

ภาคผนวก ก

รายละเอียดของโปรแกรมต่าง ๆ ที่ส่งต่อไป

ก. โปรแกรมควบคุมการทดลอง

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0000 ::::::::::::::::::::::::::::
0001 :
0002 :   GREENHOUSE PROGRAM
0003 :
0004 ::::::::::::::::::::::::::::::
0005 :
0006 : variable set
0007 :
0008 :
(2000) 0009 ORG 2000H
0010 :
(1EAF) 0011 PROGRAM EQU 1EAFH ;TO SELECT PROGRAM
(0010) 0012 SYSCAL EQU 10H ;SYSTEM CALL
(0000) 0013 PORTA EQU 00H ;OUTPUT PORT
(0002) 0014 PORTC EQU 02H ;INPUT PORT
(000B) 0015 CONP EQU 0BH ;CONTORL PORT
(1E00) 0016 SAVDISP EQU 1E ;SAVE DATA TO DISPLAY

(0010) 0017 CLOSED EQU 10H ;SWITCH OFF
(1000) 0018 SAVE EQU 1000H ;SAVE DATA
(0030) 0019 COOLED EQU 30H ;TURN ON VENTILATIN FAN
(0050) 0020 SPRAY EQU 50H ;TURN ON WATER SPRAYER
(0090) 0021 FOG EQU 90H ;TURN ON WATER INJECTION
(0070) 0022 SPC EQU 70H ;TURN ON WATER SPRAYER
; AND VENTILATING FAN

(00F0) 0023 FSFC EQU 0F0H ;TURN ON WATER SPRAYER,WATER
; INJECTION AND VENTILATING FAN
(00D0) 0024 FSP EQU 0D0H ;TURN ON WATER INJECTION
; AND WATER APRAYER
(00B0) 0025 FOC EQU 0B0H ;TURN ON WATER INJECTION
; AND VENTILATING FAN

(1E00) 0026 CLK0 EQU 1E00H ;SAVE CLOCK
(1ED2) 0027 CLK1 EQU 1ED2H ;SAVE CLOCK1
(1EA4) 0028 CLK2 EQU 1EA4H ;SAVE CLOCK2
(0000) 0029 CLEAR EQU 00H ;CLEAR CLOCK
(1E05) 0030 XI EQU 1E05H ;DELAY TURN ON WATER SPRAYER
(1E07) 0031 YY EQU 1E07H ;DELAY TURN ON WATER SPRAYER
0032 :

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0033 *****
0034 *
0035 *      MAIN PROGRAM      *
0036 *
0037 *****
0038 *
0039 * to select program
0040 *
2000 3A AF 1E 0041 LD    A,(PROGRAM)
2003 FE 01 0042 CP    01H
2005 CA 9F 22 0043 JP    Z,PROGRAM1
2008 FE 02 0044 CP    02H
200A CA DD 22 0045 JP    Z,PROGRAM2
200D FE 03 0046 CP    03H
200F CA 27 23 0047 JP    Z,PROGRAM3

2012 FE 04 0048 CP    04H
2014 CA 3D 20 0049 JP    Z,YY1
2017 FE 44 0050 CP    44H
2019 CA 26 20 0051 JP    Z,YY2
201C FE 05 0052 CP    05H
201E CA 5D 24 0053 JP    Z,PROGRAM5
2021 FE 06 0054 CP    06H
2023 CA 4F 26 0055 JP    Z,PROGRAM6
0056 *
0057 *
2026 3E 70 0058 YY2 LD    A,SPC
2028 32 AB 1E 0059 LD    (1EABH),A
202B 3E 30 0060 LD    A,COOLED
202D 32 AC 1E 0061 LD    (1EACH),A
2030 3E D0 0062 LD    A,FSP
2032 32 AD 1E 0063 LD    (1EADH),A
2035 3E 90 0064 LD    A,F06
2037 32 AE 1E 0065 LD    (1EAEH),A
203A C3 A4 23 0066 JP    PROGRAM4

203D 3E 50 0067 YY1 LD    A,SPRAY
203F 32 AB 1E 0068 LD    (1EABH),A
2042 3E 10 0069 LD    A,CLOSED
2044 32 AC 1E 0070 LD    (1EACH),A
2047 3E D0 0071 LD    A,FSP
2049 32 AD 1E 0072 LD    (1EADH),A
204C 3E 90 0073 LD    A,F06
204E 32 AE 1E 0074 LD    (1EAEH),A
2051 C3 A4 23 0075 JP    PROGRAM4
0076 *
0077 *
0078 *
0079 *****END*****

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0080 *****
0081 *
0082 * READ DATA 1 SUBROUTINE *
0083 *
0084 *****
*
* read temperature and solar radiation
*
2054 C5      0085 READ1  PUSH BC
2055 D5      0086      PUSH DE
2056 21 40 21 0087      LD    HL,NONG0
2059 7E      0088 SA0    LD    A,(HL)
205A D3 00   0089      OUT   (PORTA),A
205C D3 A0   0090      OUT   (0A0H),A ;READ DATA A TO D
205E 3E 0F   0091      LD    A,0FH
2060 06 FF   0092      LD    B,0FFH
2062 D7      0093      RST   SYSCAL
2063 DB 02   0094      IN    A,(PORTC)
2065 FD 77 00 0095      LD    (IY+0),A ;SAVE SOLAR RADIATION
2068 7E      0096      LD    A,(HL)
2069 FE 07   0097      CP    07H

206B CA 76 20 0098      JP    Z,SA1
206E FD 7E 00 0099      LD    A,(IY+0)
2071 D6 10   0100      SUB   10H
2073 FD 77 00 0101      LD    (IY+0),A ;SAVE TEMPERATURE
2076 FD 23   0102 SA1    INC    IY
2078 23      0103      INC    HL
2079 7E      0104      LD    A,(HL)
207A FE 10   0105      CP    CLOSED
207C C2 59 20 0106      JP    NZ,SA0
207F 3E 10   0107      LD    A,CLOSED
2081 D3 00   0108      OUT   (PORTA),A
0109 *
0110 * change temperature to 'C
0111 *

2083 C5      0112      PUSH  BC
2084 D5      0113      PUSH  DE
2085 06 06   0114      LD    B,06H
2087 FD 20   0115      DEC    IY
2089 16 00   0116 SA2    LD    D,00H
208B FD 7E 00 0117      LD    A,(IY+0)
208E D6 05   0118 SA3    SUB   05H
2090 14      0119      INC    D
2091 FE 00   0120      CP    00H
2093 20 12   0121      JR    Z,SA4
2095 FE 01   0122      CP    01H
2097 20 0E   0123      JR    Z,SA4
2099 FE 02   0124      CP    02H
209B 20 0A   0125      JR    Z,SA4
209D FE 03   0126      CP    03H
209F 20 06   0127      JR    Z,SA4
20A1 FE 04   0128      CP    04H
20A3 20 02   0129      JR    Z,SA4
20A5 10 E7   0130      JR    SA3

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20A7	87	0131	SA4	ADD	A
20A8	17	0132		RLA	
20A9	17	0133		RLA	
20AA	17	0134		RLA	
20AB	17	0135		RLA	
20AC	DD 77 00	0136		LD	(IX+0),A
20AF	DD 23	0137		INC	IX
20B1	7A	0138		LD	A,D
20B2	32 E5 1E	0139		LD	(1EE5H),A
20B5	CD C4 20	0140		CALL	SA6
20B8	10 05	0141		DJNZ	SA5
20BA	C1	0142		POP	BC
20BB	D1	0143		POP	DE
20BC	C3 E6 20	0144		JP	SA7
20BF	FD 2B	0145	SA5	DEC	IY
20C1	C3 89 20	0146		JP	SA2
		0147	*		
		0148			* change temperature from binary to decimal
		0149	*		
20C4	AF	0150	SA6	XOR	A
20C5	32 E8 1E	0151		LD	(1EE8H),A
20C8	0E 00	0152		LD	C,00H
20CA	3A E5 1E	0153	SA8	LD	A,(1EE5H)
20CD	CB 17	0154		RL	A
20CF	32 E5 1E	0155		LD	(1EE5H),A
20D2	3A E8 1E	0156		LD	A,(1EE8H)
20D5	8F	0157		ADC	A,A
20D6	27	0158		DAA	
20D7	32 E8 1E	0159		LD	(1EE8H),A
20DA	0D	0160		DEC	C
20DB	20 ED	0161		JR	NZ,SA8
20DD	3A E8 1E	0162		LD	A,(1EE8H)
20E0	DD 77 00	0163		LD	(IX+0),A
20E3	DD 23	0164		INC	IX
20E5	C9	0165		RET	
		0166	*		
		0167			* solar radiation data
		0168	*		
20E6	C5	0169	SA7	PUSH	BC
20E7	D5	0170		PUSH	DE
20E8	06 01	0171		LD	B,01H
20EA	FD 2B	0172		DEC	IY
20EC	FD 7E 00	0173	SA1	LD	A,(IY+0)
20EF	32 E5 1E	0174		LD	(1EE5H),A
20F2	CD 11 21	0175		CALL	SA9
20F5	10 15	0176		DJNZ	SA10
20F7	FD 23	0177		INC	IY
20F9	FD 23	0178		INC	IY
20FB	FD 23	0179		INC	IY
20FD	FD 23	0180		INC	IY
20FF	FD 23	0181		INC	IY
2101	FD 23	0182		INC	IY
2103	FD 23	0183		INC	IY
2105	FD 23	0184		INC	IY
2107	C1	0185		POP	BC

2108 D1	0186	POP	DE
2109 C1	0187	POP	BC
210A D1	0188	POP	DE
210B C9	0189	RET	
210C FD 2B	0190	DEC	IY
210E C3 EC 20	0191	JP	SA11
	0192	;	
	0193	;change solar radiation from binary to decimal	
	0194	;	
2111 C5	0195	SA9	PUSH BC
2112 D5	0196		PUSH DE
2113 AF	0197		XOR A
2114 1E 02	0198		LD E,02H
2116 16 01	0199		LD D,01H
2118 43	0200		LD B,E
2119 21 E8 1E	0201		LD HL,1EE8H
211C 77	0202	SA12	LD (HL),A
211D 23	0203		INC HL
211E 18 FC	0204		DJNZ SA12
2120 7A	0205		LD A,D
2121 87	0206		ADD A,A
2122 87	0207		ADD A,A
2123 87	0208		ADD A,A
2124 4F	0209		LD C,A
2125 2E E5	0210	SA15	LD L,0E5H
2127 42	0211		LD B,D
2128 CB 16	0212	SA13	RL (HL)
212A 23	0213		INC HL
212B 18 FB	0214		DJNZ SA13
212D 2E E8	0215		LD L,0E8H
212F 43	0216		LD B,E
2130 7E	0217	SA14	LD A,(HL)
2131 8F	0218		ADC A,A
2132 27	0219		DAA
2133 77	0220		LD (HL),A
2134 23	0221		INC HL
2135 18 F9	0222		DJNZ SA14
2137 0D	0223		DEC C
2138 20 E8	0224		JR NZ,SA15
213A 21 E8 1E	0225		LD HL,1EE8H
213D 7E	0226		LD A,(HL)
213E DD 77 00	0227		LD (IX+0),A
2141 23	0228		INC HL
2142 DD 23	0229		INC IX
2144 7E	0230		LD A,(HL)
2145 DD 77 00	0231		LD (IX+0),A
2148 DD 23	0232		INC IX
214A C1	0233		POP BC
214B D1	0234		POP DE
214C C9	0235		RET

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0236 *
0237 * selector switch for read temperature
0000 * and solar radiation
0238 *
214D 07 0239 NONG0 DB 07H ;SOLAR RADIATION
214E 04 0240 DB 04H ;WET BULB TEMP. 1 (EXTERNAL)
214F 0E 0241 DB 0EH ;DRY BULB TEMP. 1
2150 06 0242 DB 06H ;WET BULB TEMP. 2 (INTERNAL)
2151 0A 0243 DB 0AH ;DRY BULB TEMP. 2
2152 0C 0244 DB 0CH ;WET BULB TEMP. 3 (INTERNAL)
2153 02 0245 DB 02H ;DRY BULB TEMP. 3
2154 10 0246 DB CLOSED
0247 *
0248 *
0249 *****END*****

0250 *****
0251 *
0252 * DISPLAY 1 SUBROUTINE *
0253 *
0254 *****
0255 *
0256 * display temperature
0257 *
2155 C5 0258 DISP1 PUSH BC
2156 D5 0259 PUSH DE
2157 0E 01 0260 LD C,01H

2159 DD 7E 00 0261 SA16 LD A,(IX+0)
215C 32 F1 1F 0262 LD (1FF1H),A
215F DD 23 0263 INC IX
2161 DD 7E 00 0264 LD A,(IX+0)
2164 32 EF 1F 0265 LD (1FEFH),A
2167 79 0266 LD A,C
2168 C6 C8 0267 ADD 0C0H
216A 32 F0 1F 0268 LD (1FF0H),A
216D 3E 07 0269 LD A,07H
216F D7 0270 RST 10H
2170 3E 04 0271 LD A,04H
2172 D7 0272 RST SYSCAL

2173 3E 03 0273 LD A,03H
2175 D3 02 0274 OUT (2H),A
2177 3E 00 0275 LD A,00H
2179 D3 01 0276 OUT (1H),A
217B 3E 0F 0277 LD A,0FH
217D 06 01 0278 LD B,01H
217F D7 0279 RST SYSCAL
2180 DD 23 0280 INC IX
2182 0C 0281 INC C
2183 79 0282 LD A,C
2184 FE 07 0283 CP 07H
2186 20 D1 0284 JR NZ,SA16
2188 C1 0285 POP BC
2189 D1 0286 POP DE

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0287 *
0288 * display solar radiation
0289 *
218A C5 0290 PUSH BC
218B D5 0291 PUSH DE
218C 0E 01 0292 LD C,01H
218E DD 7E 00 0293 SA17 LD A,(IX+0)
2191 32 F1 1F 0294 LD (1FF1H),A
2194 DD 23 0295 INC IX
2196 DD 7E 00 0296 LD A,(IX+0)
2199 32 EF 1F 0297 LD (1FEFH),A

219C 79 0298 LD A,C
219D C6 A0 0299 ADD 0A0H
219F 32 F0 1F 0300 LD (1FF0H),A
21A2 3E 07 0301 LD A,07H
21A4 D7 0302 RST 10H
21A5 3E 04 0303 LD A,04H
21A7 D7 0304 RST SYSCAL
21A8 DD 23 0305 INC IX
21AA 0C 0306 INC C
21AB 79 0307 LD A,C
21AC FE 02 0308 CP 02H
21AE C2 0E 21 0309 JP NZ,SA17
21B1 C1 0310 POP BC
21B2 D1 0311 POP DE
21B3 C9 0312 RET

0313 *
0314 *
0315 *****END*****

0316 *****
0317 *
0318 * DELAY SUBROUTINE *
0319 * DELAY = 0.5 SEC *
0320 *
0321 *****

21B4 F5 0322 DELAY PUSH AF
21B5 C5 0323 PUSH BC
21B6 D5 0324 PUSH DE
21B7 11 FF FF 0325 LD DE,0FFFFH
21B8 1B 0326 LOOP DEC DE
21BB 7A 0327 LD A,D
21BC B3 0328 OR E
21BD C3 BA 21 0329 JP LOOP
21C0 F1 0330 POP AF
21C1 C1 0331 POP BC
21C2 D1 0332 POP DE
21C3 C9 0333 RET

0334 *
0335 *
0336 *****END*****

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```

0337 *****
0338 *
0339 * READ CLOCK SUBROUTINE *
0340 *   FOR CLOCK = 1 MIN   *
0341 *
0342 *****

21C4 08      0343      EX   AF,AF'
21C5 D9      0344      EXX
21C6 3A 00 1E 0345      LD   A,(CLK0)
21C9 C6 01    0346      ADD  01H
21CB 32 00 1E 0347      LD   (CLK0),A
21CE 08      0348      EX   AF,AF'
21CF D9      0349      EXX
21D0 ED 45    0350      RETN
0351 *
0352 *
0353 *****END*****

