หนังสืออ้างอิง

1. กฤษดา วิศวธีรานนท์,ยืน ภู่วรวรรณ, ไมโครโปรเซสเซอร์, สมาคมส่งเสริมเทคโนโลยี (ไทย-ญี่ปุ่น), 2522.
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3. ไพรัช ธัชยพงษ์ และคณะ, ไมโครโปรเซสเซอร์ Z-80, บริษัท อีเลคทรอนิคส์เวิลด์ จัดพิมพ์, 2525.
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5. ยืน ภู่วรวรรณ, การสื่อสารข้อมูลและไมโครคอมพิวเตอร์เนคเวอร์ค, บริษัท ซีเอ็ดยูเคชั่น จำกัด, 2528.
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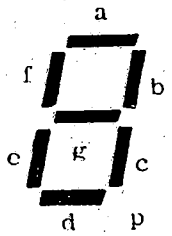
ภาคผนวก ก. รูปแบบการแสดงอักษรบนหลอดเปล่งแสงเจ็ดส่วน



7	6	5	4	3	2	1	0
d	p	c	b	a	f	g	e

DISPLAY FORMAT :

รหัสข้อมูล	BD	30	9B	BA	36	AE	AF	38	BF	BE	3F	A7	8D	B3
ข้อมูล	0	1	2	3	4	5	6	7	8	9	A	B	C	D
การแสดงผล	0	1	2	3	4	5	6	7	8	9	A	b	C	d
รหัสข้อมูล	8F	01	AD	37	89	B1	97	85	2B	23	A3	1F	3F	03
ข้อมูล	E	F	G	H	I	J	K	L	M	N	O	P	Q	R
การแสดงผล	E	F	G	H	I	J	K	L	n	n	o	P	q	r
รหัสข้อมูล	A6	87	B5	B7	A9	07	B6	8A	83	A2	32	02	C0	00
ข้อมูล	S	T	U	V	W	X	Y	Z	(	)	+	−	'	
การแสดงผล	S	t	U	V	W	X	Y	Z	(	)	+	−	'	

ภาคผนวก ข. รายละเอียดและคุณสมบัติของอุปกรณ์ต่าง ๆ

TYPES 4N25, 4N26, 4N27, 4N28
OPTO-COUPLERS

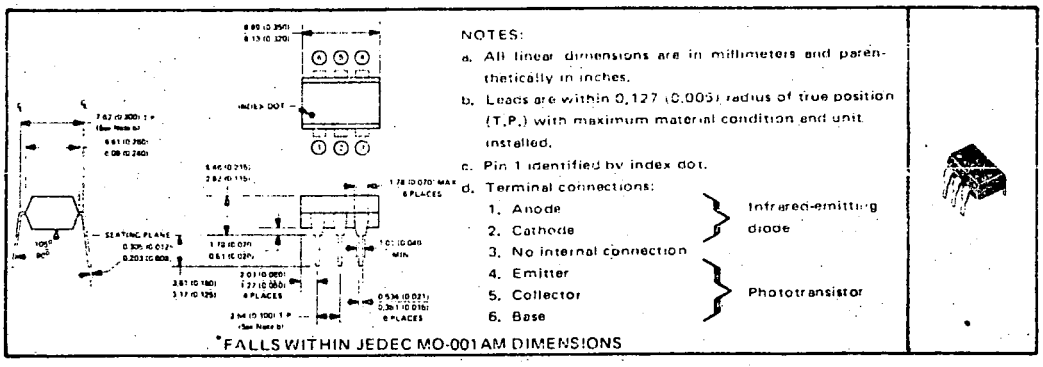
BULLETIN NO. DL-S 12648, SEPTEMBER 1978

COMPATIBLE WITH STANDARD DTL AND TTL INTEGRATED CIRCUITS

- Gallium Arsenide Diode Infrared Source Optically Coupled to a Silicon N-P-N Phototransistor
- High Direct-Current Transfer Ratio
- High-Voltage Electrical Isolation . . . 2.5-kV, 1.5-V, or 0.5-kV Rating
- Plastic Dual-In-Line Package
- High-Speed Switching . . . t_r = 2 μs, t_f = 2 μs Typical

mechanical data

The package consists of a gallium arsenide infrared-emitting diode and an n-p-n silicon phototransistor mounted on a 6-lead frame encapsulated within an electrically nonconductive plastic compound. The case will withstand soldering temperature with no deformation and device performance characteristics remain stable when operated in high-humidity conditions. Unit weight is approximately 0.52 grams.



NOTES:
a. All linear dimensions are in millimeters and parenthetically in inches.
b. Leads are within 0.127 (0.005) radius of true position (T.P.) with maximum material condition and unit installed.
c. Pin 1 identified by index dot.
d. Terminal connections:
1. Anode
2. Cathode
3. No internal connection
} Infrared-emitting diode
4. Emitter
5. Collector
6. Base
} Phototransistor

*FALLS WITHIN JEDEC MO-001AM DIMENSIONS

absolute maximum ratings at 25°C free-air temperature (unless otherwise noted)

*Peak Input-to-Output Voltage: 4N25	±2.5 kV
4N26, 4N27	±1.5 kV
4N28	±0.5 kV
*Collector-Base Voltage	70 V
*Collector-Emitter Voltage (See Note 1)	30 V
*Emitter-Collector Voltage	7 V
Emitter-Base Voltage	7 V
*Input-Diode Reverse Voltage	3 V
*Input-Diode Continuous Forward Current at (or below) 25°C Free-Air Temperature (See Note 2)	80 mA
*Input-Diode Peak Forward Current (t_W = 300 μs, duty cycle = 2%)	3 A
*Continuous Power Dissipation at (or below) 25°C Free-Air Temperature:	
Infrared-Emitting Diode (See Note 3)	150 mW
Phototransistor (See Note 4)	150 mW
Total, Infrared-Emitting Diode plus Phototransistor (See Note 5)	250 mW
*Storage Temperature Range	−55°C to 150°C
*Lead Temperature 1,6 mm (1/16 Inch) from Case for 10 Seconds	260°C

NOTES: 1. This value applies when the base emitter diode is open circuited.
2. Derate linearly to 100°C free-air temperature at the rate of 1.33 mA/°C.
3. Derate linearly to 100°C free-air temperature at the rate of 2 mW/°C.
4. Derate linearly to 100°C free-air temperature at the rate of 2 mW/°C.
5. Derate linearly to 100°C free-air temperature at the rate of 3.33 mW/°C.

*JEDEC registered data. This data sheet contains all applicable JEDEC registered data in effect at the time of publication.

TEXAS INSTRUMENTS
INCORPORATED
POST OFFICE BOX 225012 • DALLAS, TEXAS 75265

TYPES TIL31, TIL33, TIL34
P-N GALLIUM ARSENIDE INFRARED-EMITTING DIODES

BULLETIN NO. DL-S 12209, NOVEMBER 1974–REVISED MARCH 1976

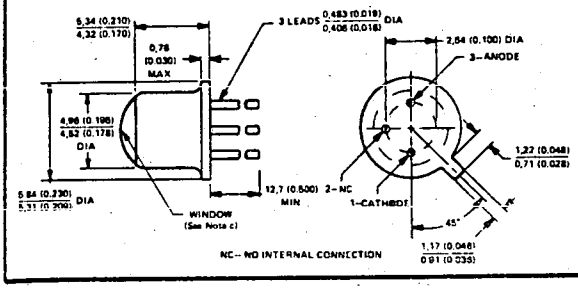
DESIGNED TO EMIT NEAR-INFRARED RADIATION WHEN FORWARD BIASED

- Output Spectrally Compatible with Silicon Sensors
- Mechanically Compatible with TIL81
- Typical Applications Include Card Readers, Encoders, Intrusion Alarms, Sector Sensors, Level Indicators, and Beginning-of-Tape/End-of-Tape Indicators

mechanical data

Each device is in a hermetically sealed welded case similar to JEDEC TO-18 with window. The TIL31 and TIL34 have convex lenses while that of the TIL33 is essentially flat. A coin header is used to increase dissipation capability. All TO-18 registration notes also apply to this outline. Approximate weight is 0.35 gram. All metal surfaces are gold plated.

THE COLLECTOR IS IN ELECTRICAL CONTACT WITH THE CASE



NOTES:

a. All linear dimensions are in millimeters and parenthetically in inches.

b. The window is Corning 7052 glass or equivalent.

c. Window dimensions are:
Minimum diameter . . 3,5 (0.140)
Maximum extension from top of case
TIL31 and TIL34 . . . 1,02 (0.040)
TIL33 . . . . . 0,26 (0.010)

absolute maximum ratings

Reverse Voltage at 25°C Case Temperature	2 V
Continuous Forward Current at 25°C Case Temperature (See Note 1)	200 mA
Operating Case Temperature Range	–65°C to 150°C
Storage Temperature Range	–65°C to 150°C
Lead Temperature 1,6 mm (1/16 Inch) from Case for 10 Seconds	240°C

operating characteristics at 25°C case temperature

PARAMETER		TEST CONDITIONS	TIL31			TIL33			TIL34			UNIT
			MIN	TYP	MAX	MIN	TYP	MAX	MIN	TYP	MAX	
P_O	Radiant Power Output	I_F = 100 mA	3.3	6		2.5	5		1.6	3		mW
λ_p	Wavelength at Peak Emission		915	940	975	915	940	975	915	940	975	nm
$\Delta\lambda$	Spectral Bandwidth			50	75		50	75		50	75	nm
θ_{HI}	Half-Intensity Beam Angle			10°			80°			10°		
V_F	Static Forward Voltage			1.4	1.75		1.4	1.75		1.4	1.75	V
t_r	Radiant Pulse Rise Time‡	I_{FM} = 50 mA, t_W = 2 μs, f = 45 kHz		600			600			600		ns
t_f	Radiant Pulse Fall Time‡			350			350			350		

†Radiant intensity is calculated from $I_e = P_O/2\pi(1-\cos 0.5\theta_{HI})$. One sterdian is the solid angle at the center of a sphere subtended by a portion of the surface area equal to the square of the radius of the sphere. There are 4π steradians in a complete sphere.

‡Radiant pulse rise time is the time required for a change in radiant intensity from 10% to 90% of its peak value for a step change in current; radiant pulse fall time is the time required for a change in radiant intensity from 90% to 10% of its peak value for a step change in current.

NOTE 1: Derate linearly to 150°C case temperature at the rate of 1.6 mA/°C.

