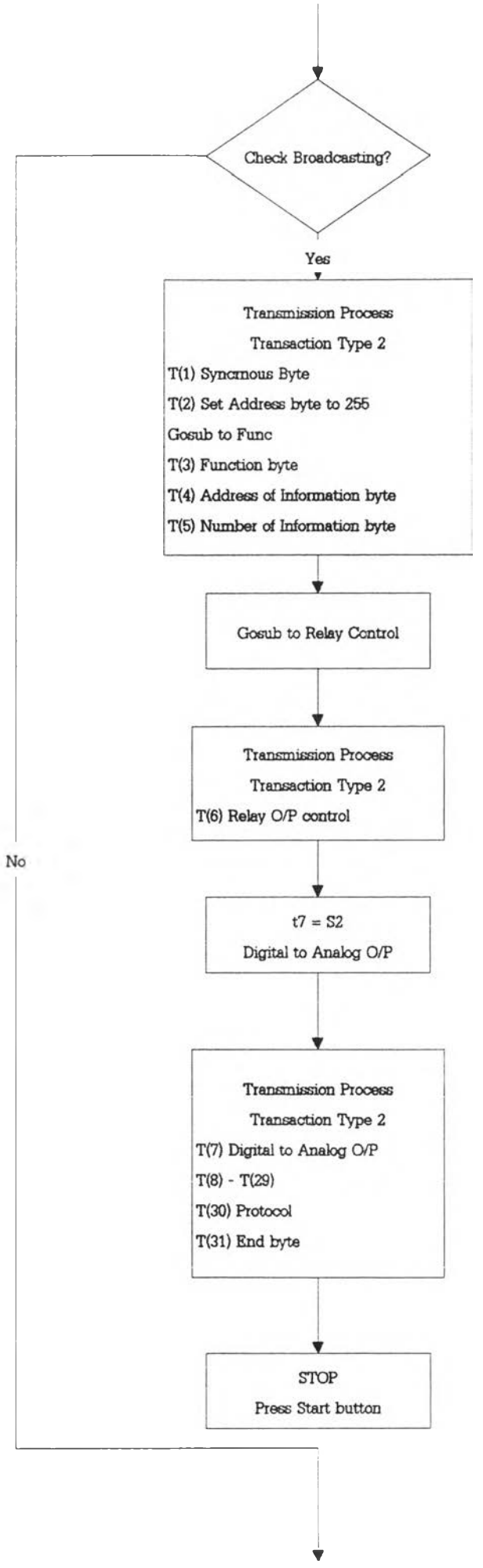
197	10110001	8D	$1+\alpha^2+\alpha^3+\alpha^7$	231	10101111	F5	$1+\alpha^2+\alpha^4+\alpha^5+\alpha^6+\alpha^7$
188	11100000	07	$1+\alpha+\alpha^2$	232	11101111	F7	$1+\alpha+\alpha^2+\alpha^4+\alpha^5+\alpha^6+\alpha^7$
199	01110000	0E	$\alpha+\alpha^2+\alpha^3$	233	11001111	F3	$1+\alpha+\alpha^4+\alpha^5+\alpha^6+\alpha^7$
200	00111000	1C	$\alpha^2+\alpha^3+\alpha^4$	234	11011111	FB	$1+\alpha+\alpha^3+\alpha^4+\alpha^5+\alpha^6+\alpha^7$
201	00011100	38	$\alpha^3+\alpha^4+\alpha^5$	235	11010111	EB	$1+\alpha+\alpha^3+\alpha^5+\alpha^6+\alpha^7$
202	00001110	70	$\alpha^4+\alpha^5+\alpha^6$	236	11010011	CB	$1+\alpha+\alpha^3+\alpha^6+\alpha^7$
203	00000111	E0	$\alpha^5+\alpha^6+\alpha^7$	237	11010001	8B	$1+\alpha+\alpha^3+\alpha^7$
204	10111011	DD	$1+\alpha^2+\alpha^3+\alpha^4+\alpha^6+\alpha^7$	238	11010000	0B	$1+\alpha+\alpha^3$
205	11100101	A7	$1+\alpha+\alpha^2+\alpha^5+\alpha^7$	239	01101000	16	$\alpha+\alpha^2+\alpha^4$
206	11001010	53	$1+\alpha+\alpha^4+\alpha^6$	240	00110100	2C	$\alpha^2+\alpha^3+\alpha^5$
207	01100101	A6	$\alpha+\alpha^2+\alpha^5+\alpha^7$	241	00011010	58	$\alpha^3+\alpha^4+\alpha^6$
208	10001010	51	$1+\alpha^4+\alpha^6$	242	00001101	B0	$\alpha^4+\alpha^5+\alpha^7$
209	01000101	A2	$\alpha+\alpha^5+\alpha^7$	243	10111110	7D	$1+\alpha^2+\alpha^3+\alpha^4+\alpha^5+\alpha^6$
210	10011010	59	$1+\alpha^3+\alpha^4+\alpha^6$	244	01011111	FA	$\alpha+\alpha^3+\alpha^4+\alpha^5+\alpha^6+\alpha^7$
211	01001101	B2	$\alpha+\alpha^4+\alpha^5+\alpha^7$	245	10010111	E9	$1+\alpha^3+\alpha^5+\alpha^6+\alpha^7$
212	10011110	79	$1+\alpha^3+\alpha^4+\alpha^5+\alpha^6$	246	11110011	CF	$1+\alpha+\alpha^2+\alpha^3+\alpha^6+\alpha^7$
213	01001111	F2	$\alpha+\alpha^4+\alpha^5+\alpha^6+\alpha^7$	247	11000001	83	$1+\alpha+\alpha^7$
214	10011111	F9	$1+\alpha^3+\alpha^4+\alpha^5+\alpha^6+\alpha^7$	248	11011000	1B	$1+\alpha+\alpha^3+\alpha^4$
215	11110111	EF	$1+\alpha+\alpha^2+\alpha^3+\alpha^5+\alpha^6+\alpha^7$	249	01101100	36	$\alpha+\alpha^2+\alpha^4+\alpha^5$
216	11000011	C3	$1+\alpha+\alpha^6+\alpha^7$	250	00110110	6C	$\alpha^2+\alpha^3+\alpha^5+\alpha^6$
217	11011001	9B	$1+\alpha+\alpha^3+\alpha^4+\alpha^7$	251	00011011	D8	$\alpha^3+\alpha^4+\alpha^6+\alpha^7$
218	11010100	2B	$1+\alpha+\alpha^3+\alpha^5$	252	10110101	AD	$1+\alpha^2+\alpha^3+\alpha^5+\alpha^7$
219	01101010	56	$\alpha+\alpha^2+\alpha^4+\alpha^6$	253	11100010	47	$1+\alpha+\alpha^2+\alpha^6$
220	00110101	AC	$\alpha^2+\alpha^3+\alpha^5+\alpha^7$	254	01110001	8E	$\alpha+\alpha^2+\alpha^3+\alpha$
221	10100010	45	$1+\alpha^2+\alpha^6$				
222	01010001	8A	$\alpha+\alpha^3+\alpha^7$				
223	10010000	09	$1+\alpha^3$				
224	01001000	12	$\alpha+\alpha^4$				
225	00100100	24	$\alpha^2+\alpha^5$				
226	00010010	48	$\alpha^3+\alpha^6$				
227	00001001	90	$\alpha^4+\alpha^7$				
228	10111100	3D	$1+\alpha^2+\alpha^3+\alpha^4+\alpha^5$				
229	01011110	7A	$\alpha+\alpha^3+\alpha^4+\alpha^5+\alpha^6$				
230	00101111	F4	$\alpha^2+\alpha^4+\alpha^5+\alpha^6+\alpha^7$				