0354 *****
0355 *
0356 *   SEC SUBROUTINE   *
0357 *
0358 *****

21D2 C5      0359      SEC      PUSH  BC
21D3 D5      0360      PUSH  DE
21D4 3A 05 1E 0361      LD   A,(XX)
21D7 32 06 1E 0362      LD   (1E06H),A
21DA CD 04 21 0363      LOOP1 CALL  DELAY
21DD 3A 06 1E 0364      LD   A,(1E06H)

21E0 D6 01    0365      SUB  01H
21E2 32 06 1E 0366      LD   (1E06H),A
21E5 3A 06 1E 0367      LD   A,(1E06H)
21E8 FE 00    0368      CP   00H
21EA C2 DA 21 0369      JP   NZ ,LOOP1
21ED C1      0370      POP  BC
21EE D1      0371      POP  DE
21EF C9      0372      RET
0373 *
0374 *
0375 *****END*****

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```

0376 *****
0377 *
0378 * DISPLAY 2 SUBROUTINE *
0379 *
0380 *****
*
* display temperature
*

```

21F0 C5	0381	DISP2	PUSH	BC
21F1 D5	0382		PUSH	DE
21F2 DD 21 05				
21F5 1E	0383		LD	IX,1E85H
21F6 16 00	0384		LD	D,00H
21F8 3A 02 1E	0385		LD	A,(1E82H)
21F8 D6 05	0386	662	SUB	05H
21FD 14	0387		INC	D
21FE FE 00	0388		CP	00H
2200 28 12	0389		JR	Z,661
2202 FE 01	0390		CP	01H
2204 28 0E	0391		JR	Z,661
2206 FE 02	0392		CP	02H
2208 28 0A	0393		JR	Z,661
220A FE 03	0394		CP	03H
220C 28 06	0395		JR	Z,661
220E FE 04	0396		CP	04H
2210 28 02	0397		JR	Z,661
2212 18 E7	0398		JR	662
2214 87	0399	661	ADD	A
2215 17	0400		RLA	
2216 17	0401		RLA	
2217 17	0402		RLA	
2218 17	0403		RLA	
2219 DD 77 00	0404		LD	(IX+0),A
221C DD 23	0405		INC	IX
221E 7A	0406		LD	A,D
221F 32 E5 1E	0407		LD	(1EE5H),A
	0408		*	
	0409		*	
2222 AF	0410		XOR	A
2223 32 E8 1E	0411		LD	(1EE8H),A
2226 0E 00	0412		LD	C,00H
2228 3A E5 1E	0413	663	LD	A,(1EE5H)
222B 17	0414		RLA	
222C 32 E5 1E	0415		LD	(1EE5H),A
222F 3A E8 1E	0416		LD	A,(1EE8H)
2232 87	0417		ADD	A,A
2233 27	0418		DAA	
2234 32 E8 1E	0419		LD	(1EE8H),A
2237 0D	0420		DEC	C
2238 20 EE	0421		JR	NZ,663
223A 3A E8 1E	0422		LD	A,(1EE8H)
223D DD 77 00	0423		LD	(IX+0),A

2240	FD 21 85		
2243	1E	0424	LD IY,1E85H
2244	DD 7E 00	0425	LD A,(IX+0)
2247	32 1F 1F	0426	LD (1F1FH),A
224A	DD 23	0427	INC IX
224C	DD 7E 00	0428	LD A,(IX+0)
224F	32 EF 1F	0429	LD (1FEFH),A
2252	3E 00	0430	LD A,00H
2254	32 F0 1F	0431	LD (1FF0H),A
2257	3E 07	0432	LD A,07H
2259	D7	0433	RST SYSCAL
225A	3E 04	0434	LD A,04H
225C	D7	0435	RST SYSCAL

225D	3E 03	0436	LD A,03H
225F	D3 02	0437	OUT (02H),A
2261	3E 00	0438	LD A,00H
2263	D3 01	0439	OUT (01H),A
2265	3E 0F	0440	LD A,0FH
2267	06 01	0441	LD B,01H
2269	D7	0442	RST SYSCAL
226A	C1	0443	POP BC
226B	D1	0444	POP DE
226C	C9	0445	RET

```

0446 *
0447 *
0448 *****END*****

```

```

0449 *****
0450 *
0451 * READ 2 SUBROUTINE *
0452 *
0453 *****

```

```

* read temperature and solar radiation
*

```

226D	00	0454	READ2 NOP
226E	7E	0455	HH0 LD A,(HL)
226F	D3 00	0456	OUT (PORTA),A
2271	D3 A0	0457	OUT (0A0H),A
2273	3E 0F	0458	LD A,0FH
2275	06 FF	0459	LD B,0FFH
2277	D7	0460	RST SYSCAL
2278	DB 02	0461	IN A,(PORTC)
227A	FD 77 00	0462	LD (IY+0),A
227D	7E	0463	LD A,(HL)
227E	FE 07	0464	CP 07H
2280	CA 95 22	0465	JP Z,HH1
2283	FE 27	0466	CP 27H
2285	CA 95 22	0467	JP Z,HH1
2288	FE 87	0468	CP 87H

228A	CA 95 22	0469	JP Z,HH1
228D	FD 7E 00	0470	LD A,(IY+0)
2290	D6 1B	0471	SUB 1BH
2292	FD 77 00	0472	LD (IY+0),A

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2295 FD 23      0473 HH1    INC    IY
2297 23        0474        INC    HL
2298 7E        0475        LD     A,(HL)
2299 FE 01     0476        CP     01H
229B C2 6E 22  0477        JP     NZ,HH0
229E C9        0478        RET
                0479        *
                0480        *
                0481 *****END*****

```

```

0482 *****
0483 *
0484 * GREENHOUSE PROGRAM 1 *
0485 *
0486 *****
*
* observed temperature , humidity
* and solar radiation
*

```

```

229F FD 21 00
22A2 10      0487 PROGRAM1 LD     IY,SAVE
22A3 3E 00   0488        LD     A,CONP
22A5 03 03   0489        OUT    (03H),A
22A7 3E 10   0490 START   LD     A,CLOSED
22A9 03 00   0491        OUT    (PORTA),A
22AB 3E 00   0492        LD     A,CLEAR
22AD 32 02 1E 0493        LD     (CLK1),A
22B0 3E 00   0494 LUD1    LD     A,CLEAR
22B2 32 00 1E 0495        LD     (CLK0),A
22B5 00 21 00
22B8 1E      0496 LUD2    LD     IX,SAVDISP
22B9 3A 00 1E 0497        LD     A,(CLK0)
22BC FE 00   0498        CP     00H
22BE C2 C7 22 0499        JP     NZ,LUD0
22C1 00 55 21 0500        CALL  DISP1
22C4 C3 B5 22 0501        JP     LUD2

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```

22C7 3A 02 1E 0502 LUD0    LD     A,(CLK1)
22CA C6 01   0503        ADD    01H
22CC 32 02 1E 0504        LD     (CLK1),A
22CF 3A 02 1E 0505        LD     A,(CLK1)
22D2 FE 02   0506        CP     02H
22D4 C2 B0 22 0507        JP     NZ,LUD1
22D7 00 54 20 0508        CALL  READ1
22DA C3 A7 22 0509        JP     START
                0510        *
                0511        *
                0512 *****END*****

```

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0513 *****
0514 *
0515 * GREENHOUSE PROGRAM 2 *
0516 *
0517 *****

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```

* to observe temperature and humidity
* when the roof is sprayed every 2 seconds.
*

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```

22D0 FD 21 00
22E0 10
22E1 3E 00
22E3 D3 03
22E5 3E 00
22E7 32 00 1E
22EA 3E 00
22EC 32 D2 1E
22EF 3E 50
22F1 D3 00
22F3 CD D2 21
22F6 3E 10
22F8 D3 00

22FA DD 21 00
22FD 1E
22FE 3A 00 1E
2301 FE 00
2303 C2 0C 23
2306 CD 55 21
2309 C3 FA 22
230C 3E 00

230E 32 00 1E
2311 3A D2 1E
2314 C6 01
2316 32 D2 1E
2319 3A D2 1E
231C FE 02
231E C2 FA 22
2321 CD 54 20
2324 C3 EA 22

0518 PROGRAM2 LD IX,SAVE
0519 LD A,COMP
0520 OUT (B3H),A
0521 LD A,CLEAR
0522 LD (CLK0),A
0523 YA2 LD A,CLEAR
0524 LD (CLK1),A
0525 LD A,SPRAY
0526 OUT (PORTA),A
0527 CALL SEC
0528 LD A,CLOSED
0529 OUT (PORTA),A

0530 YA1 LD IX,SAVDISP
0531 LD A,(CLK0)
0532 CP 00H
0533 JP NZ,YA0
0534 CALL DISP1
0535 JP YA1
0536 YA0 LD A,CLEAR

0537 LD (CLK0),A
0538 LD A,(CLK1)
0539 ADD 01H
0540 LD (CLK1),A
0541 LD A,(CLK1)
0542 CP 02H
0543 JP NZ,YA1
0544 CALL READ1
0545 JP YA2
0546 *
0547 *
0548 *****END*****

```

```

0549 *****
0550 *
0551 * GREENHOUSE PROGRAM 3 *
0552 *
0553 *****
*
* to observe temperature and humidity
* when turn on water injection
*
2327 3E 10 0554 PROGRAM3 LD A,10H
2329 57 0555 LD D,A
232A 3E 00 0556 LD A,00H
232C 5F 0557 LD E,A
232D FD 21 00
2330 10 0558 LD IX,SAVE
2331 3E 00 0559 LD A,COMP
2333 D3 83 0560 OUT (03H),A
2335 3E 00 0561 LD A,CLEAR
2337 32 00 1E 0562 LD (CLK0),A
233A 32 02 1E 0563 LD (CLK1),A
233D 3E 10 0564 PEE4 LD A,CLOSED
233F D3 00 0565 OUT (PORTA),A
2341 DD 21 00
2344 1E 0566 LD IX,SAVDISP
2345 3A 00 1E 0567 LD A,(CLK0)
2348 FE 00 0568 CP 00H
234A C2 53 23 0569 JP NZ,PEE3
234D CD 55 21 0570 CALL DISP1

2350 C3 3D 23 0571 JP PEE4
2353 3E 00 0572 PEE3 LD A,CLEAR
2355 32 00 1E 0573 LD (CLK0),A
2358 3A D2 1E 0574 LD A,(CLK1)
235B C6 01 0575 ADD 01H
235D 32 D2 1E 0576 LD (CLK1),A
2360 CD 54 20 0577 CALL READ1
2363 3A D2 1E 0578 LD A,(CLK1)
2366 BA 0579 CP D
2367 C2 3D 23 0580 JP NZ,PEE4

236A 3E 00 0581 LD A,CLEAR
236C 32 D2 1E 0582 LD (CLK1),A
236F 3E 90 0583 PEE5 LD A,F06
2371 D3 00 0584 OUT (PORTA),A
2373 DD 21 00
2376 1E 0585 LD IX,SAVDISP
2377 3A 00 1E 0586 LD A,(CLK0)
237A FE 00 0587 CP 00H
237C C2 05 23 0588 JP NZ,PEE6
237F CD 55 21 0589 CALL DISP1
2382 C3 6F 23 0590 JP PEE5
2385 3E 00 0591 PEE6 LD A,CLEAR

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2387 32 00 1E 0592 LD (CLK0),A
238A 3A D2 1E 0593 LD A,(CLK1)
238D C6 01 0594 ADD 01H
238F 32 D2 1E 0595 LD (CLK1),A
2392 CD 54 20 0596 CALL READ1
2395 3A D2 1E 0597 LD A,(CLK1)
2398 0B 0598 CP E
2399 C2 6F 23 0599 JP NZ,PEE5
239C 3E 00 0600 LD A,CLEAR
239E 32 D2 1E 0601 LD (CLK1),A
23A1 C3 3D 23 0602 JP PEE4
0603 *
0604 *
0605 *****END*****

0606 *****
0607 *
0608 * GREENHOUSE PROGRAM 4 *
0609 *
0610 *****
*
* to observe temperature and humidity
* when the roof is sprayed and turn on
* water injection or turn on ventilating fan
*
*
23A4 3E 10 0611 PROGRAM4 LD A,10H
23A6 57 0612 LD D,A
23A7 3E 00 0613 LD A,00H
23A9 5F 0614 LD E,A
23AA FD 21 00
23AD 10 0615 LD IX,SAVE
23AE 3E 00 0616 LD A,CONP
23B0 D3 83 0617 OUT (03H),A
23B2 3E 00 0618 LD A,CLEAR
23B4 32 00 1E 0619 LD (CLK0),A
23B7 32 D2 1E 0620 LD (CLK1),A
23BA 3E 00 0621 RR5 LD A,CLEAR
23BC 32 A4 1E 0622 LD (CLK2),A
23BF 3A AB 1E 0623 RR0 LD A,(1EABH)
23C2 D3 00 0624 OUT (PORTA),A

23C4 CD D2 21 0625 CALL SEC
23C7 3A AC 1E 0626 RR7 LD A,(1EACH)
23CA D3 00 0627 OUT (PORTA),A
23CC DD 21 00
23CF 1E 0628 RR1 LD IX,SAVDISP
23D0 3A 00 1E 0629 LD A,(CLK0)
23D3 FE 00 0630 CP 00H
23D5 C2 DE 23 0631 JP NZ,RR6
23D8 CD 55 21 0632 CALL DISP1
23DB C3 CC 23 0633 JP RR1

```

23DE	3E 00	0634	RR6	LD	A,CLEAR
23E0	32 00 1E	0635		LD	(CLK0),A
23E3	3A D2 1E	0636		LD	A,(CLK1)
23E6	C6 01	0637		ADD	01H
23E8	32 D2 1E	0638		LD	(CLK1),A
23EB	CD 54 20	0639		CALL	READ1
23EE	3A D2 1E	0640		LD	A,(CLK1)
23F1	FE 02	0641		CP	02H
23F3	C2 C7 23	0642		JP	NZ,RR7
23F6	3E 00	0643		LD	A,CLEAR
23F8	32 D2 1E	0644		LD	(CLK1),A
23FB	3A A4 1E	0645		LD	A,(CLK2)
23FE	C6 02	0646		ADD	02H
2400	32 A4 1E	0647		LD	(CLK2),A
2403	3A A4 1E	0648		LD	A,(CLK2)
2406	BA	0649		CP	D
2407	C2 BF 23	0650		JP	NZ,RR0
240A	3E 00	0651		LD	A,CLEAR
240C	32 A4 1E	0652		LD	(CLK2),A
240F	3A AD 1E	0653	RR2	LD	A,(1EADH)
2412	D3 00	0654		OUT	(PORTA),A
2414	CD D2 21	0655		CALL	SEC
2417	3A AE 1E	0656	RR8	LD	A,(1EAEH)
241A	D3 00	0657		OUT	(PORTA),A
241C	DD 21 B0				
241F	1E	0658	RR3	LD	IX,SAVDISP
2420	3A 00 1E	0659		LD	A,(CLK0)
2423	FE 00	0660		CP	00H
2425	C2 2E 24	0661		JP	NZ,RR4
2428	CD 55 21	0662		CALL	DISP1
242B	C3 1C 24	0663		JP	RR3
242E	3E 00	0664	RR4	LD	A,CLEAR
2430	32 00 1E	0665		LD	(CLK0),A
2433	3A D2 1E	0666		LD	A,(CLK1)
2436	C6 01	0667		ADD	01H
2438	32 D2 1E	0668		LD	(CLK1),A
243B	CD 54 20	0669		CALL	READ1
243E	3A D2 1E	0670		LD	A,(CLK1)
2441	FE 02	0671		CP	02H
2443	C2 17 24	0672		JP	NZ,RR8
2446	3E 00	0673		LD	A,CLEAR
2448	32 D2 1E	0674		LD	(CLK1),A
244B	3A A4 1E	0675		LD	A,(CLK2)
244E	C6 02	0676		ADD	02H
2450	32 A4 1E	0677		LD	(CLK2),A
2453	3A A4 1E	0678		LD	A,(CLK2)
2456	BB	0679		CP	E
2457	C2 BF 24	0680		JP	NZ,RR2
245A	C3 BA 23	0681		JP	RR5
		0682	†		
		0683	†		
		0684	*****END*****		