TYPES TIL31, TIL33, TIL34
P-N GALLIUM ARSENIDE INFRARED-EMITTING DIODES

TYPICAL CHARACTERISTICS

RELATIVE SPECTRAL CHARACTERISTICS

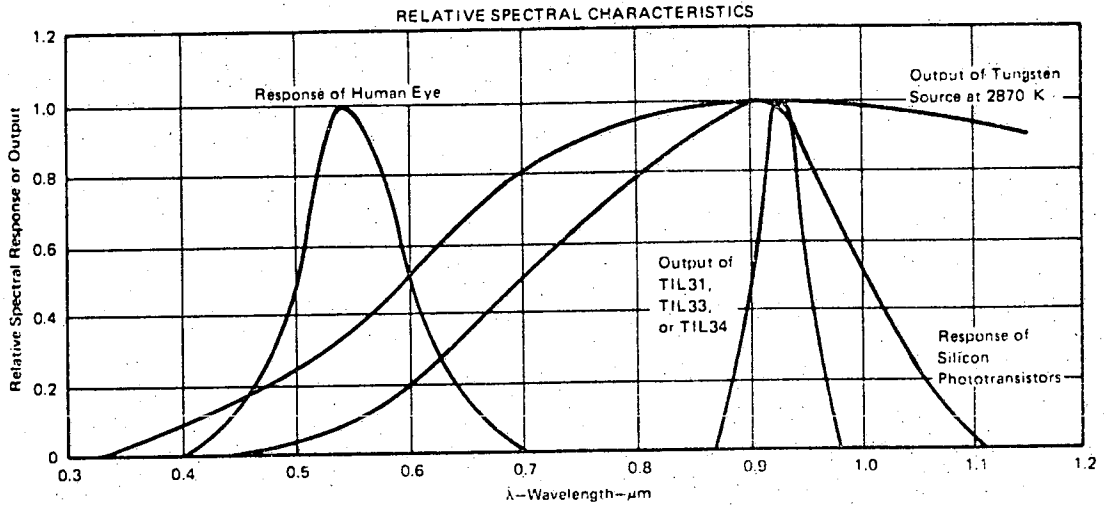


FIGURE 1

RELATIVE POWER OUTPUT vs CASE TEMPERATURE

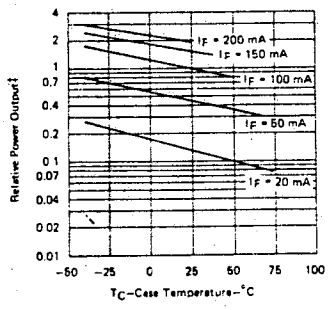


FIGURE 2

RELATIVE POWER OUTPUT vs FORWARD CURRENT

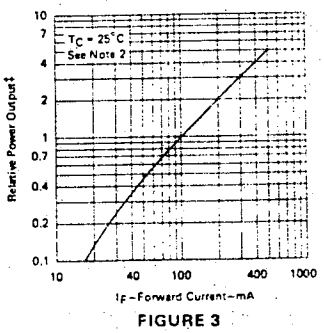


FIGURE 3

CHANGE IN WAVELENGTH AT PEAK EMISSION vs CASE TEMPERATURE

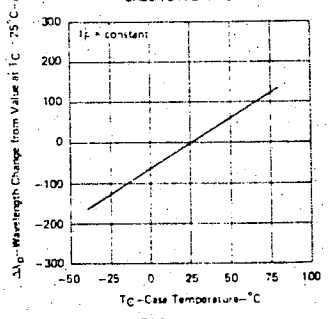


FIGURE 4

TIL31, TIL34
RELATIVE RADIANT INTENSITY vs ANGULAR DISPLACEMENT

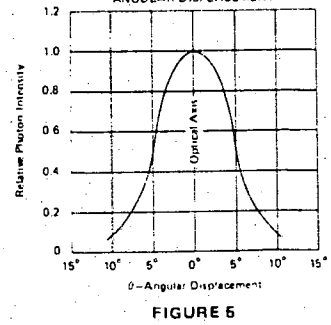


FIGURE 5

TIL33
RELATIVE RADIANT INTENSITY vs ANGULAR DISPLACEMENT

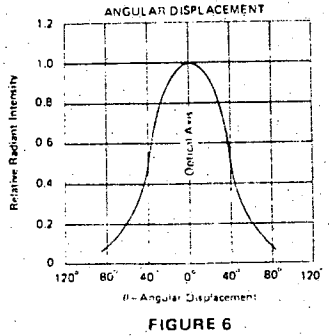


FIGURE 6

FORWARD CONDUCTION CHARACTERISTICS

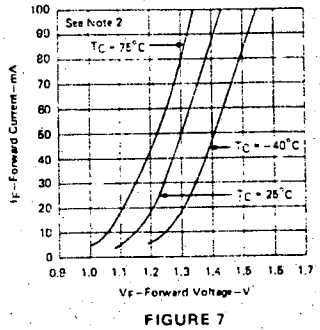


FIGURE 7

NOTE 2: This parameter must be measured using pulse techniques, t_w = 0.04 ms, duty cycle = 10%.

‡Normalized to output at I_F = 10 mA, T_C = 25°C.