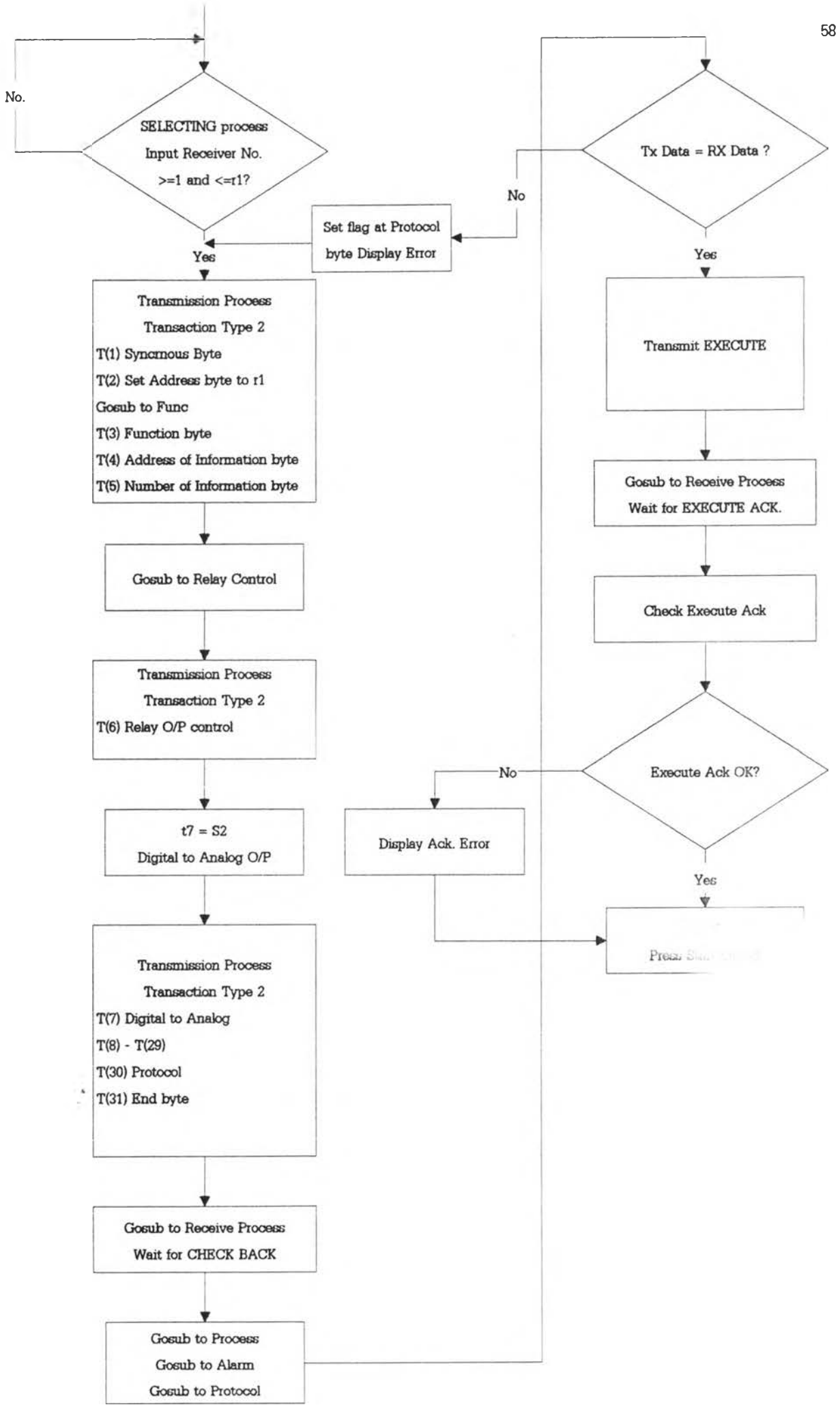
ภาคผนวก ข.