```

0138 *****
0139 *
0140 * GREENHOUSE PROGRAM 5 *
0141 *
0142 *****
*
* temperature control
*
245D FD 21 00
2460 10 0143 PROGRAM5 LD IY,SAVE
2461 3E 08 0144 LD A,COMP
2463 D3 03 0145 OUT (03H),A
2465 3E 00 0146 LD A,CLEAR
2467 32 00 1E 0147 LD (CLK0),A
246A 32 D2 1E 0148 LD (CLK1),A

246D 3A 81 1E 0149 TT0 LD A,(1E81H)
2470 CD 3E 26 0150 CALL TEMP
2473 3A 18 1E 0151 LD A,(1E18H)
2476 32 82 1E 0152 LD (1E82H),A

2479 3A 85 1E 0153 LD A,(1E85H)
247C CD 2F 26 0154 CALL SOLAR
247F 3A 81 1E 0155 LD A,(1E81H)
2482 32 86 1E 0156 LD (1E86H),A
2485 3A 86 1E 0157 LD A,(1E86H)
2488 D6 32 0158 SUB 32H
248A CB 7F 0159 BIT 7,A
248C C2 E3 24 0160 JP NZ,TT1

248F 3A 86 1E 0161 LD A,(1E86H)
2492 D6 64 0162 SUB 64H
2494 CB 7F 0163 BIT 7,A
2496 C2 E8 24 0164 JP NZ,TT2
2499 3A 86 1E 0165 LD A,(1E86H)
249C D6 96 0166 SUB 96H
249E CB 7F 0167 BIT 7,A
24A0 C2 F3 24 0168 JP NZ,TT3
24A3 3A 86 1E 0169 LD A,(1E86H)
24A6 D6 C8 0170 SUB 0C8H
24A8 CB 7F 0171 BIT 7,A
24AA C2 F8 24 0172 JP NZ,TT4

24AD 3E 0C 0173 LD A,0CH
24AF 32 05 1E 0174 LD (XX),A ;TIME = 6 SEC,0 > 800 W/m^2
24B2 CD F0 21 0175 TT5 CALL DISP2

24B5 3A 82 1E 0176 LD A,(1E82H) ;Ti (INTERNAL TEMPERATURE)
24B8 57 0177 LD D,A
24B9 3A 80 1E 0178 LD A,(1E80H) ;T (REQUIRED TEMPERATURE)
24BC 92 0179 SUB D
24BD CB 7F 0180 BIT 7,A
24BF CA 43 25 0181 JP Z,TT6
24C2 3A 00 1E 0182 LD A,(1E00H)
24C5 FE 01 0183 CP 01H
24C7 C2 D4 24 0184 JP NZ,TT7

```


24CA	3E D0	0185		LD	A,FSP	
24CC	32 60 1E	0186		LD	(1E60H),A	
24CF	D3 00	0187		OUT	(PORTA),A	
24D1	C3 AE 25	0188		JP	TT14	
24D4	3E 90	0189	TT7	LD	A,F06	
24D6	D3 00	0190		OUT	(PORTA),A	
24D8	3A 00 1E	0191		LD	A,(CLK0)	
24D8	FE 00	0192		CP	CLEAR	
24DD	C2 10 25	0193		JP	NZ,TT9	
24E0	C3 03 25	0194		JP	TT10	
24E3	3E 02	0195	TT1	LD	A,02H	
24E5	32 05 1E	0196		LD	(XX),A	;TIME = 1 SEC,Q = 0-200 W/m ²
24E8	C3 B2 24	0197		JP	TT5	
24E8	3E 04	0198	TT2	LD	A,04H	
24ED	32 05 1E	0199		LD	(XX),A	;TIME = 2 SEC,Q = 201-400 W/m ²
24F0	C3 B2 24	0200		JP	TT5	
24F3	3E 06	0201	TT3	LD	A,06H	
24F5	32 05 1E	0202		LD	(XX),A	;TIME = 3 SEC,Q = 401-600 W/m ²
24F8	C3 B2 24	0203		JP	TT5	
24FB	3E 08	0204	TT4	LD	A,08H	
24FD	32 05 1E	0205		LD	(XX),A	;TIME = 4 SEC,Q = 601-800 W/m ²
2500	C3 B2 24	0206		JP	TT5	
2503	3E 0C	0207	TT10	LD	A,0CH	
2505	32 01 1E	0208		LD	(1E01H),A	
2508	3E 07	0209		LD	A,07H	
250A	32 05 1E	0210		LD	(1E05H),A	
250D	C3 6D 24	0211		JP	TT8	
2510	21 1D 26	0212	TT9	LD	HL,NONG1	
2513	CD 6D 22	0213		CALL	READ2	
2516	3E 00	0214		LD	A,CLEAR	
2518	32 00 1E	0215		LD	(CLK0),A	
251B	3A D2 1E	0216		LD	A,(CLK1)	
251E	FE 02	0217		CP	02H	
2520	C2 38 25	0218		JP	NZ,TT11	
2523	3E 00	0219		LD	A,CLEAR	
2525	32 D2 1E	0220		LD	(CLK1),A	
2528	3A 05 1E	0221		LD	A,(XX)	
252B	32 07 1E	0222		LD	(YY),A	
252E	3E D0	0223		LD	A,FSP	
2530	D3 00	0224		OUT	(PORTA),A	
2532	CD A1 25	0225		CALL	DELAY1	
2535	C3 02 26	0226		JP	TT12	
2538	3A D2 1E	0227	TT11	LD	A,(CLK1)	
253B	C6 01	0228		ADD	01H	
253D	32 D2 1E	0229		LD	(CLK1),A	
2540	C3 03 25	0230		JP	TT10	
2543	3A 0D 1E	0231	TT6	LD	A,(1E0DH)	
2546	FE 01	0232		CP	01H	
2548	C2 55 25	0233		JP	NZ,TT13	

254B	3E 50	0234	LD	A,SPRAY
254D	32 60 1E	0235	LD	(1E60H),A
2550	D3 80	0236	OUT	(PORTA),A
2552	C3 AE 25	0237	JP	TT14
2555	3E 10	0238	LD	A,CLOSED
2557	D3 80	0239	OUT	(PORTA),A
2559	3A 00 1E	0240	LD	A,(CLK0)
255C	FE 00	0241	CP	CLEAR
255E	C2 6E 25	0242	JP	NZ,TT15
2561	3E 0C	0243	LD	A,0CH
2563	32 01 1E	0244	LD	(1E81H),A
2566	3E 07	0245	LD	A,07H
2568	32 85 1E	0246	LD	(1E85H),A
256B	C3 6D 24	0247	JP	TT0
256E	21 23 26	0248	LD	HL,NONG2
2571	CD 2B 24	0249	CALL	READ2
2574	3E 00	0250	LD	A,CLEAR
2576	32 00 1E	0251	LD	(CLK0),A
2579	3A 02 1E	0252	LD	A,(CLK1)
257C	FE 02	0253	CP	02H
257E	C2 96 25	0254	JP	NZ,TT16
2581	3E 00	0255	LD	A,CLEAR
2583	32 02 1E	0256	LD	(CLK1),A
2586	3A 05 1E	0257	LD	A,(XX)
2589	32 07 1E	0258	LD	(YY),A
258C	3E 50	0259	LD	A,SPRAY
258E	D3 80	0260	OUT	(PORTA),A
2590	CD A1 25	0261	CALL	DELAY1
2593	C3 02 26	0262	JP	TT12
2596	3A 02 1E	0263	LD	A,(CLK1)
2599	C6 01	0264	ADD	01H
259B	32 02 1E	0265	LD	(CLK1),A
259E	C3 61 25	0266	JP	TT17
25A1	C5	0267	DELAY1	PUSH BC ;DELAY = YY
25A2	D5	0268	PUSH	DE
25A3	3E 01	0269	LD	A,01H
25A5	32 0D 1E	0270	LD	(1E0DH),A
25AB	3A 07 1E	0271	LD	A,(YY)
25AB	32 06 1E	0272	LD	(1E06H),A
25AE	CD 0F 26	0273	CALL	DELAY2
25B1	3A 60 1E	0274	LD	A,(1E60H)
25B4	FE 50	0275	CP	SPRAY
25B6	CA 8E 25	0276	JP	Z,TT18
25B9	FE 00	0277	CP	FSP
25BB	CA E0 25	0278	JP	Z,TT19
25BE	3E 4C	0279	LD	A,4CH
25C0	32 01 1E	0280	LD	(1E81H),A
25C3	3E 47	0281	LD	A,47H
25C5	32 85 1E	0282	LD	(1E85H),A
25C8	3A 06 1E	0283	LD	A,(1E06H)

25CB	D6 01	0284	SUB	01H
25CD	32 06 1E	0285	LD	(1E06H),A
25DB	3A 06 1E	0286	LD	A,(1E06H)
25D3	FE 00	0287	CP	00H
25D5	C2 6D 24	0288	JP	NZ,TT0
25D8	C1	0289	POP	BC
25D9	D1	0290	POP	DE
25DA	3E 00	0291	LD	A,00H
25DC	32 0D 1E	0292	LD	(1E0DH),A
25DF	C9	0293	RET	

25E0	3E CC	0294	TT19	LD	A,0CCH
25E2	32 01 1E	0295		LD	(1E01H),A
25E5	3E C7	0296		LD	A,0C7H
25E7	32 05 1E	0297		LD	(1E05H),A
25EA	3A 06 1E	0298		LD	A,(1E06H)
25ED	D6 01	0299	SUB	01H	
25EF	32 06 1E	0300	LD	(1E06H),A	
25F2	3A 06 1E	0301	LD	A,(1E06H)	
25F5	FE 00	0302	CP	00H	
25F7	C2 6D 24	0303	JP	NZ,TT0	
25FA	C1	0304	POP	BC	
25FB	D1	0305	POP	DE	
25FC	3E 00	0306	LD	A,00H	
25FE	32 0D 1E	0307	LD	(1E0DH),A	
2601	C9	0308	RET		
2602	3A 60 1E	0309	TT12	LD	A,(1E60H)
2605	FE 50	0310	CP	SPRAY	
2607	CA 61 25	0311	JP	Z,TT17	
260A	FE D0	0312	CP	FSP	
260C	CA 03 25	0313	JP	Z,TT10	

260F	C5	0314	DELAY2	PUSH	BC
2610	D5	0315		PUSH	DE
2611	11 FF 00	0316		LD	DE,0FFH
2614	1B	0317	TT2	DEC	DE
2615	7A	0318		LD	A,D
2616	03	0319		OR	E
2617	C2 14 26	0320		JP	NZ,TT20
261A	C1	0321		POP	BC
261B	D1	0322		POP	DE
261C	C9	0323		RET	

‡
 ‡ selector switch for read temperature or solar
 ‡ radiation and turn on water injection
 ‡

261D	87	0324	NONG1	DB	87H	;SOLAR RADIATION
261E	84	0325		DB	84H	;WET BULB TEMP. (EXTERNAL)
261F	8E	0326		DB	8EH	;DRY BULB TEMP.
2620	8C	0327		DB	8CH	;WET BULB TEMP. (INTERNAL)
2621	82	0328		DB	82H	;DRY BULB TEMP.
2622	10	0329		DB	CLOSED	

```

*
* selector switch for read temperature or solar
* radiation and turn off water injection, water
* sprayer and ventilating fan
*

```

```

2623 07      0330 NON62 DB 07H ;SOLAR RADIATION
2624 04      0331 DB 04H ;WET BULB TEMP. (EXTERNAL)
2625 0E      0332 DB 0EH ;DRY BULB TEMP.
2626 0C      0333 DB 0CH ;WET BULB TEMP. (INTERNAL)
2627 02      0334 DB 02H ;DRY BULB TEMP.
2628 10      0335 DB CLOSED

```

```

*
* selector switch for read temperature or solar
* radiation and turn on ventilating fan
*

```

```

2629 27      0336 NON63 DB 27H ;SOLAR RADIATION
262A 24      0337 DB 24H ;WET BULB TEMP. (EXTERNAL)
262B 2E      0338 DB 2EH ;DRY BULB TEMP.
262C 2C      0339 DB 2CH ;WET BULB TEMP. (INTERNAL)
262D 22      0340 DB 22H ;DRY BULB TEMP.
262E 10      0341 DB CLOSED

```

```

262F D3 80    0342 SOLAR OUT (PORTA),A ;READ SOLAR RADIATION (0)
2631 D3 A0    0343 OUT (0A0H),A
2633 3E 0F    0344 LD A,0FH
2635 06 FF    0345 LD B,0FFH
2637 D7       0346 RST SYSCAL
2638 DB 82    0347 IN A,(PORTB)
263A 32 10 1E 0348 LD (1E10H),A
263D C9       0349 RET

```

```

263E D3 80    0350 TEMP OUT (PORTA),A ;READ TEMPERATURE (Ti)
2640 D3 A0    0351 OUT (0A0H),A
2642 3E 0F    0352 LD A,0FH
2644 06 FF    0353 LD B,0FFH
2646 D7       0354 RST SYSCAL
2647 DB 82    0355 IN A,(PORTB)
2649 D6 10    0356 SUB 10H
264B 32 10 1E 0357 LD (1E10H),A
264E C9       0358 RET

```

```

*
0359 *
0360 *
0361 *****END*****

```

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```
0102 *****
0103 *
0104 * GREENHOUSE PROGRAM 6 *
0105 *
0106 *****
*
* humidity control
*
264F 00 0107 PROGRAM6 NOP
2650 FD 21 00
2653 10 0108 LD IY,SAVE
2654 3E 00 0109 LD A,CONP
2656 D3 00 0110 OUT (PORTA),A
2658 3E 00 0111 LD A,CLEAR
265A 32 00 1E 0112 LD (CLK0),A
265D 32 D2 1E 0113 LD (CLK1),A

2660 3A 01 1E 0114 RH0 LD A,(1E81H)
2663 CD 3E 26 0115 CALL TEMP
2666 3A 18 1E 0116 LD A,(1E18H)
2669 32 21 1E 0117 LD (1E21H),A

266C 3A 19 1E 0118 LD A,(1E19H)
266F CD 3E 26 0119 CALL TEMP
2672 3A 18 1E 0120 LD A,(1E18H)
2675 32 23 1E 0121 LD (1E23H),A

2678 3A 05 1E 0122 LD A,(1E05H)
267B CD 2F 26 0123 CALL SOLAR
267E 3A 18 1E 0124 LD A,(1E18H)
2681 32 06 1E 0125 LD (1E06H),A
2684 D6 32 0126 SUB 32H
2686 CB 7F 0127 BIT 7,A
2688 C2 AF 26 0128 JP NZ,RH1

268B 3A 06 1E 0129 LD A,(1E06H)
268E D6 64 0130 SUB 64H
2690 C2 07 26 0131 JP NZ,RH2
2693 3A 06 1E 0132 LD A,(1E06H)
2696 D6 96 0133 SUB 96H
2698 CB 7F 0134 BIT 7,A
269A C2 0F 26 0135 JP NZ,RH3
269D 3A 06 1E 0136 LD A,(1E06H)
26A0 D6 C8 0137 SUB 0C8H
26A2 CB 7F 0138 BIT 7,A
26A4 C2 C7 26 0139 JP NZ,RH4

26A7 3E 0C 0140 LD A,0CH
26A9 32 05 1E 0141 LD (XX),A ;TIME = 6 SEC,Q > 800 W/m^2
26AC C3 CF 26 0142 JP RH5
26AF 3E 02 0143 RH1 LD A,02H
26B1 32 05 1E 0144 LD (XX),A ;TIME = 1 SEC,Q = 0-200 W/m^2
26B4 C3 CF 26 0145 JP RH5
26B7 3E 04 0146 RH2 LD A,04H
26B9 32 05 1E 0147 LD (XX),A ;TIME = 2 SEC,Q = 201-400 W/m^2
26BC C3 C F26 0148 JP RH5
```