TEXAS INSTRUMENTS
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ภาคผนวก ง. รายละเอียดคำสั่งโปรแกรมมอนิเตอร์

```
                0005 *--------------------------------*
                0010 *    THIS  IS   A   MONITOR      *
                0015 *                                 *
                0020 *        TIME  RECORDER           *
                0025 *                                 *
                0030 *              BY                 *
                0035 *                                 *
                0040 *   MR. MONGKOL LEEPRAKOBBOON     *
                0045 *                                 *
                0050 *           B515468               *
                0055 *                                 *
                0060 *    CHULALONGKORN UNIVERSITY     *
                0065 *                                 *
                0070 *        UP-DATE  13/01/86        *
                0075 *--------------------------------*
                0080 *
0040-           0085 SEG     .EQ  40H      ;8255 PORT A
0041-           0090 DIGIT   .EQ  41H      ;8255 PORT B
0042-           0095 KIN     .EQ  42H      ;8255 PORT C
0043-           0100 P8255   .EQ  43H      ;8255 CONTROL
0044-           0105 CTC0    .EQ  44H      ;CTC #0
0045-           0110 CTC1    .EQ  45H      ;CTC #1
0046-           0115 CTC2    .EQ  46H      ;CTC #2
0047-           0120 CTC3    .EQ  47H      ;CTC #3
0048-           0125 D8251   .EQ  48H      ;8251 DATA
0049-           0130 P8251   .EQ  49H      ;8251 CONTROL
6800-           0135 S373    .EQ  6800H    ;MAG. PORT
6000-           0140 H245    .EQ  6000H    ;H-EMP PORT
5800-           0145 L245    .EQ  5800H    ;L-EMP PORT
                0150 *--------------------------------
                0155 *  RAM BUFFER/SYSTEM  STACK PACK
                0160 *--------------------------------
0000-           0165 ZERO    .EQ  00H      ;FULL DISPLAY
0001-           0170 FIRST   .EQ  01H      ;FIRST DIGIT
0002-           0175 SECOND  .EQ  02H      ;SECOND DIGIT
0003-           0180 THIRD   .EQ  03H      ;THIRD DIGIT
0004-           0185 FTEMP   .EQ  04H      ;FULLY TEMP.
0006-           0190 HTEMP   .EQ  06H      ;HALF TEMP.
0008-           0195 STEMP   .EQ  08H      ;SINGLE TEMP.
0009-           0200 TIME    .EQ  09H      ;TIME STATE
000A-           0205 ALARM   .EQ  0AH      ;ALARM STATE
000B-           0210 SET     .EQ  0BH      ;SETING STATE
000C-           0215 BELL    .EQ  0CH      ;BELL STABUF
000D-           0220 UNIT    .EQ  0DH      ;TIM REC UNIT
000E-           0225 BUAD    .EQ  0EH      ;BUAD RATEBUF
000F-           0230 LOW1    .EQ  0FH      ;LOWER LIMIT
0010-           0235 LOW2    .EQ  10H
0011-           0240 HIGH1   .EQ  11H      ;HIGHER LIMIT
0012-           0245 HIGH2   .EQ  12H
0013-           0250 RES1    .EQ  13H      ;LOW POWER-UP
0014-           0255 RES2    .EQ  14H      ;HIGH POWERUP
```

```
0015-           0260 TIBUF   .EQ   15H      ;FIRST TIME
001C-           0265 TIBUF1  .EQ   1CH      ;LAST TIME
0016-           0270 SEC     .EQ   16H      ;SECOND TIME
0017-           0275 MIN     .EQ   17H      ;MINUTE TIME
0018-           0280 HOUR    .EQ   18H      ;HOUR  TIME
0019-           0285 DAY     .EQ   19H      ;DAY   TIME
001A-           0290 MONTH   .EQ   1AH      ;MONTH TIME
001B-           0295 YEAR    .EQ   1BH      ;YEAR TIME
001C-           0300 HYEAR   .EQ   1CH      ;HI-YEAR TIME
001D-           0305 ALBUF   .EQ   1DH      ;FIRST ALARM
0039-           0310 ALBUF1  .EQ   39H      ;LAST ALARM
                0315 *-------------------------------
                0320 *          ROM PARAMETER
                0325 *-------------------------------
0000-           0330 START   .EQ   0000H    ;MONITOR
0001-           0335 ER01    .EQ   01H      ;ERROR #1
0002-           0340 ER02    .EQ   02H      ;ERROR #2
0003-           0345 ER03    .EQ   03H      ;ERROR #3
0004-           0350 ER04    .EQ   04H      ;ERROR #4
0005-           0355 ER05    .EQ   05H      ;ERROR #5
0006-           0360 ER06    .EQ   06H      ;ERROR #6
0007-           0365 ER07    .EQ   07H      ;ERROR #7
0008-           0370 ER08    .EQ   08H      ;ERROR #8
0009-           0375 ER09    .EQ   09H      ;ERROR #9
0010-           0380 ER10    .EQ   10H      ;ERROR #10
0011-           0385 ER11    .EQ   11H      ;ERROR #11
0008-           0390 SRAM    .EQ   08H      ;RAM STEP
0038-           0395 MRAM    .EQ   38H      ;MAXIMUN ROM
0000-           0400 CLR     .EQ   00H      ;CLEAR VALUE
00FF-           0405 FILL    .EQ   0FFH     ;FILL VALUE
00FF-           0410 PACK    .EQ   0FFH     ;SYS. STACK
0055-           0415 BIAS    .EQ   55H      ;BIAS VALUE
0010-           0420 ALENGH  .EQ   10H      ;ALARM I.VAL
0087-           0425 COLDEL  .EQ   087H     ;COL. DELAY
0055-           0430 UPCODE  .EQ   55H      ;POWER CODE
0089-           0435 CTRL55  .EQ   89H      ;CTRL CODE
00B5-           0440 OPCTC3  .EQ   0B5H     ;OPCODE #3
0017-           0445 OPCTC2  .EQ   17H      ;OPCODE #2
0017-           0450 OPCTC1  .EQ   17H      ;OPCODE #1
0017-           0455 OPCTC0  .EQ   17H      ;OPCODE #0
008E-           0460 TICTC3  .EQ   08EH     ;TIMECONT #3
000D-           0465 TICTC2  .EQ   0DH      ;TIMECONT #2
001A-           0470 TICTC1  .EQ   1AH      ;TIMECONT #1
00D0-           0475 TICTC0  .EQ   0D0H     ;TIMECONT #0
004D-           0480 CTRL51  .EQ   04DH     ;CMMAND CODE
0040-           0485 CLR51   .EQ   40H      ;CLEAR CODE
0010-           0490 STOP51  .EQ   10H      ;CLR-CODE
0011-           0495 TRAN51  .EQ   11H      ;TRANS-CODE
0012-           0500 DTR51   .EQ   12H      ;DTR-CODE
0034-           0505 KEEP51  .EQ   34H      ;RECV-CODE
0800-           0510 EXPG    .EQ   0800H    ;EX.PAGE ROM
```

```
                        0515 *------------------------------
                        0520 *        ROM BUFFER TABLE
                        0525 *------------------------------
                        0530          .OR   START
                        0535          .TF   TEST1
0000- F3                0540 ORIGIN   DI                ;DISABLE ALL
0001- 21 00 80          0545          LD    HL,8000H
0004- 2B                0550 PDELAY   DEC   HL
0005- 7D                0555          LD    A,L
0006- B4                0560          OR    H
0007- 20 FB             0565          JR    NZ,PDELAY
0009- 18 5E             0570          JR    POWER
000B- BF                0575 M88TAB   .HS   BF          ;PATTERN "8 "
000C- FF                0580          .HS   FF          ;PATTERN "8."
000D- BF                0585          .HS   BF          ;PATTERN "8 "
000E- FF                0590          .HS   FF          ;PATTERN "8."
000F- 00                0595 BLKTAB   .HS   00          ;PATTERN "  "
0010- 00                0600          .HS   00          ;PATTERN "  "
0011- 00                0605 ERRTAB   .HS   00          ;PATTERN "  "
0012- 00                0610          .HS   00          ;PATTERN "  "
0013- 43                0615          .HS   43          ;PATTERN "r."
0014- CF                0620          .HS   CF          ;PATTERN "E."
0015- 07                0625 POSTAB   .HS   07          ;CODE KEY "7"
0016- 04                0630          .HS   04          ;CODE KEY "4"
0017- 01                0635          .HS   01          ;CODE KEY "1"
0018- 0A                0640          .HS   0A          ;CODE "CLEAR"
0019- 08                0645          .HS   08          ;CODE KEY "8"
001A- 05                0650          .HS   05          ;CODE KEY "5"
001B- 02                0655          .HS   02          ;CODE KEY "2"
001C- 00                0660          .HS   00          ;CODE KEY "0"
001D- 09                0665          .HS   09          ;CODE KEY "9"
001E- 06                0670          .HS   06          ;CODE KEY "6"
001F- 03                0675          .HS   03          ;CODE KEY "3"
0020- 0F                0680          .HS   0F          ;CODE "ENTER"
0021- 0D                0685          .HS   0D          ;CODE "ALRM"
0022- 0C                0690          .HS   0C          ;CODE "TIME"
0023- 0E                0695          .HS   0E          ;CODE "PROG"
0024- 0B                0700          .HS   0B          ;CODE " AC "
0025- BD                0705 NUMTAB   .HS   BD          ;PATTERN "0"
0026- 30                0710          .HS   30          ;PATTERN "1"
0027- 9B                0715          .HS   9B          ;PATTERN "2"
0028- BA                0720          .HS   BA          ;PATTERN "3"
0029- 36                0725          .HS   36          ;PATTERN "4"
002A- AE                0730          .HS   AE          ;PATTERN "5"
002B- AF                0735          .HS   AF          ;PATTERN "6"
002C- 38                0740          .HS   38          ;PATTERN "7"
002D- BF                0745          .HS   BF          ;PATTERN "8"
002E- BE                0750          .HS   BE          ;PATTERN "9"
002F- CF                0755 SEGTAB   .HS   CF          ;PATTERN "E."
0030- 66                0760          .HS   66          ;PATTERN "S."
0031- 41                0765          .HS   41          ;PATTERN "I."
0032- 6B                0770          .HS   6B          ;PATTERN "M."
0033- 43                0775          .HS   43          ;PATTERN "r."
0034- 77                0780          .HS   77          ;PATTERN "H."
0035- 7F                0785          .HS   7F          ;PATTERN "A."
0036- F3                0790          .HS   F3          ;PATTERN "d."
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0037- E3          0795          .HS   E3        ;PATTERN "o."
0038- 6B          0800          .HS   6B        ;PATTERN "M."
0039- 43          0805          .HS   43        ;PATTERN "r."
003A- F6          0810          .HS   F6        ;PATTERN "y."
003B- 03          0815          .HS   03        ;PATTERN "r "
003C- B6          0820          .HS   B6        ;PATTERN "y "
003D- 59          0825 MAXTAB   .HS   59        ;MAX "SECOND"
003E- 59          0830          .HS   59        ;MAX "MINUTE"
003F- 23          0835          .HS   23        ;MAX "HOUR"
0040- 31          0840          .HS   31        ;MAX"JAN DAY"
0041- 28          0845          .HS   28        ;MAX"FEB DAY"
0042- 31          0850          .HS   31        ;MAX"MAR DAY"
0043- 30          0855          .HS   30        ;MAX"APL DAY"
0044- 31          0860          .HS   31        ;MAX"MAY DAY"
0045- 30          0865          .HS   30        ;MAX"JUN DAY"
0046- 31          0870          .HS   31        ;MAX"JUL DAY"
0047- 31          0875          .HS   31        ;MAX"AUG DAY"
0048- 30          0880          .HS   30        ;MAX"SEP DAY"
0049- 31          0885          .HS   31        ;MAX"OCT DAY"
004A- 30          0890          .HS   30        ;MAX"NOV DAY"
004B- 31          0895          .HS   31        ;MAX"DEC DAY"
004C- 29          0900          .HS   29        ;Spec FEB DAY
004D- 12          0905          .HS   12        ;MAX "MONTH"
004E- 99          0910          .HS   99        ;MAX "YEAR"
004F- 99          0915          .HS   99        ;MAX "HYEAR"
0050- 33          0920 JUMTAB   .DA   #TIST
0051- 01          0925          .DA   /TIST
0052- 77          0930          .DA   #ALST
0053- 01          0935          .DA   /ALST
0054- BE          0940          .DA   #PROG
0055- 01          0945          .DA   /PROG
0056- 43          0950          .DA   #RUNCHK
0057- 02          0955          .DA   /RUNCHK
0058- 3A          0960 NTCTC0   .DA   #INTIM
0059- 03          0965          .DA   /INTIM
005A- 3A          0970 NTCTC1   .DA   #INTIM
005B- 03          0975          .DA   /INTIM
005C- 3A          0980 NTCTC2   .DA   #INTIM
005D- 03          0985          .DA   /INTIM