ผังงานของโปรแกรมสถานีแม่ข่าย

Master Station Flowchart



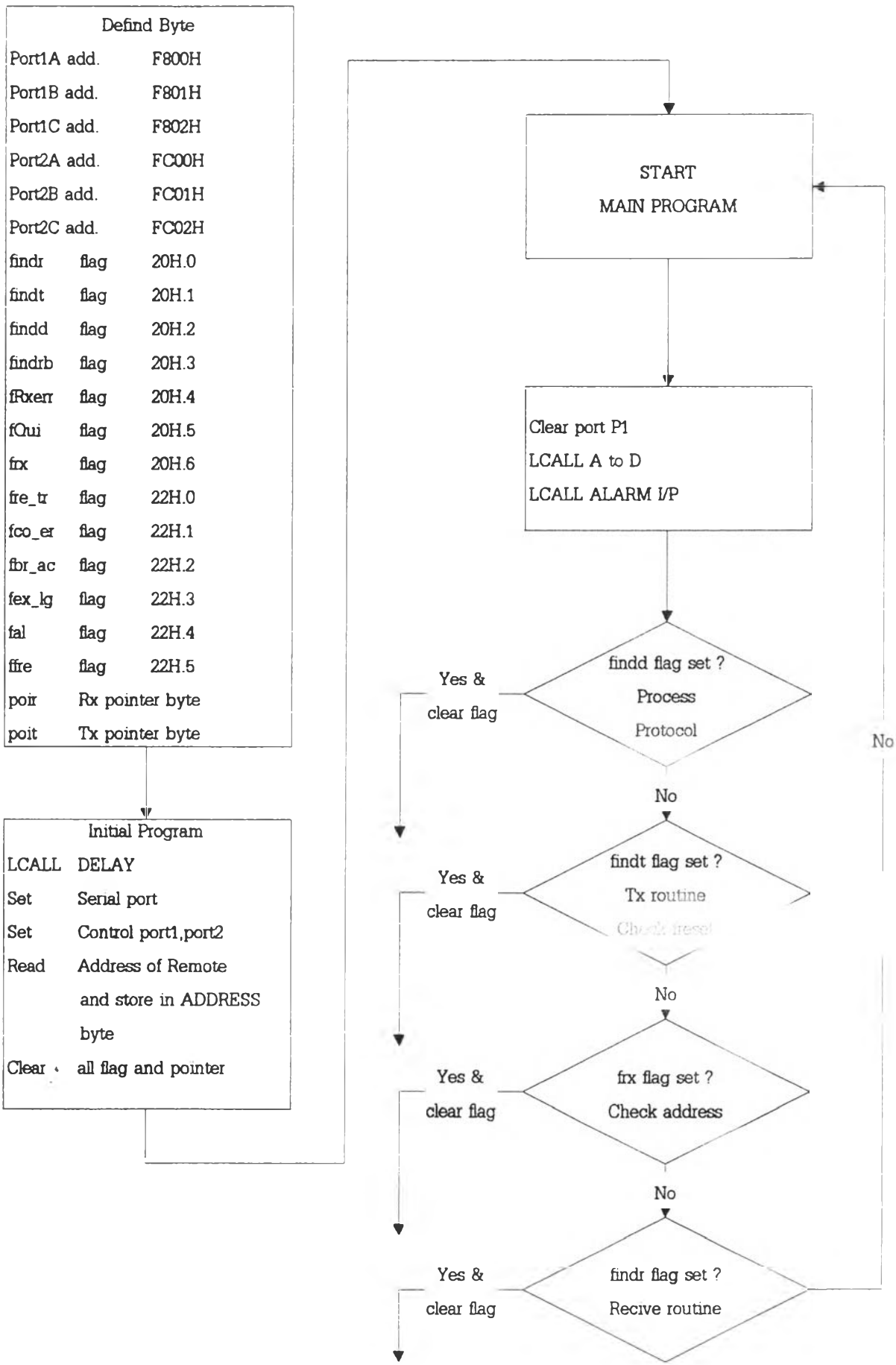

Check Broadcasting?
Yes
No
Transmission Process
Transaction Type 2
T(1) Syncronous Byte
T(2) Set Address byte to 255
Gosub to Func
T(3) Function byte
T(4) Address of Information byte
T(5) Number of Information byte
Gosub to Relay Control
Transmission Process
Transaction Type 2
T(6) Relay O/P control
t7 = S2
Digital to Analog O/P
Transmission Process
Transaction Type 2
T(7) Digital to Analog O/P
T(8) - T(29)
T(30) Protocol
T(31) End byte
STOP
Press Start button

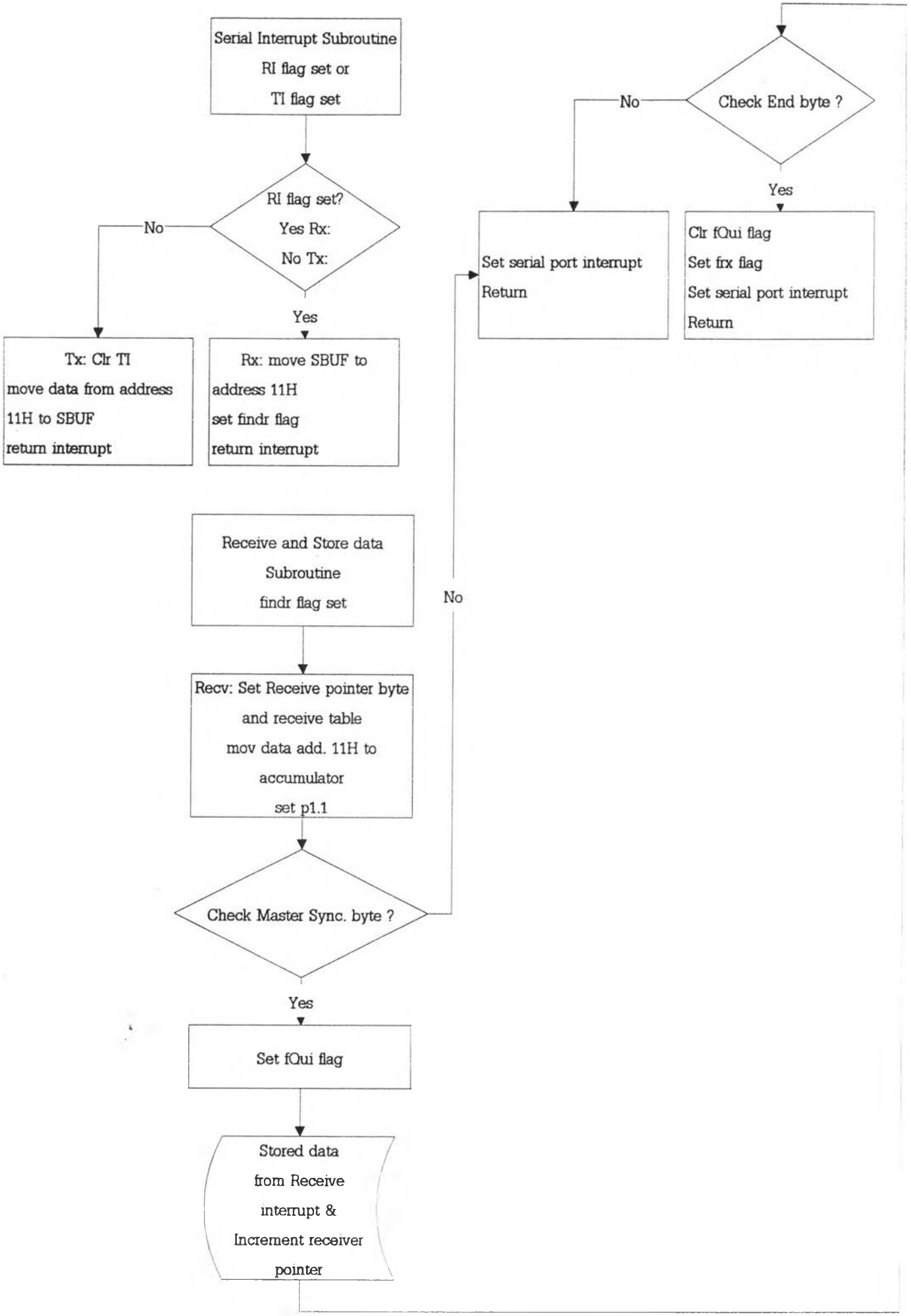

No.
SELECTING process
Input Receiver No.
>=1 and <=r1?
Yes
Set flag at Protocol
byte Display Error
No
Tx Data = RX Data ?
Yes
Transmission Process
Transaction Type 2
T(1) Syncmous Byte
T(2) Set Address byte to r1
Gosub to Func
T(3) Function byte
T(4) Address of Information byte
T(5) Number of Information byte
Transmit EXECUTE
Gosub to Receive Process
Wait for EXECUTE ACK.
Gosub to Relay Control
Check Execute Ack
Transmission Process
Transaction Type 2
T(6) Relay O/P control
Execute Ack OK?
No
Display Ack. Error
Yes
t7 = S2
Digital to Analog O/P
Transmission Process
Transaction Type 2
T(7) Digital to Analog
T(8) - T(29)
T(30) Protocol
T(31) End byte
Gosub to Receive Process
Wait for CHECK BACK
Gosub to Process
Gosub to Alarm
Gosub to Protocol