26BF	3E 06	0149	RH3	LD	A,06H	
26C1	32 05 1E	0150		LD	(XX),A	;TIME = 3 SEC,Q = 401-600 W/m ²
26C4	C3 CF 26	0151		JP	RH5	
26C7	3E 08	0152	RH4	LD	A,08H	
26C9	32 05 1E	0153		LD	(XX),A	;TIME = 4 SEC,Q = 601-800 W/m ²
26CC	C3 CF 26	0154		JP	RH5	
26CF	3A 21 1E	0155	RH5	LD	A,(1E21H)	;DRY-BULB TEMP.
26D2	CD C9 29	0156		CALL	SVP	
26D5	3A 32 1E	0157		LD	A,(1E32H)	
26D8	32 34 1E	0158		LD	(1E34H),A	;SVP AT DRY-BULB (Td)
26DB	3A 33 1E	0159		LD	A,(1E33H)	
26DE	32 35 1E	0160		LD	(1E35H),A	
26E1	3A 23 1E	0161		LD	A,(1E23H)	
26E4	CD C9 29	0162		CALL	SVP	
26E7	3A 32 1E	0163		LD	A,(1E32H)	
26EA	32 36 1E	0164		LD	(1E36H),A	;SVP AT WET-BULB (Tw)
26ED	3A 33 1E	0165		LD	A,(1E33H)	
26F0	32 37 1E	0166		LD	(1E37H),A	
26F3	2A 21 00	0167		LD	HL,(21H)	
26F9	00	0168		LD	DE,(23H)	
26FA	ED 52	0169		SBC	HL,DE	
26FC	22 25 00	0170		LD	(25H),HL	
26FF	3E 00	0171		LD	A,00H	
2701	4F	0172		LD	C,A	
2702	3E 10	0173		LD	A,10H	
2704	06 10	0174		LD	B,10H	
2706	ED 58 25					
2709	1E	0175		LD	DE,(1E25H); Td - Tw	
270A	21 00 00	0176		LD	HL,00H	
270D	CB 39	0177	RH7	SRL	C	
270F	1F	0178		RRA		
2710	30 01	0179		JR	NC,RH6	
2712	19	0180		ADD	HL,DE	
2713	EB	0181	RH6	EX	DE,HL	
2714	22 30 1E	0182		LD	(1E30H),HL	
2717	10 F4	0183		DJNZ	RH7	
2719	3E 00	0184		LD	A,00H	
271B	4F	0185		LD	C,A	
271C	3E 0A	0186		LD	A,0AH	
271E	06 10	0187		LD	B,10H	
2720	ED 58 36					
2723	1E	0188		LD	DE,(1E36H)	
2724	21 00 00	0189		LD	HL,00H	
2727	CB 39	0190	RH8	SRL	C	
2729	1F	0191		RRA		
272A	30 01	0192		JR	NC,RH07	
272C	19	0193		ADD	HL,DE	
272D	EB	0194	RH07	EX	DE,HL	
272E	22 55 1E	0195		LD	(1E55H),HL	
2731	10 F4	0196		DJNZ	RH8	
2733	2A 55 1E	0197		LD	HL,(1E55H)	

2736	ED 5B 30			
2739	1E	0198	LD	DE, (30H)
273A	ED 52	0199	SBC	HL, DE
273C	22 30 00	0200	LD	(30H), HL
		*		
273F	3E 00	0201	LD	A, 00H
2741	4F	0202	LD	C, A
2742	3E 0A	0203	LD	A, 0AH
2744	06 10	0204	LD	B, 10H
2746	ED 5B 30			
2749	1E	0205	LD	DE, (1E30H)
274A	21 00 00	0206	LD	HL, 00H
274D	CB 39	0207	RH10 SRL	C
274F	1F	0208	RRR	
2750	30 01	0209	JR	NC, RH9
2752	19	0210	ADD	HL, DE
2753	EB	0211	RH9 EX	DE, HL
2754	29	0212	ADD	HL, HL
2755	EB	0213	EX	DE, HL
2756	22 3A 1E	0214	LD	(1E3AH), HL
2759	10 F2	0215	DJNZ	RH10
275B	ED 5B 3A			
275E	1E	0216	LD	DE, (1E3AH)
275F	ED 4B 34			
2762	1E	0217	LD	BC, (1E34H)
2763	AF	0218	XOR	A
2764	67	0219	LD	H, A
2765	6F	0220	LD	L, A
2766	3E 10	0221	LD	A, 10H
2768	CB 13	0222	RH11 RL	E
276A	CB 12	0223	RL	D
276C	ED 6A	0224	ADC	HL, HL
276E	ED 42	0225	SBC	HL, BC
2770	30 01	0226	JR	NC, RH011
2772	09	0227	ADD	HL, BC
2773	3F	0228	RH011 CCF	
2774	3D	0229	DEC	A
2775	18 F1	0230	JR	RH11
2777	EB	0231	EX	DE, HL
2778	ED 6A	0232	ADC	HL, HL
277A	22 3C 1E	0233	LD	(1E3CH), HL; RELATIVE HUMIDITY (RH)
277D	ED 53 3E			
2780	1E	0234	LD	(1E3EH), DE
		*		
		*	display relative humidity (RH)	
		*		
2781	C5	0235	PUSH	BC
2782	D5	0236	PUSH	DE
2783	3A 3C 1E	0237	LD	A, (1E3CH)
2786	32 50 1E	0238	LD	(1E50H), A
2789	AF	0239	XOR	A
278A	1E 02	0240	LD	E, 02H
278C	16 01	0241	LD	D, 01H

278E	43	0242	LD	B,E
278F	21 E8 1E	0243	LD	HL,1EE8H
2792	77	0244	LD	(HL),A
2793	23	0245	INC	HL
2794	18 FC	0246	DJNZ	RH12
2796	7A	0247	LD	A,D
2797	87	0248	ADD	A,A
2798	87	0249	ADD	A,A
2799	87	0250	ADD	A,A
279A	4F	0251	LD	C,A
279B	2E 50	0252	LD	L,50H
279D	42	0253	LD	B,D
279E	CB 16	0254	RL	(HL)
27A0	23	0255	INC	HL
27A1	18 FB	0256	DJNZ	RH13
27A3	2E E8	0257	LD	L,0E8H
27A5	43	0258	LD	B,E
27A6	7E	0259	LD	A,(HL)
27A7	87	0260	ADD	A,A
27A8	27	0261	DAA	
27A9	77	0262	LD	(HL),A
27AA	23	0263	INC	HL
27AB	18 F9	0264	DJNZ	RH14
27AD	8D	0265	DEC	C
27AE	28 EB	0266	JR	NZ,RH15
27B0	21 E8 1E	0267	LD	HL,1EE8H
27B3	7E	0268	LD	A,(HL)
27B4	32 48 1E	0269	LD	(1E48H),A
27B7	23	0270	INC	HL
27B8	7E	0271	LD	A,(HL)
27B9	32 41 1E	0272	LD	(1E41H),A
27BC	C1	0273	POP	BC
27BD	D1	0274	POP	DE
27BE	C5	0275	PUSH	BC
27BF	D5	0276	PUSH	DE
27C0	3A 48 1E	0277	LD	A,(1E48H)
27C3	32 1F 1F	0278	LD	(1F1FH),A
27C6	3A 41 1E	0279	LD	A,(1E41H)
27C9	32 EF 1F	0280	LD	(1FEFH),A
27CC	3E 00	0281	LD	A,00H
27CE	32 F8 1F	0282	LD	(1FF8H),A
27D1	3E 07	0283	LD	A,07H
27D3	D7	0284	RST	SYSCAL
27D4	3E 04	0285	LD	A,04H
27D6	D7	0286	RST	SYSCAL
27D7	C1	0287	POP	BC
27D8	D1	0288	POP	DE
27D9	3A 3C 1E	0289	LD	A,(1E3CH) ;RH
27DC	5F	0290	LD	E,A
27DD	3A 17 1E	0291	LD	A,(1E17H) ;RHmax
27E0	93	0292	SUB	E
27E1	CB 7F	0293	BIT	7,A


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27E3 C2 F2 27 0294 JP NZ,RH16 ;
27E6 3A 80 1E 0295 LD A,(1E80H);RHmin
27E9 93 0296 SUB E
27EA CB 7F 0297 BIT 7,A
27EC C2 55 28 0298 JP NZ,RH17
27EF C3 88 28 0299 JP RH18

*
* RH > RHmax
*
27F2 3A 8D 1E 0300 RH16 LD A,(1E8DH)
27F5 FE 01 0301 CP 01H
27F7 C2 04 28 0302 JP NZ,RH19
27FA 3E 70 0303 LD A,SPC
27FC 32 60 1E 0304 LD (1E60H),A
27FF D3 80 0305 OUT (PORTA),A
2801 C3 2D 29 0306 JP RH20
2804 3E 30 0307 RH19 LD A,COOLED
2806 D3 80 0308 OUT (PORTA),A
2808 3A 00 1E 0309 LD A,(CLK0)
280B FE 00 0310 CP CLEAR
280D C2 22 28 0311 JP NZ,RH21
2810 3E 2C 0312 RH24 LD A,2CH

2812 32 81 1E 0313 LD (1E81H),A
2815 3E 22 0314 LD A,22H
2817 32 19 1E 0315 LD (1E19H),A
281A 3E 27 0316 LD A,27H
281C 32 85 1E 0317 LD (1E85H),A
281F C3 60 26 0318 JP RH0
2822 3E 00 0319 RH21 LD A,00H
2824 32 00 1E 0320 LD (CLK0),A

2827 21 29 26 0321 LD HL,NONG3
282A CD 6D 22 0322 CALL READ2
282D 3A D2 1E 0323 LD A,(CLK1)
2830 FE 02 0324 CP 02H
2832 C2 4A 28 0325 JP NZ,RH22
2835 3E 00 0326 LD A,00H
2837 32 D2 1E 0327 LD (CLK1),A
283A 3A 05 1E 0328 LD A,(XX)
283D 32 07 1E 0329 LD (YY),A
2840 3E 70 0330 LD A,SPC
2842 D3 80 0331 OUT (PORTA),A
2844 CD 20 29 0332 CALL DELAY3
2847 C3 87 29 0333 JP RH23
284A 3A D2 1E 0334 RH22 LD A,(CLK1)
284D C6 01 0335 ADD 01H
284F 32 D2 1E 0336 LD (CLK1),A
2852 C3 10 28 0337 JP RH24

*
* RH > RHmin
*
2855 3A 0D 1E 0338 RH17 LD A,(1E0DH)
2858 FE 01 0339 CP 01H
285A C2 67 28 0340 JP NZ,RH25
285D 3E 50 0341 LD A,SPRAY

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285F	32 60 1E	0342		LD	(1E60H),A
2862	D3 00	0343		OUT	(PORTA),A
2864	C3 20 29	0344		JP	RH20
2867	3E 10	0345	RH25	LD	A,CLOSED
2869	D3 00	0346		OUT	(PORTA),A
286B	3A 00 1E	0347		LD	A,(CLK0)
286E	FE 00	0348		CP	CLEAR
2870	C2 05 28	0349		JP	NZ,RH26
2873	3E 0C	0350	RH28	LD	A,0CH
2875	32 01 1E	0351		LD	(1E81H),A
2878	3E 02	0352		LD	A,02H
287A	32 19 1E	0353		LD	(1E19H),A
287D	3E 07	0354		LD	A,07H
287F	32 05 1E	0355		LD	(1E85H),A
2882	C3 60 26	0356		JP	RH0
2885	21 23 26	0357	RH26	LD	HL,NON62
2888	CD 60 22	0358		CALL	READ2
288B	3E 00	0359		LD	A,CLEAR
288D	32 00 1E	0360		LD	(CLK0),A
2890	3A D2 1E	0361		LD	A,(CLK1)
2893	FE 02	0362		CP	02H
2895	C2 AD 28	0363		JP	NZ,RH27
2898	3E 00	0364		LD	A,CLEAR
289A	32 D2 1E	0365		LD	(CLK1),A
289D	3A 05 1E	0366		LD	A,(1E05H)
28A0	32 07 1E	0367		LD	(1E07H),A
28A3	3E 50	0368		LD	A,SPRAY
28A5	D3 00	0369		OUT	(PORTA),A
28A7	CD 20 29	0370		CALL	DELAY3
28AA	C3 07 29	0371		JP	RH23
28AD	3A D2 1E	0372	RH27	LD	A,(CLK1)
28B0	C6 01	0373		ADD	01H
28B2	32 D2 1E	0374		LD	(CLK1),A
28B5	C3 73 28	0375		JP	RH28
* RH < RHmin,RH = RHmin					
28B8	3A 0D 1E	0376	RH18	LD	A,(1E0DH)
28BB	FE 01	0377		CP	01H
28BD	C2 CF 28	0378		JP	NZ,RH29
28C0	3E 00	0379		LD	A,FSP
28C2	32 60 1E	0380		LD	(1E60H),A
28C5	D3 00	0381		OUT	(PORTA),A
28C7	32 60 1E	0382		LD	(1E60H),A
28CA	D3 00	0383		OUT	(PORTA),A
28CC	CD 0F 26	0384		CALL	DELAY2
28CF	3E 90	0385	RH29	LD	A,F06
28D1	D3 00	0386		OUT	(PORTA),A
28D3	3A 00 1E	0387		LD	A,(CLK0)
28D6	FE 00	0388		CP	CLEAR
28D8	C2 ED 28	0389		JP	NZ,RH30
28DB	3E 0C	0390	RH32	LD	A,0CH

28DD	32 81 1E	0391		LD	(1E81H),A	
28E0	3E 82	0392		LD	A,82H	
28E2	32 19 1E	0393		LD	(1E19H),A	
28E5	3E 57	0394		LD	A,87	
28E7	32 85 1E	0395		LD	(1E85H),A	
28EA	C3 60 26	0396		JP	RH0	
28ED	21 1D 26	0397	RH30	LD	HL,NONG1	
28F0	CD 6D 22	0398		CALL	READ2	
28F3	3E 00	0399		LD	A,CLEAR	
28F5	32 00 1E	0400		LD	(CLK0),A	
28F8	3A D2 1E	0401		LD	A,(CLK1)	
28FB	FE 02	0402		CP	02H	
28FD	C2 15 29	0403		JP	NZ,RH31	
2900	3E 00	0404		LD	A,CLEAR	
2902	32 D2 1E	0405		LD	(CLK1),A	
2905	3A 05 1E	0406		LD	A,(XX)	
2908	32 07 1E	0407		LD	(YY),A	
290B	3E D0	0408		LD	A,FSP	
290D	D3 80	0409		OUT	(PORTA),A	
290F	CD 20 29	0410		CALL	DELAY3	
2912	C3 87 29	0411		JP	RH23	
2915	3A D2 1E	0412	RH31	LD	A,(CLK1)	
2918	C6 01	0413		ADD	01H	
291A	32 D2 1E	0414		LD	(CLK1),A	
291D	C3 D8 28	0415		JP	RH32	
2920	C5	0416	DELAY3	PUSH	BC	;DELAY = YY
2921	D5	0417		PUSH	DE	
2922	3E 01	0418		LD	A,01H	
2924	32 8D 1E	0419		LD	(1E8DH),A	
2927	3A 07 1E	0420		LD	A,(1E07H)	
292A	32 06 1E	0421		LD	(1E06H),A	
292D	CD 0F 26	0422	RH20	CALL	DELAY2	
2930	3A 60 1E	0423		LD	A,(1E60H)	
2933	FE 50	0424		CP	SPRAY	
2935	CA 42 29	0425		JP	Z,RH33	
2938	FE D0	0426		CP	FSP	
293A	CA 69 29	0427		JP	Z,RH34	
293D	FE 70	0428		CP	SPC	
293F	CA 90 29	0429		JP	Z,RH35	
2942	3E 4C	0430	RH33	LD	A,4CH	
2944	32 81 1E	0431		LD	(1E81H),A	
2947	3E 42	0432		LD	A,42H	
2949	32 19 1E	0433		LD	(1E19H),A	
294C	3E 27	0434		LD	A,27H	
294E	32 85 1E	0435		LD	(1E85H),A	
2951	3A 60 1E	0436		LD	A,(1E60H)	
2954	D6 01	0437		SUB	01H	
2956	32 06 1E	0438		LD	(1E06H),A	
2959	3A 06 1E	0439		LD	A,(1E06H)	
295C	FE 00	0440		CP	00H	
295E	C2 60 26	0441		JP	NZ,RH0	