005E- 3A          0990 NTCTC3   .DA   #INTIM
005F- 03          0995          .DA   /INTIM
0060- FA          1000 CONTAB   .HS   FA        ;CONV BCD=10
0061- FB          1005          .HS   FB        ;CONV BCD=11
0062- FC          1010          .HS   FC        ;CONV BCD=12
0063- FD          1015          .HS   FD        ;CONV BCD=13
0064- FE          1020          .HS   FE        ;CONV BCD=14
0065- FF          1025          .HS   FF        ;CONV BCD=15
                  1030 *-------------------------------
                  1035 * NONMASKABLE INTERRUPT ROUTINE
                  1040 *-------------------------------
0066- C3 00 08    1045 NMI      JP    EXPG      ; TO EX.PAGE
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                    1050 *-------------------------------
                    1055 *        POWER-UP OR RESET
                    1060 *-------------------------------
0069- 3E 89         1065 POWER  LD   A,CTRL55  ;CTRL 8255
006B- D3 43         1070        OUT  (P8255),A
006D- AF            1075        XOR  A         ;CLEAR A.
006E- 32 00 68      1080        LD   (S373),A  ;CLR MAG.P.
0071- D3 40         1085        OUT  (SEG),A   ;CLR SEG
0073- D3 41         1090        OUT  (DIGIT),A ;CLR DIGIT
0075- FD 7E 13      1095        LD   A,(IY+RES1)  ;CHECK
0078- FE 55         1100        CP   UPCODE    ;RESET1=55
007A- 20 07         1105        JR   NZ,INIT   ;NO INIT
007C- FD AE 14      1110        XOR  (IY+RES2) ;RESET2=AA
007F- 3C            1115        INC  A
0080- CA 04 01      1120        JP   Z,INKEY   ;YES INKEY
                    1125 *-------------------------------
                    1130 *     INITIALIZATION  ROUTINE
                    1135 *-------------------------------
0083- AF            1140 INIT   XOR  A
0084- 6F            1145        LD   L,A
0085- 26 08         1150        LD   H,SRAM  ;ST.FIND RAM
0087- 7E            1155 INIT1  LD   A,(HL)  ;RAM CHK
0088- 2F            1160        CPL
0089- 77            1165        LD   (HL),A
008A- 7E            1170        LD   A,(HL)
008B- 2F            1175        CPL
008C- 77            1180        LD   (HL),A
008D- BE            1185        CP   (HL)
008E- 28 0B         1190        JR   Z,INIT2 ;RAM FIND HI
0090- 3E 08         1195        LD   A,SRAM
0092- 84            1200        ADD  A,H
0093- FE 38         1205        CP   MRAM    ;CHK NO-RAM
0095- D4 2A 07      1210        CALL NC,ERRH ;DISP.& HOLD
0098- 67            1215        LD   H,A
0099- 18 EC         1220        JR   INIT1
009B- 5D            1225 INIT2  LD   E,L     ;TRAN.DE=LOW
009C- 54            1230        LD   D,H
009D- 3E 08         1235 INIT3  LD   A,SRAM
009F- 84            1240        ADD  A,H
00A0- FE 38         1245        CP   MRAM    ;CHK OVER-RAM
00A2- D4 2A 07      1250        CALL NC,ERRH ;DISP.$ HOLD
00A5- 67            1255        LD   H,A
00A6- 7E            1260        LD   A,(HL)  ;RAM CHK
00A7- 2F            1265        CPL
00A8- 77            1270        LD   (HL),A
00A9- 7E            1275        LD   A,(HL)
00AA- 2F            1280        CPL
00AB- 77            1285        LD   (HL),A
00AC- BE            1290        CP   (HL)
00AD- 28 EE         1295        JR   Z,INIT3 ;FIND AGAIN
00AF- 2B            1300        DEC  HL      ;DECRETE ONE
00B0- 44            1305        LD   B,H     ;BC=HI  RAM
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00B1- 4D        1310          LD   C,L
00B2- 7D        1315          LD   A,L      ;ST.SYS STK
00B3- D6 FF     1320          SUB  PACK     ;L-PACK)=00
00B5- 6F        1325          LD   L,A
00B6- F9        1330          LD   SP,HL    ;SP=SYS STK
00B7- 23        1335          INC  HL       ;SAPARATE IT
00B8- E5        1340          PUSH HL       ;ST.RAM STK
00B9- FD E1     1345          POP  IY       ;IY=ST. RAM
00BB- D5        1350          PUSH DE
00BC- DD E1     1355          POP  IX       ;IX=ST. MEM
00BE- C5        1360          PUSH BC
00BF- D9        1365          EXX
00C0- 3E FF     1370          LD   A,FILL
00C2- CD 11 07  1375          CALL BATCH1   ;FILL LO-MEM
00C5- E1        1380          POP  HL
00C6- E5        1385          PUSH HL
00C7- FD E5     1390          PUSH IY
00C9- D1        1395          POP  DE
00CA- 12        1400          LD   (DE),A
00CB- CD 1B 07  1405          CALL BATCH2   ;FILL UP-MEM
00CE- 3E 00     1410          LD   A,CLR
00D0- CD 11 07  1415          CALL BATCH1   ;CLEAR LO-MEM
00D3- E1        1420          POP  HL
00D4- FD E5     1425          PUSH IY
00D6- D1        1430          POP  DE
00D7- 12        1435          LD   (DE),A
00D8- CD 1B 07  1440          CALL BATCH2   ;CLEAR UP-MEM
00DB- D9        1445          EXX
00DC- 3E 0F     1450          LD   A,LOW1
00DE- 85        1455          ADD  A,L
00DF- 6F        1460          LD   L,A
00E0- 73        1465          LD   (HL),E   ;SAV LO-MEM
00E1- 23        1470          INC  HL
00E2- 72        1475          LD   (HL),D
00E3- 23        1480          INC  HL
00E4- 71        1485          LD   (HL),C   ;SAV HI-MEM
00E5- 23        1490          INC  HL
00E6- 70        1495          LD   (HL),B
00E7- 23        1500          INC  HL
00E8- 3E 55     1505          LD   A,UPCODE
00EA- 77        1510          LD   (HL),A   ;SAV LO-CODE
00EB- 23        1515          INC  HL
00EC- 2F        1520          CPL
00ED- 77        1525          LD   (HL),A   ;SAV HI-CODE
00EE- FD E5     1530          PUSH IY
00F0- FD 21 0F
00F3- 00        1535          LD   IY,BLKTAB ;INIT PAT
00F4- 0E 05     1540          LD   C,05H     ;PAT COUNT
00F6- 06 40     1545 INIT4    LD   B,40H     ;DISP.06 S
00F8- CD FE 05  1550 INIT5    CALL SCAN1
00FB- 10 FB     1555          DJNZ INIT5
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00FD- FD 2B     1560         DEC  IY          ;NEXT PAT
00FF- 0D        1565         DEC  C
0100- 20 F4     1570         JR   NZ,INIT4
0102- FD E1     1575         POP  IY
                1580 *-------------------------------
                1585 *        INKEY   SUBROUTINE
                1590 *-------------------------------
0104- 3E 4D     1595 INKEY   LD   A,CTRL51
0106- FD 77 0B  1600         LD   (IY+SET),A
0109- 3E D0     1605         LD   A,TICTCO
010B- FD 77 0E  1610         LD   (IY+BUAD),A
010E- 11 0B 00  1615 INKEY1  LD   DE,M88TAB ;STD.PAT
0111- FD E5     1620         PUSH IY
0113- E1        1625         POP  HL        ;HL=DISP BUF
0114- 06 04     1630         LD   B,04H     ;GET 4 DIGIT
0116- CD A5 07  1635         CALL SHIFT1
0119- CD D1 05  1640         CALL SCAN
011C- D6 0C     1645         SUB  0CH       ;DATA CL & AC
011E- 38 EE     1650         JR   C,INKEY1  ;SCAN AGAIN
0120- 21 50 00  1655         LD   HL,JUMTAB ;JUMP TABLE
0123- CB 27     1660         SLA  A
0125- 85        1665         ADD  A,L       ;NOTE A+L<FFH
0126- 6F        1670         LD   L,A
0127- 5E        1675         LD   E,(HL)
0128- 23        1680         INC  HL
0129- 56        1685         LD   D,(HL)
012A- EB        1690         EX   DE,HL
012B- E9        1695         JP   (HL)      ;PROGRESS ?
012C- 3E 01     1700         LD   A,ER01    ;##ERROR 01##
012E- CD 33 07  1705 JUERR1  CALL ERROR     ;DISP. MINUTE
0131- 18 DB     1710 JUMP1   JR   INKEY1
                1715 *-------------------------------
                1720 *        TIME SET PROGRAM
                1725 *-------------------------------
0133- 11 2F 00  1730 TIST    LD    DE,SEGTAB
0136- FD E5     1735         PUSH  IY
0138- E1        1740         POP   HL        ;HL=REAL TIME
0139- 3E 16     1745         LD    A,SEC
013B- 85        1750         ADD   A,L       ;NOTE A+L=<FF
013C- 6F        1755         LD    L,A       ;HL=BOT. REAL
013D- AF        1760 TISTAC  XOR   A
013E- 4F        1765 TIST1   LD    C,A       ;TIME STATE
013F- CB 07     1770         RLC   A
0141- 47        1775         LD    B,A       ;DOUBLE TIME
0142- E5        1780         PUSH  HL        ;SAVE POINTER
0143- D5        1785         PUSH  DE
0144- 7B        1790         LD    A,E
0145- 80        1795         ADD   A,B       ;NOTE E+B<=FF
0146- 5F        1800         LD    E,A       ;DE=SEG .TIME
0147- 7D        1805         LD    A,L
0148- 81        1810         ADD   A,C       ;NOTE L+C<=FF
0149- 6F        1815         LD    L,A       ;HL=REAL.TIME
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014A- CD 8D 07  1820 TIST2   CALL   KEEP    ;MOVE DATA
014D- CD D1 05  1825         CALL   SCAN
0150- FE 0A     1830         CP     0AH
0152- 30 04     1835         JR     NC,TIST3 ;DATA KEY ?
0154- ED 6F     1840         RLD             ;SHIFT DATA
0156- 18 F2     1845         JR     TIST2
0158- D1        1850 TIST3   POP    DE
0159- E1        1855         POP    HL
015A- 28 0C     1860         JR     Z,TISTCL ;CLR KEY
015C- FE 0C     1865         CP     0CH
015E- 38 DD     1870         JR     C,TISTAC ;AC  KEY
0160- FE 0F     1875         CP     0FH
0162- 28 0B     1880         JR     Z,TISTEN ;ENTER KEY
0164- 3E 02     1885         LD     A,ER02   ;#ERROR 02#
0166- 18 C6     1890 JUERR2  JR     JUERR1
0168- 79        1895 TISTCL  LD     A,C
0169- B7        1900         OR     A
016A- 28 D2     1905         JR     Z,TIST1
016C- 3D        1910         DEC    A
016D- 18 CF     1915         JR     TIST1
016F- 79        1920 TISTEN  LD     A,C
0170- 3C        1925         INC    A
0171- FE 07     1930         CP     07H     ;FINAL STATE
0173- 20 C9     1935         JR     NZ,TIST1
0175- 18 BA     1940 JUMP2   JR     JUMP1
                1945 *-------------------------------
                1950 *       ALARM SET PROGRAM
                1955 *-------------------------------
0177- 11 2F 00  1960 ALST    LD     DE,SEGTAB ;SEG.TAB
017A- FD E5     1965         PUSH   IY
017C- E1        1970         POP    HL      ;MAX TIME
017D- 3E 1D     1975         LD     A,ALBUF
017F- 85        1980         ADD    A,L     ;NOTE A+L=<FF
0180- 6F        1985         LD     L,A     ;HL=TIME TAB
0181- AF        1990 ALSTAC  XOR    A
0182- 4F        1995 ALST1   LD     C,A     ;TIME STATE
0183- E6 01     2000         AND    01H     ;(0000,0001)
0185- 3C        2005         INC    A
0186- CB 07     2010         RLC    A
0188- 47        2015         LD     B,A     ;DOUBLE TIME
0189- E5        2020         PUSH   HL      ;POINTER HL
018A- D5        2025         PUSH   DE      ;POINTER DE
018B- 7B        2030         LD     A,E
018C- 80        2035         ADD    A,B     ;NOTE E+B<=FF
018D- 5F        2040         LD     E,A     ;DE=SEG.TIME
018E- 7D        2045         LD     A,L
018F- 81        2050         ADD    A,C     ;NOTE A+C<=FF
0190- 6F        2055         LD     L,A     ;HL=AL .TIME
0191- CD 8D 07  2060 ALST2   CALL   KEEP    ;MOVE  DISP.
0194- CD D1 05  2065         CALL   SCAN
0197- FE 0A     2070         CP     0AH
0199- 30 04     2075         JR     NC,ALST3 ;DATA KEY
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019B- ED 6F     2080 ALSTDA RLD          ;SHIFT DATA
019D- 18 F2     2085        JR    ALST2
019F- D1        2090 ALST3  POP   DE
01A0- E1        2095        POP   HL
01A1- 28 0C     2100        JR    Z,ALSTCL ;CHK CLR K.
01A3- FE 0C     2105        CP    0CH
01A5- 38 DA     2110        JR    C,ALSTAC ;CHK AC K.
01A7- FE 0F     2115        CP    0FH
01A9- 28 0B     2120        JR    Z,ALSTEN ;CHK ENT K.
01AB- 3E 03     2125        LD    A,ER03 ;##ERROR 03##
01AD- 18 B7     2130 JUERR3 JR    JUERR2
01AF- 79        2135 ALSTCL LD    A,C
01B0- B7        2140        OR    A
01B1- 28 CF     2145        JR    Z,ALST1
01B3- 3D        2150        DEC   A
01B4- 18 CC     2155        JR    ALST1
01B6- 79        2160 ALSTEN LD    A,C
01B7- 3C        2165        INC   A
01B8- FE 1C     2170        CP    1CH     ;FINAL STATE