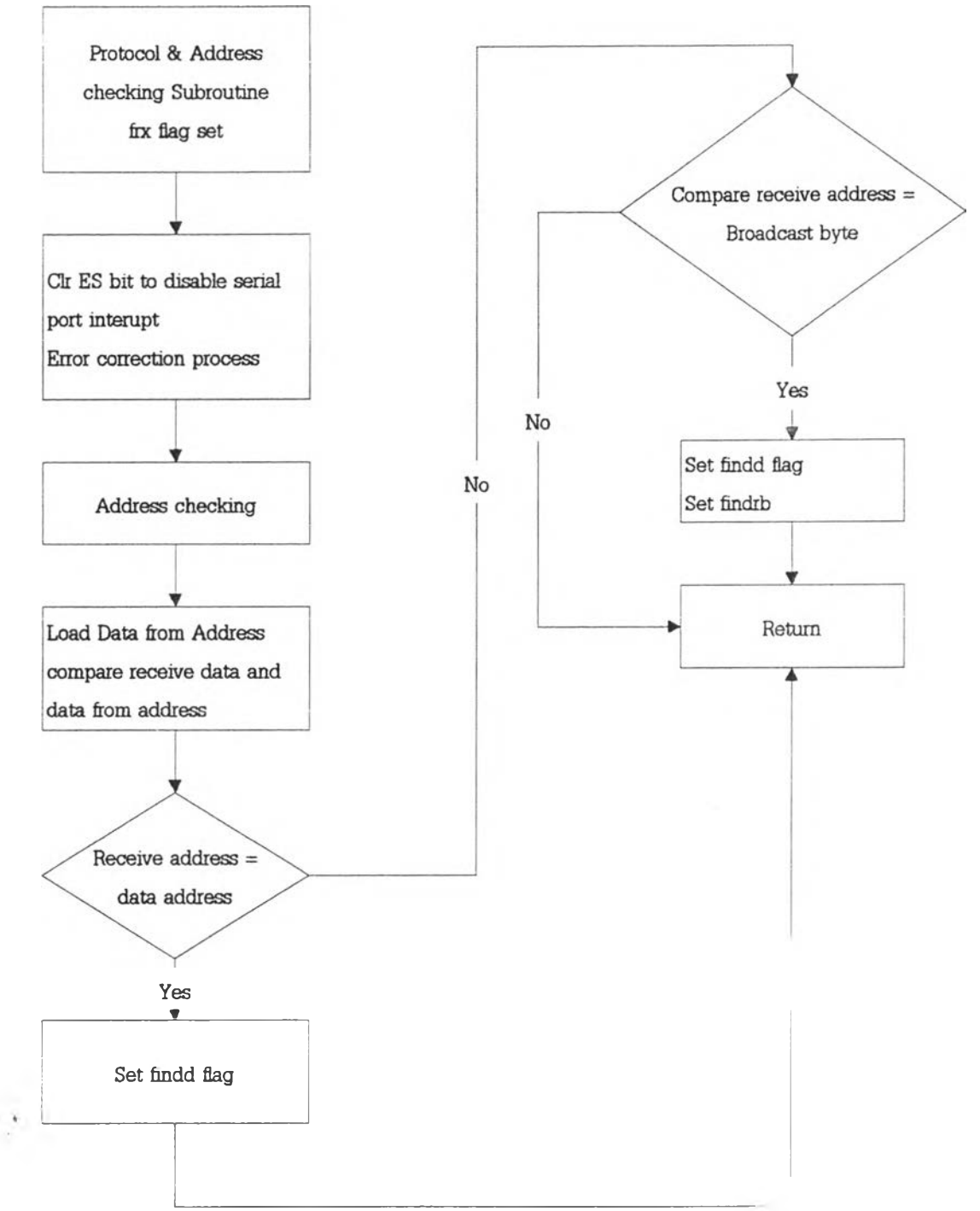
ภาคผนวก ค.