2961	C1	0442	POP	BC
2962	D1	0443	POP	DE
2963	3E 00	0444	LD	A,00H
2965	32 00 1E	0445	LD	(1E0DH),A
2968	C9	0446	RET	
2969	3E CC	0447	RH34	LD
296B	32 01 1E	0448	LD	A,0CCH
296E	3E C2	0449	LD	(1E01H),A
2970	32 19 1E	0450	LD	A,0C2H
2973	3E C7	0451	LD	(1E19H),A
2975	32 05 1E	0452	LD	A,0C7H
2978	3A 06 1E	0453	LD	(1E05H),A
297B	D6 01	0454	LD	A,(1E06H)
297D	32 06 1E	0455	SUB	01H
2980	3A 06 1E	0456	LD	(1E06H),A
2983	FE 00	0457	LD	A,(1E06H)
2985	C2 60 26	0458	CP	00H
2988	C1	0459	JP	NZ,RH0
2989	D1	0460	POP	BC
298A	3E 00	0461	POP	DE
298C	32 00 1E	0462	LD	A,00H
298F	C9	0463	LD	(1E0DH),A
2990	3E 6C	0464	RET	
2992	32 81 1E	0465	RH35	LD
2995	3E 62	0466	LD	A,6CH
2997	32 19 1E	0467	LD	(1E01H),A
299A	3E 67	0468	LD	A,62H
299C	32 05 1E	0469	LD	(1E19H),A
299F	3A 06 1E	0470	LD	A,67H
29A2	D6 01	0471	LD	(1E05H),A
29A4	32 06 1E	0472	LD	A,(1E06H)
29A7	3A 06 1E	0473	LD	(1E06H),A
29AA	FE 00	0474	SUB	01H
29AC	C2 60 26	0475	LD	A,(1E06H)
29AF	C1	0476	LD	A,(1E06H)
29B0	D1	0477	CP	00H
29B1	3E 00	0478	JP	NZ,RH0
29B3	32 00 1E	0479	POP	BC
29B6	C9	0480	POP	DE
29B7	3A 60 1E	0481	LD	A,00H
29BA	FE 50	0482	LD	(1E0DH),A
29BC	CA 73 28	0483	RET	
29BF	FE D0	0484	RH23	LD
29C1	CA D0 28	0485	LD	A,(1E60H)
29C4	FE 70	0486	CP	SPRAY
29C6	CA 10 28	0487	JP	Z,RH28
			CP	FSP
			JP	Z,RH32
			CP	SPC
			JP	Z,RH24

! saturation vapour pressure (svp)

29C9	FE 3C	0488	SVP	CP	3CH	;T = 12 'C
29C8	CA DD 29	0489		JP	Z,SVP1	
						;T = 12.2-21.4 'C
29CE	FE 6C	0490		CP	6CH	;T = 21.6 'C
29D8	CA E5 29	0491		JP	Z,SVP49	
						;T = 21.8-33.2 'C
29D3	FE A7	0492		CP	0A7H	;T = 33.4 'C
29D5	CA ED 29	0493		JP	Z,SVP115	
						;T = 33.6-39.8 'C
29D8	FE C8	0494		CP	0C8H	;T = 40 'C
29DA	CA F5 29	0495		JP	Z,SVP145	
29DD	3E 8C	0496	SVP1	LD	A,8CH	
29DF	32 32 1E	0497		LD	(1E32H),A	
29E2	C3 FD 29	0498		JP	RH36	
29E5	3E 01	0499	SVP49	LD	A,01H	
29E7	32 32 1E	0500		LD	(1E32H),A	
29EA	C3 03 2A	0501		JP	RH37	
29ED	3E 02	0502	SVP115	LD	A,02H	
29EF	32 32 1E	0503		LD	(1E32H),A	
29F2	C3 09 2A	0504		JP	RH38	
29F5	3E E1	0505	SVP145	LD	A,0E1H	
29F7	32 32 1E	0506		LD	(1E32H),A	
29FA	C3 09 2A	0507		JP	RH38	
29FD	3E 00	0508	RH36	LD	A,00H	
29FF	32 33 1E	0509		LD	(1E33H),A	
2A02	C9	0510		RET		
2A03	3E 01	0511	RH37	LD	A,01H	
2A05	32 33 1E	0512		LD	(1E33H),A	
2A08	C9	0513		RET		
2A09	3E 02	0514	RH38	LD	A,02H	
2A0B	32 33 1E	0515		LD	(1E33H),A	
2A0E	C9	0516		RET		

Errors

0

A>

ข. โปรแกรมส่งข้อมูล

```

0002
0003 *****
0004 *
0005 * TRANSFER DATA PROGRAM *
0006 *
0007 *****
0008 *
0009 *
0010 *
0011
0012 LD A,88H
0013 OUT (83H),A
0014 LD HL,1000H
0015 LD BC,0A00H
0016 LOOP2 LD A,00H
0017 OUT (80H),A
0018 LD D,(HL)
0019 LD A,01H
0020 OUT (80H),A
0021 CALL YY

0022 LD A,D
0023 LD E,08H
0024 LOOP1 OUT (80H),A
0025 CALL YY
0026 RRA
0027 DEC E
0028 JP NZ,LOOP1
0029 LD A,00H
0030 OUT (80H),A
0031 CALL YY
0032 CALL YY

0033 INC HL
0034 DEC BC
0035 LD A,B
0036 OR C
0037 JP NZ,LOOP2
0038 RST 18H

0039 YY PUSH BC
0040 LD B,12H
0041 LOOP4 LD C,15H
0042 LOOP3 DEC C
0043 JP NZ,LOOP3
0044 DJNZ LOOP4
0045 POP BC
0046 RET
*
*
*****END*****