01BA- 20 C6     2175        JR    NZ,ALST1
01BC- 18 B7     2180 JUMP3  JR   JUMP2
                2185 *-------------------------------
                2190 * PROGRAM PERIPHERAL SUBROUTINE
                2195 *-------------------------------
01BE- CD 82 07  2200 PROG   CALL CLEAR   ;CLEAR DISP.
01C1- 3E 1F     2205        LD   A,1FH   ;SETING STATE
01C3- FD 77 01  2210        LD   (IY+01H),A
01C6- CD 5C 07  2215        CALL DATA    ;DATASCAN
01C9- 28 F1     2220        JR   Z,JUMP3 ;CHK "0"
01CB- FE 05     2225        CP   05H
01CD- 30 4F     2230        JR   NC,PROGER ;CHK ERROR
01CF- 4F        2235        LD   C,A     ;SAVE STATE
01D0- CD C2 07  2240        CALL HEX     ;CONV SEGMENT
01D3- FD 77 00  2245        LD   (IY+00H),A
01D6- 79        2250        LD   A,C
01D7- FE 02     2255        CP   02H
01D9- 38 47     2260        JR   C,PROG1 ;CHK PROG=1
01DB- 28 4D     2265        JR   Z,PROG2 ;CHK PROG=2
01DD- CD 5C 07  2270        CALL DATA    ;DATASCAN
01E0- FE 03     2275        CP   03H
01E2- 30 3A     2280        JR   NC,PROGER ;CHK ERROR
01E4- FE 01     2285        CP   01H
01E6- FD 7E 0B  2290        LD   A,(IY+SET) ;SET BUF
01E9- F5        2295        PUSH AF
01EA- 79        2300        LD   A,C     ;RE  STATE
01EB- FE 04     2305        CP   04H
01ED- 38 1A     2310        JR   C,PROG3 ;CHK  PROG=3
01EF- F1        2315 PROG4  POP  AF      ;DONE PROG=4
01F0- 38 0E     2320        JR   C,PRO2
01F2- 28 06     2325        JR   Z,PRO1
01F4- CB F7     2330        SET  6,A     ;SET 2.  STOP
01F6- CB FF     2335        SET  7,A
01F8- 18 0A     2340        JR   PRO3
01FA- CB B7     2345 PRO1   RES  6,A     ;SET 1.5 STOP
01FC- CB FF     2350        SET  7,A
01FE- 18 04     2355        JR   PRO3
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0200- CB F7     2360 PRO2   SET  6,A      ;SET 1.  STOP
0202- CB BF     2365        RES  7,A
0204- FD 77 0B  2370 PRO3   LD   (IY+SET),A
0207- 18 B3     2375        JR   JUMP3
0209- F1        2380 PROG3  POP  AF
020A- 38 0E     2385        JR   C,PRO5
020C- 28 06     2390        JR   Z,PRO4
020E- CB E7     2395        SET  4,A      ;SET EVEN CHK
0210- CB EF     2400        SET  5,A
0212- 18 F0     2405        JR   PRO3
0214- CB E7     2410 PRO4   SET  4,A      ;SET ODD  CHK
0216- CB AF     2415        RES  5,A
0218- 18 EA     2420        JR   PRO3
021A- CB A7     2425 PRO5   RES  4,A      ;SET NONE CHK
021C- 18 E6     2430        JR   PRO3
021E- 3E 04     2435 PROGER LD   A,ER04   ;##ERROR 04##
0220- 18 8B     2440 JUERR4 JR   JUERR3
0222- CD 5C 07  2445 PROG1  CALL DATA     ;DATASCAN
0225- FD 77 0D  2450        LD   (IY+UNIT),A
0228- 18 92     2455 JUMP4  JR   JUMP3
022A- CD 5C 07  2460 PROG2  CALL DATA     ;DATASCAN
022D- 20 04     2465        JR   NZ,PRO6 ;CHK "0"
022F- 3E D0     2470        LD   A,TICTC0
0231- 18 0B     2475        JR   PRO8
0233- FE 06     2480 PRO6   CP   06H
0235- 30 E7     2485        JR   NC,PROGER ;CHK ERROR
0237- 47        2490        LD   B,A
0238- 3E D0     2495        LD   A,TICTC0
023A- CB 3F     2500 PRO7   SRL  A
023C- 10 FC     2505        DJNZ PRO7
023E- FD 77 0E  2510 PRO8   LD   (IY+BUAD),A
0241- 18 E5     2515        JR   JUMP4
                2520 *-------------------------------
                2525 *     RUN CHECK SUBROUTINE
                2530 *-------------------------------
0243- 11 3D 00  2535 RUNCHK LD   DE,MAXTAB ;DE=MAXTAB
0246- 13        2540        INC  DE       ;SPIT SEC TIM
0247- FD E5     2545        PUSH IY
0249- E1        2550        POP  HL       ;HL=ALARM TIM
024A- 3E 1D     2555        LD   A,ALBUF
024C- 85        2560        ADD  A,L
024D- 6F        2565        LD   L,A
024E- 06 07     2570        LD   B,07H    ;CHK 7 ARRAY
0250- D5        2575 RUN01  PUSH DE       ;CHK ALARM ER
0251- 0E 02     2580        LD   C,02H    ;2 SET/ARRAY
0253- C5        2585 RUN02  PUSH BC
0254- CD ED 06  2590        CALL LEBCD
0257- C1        2595        POP  BC
0258- D1        2600        POP  DE
0259- 30 04     2605        JR   NC,RUN03
025B- 3E 05     2610        LD   A,ER05   ;##ERROR 05##
025D- 18 C1     2615 JUERR5 JR   JUERR4
025F- D5        2620 RUN03  PUSH DE
0260- 0D        2625        DEC  C
0261- 20 F0     2630        JR   NZ,RUN02
0263- D1        2635        POP  DE
0264- 10 EA     2640        DJNZ RUN01
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0266- CD 97 06 2645          CALL PRECAL  ;PRE-CAL YEAR
0269- 11 3D 00 2650          LD   DE,MAXTAB ;MAX TABLE
026C- FD E5    2655          PUSH IY
026E- E1       2660          POP  HL      ;REAL TIME
026F- 3E 16    2665          LD   A,SEC
0271- 85       2670          ADD  A,L
0272- 6F       2675          LD   L,A
0273- 06 03    2680          LD   B,03H
0275- CD EF 06 2685          CALL LEBCD1  ;COMP. 3 BCD
0278- 30 04    2690          JR   NC,RUN04
027A- 3E 06    2695 RUNER1   LD   A,ER06  ;##ERROR 06##
027C- 18 DF    2700 JUERR6   JR   JUERR5
027E- 7E       2705 RUN04    LD   A,(HL)  ;LD DAY VALUE
027F- B7       2710          OR   A       ;CHK ZERO
0280- 28 F8    2715          JR   Z,RUNER1
0282- E5       2720          PUSH HL      ;SA REAL TIME
0283- 23       2725          INC  HL
0284- 7E       2730          LD   A,(HL)  ;LD MONTH VAL
0285- B7       2735          OR   A       ;CHK ZERO
0286- E1       2740          POP  HL      ;RE REAL TIME
0287- 28 F1    2745          JR   Z,RUNER1
0289- E5       2750          PUSH HL      ;SA REAL TIME
028A- 23       2755          INC  HL      ;FIND MONTH
028B- 7E       2760          LD   A,(HL)
028C- E1       2765          POP  HL
028D- FE 02    2770          CP   02H     ;CHK FEB MON.
028F- 20 10    2775          JR   NZ,RUN05 ;JP  NOT FEB
0291- FD CB 09
0294- 7E       2780          BIT  7,(IY+TIME) ;CHK SPE.
0295- 28 0A    2785          JR   Z,RUN05 ;JUMP NOT SPE
0297- 3E 0C    2790          LD   A,0CH   ;ADJUST ALL
0299- 83       2795          ADD  A,E
029A- 5F       2800          LD   E,A     ;MAX DAY FOR
029B- 1A       2805          LD   A,(DE)  ;SPE.FEB MON
029C- 96       2810          SUB  (HL)
029D- 38 DB    2815          JR   C,RUNER1
029F- 18 14    2820          JR   RUN06
02A1- FE 13    2825 RUN05    CP   13H     ;CHK ERR
02A3- 30 D5    2830          JR   NC,RUNER1
02A5- D5       2835          PUSH DE
02A6- CD F9 06 2840          CALL CONV    ;BCD TO BI.
02A9- 3D       2845          DEC  A
02AA- 83       2850          ADD  A,E
02AB- 5F       2855          LD   E,A
02AC- 1A       2860          LD   A,(DE)  ;MAX DAY FOR
02AD- 96       2865          SUB  (HL)    ;NORMAL MON
02AE- D1       2870          POP  DE
02AF- 38 C9    2875          JR   C,RUNER1
02B1- 3E 0C    2880          LD   A,0CH   ;ADJUST ALL
02B3- 83       2885          ADD  A,E
02B4- 5F       2890          LD   E,A
02B5- 13       2895 RUN06    INC  DE
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02B6- 23          2900          INC  HL
02B7- 1A          2905          LD   A,(DE)  ;LD MAX MONTH
02B8- 96          2910          SUB  (HL)    ;CP REAL MONTH
02B9- 38 BF       2915          JR   C,RUNER1
02BB- CD CB 07    2920          CALL STROBE  ;STB EMP-CODE
02BE- 78          2925          LD   A,B
02BF- EE C1       2930          XOR  0C1H    ;(1100,0001)
02C1- 3C          2935          INC  A
02C2- 28 04       2940          JR   Z,RUN07
02C4- 3E 07       2945 RUNER2   LD   A,ER07  ;##ERROR 07##
02C6- 18 B4       2950 JUERR7   JR   JUERR6
02C8- 79          2955 RUN07    LD   A,C
02C9- 3C          2960          INC  A
02CA- 20 F8       2965          JR   NZ,RUNER2
02CC- DB 42       2970          IN   A,(KIN)
02CE- CB 77       2975          BIT  6,A
02D0- 28 04       2980          JR   Z,RUN08
02D2- 3E 08       2985          LD   A,ER08  ;##ERROR 08##
02D4- 18 F0       2990 JUERR8   JR   JUERR7
02D6- FD 7E 0B    2995 RUN08    LD   A,(IY+SET) ;CTRL 8251
02D9- D3 49       3000          OUT  (P8251),A
02DB- 21 58 00    3005          LD   HL,NTCTC0  ;SET I.REG
02DE- 7C          3010          LD   A,H
02DF- ED 47       3015          LD   I,A
02E1- 3E 17       3020          LD   A,OPCTC0   ;OPCODE #0
02E3- D3 44       3025          OUT  (CTC0),A
02E5- FD 7E 0E    3030          LD   A,(IY+BUAD) ;TIME #0
02E8- D3 44       3035          OUT  (CTC0),A
02EA- 7D          3040          LD   A,L
02EB- D3 44       3045          OUT  (CTC0),A
02ED- 3E 17       3050          LD   A,OPCTC1   ;OPCODE #1
02EF- D3 45       3055          OUT  (CTC1),A
02F1- 3E 1A       3060          LD   A,TICTC1   ;TIME #1
02F3- D3 45       3065          OUT  (CTC1),A
02F5- 3E 17       3070          LD   A,OPCTC2   ;OPCODE #2
02F7- D3 46       3075          OUT  (CTC2),A
02F9- 3E 0D       3080          LD   A,TICTC2   ;TIME #2
02FB- D3 46       3085          OUT  (CTC2),A
02FD- 3E B5       3090          LD   A,OPCTC3   ;OPCODE #3
02FF- D3 47       3095          OUT  (CTC3),A
0301- 3E 8E       3100          LD   A,TICTC3   ;TIME #3
0303- D3 47       3105          OUT  (CTC3),A
0305- ED 5E       3110          IM2
0307- FB          3115          EI
0308- FD CB 09
030B- 76          3120 RUN09    BIT  6,(IY+TIME) ;CHK PRE-
030C- CC 97 06    3125          CALL Z,PRECAL
030F- FD CB 09
0312- 6E          3130          BIT  5,(IY+TIME) ;FLASH ?
0313- 20 0A       3135          JR   NZ,RUN10
0315- 0E 17       3140          LD   C,MIN    ;DISPLACEMENT
0317- CD E5 05    3145          CALL MOVE     ;MOVE & SCAN1
031A- FE 0E       3150          CP   0EH      ;CHK PROG K.
031C- CC 42 04    3155          CALL Z,TEST
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031F- 3A 00 60 3160 RUN10  LD   A,(H245) ;EMTRY CARD
0322- 0F       3165        RRCA
0323- DC 82 04 3170        CALL C,EMPLOY
0326- 3E 10    3175        LD   A,STOP51 ;DSR TO LOW
0328- D3 49    3180        OUT  (P8251),A
032A- DB 49    3185        IN   A,(P8251)
032C- 07       3190        RLCA
032D- 30 D9    3195        JR   NC,RUN09 ;PROT NOISE
032F- CD F5 07 3200        CALL DELAY
0332- DB 49    3205        IN   A,(P8251)
0334- 07       3210        RLCA
0335- DC 28 05 3215        CALL C,RS232  ;RS232 ROUT.
0338- 18 CE    3220        JR   RUN09
               3225 *------------------------------
               3230 *   TIMER INTERRUPT SUBROUTINE
               3235 *------------------------------
033A- F5       3240 INTIM  PUSH AF          ;SAVE ALL
033B- C5       3245        PUSH BC
033C- D5       3250        PUSH DE
033D- E5       3255        PUSH HL
033E- AF       3260        XOR  A
033F- FD 7E 15 3265        LD   A,(IY+TIBUF)
0342- 3C       3270        INC  A
0343- 27       3275        DAA
0344- FD 77 15 3280        LD   (IY+TIBUF),A
0347- FE 55    3285        CP   BIAS
0349- 20 2B    3290        JR   NZ,INTIM4
034B- AF       3295        XOR  A
034C- FD 77 15 3300        LD   (IY+TIBUF),A
034F- FD E5    3305        PUSH IY
0351- D1       3310        POP  DE
0352- D5       3315        PUSH DE
0353- CD 7D 03 3320        CALL ADDCHK      ;ADD & CHK
0356- D1       3325        POP  DE
0357- D5       3330        PUSH DE
0358- CD F0 03 3335        CALL ALCHK       ;ALARM CHK
035B- D1       3340        POP  DE
035C- 3E 09    3345        LD   A,TIME
035E- 83       3350        ADD  A,E
035F- 5F       3355        LD   E,A
0360- 1A       3360        LD   A,(DE)
0361- CB 67    3365        BIT  4,A         ;TEST.FLAG
0363- CB E7    3370        SET  4,A         ; FLAG.ON
0365- 28 02    3375        JR   Z,INTIM1
0367- CB A7    3380        RES  4,A         ; FLAG.OFF
0369- CB 5F    3385 INTIM1 BIT  3,A         ;TEST.DISP
036B- 28 06    3390        JR   Z,INTIM2
036D- CB 6F    3395        BIT  5,A         ;TEST.FLAG
036F- CB EF    3400        SET  5,A         ; DISP.OFF
0371- 28 02    3405        JR   Z,INTIM3
0373- CB AF    3410 INTIM2 RES  5,A         ; DISP.ON
0375- 12       3415 INTIM3 LD   (DE),A
```