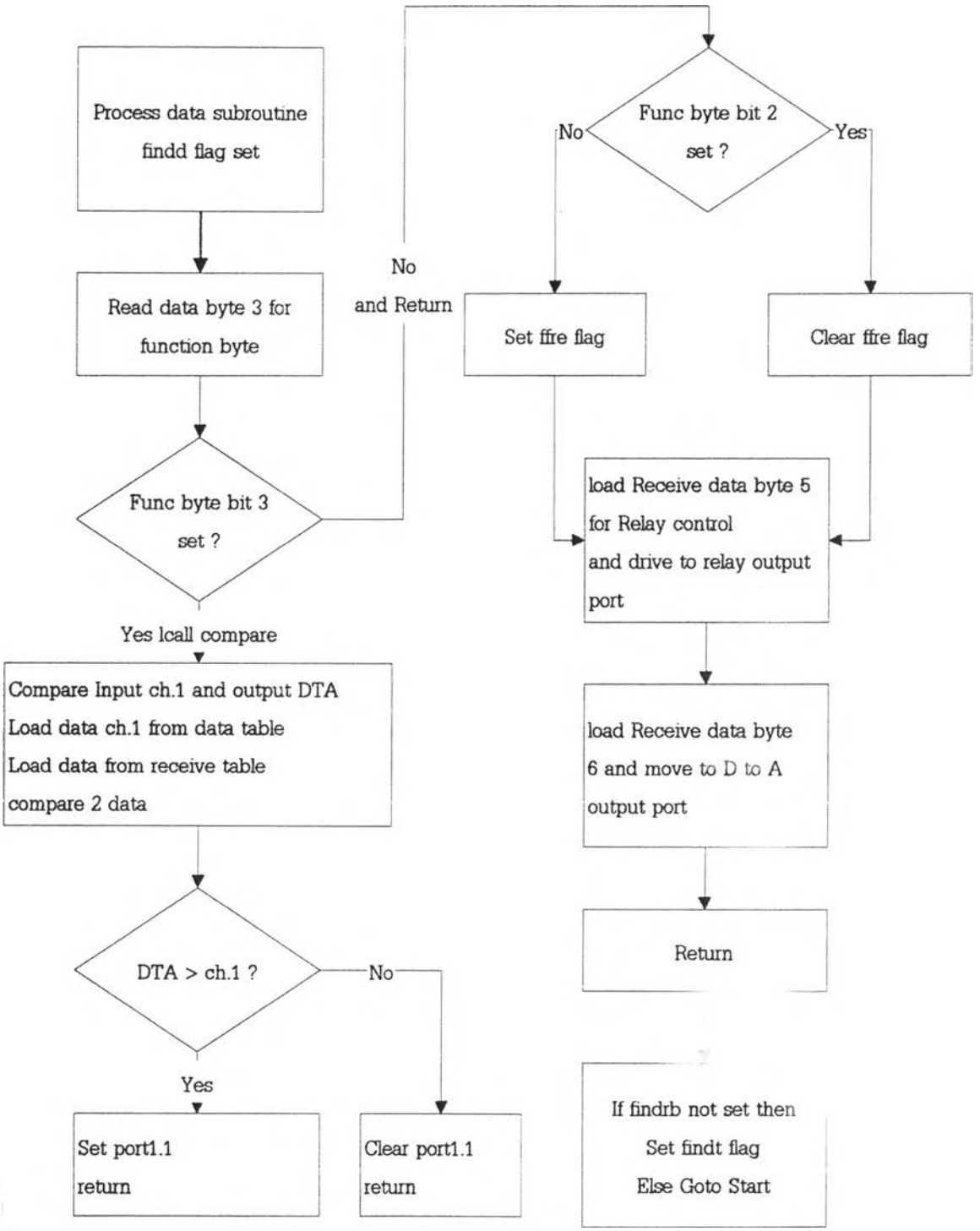
ผังงานของโปรแกรมสถานีลูกข่าย

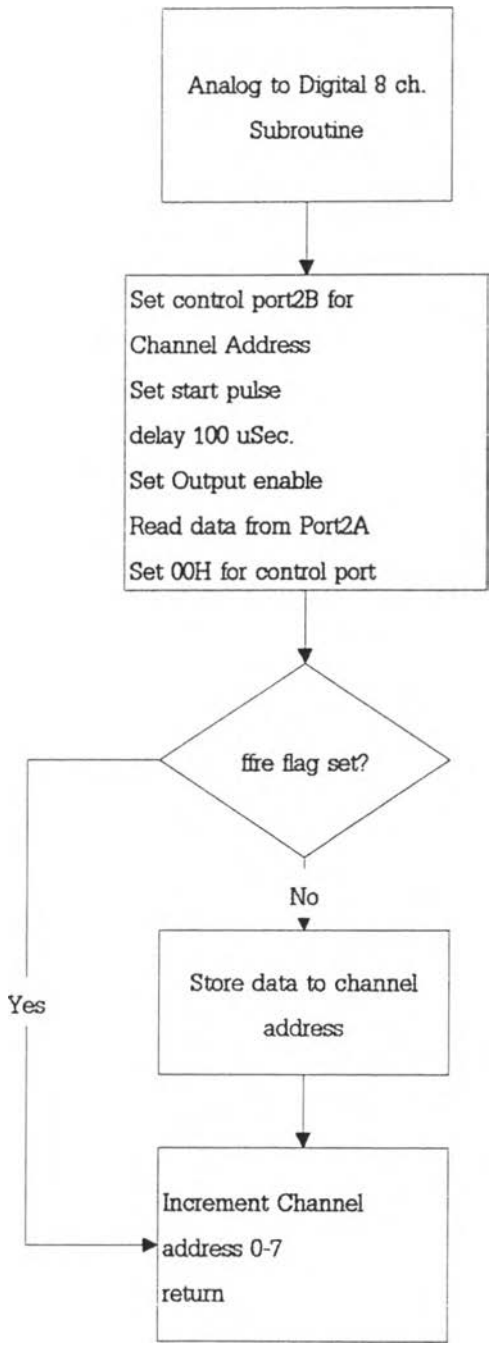
Remote Terminal Unit Flow Chart

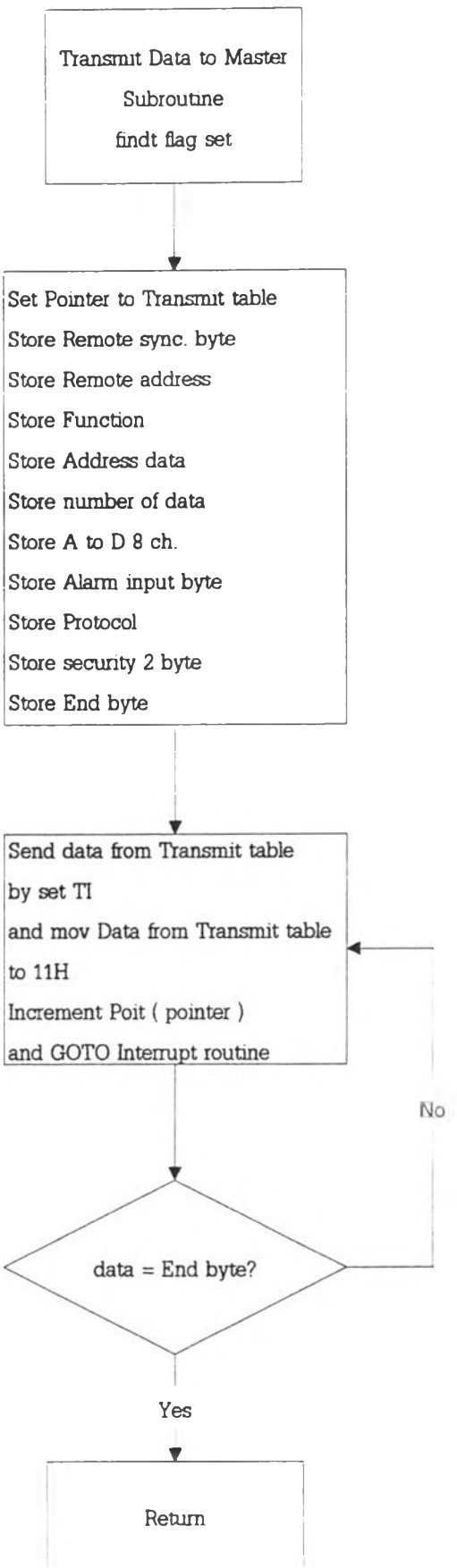



Serial Interrupt Subroutine
RI flag set or
TI flag set
RI flag set?
Yes Rx:
No Tx:
No
Yes
Tx: Clr TI
move data from address
11H to SBUF
return interrupt
Rx: move SBUF to
address 11H
set findr flag
return interrupt
Check End byte ?
No
Yes
Set serial port interrupt
Return
Clr fQui flag
Set frx flag
Set serial port interrupt
Return
Receive and Store data
Subroutine
findr flag set
Recv: Set Receive pointer byte
and receive table
mov data add. 11H to
accumulator
set p1.1
Check Master Sync. byte ?
No
Yes
Set fQui flag
Stored data
from Receive
interrupt &
Increment receiver
pointer


Protocol & Address checking Subroutine frx flag set
Clr ES bit to disable serial port interupt
Error correction process
Address checking
Load Data from Address compare receive data and data from address
Receive address = data address
No
Yes
Set findd flag
Compare receive address = Broadcast byte
No
Yes
Set findd flag
Set findrb
Return