```

ค. โปรแกรมรับข้อมูล

```

*****
*                                     *
*   TRANSFER DATA PROGRAM   *
*                                     *
*****
*
*
2000 1E      0000      PUSH DS
2001 B8 10 20 0001      MOV AX,2010H
2C 4 8E D8    0002      MOV DS,AX
2004 BA 79 03 0003      MOV DI,0379H
2005 27 00 00 0004      MOV SI,0000H
200C B9 00 0A 0005      MOV CX,0A00H

200F 51      0006 AA      PUSH CX
2010 EC      0007 CC      IN AL,DX
2011 24 10    0008      AND AL,10H
2013 74 FB    0009      JZ CC
2015 B9 B7 02 0010      MOV CX,02B7H
2016 E0 FE    0011      LOOP NZ,2018H
201A B1 04    0012      MOV CL,08H

201C 51      0013 BB      PUSH CX
201D EC      0014      IN AL,DX
201E B1 04    0015      MOV CL,04H
2020 D2 E0    0016      SHL AL,CL
2022 DC DB    0017      RCR BL,1
2024 59      0018      POP CX

2025 51      0019      PUSH CX
2026 B9 A1 01 0020      MOV CX,01A1H
2029 E0 FE    0021 DD      LOOP NZ,DD
202B 59      0022      POP CX
202C E0 EB    0023      LOOP NZ,BB
202E 48 1C    0024      MOV [SI],BL
2030 46      0025      INC SI
2031 59      0026      POP CX
2032 E0 DB    0027      LOOP NZ,AA
2034 1F      0028      POP DS
2035 CB      0029      RET F

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*****END*****


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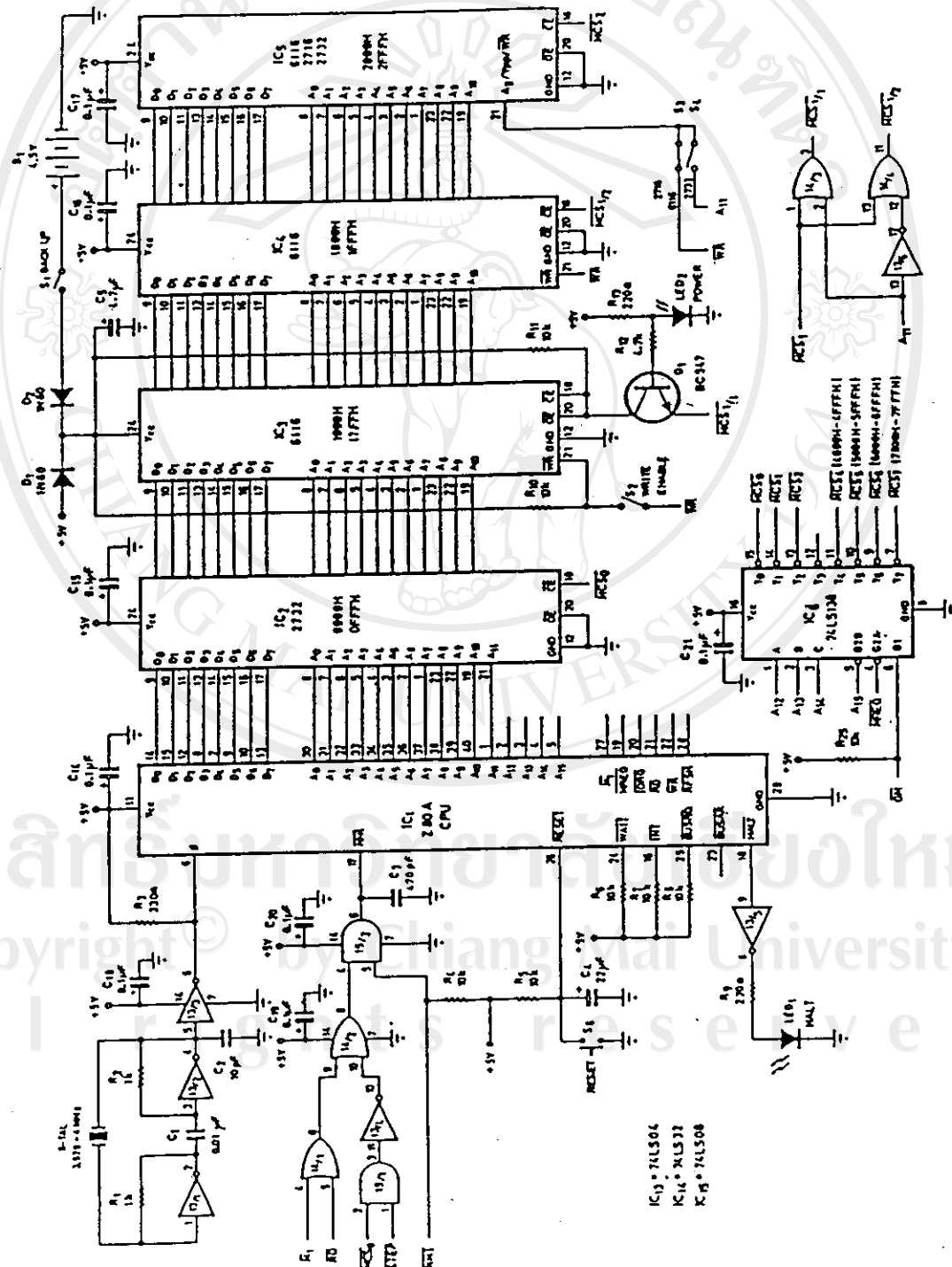
10 GOSUB 300
20 ' PROGRAM WRITE DATA
40 LOCATE 2,30:PRINT"PROGRAM TRANSFER DATA FROM RT. TO ME"
50 LOCATE 7,25:INPUT "NUMBER OF OBSERVATION (N) =";A
60 DEF SEG=&H2000
70 N=&H100
80 DIM D(5*A):N=9
90 'READ DATA FROM MEMORY
100 FOR I=1 TO 7*A
110 D(I)=PEEK(N):N=N+1:IF N=19 THEN N=9:LOCATE 19,26:PRINT " "
120 LOCATE 9,43:PRINT " N":LOCATE 9,57:PRINT "DATA"
130 LINE (200,80)-(550,100),,B:N=N+1
140 LOCATE N,41:PRINT ,I,D(I)
150 LOCATE N,39:PRINT " "
160 LOCATE N-1,39:PRINT " "
170 NEXT I
175 PRINT "Insert data diskette in drive A: "
180 FOR I=1 TO 8 :BEEP:NEXT I
190 FOR J=1 TO 7
200 INPUT "NAME OF FILE :XXXX.PRN=";FILES$
210 OPEN FILES$ FOR APPEND ASE1
220 FOR I=J TO 7*A STEP 7
230 WRITE #1,D(I)
240 NEXT I
250 CLOSE #1
260 NEXT J

270 PRINT "-----"
280 END
300 CLS
310 DEF SEG=&H2000
320 DIM X(80)
330 OPEN "REC00.BAS" FOR INPUT ASE1
340 FOR I = 0 TO 54
350 IF EOF (1) THEN 400
360 INPUT #1,X(I)
370 POKE I,X(I)
380 NEXT I
385 CLOSE #1
395 LOCATE 2,30:PRINT " WELCOME TO RN-PROGRAM "
400 LOCATE 4,25:INPUT "Total numbers of data observation:(7*N)= ";L
405 LOCATE 4,50:PRINT "NOW RUN RT. TO TRANSFER DATA TO ME....."
410 NB = INT (L/256): LB = L - NB*256
420 DEF SEG=&H2000:A=0
430 POKE 13,LB:POKE 14,NB:CALL A
440 LOCATE 5,50:PRINT "DATA READY IN MEMORY!!!!"
450 RETURN

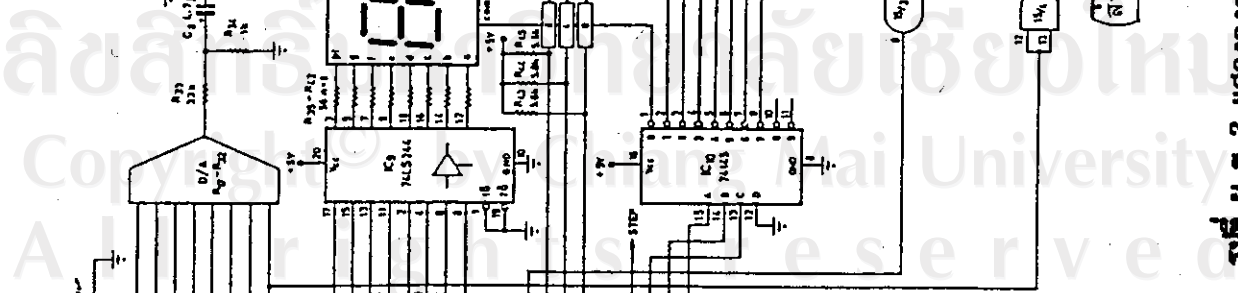
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ภาคผนวก ข

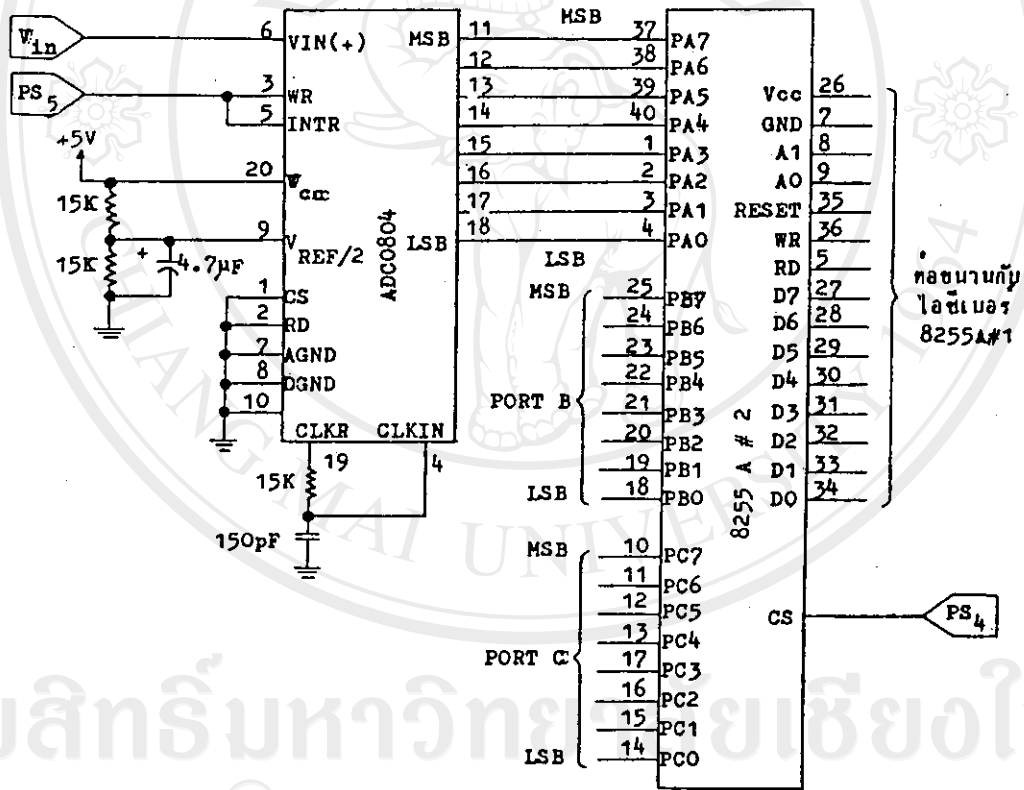
แสดงรายละเอียดคาร์ดแวร์ของซิงเกิลบอร์ด



รูปที่ ผ.ข.1 แสดงวงจรรหัส CPU+ROM+RAM+CLOCK+DECODE ของซิงเกิลบอร์ด



รูปที่ ๙.๑.๒ แสดงวงจรส่วน I/O PORT+DISPLAY+KEYBOARD ของเครื่องคอมพิวเตอร์



ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
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รูปที่ ผ.บ.3 แสดงวงจรแปลงสัญญาณอะนาล็อกเป็นดิจิทัล

ภาคผนวก ค

คุณสมบัติของไอซีต่าง ๆ ที่ใช้ทดลอง

CD4067B, CD4097B Types

COS/MOS Analog
Multiplexers/Demultiplexers

High-Voltage Types (20-Volt Rating)

CD4067B – Single 16-Channel
Multiplexer/DemultiplexerCD4097B – Differential 8-Channel
Multiplexer/Demultiplexer

The RCA-CD4067B and CD4097B COS/MOS analog multiplexers/demultiplexers* are digitally controlled analog switches having low ON impedance, low OFF leakage current, and internal address decoding. In addition, the ON resistance is relatively constant over the full input-signal range.

The CD4067B is a 16-channel multiplexer with four binary control inputs, A, B, C, D, and an inhibit input, arranged so that any combination of the inputs selects one switch.

The CD4097B is a differential 8-channel multiplexer having three binary control inputs, A, B, C, and an inhibit input. The inputs permit selection of one of eight pairs of switches.

A logic "1" present at the inhibit input turns all channels off.

The CD4067 and CD4097 are supplied in 24-lead dual-in-line white ceramic packages (D suffix), 24-lead ceramic flat-packs (K suffix), 24-lead dual-in-line frit-seal ceramic packages (F suffix), 24-lead dual-in-line plastic packages (E suffix), and in chip form (H suffix).

When these devices are used as demultiplexers, the channel in/out terminals are the outputs and the common out/in terminals are the inputs.

Recommended Operating Conditions at $T_A = 25^\circ\text{C}$ (Unless Otherwise Specified)

For maximum reliability, nominal operating conditions should be selected so that operation is always within the following ranges. Values shown apply to all types except as noted.

Characteristic	Min.	Max.	Units
Supply-Voltage Range (If Full Package-Temp. Range)	3	18	V
Multiplexer Switch Input Current Capability	—	25	mA
Output Load Resistance	100	—	Ω

NOTE:

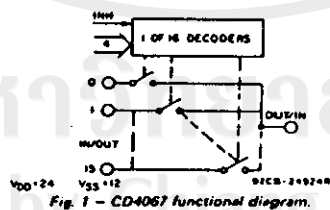
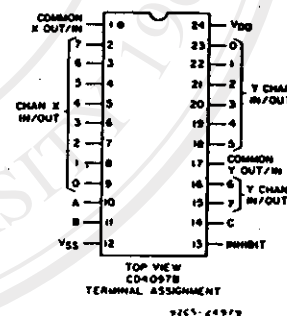
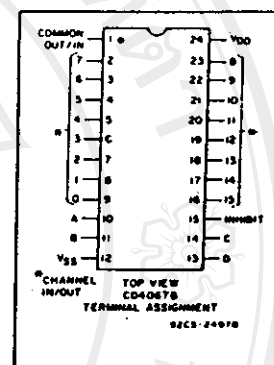
In certain applications, the external load-resistor current may include both VDD and signal-line components. To avoid drawing VDD current when switch current flows into the transmission gate inputs, the voltage drop across the bidirectional switch must not exceed 0.8 volt (calculated from R_{DS} values shown in ELECTRICAL CHARACTERISTICS CHART). No VDD current will flow through R_L if the switch current flows into terminal 1 on the CD4067; terminals 1 and 17 on the CD4097.

Features:

- Low ON resistance: $125\ \Omega$ (typ.) over 15 Vp-p signal-input range for VDD–VSS=15 V
- High OFF resistance: channel leakage of $\pm 10\ \text{pA}$ (typ.) @ VDD–VSS=10 V
- Matched switch characteristics: $R_{ON}=5\ \Omega$ (typ.) for VDD–VSS=15 V
- Very low quiescent power dissipation under all digital-control input and supply conditions: $0.2\ \mu\text{W}$ (typ.) @ VDD–VSS=10 V
- Binary address decoding on chip
- 5-V, 10-V, and 15-V parametric ratings
- 100% tested for quiescent current at 20 V
- Standardized symmetrical output characteristics
- Maximum input current of $1\ \mu\text{A}$ at 18 V over full package temperature range; $100\ \text{nA}$ at 18 V and 25°C
- Meets all requirements of JEDEC Tentative Standard No. 13A, "Standard Specifications for Description of 'B' Series CMOS Devices"

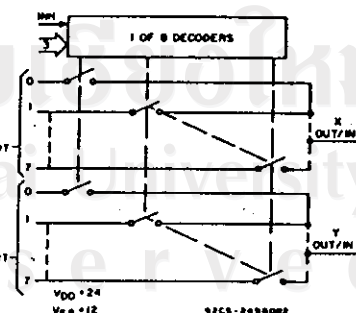
Applications:

- Analog and digital multiplexing and demultiplexing
- A/D and D/A conversion
- Signal gating



CD4067 TRUTH TABLE

A	B	C	D	Inh	Selected Channel
X	X	X	X	1	None
0	0	0	0	0	0
1	0	0	0	0	1
0	1	0	0	0	2
1	1	0	0	0	3
0	0	1	0	0	4
1	0	1	0	0	5
0	1	1	0	0	6
1	1	1	0	0	7
0	0	0	1	0	8
1	0	0	1	0	9
0	1	0	1	0	10
1	1	0	1	0	11
0	0	1	1	0	12
1	0	1	1	0	13
0	1	1	1	0	14
1	1	1	1	0	15



CD4097 TRUTH TABLE

A	B	C	Inh	Selected Channel
X	X	X	1	None
0	0	0	0	0X, 0Y
1	0	0	0	1X, 1Y
0	1	0	0	2X, 2Y
1	1	0	0	3X, 3Y
0	0	1	0	4X, 4Y
1	0	1	0	5X, 5Y
0	1	1	0	6X, 6Y
1	1	1	0	7X, 7Y

CD4067B, CD4097B Types

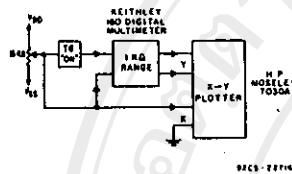


Fig. 13-Channel ON resistance measurement circuit.

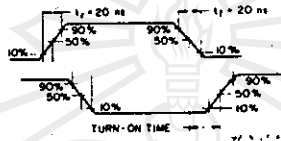
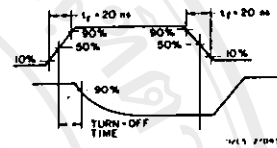
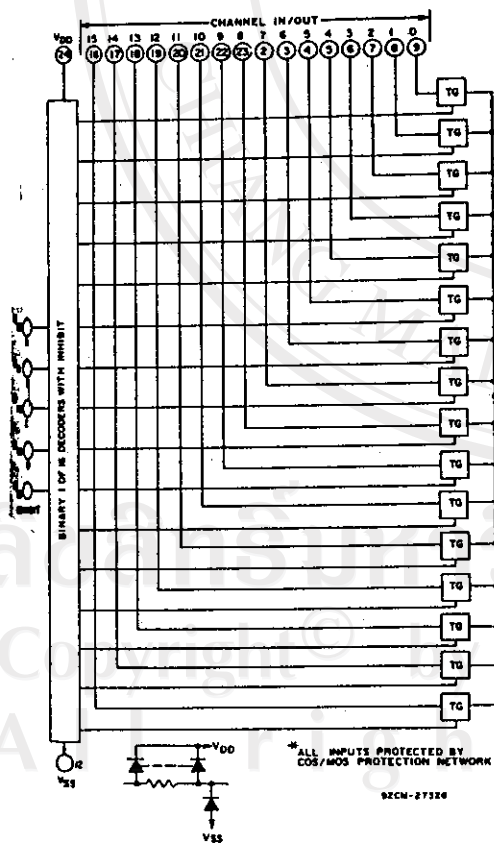
Fig. 14-Propagation delay waveform channel being turned ON ($R_L = 10\text{ K}\Omega$, $C_L = 50\text{ pF}$).Fig. 15-Propagation delay waveform, channel being turned OFF ($R_L = 300\ \Omega$, $C_L = 50\text{ pF}$).

Fig. 16-CD4067 logic diagram.

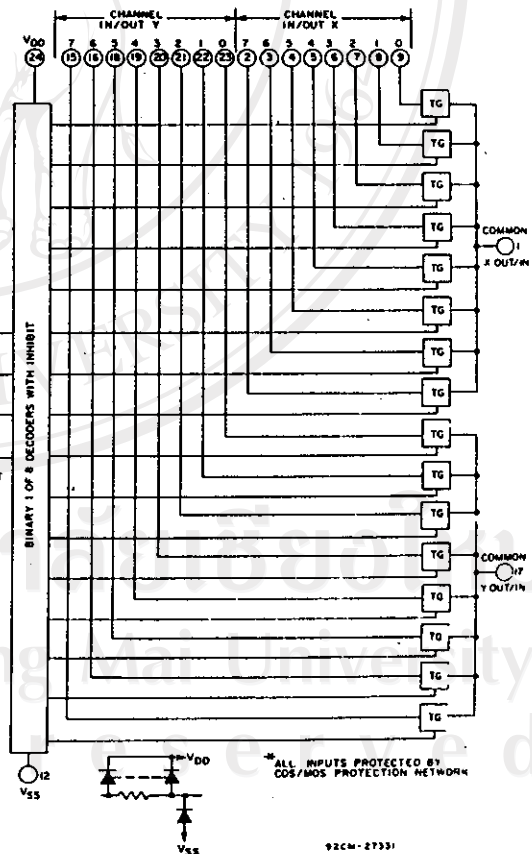


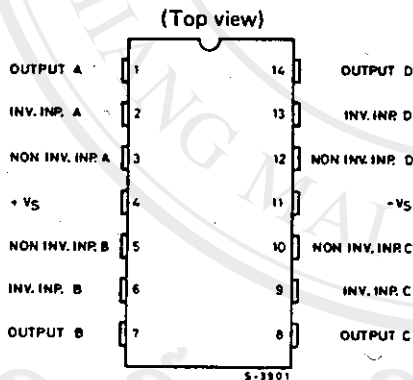
Fig. 17-CD4097 logic diagram.



ABSOLUTE MAXIMUM RATINGS

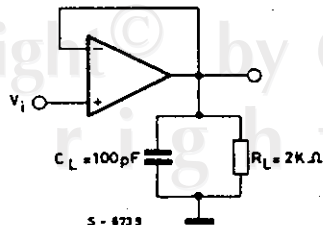
V_s	Supply voltage	± 18	V
V_k	Differential input voltage	± 30	V
V_i	Input voltage	± 15	V
T_{op}	Operating temperature (TL084I) (TL084C) (TL084M)	-25 to 85 0 to 70 -55 to 125	$^{\circ}\text{C}$
T_j	Junction temperature	150	$^{\circ}\text{C}$
T_{stg}	Storage temperature	-55 to 150	$^{\circ}\text{C}$

CONNECTION DIAGRAM AND ORDERING NUMBERS

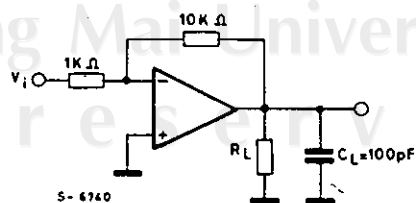


0 to 70°C	-25 + 85°C	-55 + 125°C	Package
TL084CJ TL084ACJ TL084BCJ	TL084IJ — —	TL084MJ — —	Ceramic DIP-14
TL084CN TL084ACN TL084BCN	TL084IN — —	— — —	Plastic DIP-14
TL084CD	TL084ID	—	SO-14

TEST CIRCUIT



Unity gain amplifier



Gain of 10 inverting amplifier