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0376- E1          3420 INTIM4 POP  HL          ;RESTORE-ALL
0377- D1          3425        POP  DE
0378- C1          3430        POP  BC
0379- F1          3435        POP  AF
037A- FB          3440        EI
037B- ED 4D       3445        RETI
                  3450 *--------------------------------
                  3455 *     ADDITION    SUBROUTINE
                  3460 *--------------------------------
037D- 21 3D 00    3465 ADDCHK LD HL,MAXTAB ;PT.MAX TAB
0380- 3E 16       3470        LD   A,SEC   ;PT.REAL TAB
0382- 83          3475        ADD  A,E
0383- 5F          3480        LD   E,A
0384- 06 03       3485        LD   B,03H   ;INC & CHK
0386- 1A          3490 INCHK  LD   A,(DE)  ;    FOR
0387- 3C          3495        INC  A       ;SEC MIN HOUR
0388- 27          3500        DAA
0389- 12          3505        LD   (DE),A
038A- 3D          3510        DEC  A
038B- BE          3515        CP   (HL)    ;CP.MAX VALUE
038C- D8          3520        RET  C       ;QUIT L&E.
038D- AF          3525        XOR  A
038E- 12          3530        LD   (DE),A
038F- 23          3535        INC  HL      ;NEXT
0390- 13          3540        INC  DE
0391- 1A          3545        LD   A,(DE)
0392- D6 12       3550        SUB  12H
0394- 30 09       3555        JR   NC,INCHKK
0396- 78          3560        LD   A,B
0397- 3D          3565        DEC  A
0398- FE 01       3570        CP   01H
039A- 20 03       3575        JR   NZ,INCHKK
039C- FD 77 16    3580        LD   (IY+SEC),A
039F- 10 E5       3585 INCHKK DJNZ INCHK
03A1- D5          3590        PUSH DE
03A2- 13          3595        INC  DE
03A3- 1A          3600        LD   A,(DE)
03A4- D1          3605        POP  DE
03A5- FE 02       3610        CP   02H     ;CHK FEBRUARY
03A7- 20 13       3615        JR   NZ,ADD1
03A9- FD CB 09
03AC- 7E          3620        BIT  7,(IY+TIME) ;CHK SPE.
03AD- 28 0D       3625        JR   Z,ADD1
03AF- 3E 0C       3630        LD   A,0CH   ;ADJUST ALL
03B1- 85          3635        ADD  A,L
03B2- 6F          3640        LD   L,A     ;SPECIAL FEB.
03B3- 1A          3645        LD   A,(DE)
03B4- 3C          3650        INC  A
03B5- 27          3655        DAA
03B6- 12          3660        LD   (DE),A
03B7- 3D          3665        DEC  A
03B8- BE          3670        CP   (HL)    ;COMPARE MAX.
03B9- D8          3675        RET  C       ;QUIT  LE.
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03BA- 18 13     3680          JR    ADD2
03BC- E5        3685 ADD1     PUSH  HL
03BD- CD F9 06  3690          CALL  CONV      ;BCD TO BI.
03C0- 3D        3695          DEC   A
03C1- 85        3700          ADD   A,L
03C2- 6F        3705          LD    L,A       ;OTHER  FEB.
03C3- 1A        3710          LD    A,(DE)
03C4- 3C        3715          INC   A
03C5- 27        3720          DAA
03C6- 12        3725          LD    (DE),A
03C7- 3D        3730          DEC   A
03C8- BE        3735          CP    (HL)      ;COMPARE MAX.
03C9- E1        3740          POP   HL
03CA- D8        3745          RET   C         ;QUIT  LE.
03CB- 3E 0C     3750          LD    A,0CH     ;ADJUST ALL
03CD- 85        3755          ADD   A,L
03CE- 6F        3760          LD    L,A
03CF- AF        3765 ADD2     XOR   A
03D0- 3C        3770          INC   A
03D1- 12        3775          LD    (DE),A
03D2- 23        3780          INC   HL
03D3- 13        3785          INC   DE
03D4- 1A        3790          LD    A,(DE)    ;REAL MONTH
03D5- 3C        3795          INC   A
03D6- 27        3800          DAA
03D7- 12        3805          LD    (DE),A
03D8- 3D        3810          DEC   A
03D9- BE        3815          CP    (HL)      ;CP MAX MONTH
03DA- D8        3820          RET   C         ;QUIT  LE.
03DB- AF        3825          XOR   A
03DC- 3C        3830          INC   A
03DD- 12        3835          LD    (DE),A
03DE- 23        3840          INC   HL
03DF- 13        3845          INC   DE
03E0- FD CB 09
03E3- B6        3850          RES   6,(IY+TIME)  ;RESET-
                3855 *                          ;PRECALCULATE
03E4- 1A        3860          LD    A,(DE)    ;LOAD YEAR
03E5- 3C        3865          INC   A
03E6- 27        3870          DAA
03E7- 12        3875          LD    (DE),A
03E8- C0        3880          RET   NZ
03E9- AF        3885          XOR   A         ;CLR  FLAG
03EA- 13        3890          INC   DE
03EB- 1A        3895          LD    A,(DE)    ;LOAD HYEAR
03EC- 3C        3900          INC   A
03ED- 27        3905          DAA
03EE- 12        3910          LD    (DE),A
03EF- C9        3915          RET
```

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                        3920 *--------------------------------
                        3925 *     ALARM  CHECK  SUBROUTINE
                        3930 *--------------------------------
03F0- D5                3935 ALCHK   PUSH DE       ;TIME TABLE
03F1- E1                3940         POP  HL
03F2- 3E 17             3945         LD   A,MIN
03F4- 85                3950         ADD  A,L
03F5- 6F                3955         LD   L,A
03F6- 3E 1D             3960         LD   A,ALBUF ;ALARM TABLE
03F8- 83                3965         ADD  A,E
03F9- 5F                3970         LD   E,A
03FA- 06 01             3975         LD   B,01H   ;1ST CHANNEL
03FC- C5                3980 ALCHK1  PUSH BC
03FD- AF                3985         XOR  A
03FE- 3C                3990         INC  A
03FF- 17                3995 ALSHF   RLA          ;CHANGE VALUE
0400- 10 FD             4000         DJNZ ALSHF   ; TO POSITION
0402- C1                4005         POP  BC
0403- 4F                4010         LD   C,A     ;SA. POSITION
0404- C5                4015         PUSH BC
0405- E5                4020         PUSH HL
0406- CD DA 06          4025         CALL GEBCD   ;CP. TIME IN
0409- E1                4030         POP  HL
040A- C1                4035         POP  BC
040B- 28 0B             4040         JR   Z,ALCHK2
040D- C5                4045         PUSH BC
040E- E5                4050         PUSH HL
040F- CD DA 06          4055         CALL GEBCD   ;CP. TIME OUT
0412- E1                4060         POP  HL
0413- C1                4065         POP  BC
0414- 20 17             4070         JR   NZ,ALCHK4
0416- 18 02             4075         JR   ALCHK3
0418- 13                4080 ALCHK2  INC  DE
0419- 13                4085         INC  DE
041A- FD 7E 16          4090 ALCHK3  LD   A,(IY+SEC) ;PT.SEC TI
041D- FE 10             4095         CP   ALENGH
041F- 30 0C             4100         JR   NC,ALCHK4
0421- 79                4105         LD   A,C        ;CHK STAT
0422- FD A6 0C          4110         AND  (IY+BELL)
0425- 20 06             4115         JR   NZ,ALCHK4
0427- 79                4120         LD   A,C
0428- FD B6 0C          4125         OR   (IY+BELL)  ;ALARM ON
042B- 18 05             4130         JR   ALCHK5
042D- 79                4135 ALCHK4  LD   A,C
042E- 2F                4140         CPL
042F- FD A6 0C          4145         AND  (IY+BELL)  ;ALARM OFF
0432- FD 77 0C          4150 ALCHK5  LD   (IY+BELL),A
0435- 04                4155         INC  B
0436- 78                4160         LD   A,B
0437- FE 08             4165         CP   08H
0439- 20 C1             4170         JR   NZ,ALCHK1
043B- FD 7E 0C          4175         LD   A,(IY+BELL) ;STB. OUT
043E- 32 00 68          4180         LD   (S373),A
0441- C9                4185         RET
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                        4190 *--------------------------------
                        4195 *   TEST PERIPHERAL SUBROUTINE
                        4200 *--------------------------------
0442- CD 82 07          4205 TEST    CALL CLEAR    ;CLR DISPLAY
0445- 3E CF             4210         LD   A,0CFH   ;PATTERN "E"
0447- FD 77 00          4215         LD   (IY+00H),A
044A- 3E 87             4220         LD   A,87H    ;PATTERN "t"
044C- FD 77 01          4225         LD   (IY+01H),A
044F- CD 5C 07          4230         CALL DATA     ;DATASCAN
0452- 28 06             4235         JR   Z,TESTER ;CHK ERROR
0454- FE 02             4240         CP   02H
0456- 38 08             4245         JR   C,TEST1  ;CHK TEST=1
0458- 28 0E             4250         JR   Z,TEST2  ;CHK TEST=2
045A- 3E 11             4255 TESTER  LD   A,ER11   ;##ERROR 11##
045C- CD 33 07          4260 JUER1   CALL ERROR
045F- C9                4265         RET
0460- 0E 15             4270 TEST1   LD   C,TIBUF
0462- 06 04             4275         LD   B,04H
0464- CD 4B 07          4280         CALL DISP1
0467- C9                4285         RET
0468- 3E 9B             4290 TEST2   LD   A,9BH    ;PATTERN "2"
046A- FD 77 00          4295         LD   (IY+00H),A
046D- CD 5C 07          4300         CALL DATA     ;DATASCAN
0470- 28 E8             4305         JR   Z,TESTER ;CHK ERROR
0472- FE 08             4310         CP   08H
0474- 30 E4             4315         JR   NC,TESTER
0476- 3D                4320         DEC  A        ;FOR ADJUST
0477- CB 27             4325         SLA  A        ;MULT BY 4
0479- CB 27             4330         SLA  A
047B- C6 1D             4335         ADD  A,ALBUF
047D- 4F                4340         LD   C,A
047E- CD 49 07          4345         CALL DISP
0481- C9                4350         RET
                        4355 *--------------------------------
                        4360 *     EMPLOYEE   SUBROUTINE
                        4365 *--------------------------------
0482- 3E 1F             4370 EMPLOY  LD   A,1FH     ;PAUSE STATE
0484- D3 40             4375         OUT  (SEG),A
0486- 3E 01             4380         LD   A,01H    ;SET DIGID-0
0488- D3 41             4385         OUT  (DIGIT),A
048A- CD CB 07          4390         CALL STROBE   ;STB EMP-CODE
048D- 78                4395         LD   A,B
048E- CB 3F             4400         SRL  A        ;CHK CARD
0490- 38 04             4405         JR   C,EMP1
0492- 3E 09             4410 EMPER1  LD   A,ER09   ;##ERROR 09##
0494- 18 C6             4415 JUER2   JR   JUER1
0496- CB 3F             4420 EMP1    SRL  A        ;CHK POSITION
0498- 30 F8             4425         JR   NC,EMPER1
049A- 47                4430         LD   B,A
049B- DD E5             4435         PUSH IX       ;CHK USER-R.
049D- E1                4440         POP  HL
049E- 71                4445         LD   (HL),C   ;STORE LO-EMP
049F- 23                4450         INC  HL
04A0- 70                4455         LD   (HL),B   ;STORE HI-EMP
04A1- 23                4460         INC  HL
04A2- FD E5             4465         PUSH IY
04A4- D1                4470         POP  DE
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04A5- 3E 17     4475          LD    A,MIN
04A7- 83        4480          ADD   A,E
04A8- 5F        4485          LD    E,A
04A9- C5        4490          PUSH  BC
04AA- 06 03     4495          LD    B,03H
04AC- CD A5 07  4500          CALL  SHIFT1
04AF- C1        4505          POP   BC          ;RE-EMPCODE
04B0- 3A 00 60  4510          LD    A,(H245)    ;CHK ER-CARD
04B3- CB 3F     4515          SRL   A
04B5- 30 DB     4520          JR    NC,EMPER1
04B7- E5        4525          PUSH  HL          ;SA-USERCOUNT
04B8- AF        4530          XOR   A
04B9- 5F        4535          LD    E,A
04BA- 57        4540          LD    D,A         ;16 BIT COUNT
04BB- 26 10     4545          LD    H,10H       ;TO 2-BCD
04BD- CB 11     4550 LOOP     RL    C
04BF- CB 10     4555          RL    B
04C1- 7B        4560          LD    A,E
04C2- 8F        4565          ADC   A,A
04C3- 27        4570          DAA
04C4- 5F        4575          LD    E,A
04C5- 7A        4580          LD    A,D
04C6- 8F        4585          ADC   A,A
04C7- 27        4590          DAA