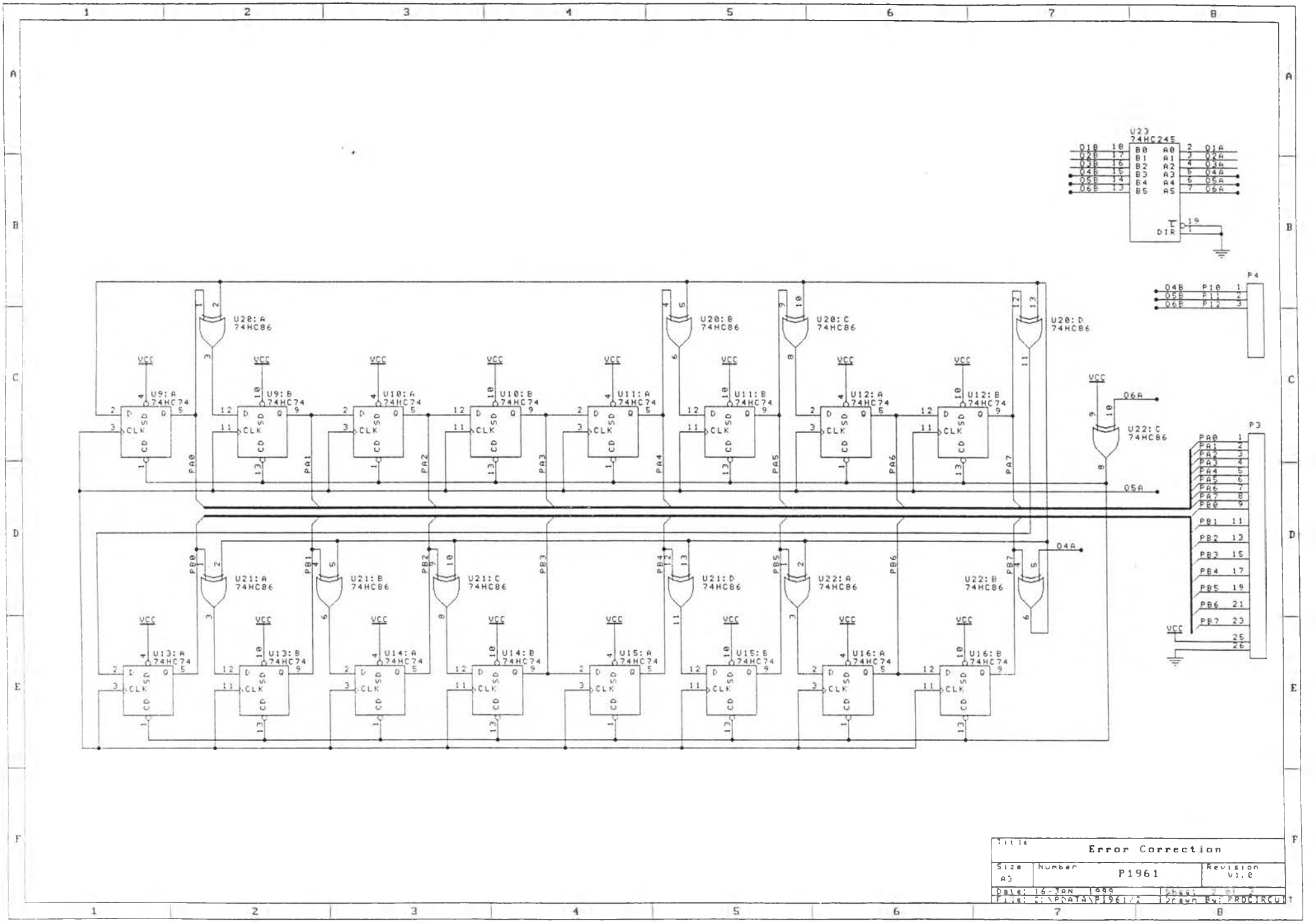

Process data subroutine
findd flag set
Read data byte 3 for
function byte
Func byte bit 3
set ?
No
and Return
Yes lcall compare
Compare Input ch.1 and output DTA
Load data ch.1 from data table
Load data from receive table
compare 2 data
DTA > ch.1 ?
No
Yes
Set port1.1
return
Clear port1.1
return
Func byte bit 2
set ?
No
Yes
Set ffre flag
Clear ffre flag
load Receive data byte 5
for Relay control
and drive to relay output
port
load Receive data byte
6 and move to D to A
output port
Return
If findrb not set then
Set findt flag
Else Goto Start

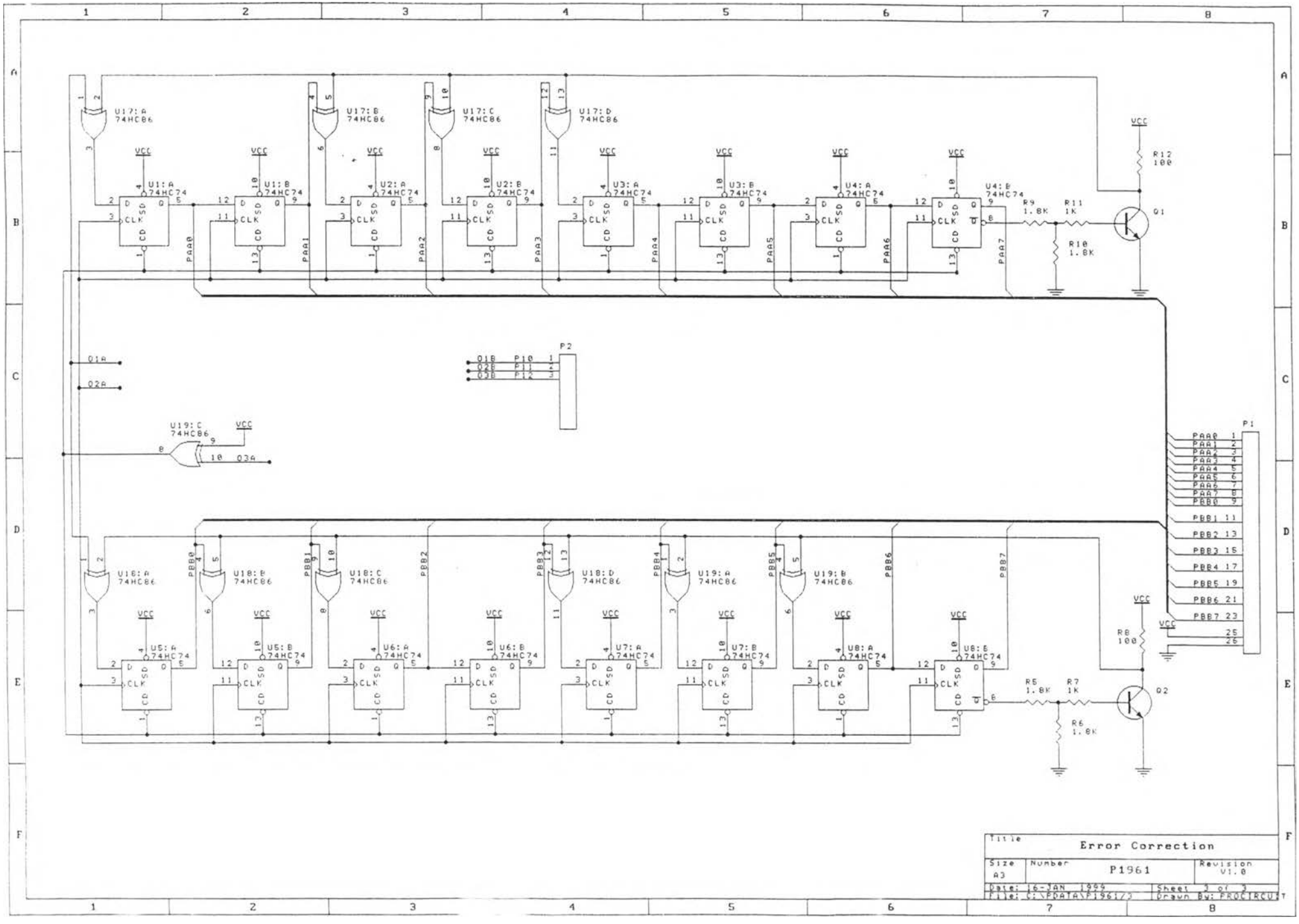

Analog to Digital 8 ch.
Subroutine
Set control port2B for
Channel Address
Set start pulse
delay 100 uSec.
Set Output enable
Read data from Port2A
Set 00H for control port
ffre flag set?
No
Yes
Store data to channel
address
Increment Channel
address 0-7
return