THERMAL DATA

THERMAL DATA			Ceramic DIP-14	SO-14	Plastic DIP-14
$R_{th j-amb}$	Thermal resistance junction-ambient	max	150°C/W	165°C/W	200°C/W

Fig. 1 — Maximum peak to peak output voltage vs. frequency.

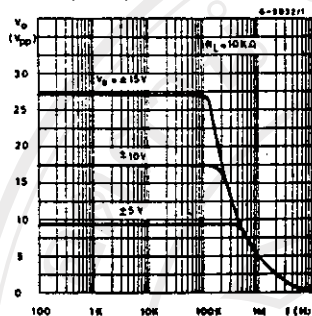


Fig. 2 — Maximum peak to peak output voltage vs. frequency.

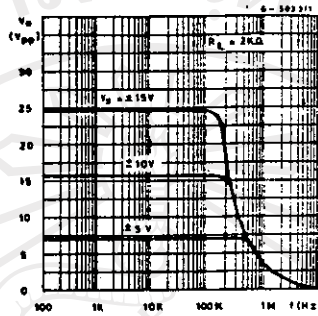


Fig. 3 — Maximum peak to peak output voltage vs. load resistance.

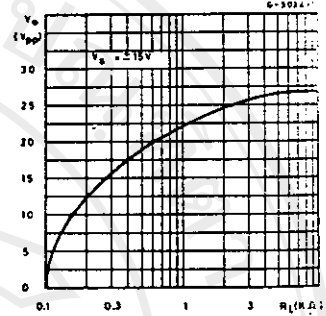


Fig. 4 — Large signal voltage gain and phase shift vs. frequency.

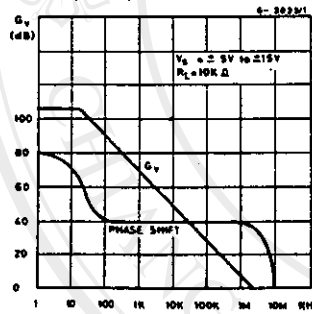


Fig. 5 — Supply current vs. temperature.

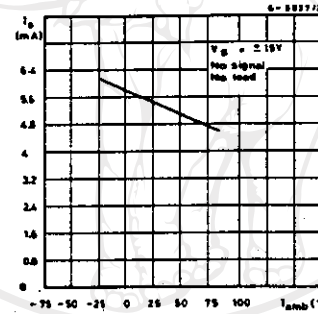


Fig. 6 — Supply current vs. supply voltage.

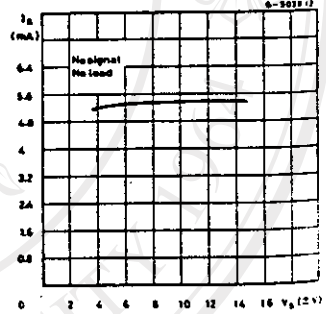


Fig. 7 — Input bias current vs. temperature.

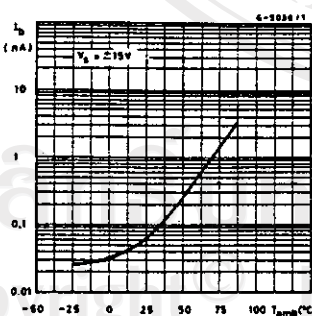


Fig. 8 — Voltage follower large signal pulse response.

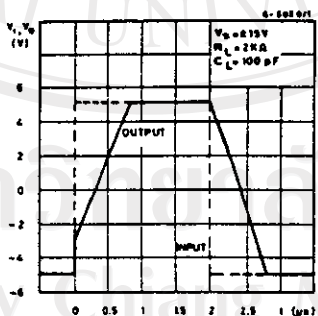


Fig. 9 — Output voltage vs. elapsed time.

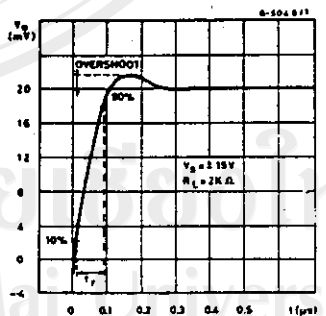


Fig. 10 — Equivalent input noise voltage vs. frequency.

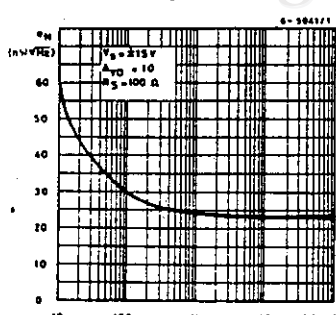


Fig. 11 — Total harmonic distortion vs. frequency.

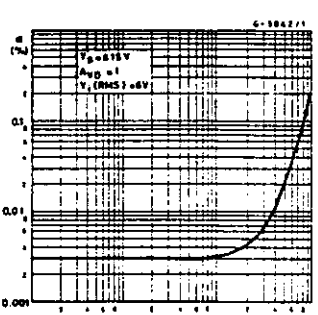
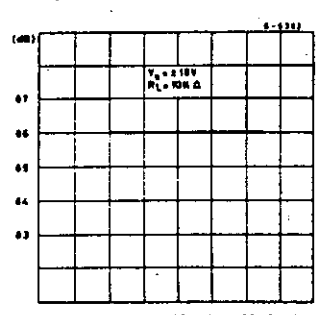


Fig. 12 — Common mode rejection vs. temperature.



ELECTRICAL CHARACTERISTICS ($V_s = \pm 15V$, $T_{amb} = 25^\circ C$, otherwise specified)

Parameter	Test Conditions		"I"			"C"			"M"			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
V_{OS} Input offset voltage	$R_s = 50\Omega$	TL084		3	6		5	16		3	9	mV
		TL084A					3	6				
		TL084B					2	3				
	$R_s = 50\Omega$ $T_{amb} = \text{full range}$	TL084			9		20				15	
		TL084A					7.5					
		TL084B					5					
$\frac{\Delta V_{OS}}{\Delta T}$ Input offset voltage drift	$R_s = 50\Omega$ $T_{amb} = \text{full range}$			10			10			10	$\mu V/^\circ C$	
I_{OS} Input offset current		TL084		5	100		5	200		5	100	pA
		TL084A					5	100				
		TL084B					5	100				
	$T_{amb} = \text{full range}$	TL084			10		5				20	
		TL084A					3					
		TL084B					3					
I_b Input bias current		TL084		30	200		30	400		30	200	pA
		TL084A					30	200				
		TL084B					30	200				
	$T_{amb} = \text{full range}$	TL084			20		10				50	
		TL084A					7					
		TL084B					7					
V_{CM} Common mode input voltage range		TL084	± 11	± 12		± 10	± 11		± 11	± 12	V	
		TL084A				± 11	± 12					
		TL084B				± 11	± 12					
V_{OPP} Large signal voltage gain	$R_L = 10K\Omega$ $T_{amb} = \text{full range}$	$R_L = 10K\Omega$	24	27		24	27		24	27	V	
		$R_L > 10K\Omega$	24			24			24			
		$R_L > 2K\Omega$	20	24		20	24		20	24		
G_V Large signal voltage gain	$R_L > 2K\Omega$ $V_o = \pm 10V$	TL084	50	200		25	200				V/mV	
		TL084A				50	200					
		TL084B				50	200					
	$R_L > 2K\Omega$ $V_o = \pm 10V$ $T_{amb} = \text{full range}$	TL084	25			15			15			
		TL084A				25						
		TL084B				25						
B Unity gain bandwidth			3			3			3		MHz	
R_i Input resistance			10^{12}			10^{12}			10^{12}		Ω	
CMR Common mode rejection	$R_s > 10K\Omega$	TL084	80	86		70	86		80	86	dB	
		TL084A				80	86					
		TL084B				80	86					
SVR Supply voltage rejection	$R_s > 10K\Omega$	TL084	80	86		70	86		80	86	dB	
		TL084A				80	86					
		TL084B				80	86					
I_S Supply current	$R_L = \infty$			5.6	11.2		5.6	11.2		5.6	11.2	mA
Parameter	Test Conditions		"I"			"C"			"M"			Unit
			Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	
CS Channel separation	$G_V = 100$			120			120			120		dB
SR Slew-rate at unity gain	$V_i = 10V$ $C_L = 100pF$	$R_L = 2K\Omega$		13			12		8	13		V/ μs
t_r Rise time	$V_i = 20mV$ $C_L = 100pF$	$R_L = 2K\Omega$		0.1			0.1			0.1		μs
				10			10			10		%
e_N Total input noise Voltage	$R_s = 100\Omega$ $f = 1KHz$			25			25			25		$\frac{nV}{\sqrt{Hz}}$


MOTOROLA
OPTICALLY ISOLATED TRIAC DRIVERS

These devices consist of gallium-arsenide infrared-emitting diodes, optically coupled to silicon bilateral switches. They are designed for applications requiring isolated triac triggering.

- UL Recognized File Number E54915
- Output Driver Designed for 220 Vac Line
- V_{ISO} Isolation Voltage of 7500 V Peak
- Standard 6-Pin Plastic DIP

MAXIMUM RATINGS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Rating	Symbol	Value	Unit
INFRARED EMITTING DIODE MAXIMUM RATINGS			
Reverse Voltage	V_R	3.0	Volts
Forward Current - Continuous	I_F	50	mA
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Negligible Power in Triac Driver Derate above 25°C	P_D	100	mW
		1.33	mW/ $^\circ\text{C}$

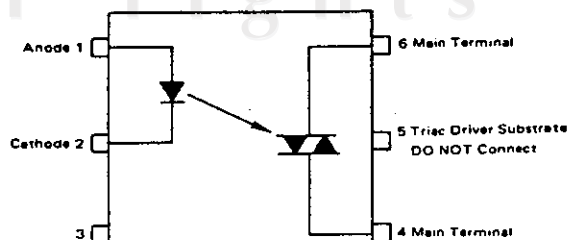
OUTPUT DRIVER MAXIMUM RATINGS

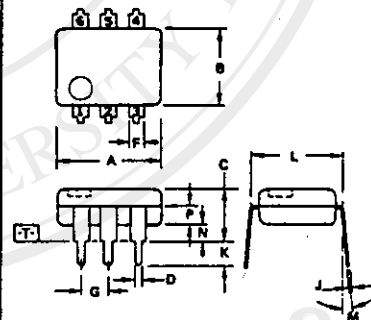
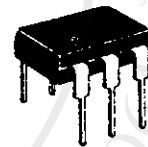
Off-State Output Terminal Voltage	V_{ORM}	400	Volts
On-State RMS Current $T_A = 25^\circ\text{C}$ (Full Cycle, 50 to 60 Hz) $T_A = 70^\circ\text{C}$	$I_T(\text{RMS})$	100 50	mA
Peak Nonrepetitive Surge Current (PW = 10 ms, DC = 10%)	I_{TSM}	1.2	A
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	300	mW
		4.0	mW/ $^\circ\text{C}$

TOTAL DEVICE MAXIMUM RATINGS

Isolation Surge Voltage (1) (Peak ac Voltage, 60 Hz, 5 Second Duration)	V_{ISO}	7500	Vac
Total Power Dissipation @ $T_A = 25^\circ\text{C}$ Derate above 25°C	P_D	330	mW
		4.4	mW/ $^\circ\text{C}$
Junction Temperature Range	T_J	-40 to +100	$^\circ\text{C}$
Ambient Operating Temperature Range	T_A	-40 to +70	$^\circ\text{C}$
Storage Temperature Range	T_{stg}	-40 to +150	$^\circ\text{C}$
Soldering Temperature (10 s)	-	260	$^\circ\text{C}$

(1) Isolation Surge Voltage, V_{ISO} , is an internal device dielectric breakdown rating.


**MOC3020
MOC3021
MOC3022
MOC3023**
**OPTO
COUPLER/ISOLATOR**
PHOTO TRIAC DRIVER
OUTPUT

400 VOLTS

STYLE 6:

1. ANODE
2. CATHODE
3. NC
4. MAIN TERMINAL
5. SUBSTRATE
6. MAIN TERMINAL

- NOTES:
1. DIMENSIONS A AND B ARE DATUMS.
 2. [T] IS SEATING PLANE.
 3. POSITIONAL TOLERANCES FOR LEADS:
[Q] 0.13 (0.005) [Q] [T] A [Q] [Q]
 4. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
 5. DIMENSIONING AND TOLERANCING PER ANSI Y14.5, 1973.

DIM	MIN	MAX	MIN	MAX
A	6.13	8.89	0.320	0.350
B	6.10	6.60	0.240	0.260
C	2.92	5.08	0.115	0.200
D	0.41	0.51	0.016	0.020
E	1.02	1.78	0.040	0.070
F	2.54 BSC		0.100 BSC	
G	0.20	0.30	0.008	0.012
H	2.54	3.81	0.100	0.150
I	7.62 BSC		0.300 BSC	
J	0.00	1.50	0.00	1.50
K	0.38	2.54	0.015	0.100
L	1.27	2.03	0.050	0.080

CASE 730A-01

MOC3020, MOC3021, MOC3022, MOC3023

ELECTRICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
LED CHARACTERISTICS					
Reverse Leakage Current ($V_R = 3.0\text{ V}$)	I_R	—	0.05	100	μA
Forward Voltage ($I_F = 10\text{ mA}$)	V_F	—	1.2	1.5	Volts
DETECTOR CHARACTERISTICS ($I_F = 0$ unless otherwise noted)					
Peak Blocking Current, Either Direction (Rated V_{DRM} , Note 1)	I_{DRM}	—	10	100	nA
Peak On-State Voltage, Either Direction ($I_{TM} = 100\text{ mA Peak}$)	V_{TM}	—	2.5	3.0	Volts
Critical Rate of Rise of Off-State Voltage, $T_A = 85^\circ\text{C}$	dv/dt	—	12	—	$\text{V}/\mu\text{s}$
COUPLED CHARACTERISTICS					
LED Trigger Current, Current Required to Latch Output (Main Terminal Voltage = 3.0 V, Note 2)	I_{FT}	—	15	30	mA
	MOC3020	—	8.0	15	
	MOC3021	—	—	10	
	MOC3022	—	—	5.0	
	MOC3023	—	—	—	
Holding Current, Either Direction	I_H	—	100	—	μA

Note 1. Test voltage must be applied within dv/dt rating.

2. All devices are guaranteed to trigger at an I_F value less than or equal to max I_{FT} .

TYPICAL ELECTRICAL CHARACTERISTICS

$T_A = 25^\circ\text{C}$

FIGURE 1 — ON-STATE CHARACTERISTICS

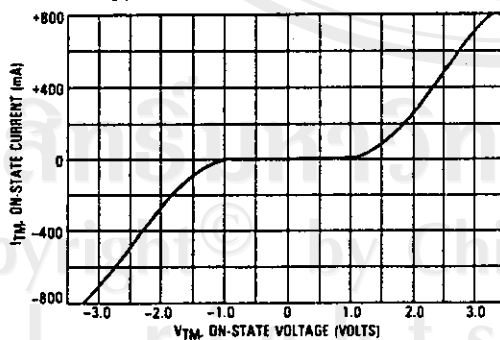


FIGURE 2 — TRIGGER CURRENT versus TEMPERATURE

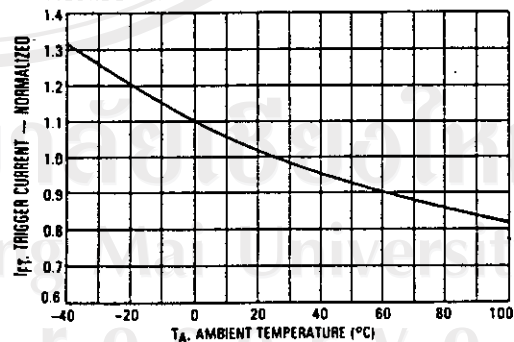
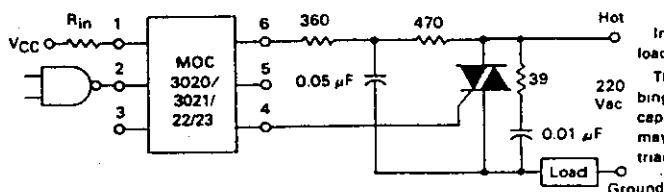


FIGURE 3 — TYPICAL APPLICATION CIRCUIT



In this circuit the "hot" side of the line is switched and the load connected to the cold or ground side.

The 39 ohm resistor and 0.01 μF capacitor are for snubbing of the triac, and the 470 ohm resistor and 0.05 μF capacitor are for snubbing the coupler. These components may or may not be necessary depending upon the particular triac and load used.

Additional information on the use of optically coupled triac drivers is available in Application Note AN-780A.



Sensors/Transducers

LM135/LM235/LM335, LM135A/LM235A/LM335A Precision Temperature Sensors

General Description