04C8- 57        4595          LD    D,A
04C9- 25        4600          DEC   H
04CA- 20 F1     4605          JR    NZ,LOOP
04CC- FD E5     4610          PUSH  IY
04CE- E1        4615          POP   HL          ;RE-DISBUF
04CF- 7B        4620          LD    A,E
04D0- CD AD 07  4625          CALL  HEXSG1
04D3- 7A        4630          LD    A,D
04D4- CD AD 07  4635          CALL  HEXSG1
04D7- E1        4640          POP   HL          ;RE-USERCOUNT
04D8- CD FE 05  4645 EMP2     CALL  SCAN1
04DB- 3A 00 60  4650          LD    A,(H245)    ;CHK RELEAVE
04DE- CB 3F     4655          SRL   A
04E0- 38 F6     4660          JR    C,EMP2
04E2- DD E5     4665          PUSH  IX
04E4- D1        4670          POP   DE
04E5- 7B        4675          LD    A,E
04E6- D6 05     4680          SUB   05H         ;LAST EMP-CODE
04E8- 5F        4685          LD    E,A
04E9- 1A        4690          LD    A,(DE)      ;CHK EVER REG.
04EA- DD BE 00  4695          CP    (IX+0H)
04ED- 20 0B     4700          JR    NZ,EMP3
04EF- 13        4705          INC   DE
04F0- 1A        4710          LD    A,(DE)
04F1- DD BE 01  4715          CP    (IX+01H)
04F4- 20 04     4720          JR    NZ,EMP3
04F6- 3E 10     4725          LD    A,ER10      ;##ERROR 10##
04F8- 18 9A     4730 JUER3    JR    JUER2
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04FA- E5          4735 EMP3   PUSH HL
04FB- DD E1       4740        POP  IX      ;NEW USED AREA
04FD- FD 4E 0F    4745        LD   C,(IY+LOW1) ;BC=LOMEM
0500- FD 46 10    4750        LD   B,(IY+LOW2)
0503- AF          4755        XOR  A       ;CLEAR CARRY
0504- ED 42       4760        SBC  HL,BC   ;FIND USED MEM
0506- EB          4765        EX   DE,HL   ;SAVE INTO DE
0507- FD E5       4770        PUSH IY
0509- E1          4775        POP  HL
050A- AF          4780        XOR  A
050B- ED 42       4785        SBC  HL,BC   ;FIND USER MEM
050D- E5          4790        PUSH HL
050E- CB 3C       4795        SRL  H       ;DIVISION BY 2
0510- CB 1D       4800        RR   L
0512- E5          4805        PUSH HL      ;SAVE INTO BC
0513- C1          4810        POP  BC
0514- AF          4815        XOR  A
0515- ED 52       4820        SBC  HL,DE   ;CHK USED>50%
0517- E1          4825        POP  HL
0518- D0          4830        RET  NC      ;QUIT USED<50%
0519- FD CB 09
051C- DE          4835        SET  3,(IY+TIME) ;FLASHING
051D- CB 38       4840        SRL  B       ;DIVISION BY 2
051F- CB 19       4845        RR   C
0521- AF          4850        XOR  A       ;CLEAR CARRY
0522- ED 42       4855        SBC  HL,BC   ;FIND 75% MEM
0524- AF          4860        XOR  A       ;CLEAR CARRY
0525- ED 52       4865        SBC  HL,DE   ;CHK USED>75%
0527- D0          4870        RET  NC      ;QUIT USED<75%
                  4875 *-------------------------------
                  4880 *       RS232   SUBROUTINE
                  4885 *-------------------------------
0528- 3E A6       4890 RS232  LD   A,0A6H ;SEND STATE
052A- D3 40       4895        OUT  (SEG),A
052C- 3E 01       4900        LD   A,01H  ;SET DIGID-0
052E- D3 41       4905        OUT  (DIGIT),A
0530- 3E 12       4910        LD   A,DTR51
0532- D3 49       4915        OUT  (P8251),A
0534- CD F5 07    4920        CALL DELAY
0537- CD 85 06    4925        CALL RECV   ;RECV UNIT NO.
053A- FD BE 0D    4930        CP   (IY+UNIT)
053D- 28 06       4935        JR   Z,RSS2 ;CORRECT UNIT
053F- DB 49       4940 RSS1   IN   A,(P8251)
0541- 07          4945        RLCA
0542- 38 FB       4950        JR   C,RSS1
0544- C9          4955        RET
0545- 47          4960 RSS2   LD   B,A    ;SAVE UNIT NO.
0546- 3E 12       4965        LD   A,DTR51
0548- D3 49       4970        OUT  (P8251),A
054A- DB 49       4975 RSS3   IN   A,(P8251)
054C- 07          4980        RLCA
054D- 38 FB       4985        JR   C,RSS3
054F- 3E 41       4990 RS232A LD   A,41H  ;SEND ASCII-A
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0551- CD 3B 06 4995          CALL CMD1    ;COMMAND PAT
0554- FD E5    5000          PUSH IY
0556- E1       5005          POP  HL
0557- 3E 16    5010          LD   A,SEC
0559- 85       5015          ADD  A,L
055A- 6F       5020          LD   L,A
055B- 06 07    5025          LD   B,07H   ;7-BYTE SEND
055D- C5       5030 RS232B   PUSH BC
055E- 7E       5035          LD   A,(HL) ;SEC MIN HOUR
055F- CD 4B 06 5040          CALL OUT    ;DAY MONTH
0562- 23       5045          INC  HL      ;YEAR HYEAR
0563- C1       5050          POP  BC
0564- 10 F7    5055          DJNZ RS232B
0566- DD E5    5060          PUSH IX
0568- E1       5065          POP  HL
0569- FD 5E 0F 5070          LD   E,(IY+LOW1)
056C- FD 56 10 5075          LD   D,(IY+LOW2)
056F- AF       5080          XOR  A
0570- ED 52    5085          SBC  HL,DE   ;FIND USER SP
0572- EB       5090          EX   DE,HL   ;DE=SPACE NOW
0573- FD 7E 0D 5095          LD   A,(IY+UNIT) ;HL=LOMEM
0576- CD 4B 06 5100          CALL OUT
0579- 7B       5105          LD   A,E     ;SEND LO-RANGE
057A- CD 4B 06 5110          CALL OUT
057D- 7A       5115          LD   A,D     ;SEND HI-RANGE
057E- CD 4B 06 5120          CALL OUT
0581- 3E 42    5125          LD   A,42H   ;SEND ASCII-B
0583- CD 3B 06 5130          CALL CMD1
0586- 7B       5135          LD   A,E     ;CHK 0-RANGE
0587- B2       5140          OR   D
0588- 28 0A    5145          JR   Z,RS232D
058A- 7E       5150 RS232C   LD   A,(HL) ;SEND EMPLOYE
058B- CD 4B 06 5155          CALL OUT     ;AND TIME
058E- 23       5160          INC  HL
058F- 1B       5165          DEC  DE
0590- 7B       5170          LD   A,E
0591- B2       5175          OR   D
0592- 20 F6    5180          JR   NZ,RS232C
0594- 3E 46    5185 RS232D   LD   A,46H   ;SEND ASCII-F
0596- CD 3B 06 5190          CALL CMD1    ;COMMAND PAT.
0599- 3E 00    5195 RSS4     LD   A,00H
059B- CD 4B 06 5200          CALL OUT
059E- 30 F4    5205          JR   NC,RS232D
05A0- 79       5210          LD   A,C
05A1- FE 41    5215          CP   41H     ;CHK ASCII-A
05A3- 20 1C    5220          JR   NZ,RSS8
05A5- CD 08 07 5225          CALL BATCH
05A8- E5       5230          PUSH HL      ;SA.LOMEM
05A9- 3E 55    5235 RSS5     LD   A,55H
05AB- CD 4B 06 5240          CALL OUT
05AE- 38 04    5245          JR   C,RSS6
05B0- 77       5250          LD   (HL),A ;STORE DATA
05B1- 23       5255          INC  HL
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05B2- 18 F5     5260            JR    RSS5
05B4- FE 43     5265 RSS6       CP    43H     ;CHK ASCII-C
05B6- 20 03     5270            JR    NZ,RSS7
05B8- 2B        5275            DEC   HL
05B9- 18 EE     5280            JR    RSS5
05BB- E1        5285 RSS7       POP   HL
05BC- FE 42     5290            CP    42H     ;CHK ASCII-B
05BE- 20 01     5295            JR    NZ,RSS8 ;COMMU.ERROR
05C0- E9        5300            JP    (HL)    ;PROGRESS?
05C1- FE 45     5305 RSS8       CP    45H     ;CHK ASCII-E
05C3- 28 8A     5310            JR    Z,RS232A ;ERROR ALL
05C5- FE 46     5315            CP    46H     ;CHK ASCII-F
05C7- 20 D0     5320            JR    NZ,RSS4
05C9- CD 08 07  5325            CALL  BATCH
05CC- FD CB 09
05CF- 9E        5330            RES   3,(IY+TIME) ;RESFLASH
05D0- C9        5335            RET
                5340 *-------------------------------
                5345 *        SCAN  SUBROUTINE
                5350 *-------------------------------
05D1- CD FE 05  5355 SCAN       CALL  SCAN1
05D4- 38 FB     5360            JR    C,SCAN  ;PRESSED KEY?
05D6- 06 06     5365            LD    B,06H   ;DELAY 40 ms
05D8- CD FE 05  5370 PRESS      CALL  SCAN1
05DB- 10 FB     5375            DJNZ  PRESS
05DD- 38 F2     5380            JR    C,SCAN  ;PROT. NOISE
05DF- CD FE 05  5385 LEAVE      CALL  SCAN1   ;LEAVED KEY?
05E2- 30 FB     5390            JR NC,LEAVE
05E4- C9        5395            RET
                5400 *-------------------------------
                5405 *      MOVE   SUBROUTINE
                5410 *-------------------------------
05E5- FD E5     5415 MOVE       PUSH  IY        ;PT. DISPBUF
05E7- E1        5420            POP   HL
05E8- E5        5425            PUSH  HL        ;PT. TIMEBUF
05E9- D1        5430            POP   DE
05EA- 79        5435            LD    A,C  ;C=DISPLACEMENT
05EB- 83        5440            ADD   A,E
05EC- 5F        5445            LD    E,A
05ED- CD AC 07  5450 MOVE1      CALL  HEXSG
05F0- 13        5455            INC   DE
05F1- CD AC 07  5460            CALL  HEXSG
05F4- FD CB 09
05F7- 66        5465            BIT   4,(IY+TIME) ;TES.FLAG
05F8- 28 04     5470            JR    Z,SCAN1
05FA- FD CB 02
05FD- F6        5475            SET   6,(IY+SECOND)
```

```
                        5480 *-------------------------------
                        5485 *       SCAN1 SUBROUTINE
                        5490 *-------------------------------
05FE- 37                5495 SCAN1  SCF             ;SET CARRY
05FF- D9                5500        EXX             ;SAVE ALL
0600- 08                5505        EX    AF,AF'
0601- FD E5             5510        PUSH  IY        ;HL=DISBUF
0603- E1                5515        POP   HL
0604- 0E 00             5520        LD    C,00H     ;INIT POSCODE
0606- 16 04             5525        LD    D,04H     ;ACTIVE DIGIT
0608- 1E 01             5530        LD    E,01H     ;FIRST DIGIT
060A- 7E                5535 KCOL   LD    A,(HL)    ;DIS. SEGMENT
060B- D3 40             5540        OUT   (SEG),A
060D- 7B                5545        LD    A,E
060E- D3 41             5550        OUT   (DIGIT),A
0610- 06 87             5555        LD    B,COLDEL  ;DELAY 2.3ms
0612- E5                5560 CDELAY PUSH  HL
0613- E1                5565        POP   HL
0614- 10 FC             5570        DJNZ  CDELAY
0616- 06 04             5575        LD    B,04H     ;ACTIVE ROW
0618- DB 42             5580        IN    A,(KIN)
061A- CB 1F             5585 KROW   RR    A         ;SHF TO CARRY
061C- 38 04             5590        JR    C,NOKEY   ;JUMP NO KEY
061E- F5                5595        PUSH  AF
061F- 79                5600        LD    A,C
0620- 08                5605        EX    AF,AF'    ;SAVE POS-KEY
0621- F1                5610        POP   AF
0622- 0C                5615 NOKEY  INC   C         ;INCRE. CODE
0623- 10 F5             5620        DJNZ  KROW
0625- 23                5625        INC   HL        ;NEXT SEGMENT
0626- CB 23             5630        SLA   E         ;NEXT DIGIT
0628- 15                5635        DEC   D
0629- 20 DF             5640        JR    NZ,KCOL   ;PROGRESS ?
062B- AF                5645        XOR   A
062C- D3 41             5650        OUT   (DIGIT),A
062E- 08                5655        EX    AF,AF'
062F- 38 06             5660        JR    C,NOPOST  ;JUMP NO KEY
0631- 21 15 00          5665        LD    HL,POSTAB ;CON. CODE
0634- 85                5670        ADD   A,L
0635- 6F                5675        LD    L,A       ;NOTE A+L<=FF
0636- 7E                5680        LD    A,(HL)
0637- D9                5685 NOPOST EXX             ;RESTORE ALL
0638- C9                5690        RET
                        5695 *-------------------------------
                        5700 *   COMMAND  SEND  SUBROUTINE
                        5705 *-------------------------------
0639- 3E 43             5710 CMD    LD    A,43H     ;SEND ASCII-C
063B- F5                5715 CMD1   PUSH  AF        ;SAVE COMMAND
063C- 3E 00             5720        LD    A,00H     ;PATTERN-00-
063E- CD 4B 06          5725        CALL  OUT
0641- 3E FF             5730        LD    A,0FFH    ;PATTERN-FF-
0643- CD 4B 06          5735        CALL  OUT
0646- F1                5740        POP   AF        ;RES. COMMAND
0647- CD 4B 06          5745        CALL  OUT
064A- C9                5750        RET
```