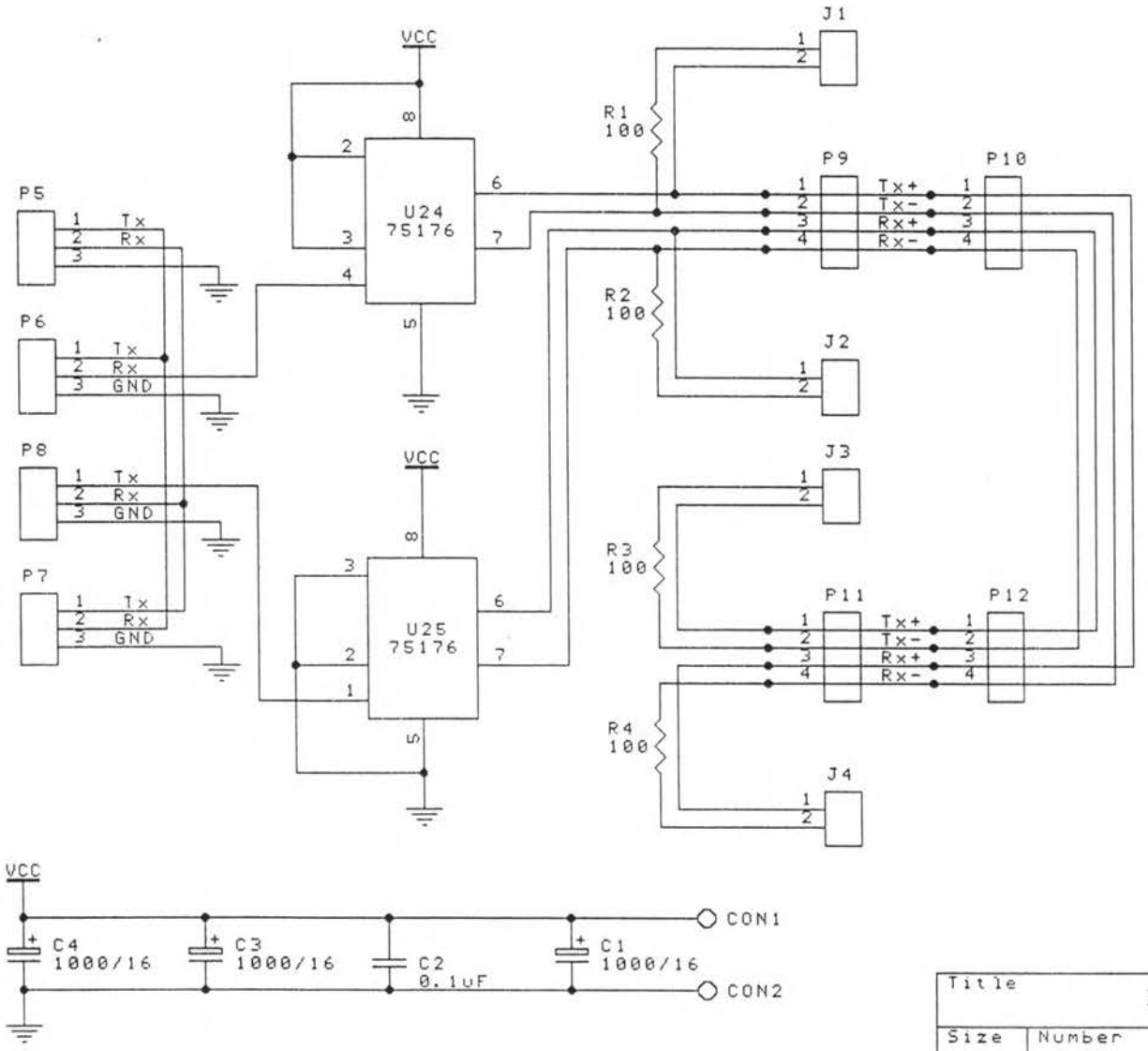

Transmit Data to Master
Subroutine
findt flag set
Set Pointer to Transmit table
Store Remote sync. byte
Store Remote address
Store Function
Store Address data
Store number of data
Store A to D 8 ch.
Store Alarm input byte
Store Protocol
Store security 2 byte
Store End byte
Send data from Transmit table
by set TI
and mov Data from Transmit table
to 11H
Increment Poit (pointer)
and GOTO Interrupt routine
No
data = End byte?
Yes
Return

ภาคผนวก ง.

วงจรเข้ารหัสและวงจรถอดรหัส


U23
74HC245
DIR
P4
P3
U20: A
74HC86
U20: B
74HC86
U20: C
74HC86
U20: D
74HC86
U22: C
74HC86
U21: A
74HC86
U21: B
74HC86
U21: C
74HC86
U21: D
74HC86
U22: A
74HC86
U22: B
74HC86
U9: A
74HC74
U9: B
74HC74
U10: A
74HC74
U10: B
74HC74
U11: A
74HC74
U11: B
74HC74
U12: A
74HC74
U12: B
74HC74
U13: A
74HC74
U13: B
74HC74
U14: A
74HC74
U14: B
74HC74
U15: A
74HC74
U15: B
74HC74
U16: A
74HC74
U16: B
74HC74
VCC
Q6A
Q5A
Q4A
PA0
PA1
PA2
PA3
PA4
PA5
PA6
PA7
PB0
PB1
PB2
PB3
PB4
PB5
PB6
PB7
Title
Error Correction
Size
A3
Number
P1961
Revision
V1.0
Date: 16-JAN-1999
Sheet 2 of 2
File: C:\PDATA\P1961.A
Drawn By: PROCIRCUIT