The LM135 series are precision, easily-calibrated, integrated circuit temperature sensors. Operating as a 2-terminal zener, the LM135 has a breakdown voltage directly proportional to absolute temperature at $+10 \text{ mV}/^\circ\text{K}$. With less than 1Ω dynamic impedance the device operates over a current range of $400 \mu\text{A}$ to 5 mA with virtually no change in performance. When calibrated at 25°C the LM135 has typically less than 1°C error over a 100°C temperature range. Unlike other sensors the LM135 has a linear output.

Applications for the LM135 include almost any type of temperature sensing over a -55°C to $+150^\circ\text{C}$ temperature range. The low impedance and linear output make interfacing to readout or control circuitry especially easy.

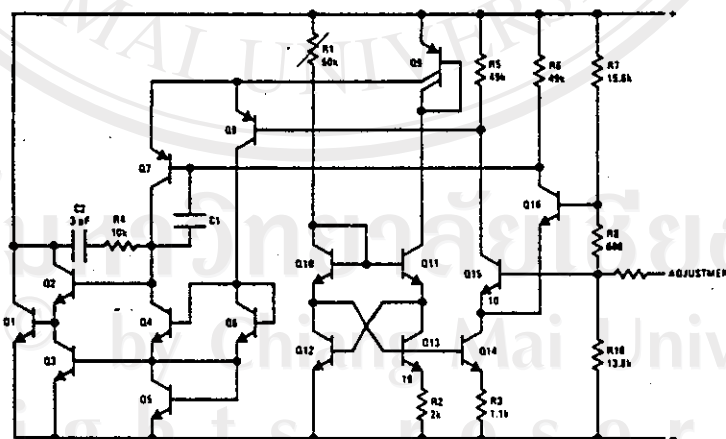
The LM135 operates over a -55°C to $+150^\circ\text{C}$ temperature range while the LM235 operates over a -40°C

to $+125^\circ\text{C}$ temperature range. The LM335 operates from -10°C to $+100^\circ\text{C}$. The LM135/LM235/LM335 are available packaged in hermetic TO-46 transistor packages while the LM235 and LM335 are also available in plastic TO-92 packages.

Features

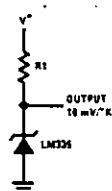
- Directly calibrated in $^\circ\text{Kelvin}$
- 1°C initial accuracy available
- Operates from $400 \mu\text{A}$ to 5 mA
- Less than 1Ω dynamic impedance
- Easily calibrated
- Wide operating temperature range
- 200°C overrange
- Low cost

Schematic Diagram

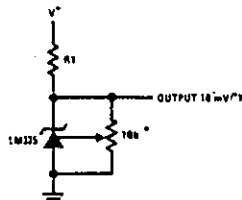


Typical Applications

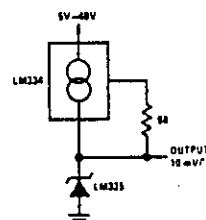
Basic Temperature Sensor



Calibrated Sensor



Wide Operating Supply



Absolute Maximum Ratings

Reverse Current	10 mA
Forward Current	10 mA
Storage Temperature	
TO-46 Package	-60°C to +180°C
TO-92 Package	-60°C to +150°C
Specified Operating Temperature Range	
	Continuous Intermittent
LM135, LM135A	-55°C to +150°C 150°C to 200°C
LM235, LM235A	-40°C to +125°C 125°C to 150°C
LM335, LM335A	-10°C to +100°C 100°C to 125°C
Lead Temperature (Soldering, 10 seconds)	300°C

Temperature Accuracy LM135/LM235, LM135A/LM235A (Note 1)

PARAMETER	CONDITIONS	LM135A/LM235A			LM135/LM235			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
Operating Output Voltage	$T_C = 25^\circ\text{C}$, $I_R = 1\text{ mA}$	2.97	2.98	2.99	2.95	2.98	3.01	V
Uncalibrated Temperature Error	$T_C = 25^\circ\text{C}$, $I_R = 1\text{ mA}$		0.5	1		1	3	°C
Uncalibrated Temperature Error	$T_{\text{MIN}} < T_C < T_{\text{MAX}}$, $I_R = 1\text{ mA}$		1.3	2.7		2	5	°C
Temperature Error with 25°C Calibration	$T_{\text{MIN}} < T_C < T_{\text{MAX}}$, $I_R = 1\text{ mA}$		0.3	1		0.5	1.5	°C
Calibrated Error at Extended Temperatures	$T_C = T_{\text{MAX}}$ (Intermittent)		2			2		°C
Non-Linearity	$I_R = 1\text{ mA}$		0.3	0.5		0.3	1	°C

Temperature Accuracy LM335, LM335A (Note 1)

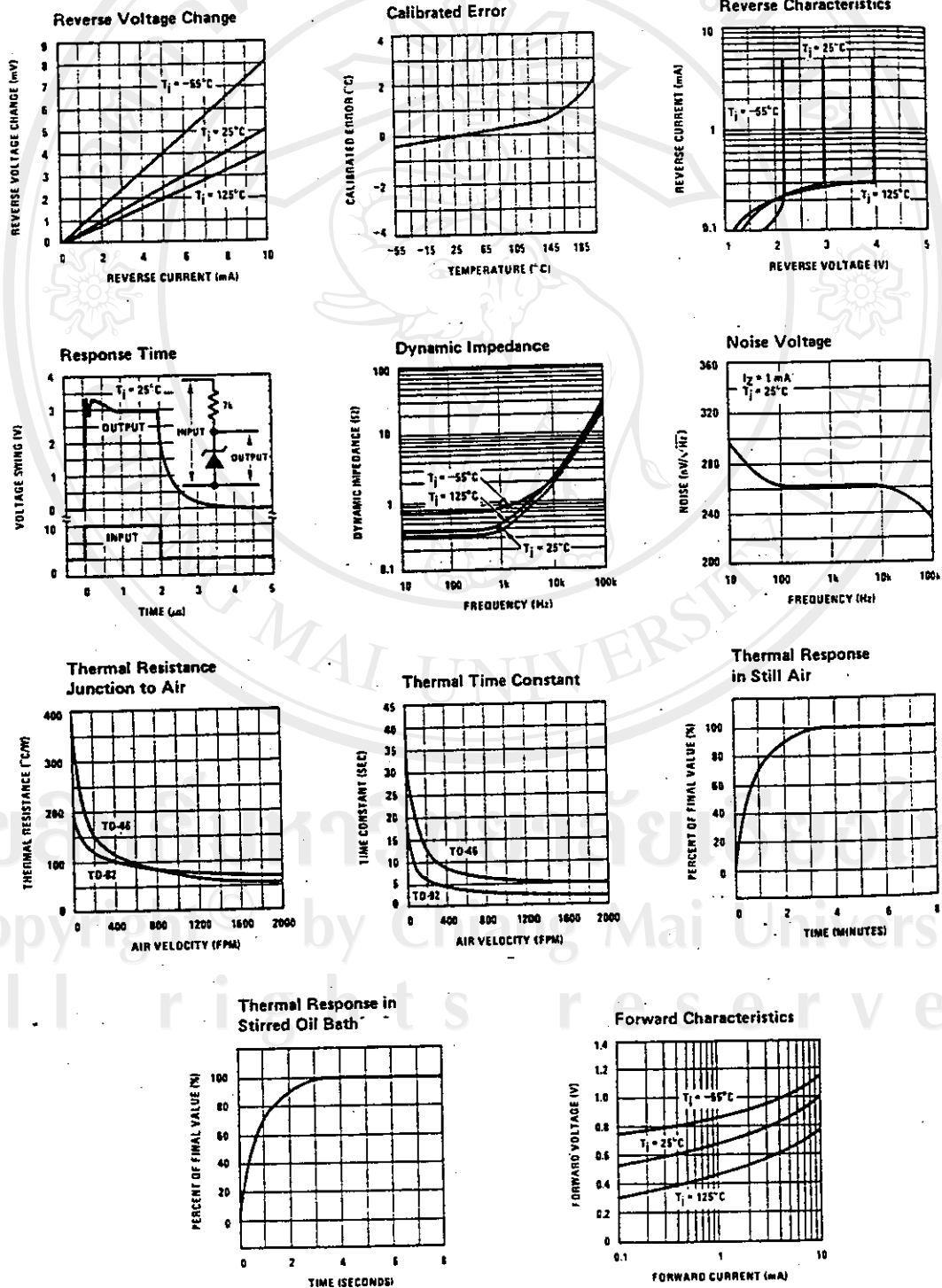
PARAMETER	CONDITIONS	LM335A			LM335			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
Operating Output Voltage	$T_C = 25^\circ\text{C}$, $I_R = 1\text{ mA}$	2.95	2.98	3.01	2.92	2.98	3.04	V
Uncalibrated Temperature Error	$T_C = 25^\circ\text{C}$, $I_R = 1\text{ mA}$		1	3		2	6	°C
Uncalibrated Temperature Error	$T_{\text{MIN}} < T_C < T_{\text{MAX}}$, $I_R = 1\text{ mA}$		2	5		4	9	°C
Temperature Error with 25°C Calibration	$T_{\text{MIN}} < T_C < T_{\text{MAX}}$, $I_R = 1\text{ mA}$		0.5	1		1	2	°C
Calibrated Error at Extended Temperatures	$T_C = T_{\text{MAX}}$ (Intermittent)		2			2		°C
Non-Linearity	$I_R = 1\text{ mA}$		0.3	1.5		0.3	1.5	°C

Electrical Characteristics (Note 1)

PARAMETER	CONDITIONS	LM135/LM235 LM135A/LM235A			LM335 LM335A			UNITS
		MIN	TYP	MAX	MIN	TYP	MAX	
Operating Output Voltage Change with Current	$400\text{ }\mu\text{A} < I_R < 5\text{ mA}$ At Constant Temperature		2.5	10		3	14	mV
Dynamic Impedance	$I_R = 1\text{ mA}$		0.5			0.6		Ω
Output Voltage Temperature Drift			+10			+10		mV/°C
Time Constant	Still Air		80			80		sec
	100 ft/Min Air		10			10		sec
	Stirred Oil		1			1		sec
Time Stability	$T_C = 125^\circ\text{C}$		0.2			0.2		°C/khr

Note 1: Accuracy measurements are made in a well-stirred oil bath. For other conditions, self heating must be considered.

Typical Performance Characteristics



INTERMIL

ICL741/AD741/ LM741/ μ A741 **Operational Amplifiers**

GENERAL DESCRIPTION

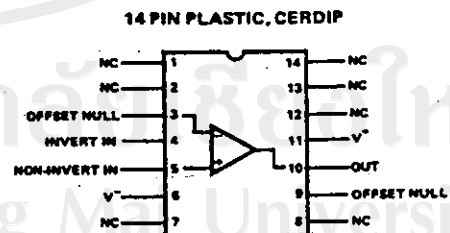
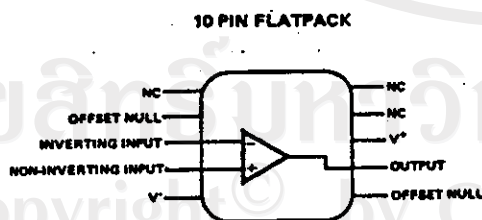
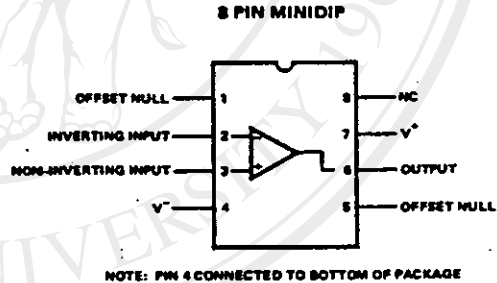
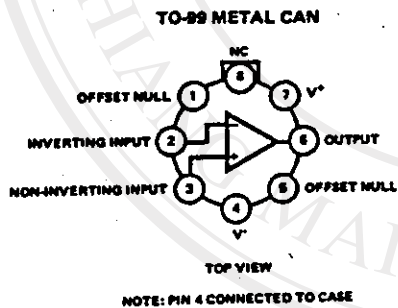
The 741 and 741C are general purpose operational amplifiers which feature improved performance over industry standards like the LM709. They are direct, plug-in replacements for the 709C, LM201, MC1439 and 748 in most applications.

The offset voltage and offset current are guaranteed over the entire common mode range. The amplifiers also offer

many features which make their application nearly fool-proof: overload protection on the input and output, no latch-up when the common mode range is exceeded, as well as freedom from oscillations.

The 741C is identical to the 741 except that the 741C has its performance guaranteed over a 0°C to 70°C temperature range, instead of -55°C to 125°C.

CONNECTION DIAGRAMS



	TO-99 CAN (TY)	8-PIN MINIDIP (PA)	14 PIN PLASTIC (PD)	14 PIN CERDIP (JD)	10 PIN FLATPACK (FB)
LM741 LM741C	LM741H LM741CH	LM741CN	LM741CN-14	LM741J LM741CJ	LM741CJ
μ A741 μ A741C	μ A741HM μ A741HC	μ A741TC	μ A741PC	μ A741DM μ A741DC	μ A741FM
AD741 AD741C	AD741H AD741CH	AD741CN			
ICL741 ICL741C	ICL741MTY ICL741CTY	ICL741CPA	ICL741CPD	ICL741MJD ICL741CJD	ICL741MFB

ICL741/AD741/LM741/ μ A741

INTERMIL

ABSOLUTE MAXIMUM RATINGS

Supply Voltage 741	$\pm 22V$
741C	$\pm 18V$
Power Dissipation (Note 1)	500 mW
Differential Input Voltage	$\pm 30V$
Input Voltage (Note 2)	$\pm 15V$
Output Short Circuit Duration	Indefinite
Operating Temperature Range 741	$-55^{\circ}C$ to $125^{\circ}C$
741C	$0^{\circ}C$ to $70^{\circ}C$
Storage Temperature Range	$-65^{\circ}C$ to $150^{\circ}C$
Lead Temperature: Soldering, 10 sec.	$300^{\circ}C$

NOTE: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent device failure. These are stress ratings only and functional operation of the devices at these or any other conditions above those indicated in the operation sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may cause device failures.

ELECTRICAL CHARACTERISTICS (Note 3)

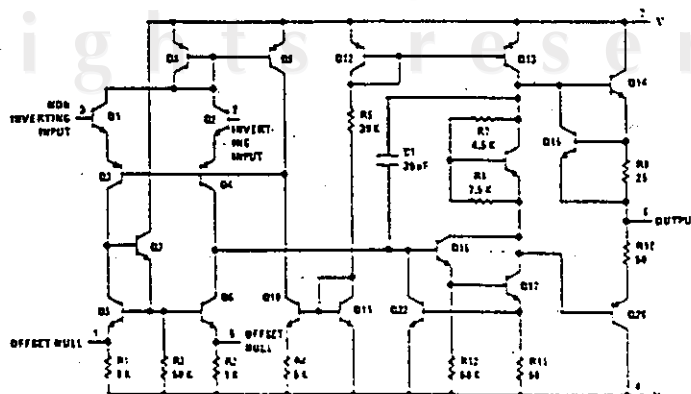
PARAMETER	CONDITIONS	741			741C			UNITS
		MIN.	TYP.	MAX.	MIN.	TYP.	MAX.	
Input Offset Voltage	$T_A = 25^{\circ}C, R_S < 10\text{ k}\Omega$		1.0	5.0		1.0	6.0	mV
Input Offset Current	$T_A = 25^{\circ}C$		30	200		30	200	nA
Input Bias Current	$T_A = 25^{\circ}C$		200	500		200	500	nA
Input Resistance	$T_A = 25^{\circ}C$	0.3	1.0		0.3	1.0		M Ω
Supply Current	$T_A = 25^{\circ}C, V_S = \pm 15V$		1.7	2.8		1.7	2.8	mA
Large Signal Voltage Gain	$T_A = 25^{\circ}C, V_S = \pm 15V$ $V_{OUT} = \pm 10V, R_L > 2\text{ k}\Omega$	50	160		25	160		V/mV
Input Offset Voltage	$R_S < 10\text{ k}\Omega$			6.0			7.5	mV
Input Offset Current				500			300	nA
Input Bias Current				1.5			0.8	μA
Large Signal Voltage Gain	$V_S = \pm 15V, V_{OUT} = \pm 10V$ $R_L > 2\text{ k}\Omega$	25			15			V/mV
Output Voltage Swing	$V_S = \pm 15V, R_L = 10\text{ k}\Omega$ $R_L = 2\text{ k}\Omega$	± 12 ± 10	± 14 ± 13		± 12 ± 10	± 14 ± 13		V
Input Voltage Range	$V_S = \pm 15V$	± 12			± 12			V
Common Mode Rejection Ratio	$R_S < 10\text{ k}\Omega$	70	90		70	90		dB
Supply Voltage Rejection Ratio	$R_S < 10\text{ k}\Omega$	77	96		77	96		dB

Note 1: The maximum junction temperature of the 741 is $150^{\circ}C$, while that of the 741C is $100^{\circ}C$. For operating at elevated temperatures, devices in the TO-8 package must be derated based on a thermal resistance of $150^{\circ}C/W$, junction to case.

Note 2: For supply voltages less than $\pm 15V$, the absolute maximum input voltage is equal to the supply voltage.

Note 3: These specifications apply for $V_S = \pm 15V$ and $-55^{\circ}C \leq T_A \leq 125^{\circ}C$, unless otherwise specified. With the 741C, however, all specifications are limited to $0^{\circ}C \leq T_A \leq 70^{\circ}C$ and $V_S = \pm 15V$.

SCHEMATIC DIAGRAM



ประวัติการศึกษา

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มัธยมศึกษาปีที่ 5	โรงเรียนเบญจมราชูทิศ จ.นครศรีธรรมราช	2521
การศึกษานัดเกิด	มหาวิทยาลัยศรีนครินทรวิโรฒ จ.สงขลา	2525

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