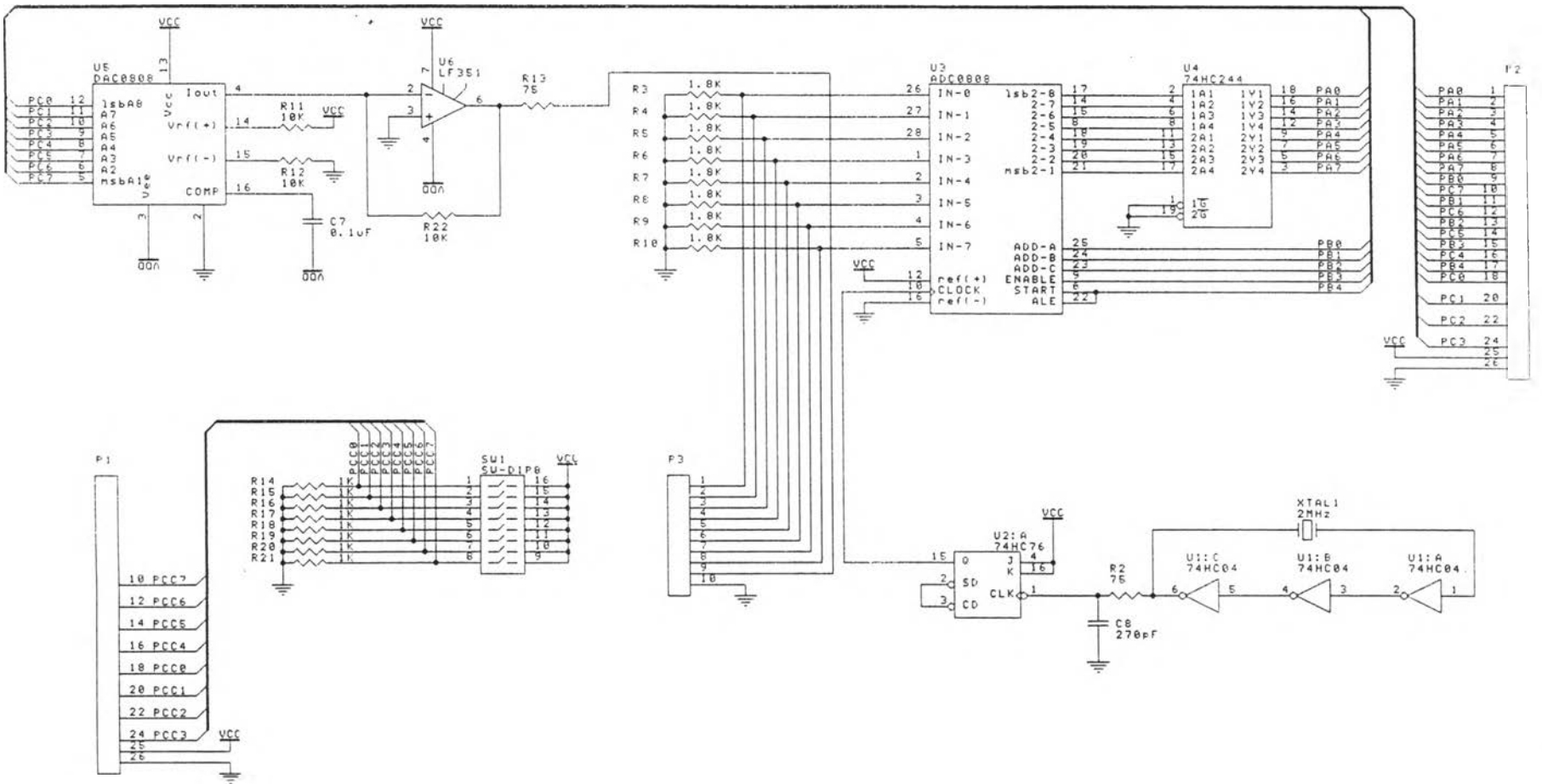

U17:A 74HC86
U17:B 74HC86
U17:C 74HC86
U17:D 74HC86
U1:A 74HC74
U1:B 74HC74
U2:A 74HC74
U2:B 74HC74
U3:A 74HC74
U3:B 74HC74
U4:A 74HC74
U4:B 74HC74
VCC
R12 100
R9 1.8K
R11 1K
R10 1.8K
Q1
PAA0
PAA1
PAA2
PAA3
PAA4
PAA5
PAA6
PAA7
Q1A
Q2A
Q3A
P2
Q1B P10
Q2B P11
Q3B P12
U19:C 74HC86
P1
PAA0 1
PAA1 2
PAA2 3
PAA3 4
PAA4 5
PAA5 6
PAA6 7
PAA7 8
PBB0 9
PBB1 11
PBB2 13
PBB3 15
PBB4 17
PBB5 19
PBB6 21
PBB7 23
25
26
U16:A 74HC86
U18:B 74HC86
U18:C 74HC86
U18:D 74HC86
U19:A 74HC86
U19:B 74HC86
U5:A 74HC74
U5:B 74HC74
U6:A 74HC74
U6:B 74HC74
U7:A 74HC74
U7:B 74HC74
U8:A 74HC74
U8:B 74HC74
PBB0
PBB1
PBB2
PBB3
PBB4
PBB5
PBB6
PBB7
R8 100
R5 1.8K
R7 1K
R6 1.8K
Q2
Title
Error Correction
Size A3
Number P1961
Revision V1.0
Date: 6-JAN 1996
Sheet 3 of 3
File: C:\PDATA\P1961\3
Drawn By: PROJECT



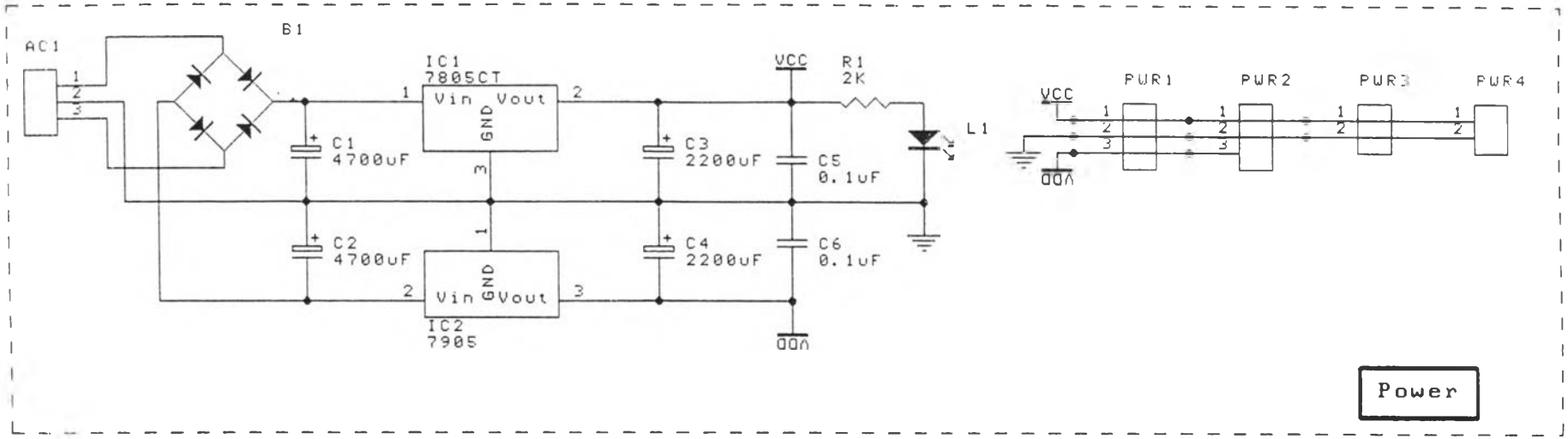
Title	Error Correction	
Size A4	Number P1961	Revision V1.0
Date: 16-JAN 1999		Sheet 1 of 3
File: C:\PDATA\P1961/1		Drawn By: PROCIRCUIT

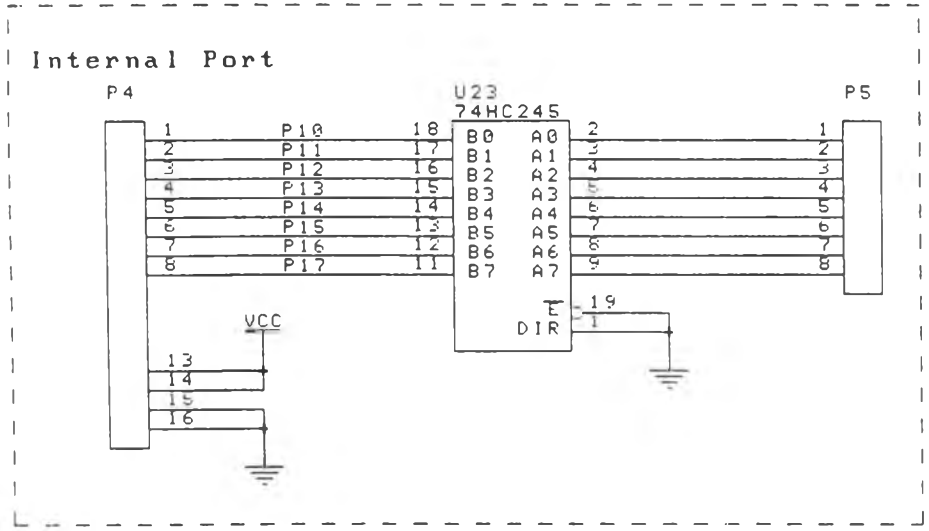
ภาคผนวก จ.

วงจรภายในของ RTU



Title	IO Interface	
Size A3	Number P1962	Revision V1.0
Date: 18-JAN 1999	Sheet 1 of 2	
File: C:\PDATA\P1962.*	Drawn By: PROJECT	





Title	IO Interface		
Size A4	Number P1962		Revision V1.0
Date: 16-JAN 1999		Sheet 1 of 2	
File: C:\PDATA\P1962/1		Drawn By: PROCIRCUIT	

ประวัติผู้เขียน

นายรณน สถิตย์ปัญญาพันธ์ เกิดวันที่ 18 มีนาคม พ.ศ. 2512 ที่เขตพระนคร จังหวัดกรุงเทพมหานคร สำเร็จการศึกษาปริญญาตรีวิศวกรรมศาสตรบัณฑิต สาขาอิเล็กทรอนิกส์ ภาควิชาวิศวกรรมไฟฟ้า คณะวิศวกรรมศาสตร์ สถาบันเทคโนโลยีพระจอมเกล้า เจ้าคุณทหาร ลาดกระบัง ในปีการศึกษา 2534 และเข้าศึกษาต่อในหลักสูตรวิศวกรรมศาสตรมหาบัณฑิต ณ คณะวิศวกรรมศาสตร จุฬาลงกรณ์มหาวิทยาลัย เมื่อปี พ.ศ. 2538

รณน สถิตย์ปัญญาพันธ์