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                        5755 *--------------------------------
                        5760 *     OUTPUT   SUBROUTINE
                        5765 *--------------------------------
064B- B7                5770 OUT    OR   A          ;CLEAR FLAG
064C- F5                5775        PUSH AF         ;SAVE DATA
064D- CD 71 06          5780        CALL COMMU      ;TRANS & RECV
0650- 2F                5785        CPL
0651- B8                5790        CP   B
0652- 20 02             5795        JR   NZ,OUT1
0654- F1                5800        POP  AF         ;GOOD DATA
0655- C9                5805        RET
0656- 79                5810 OUT1   LD   A,C
0657- FE 00             5815        CP   00H        ;FIND 00-CMD
0659- 20 08             5820        JR   NZ,OUT2    ;ERROR DATA
065B- 2F                5825        CPL             ;ECHO FF-CMD
065C- CD 71 06          5830        CALL COMMU      ;TRANS & RECV
065F- 79                5835        LD   A,C
0660- B8                5840        CP   B
0661- 28 06             5845        JR   Z,OUT3
0663- CD 39 06          5850 OUT2   CALL CMD        ;SEND ASCII-C
0666- F1                5855        POP  AF         ;RES. DATA
0667- 18 E2             5860        JR   OUT
0669- 3E 46             5865 OUT3   LD   A,46H      ;ECHO ASCII-F
066B- CD 71 06          5870        CALL COMMU      ;TRANS & RECV
066E- F1                5875        POP  AF
066F- 37                5880        SCF
0670- C9                5885        RET
                        5890 *--------------------------------
                        5895 *  PROTOCAL TRANS &RECV COMMU.
                        5900 *--------------------------------
0671- 47                5905 COMMU  LD   B,A         ;SAVE DATA
0672- DB 49             5910 TRAN   IN   A,(P8251)
0674- CB 57             5915        BIT  2,A        ;CHK TXEMP
0676- 28 FA             5920        JR   Z,TRAN
0678- 78                5925        LD   A,B        ;LOAD DATA
0679- D3 48             5930        OUT  (D8251),A
067B- 3E 11             5935        LD   A,TRAN51   ;TRANS-EN
067D- D3 49             5940        OUT  (P8251),A
067F- DB 49             5945 TRAN1  IN   A,(P8251)
0681- CB 47             5950        BIT  0,A
0683- 28 FA             5955        JR   Z,TRAN1
0685- 3E 34             5960 RECV   LD   A,KEEP51
0687- D3 49             5965        OUT  (P8251),A
0689- DB 49             5970 RECV1  IN   A,(P8251)
068B- CB 4F             5975        BIT  1,A        ;CHK RxRDY
068D- 28 FA             5980        JR   Z,RECV1
068F- 3E 10             5985        LD   A,STOP51   ;LEAVE COMM
0691- D3 49             5990        OUT  (P8251),A
0693- DB 48             5995        IN   A,(D8251)  ;SAVE DATA
0695- 4F                6000        LD   C,A
0696- C9                6005        RET
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                        6010 *-------------------------------
                        6015 *     PRE-CALCULATE  YEAR
                        6020 *-------------------------------
0697- FD 6E 1B          6025 PRECAL LD   L,(IY+YEAR)
069A- FD 66 1C          6030        LD   H,(IY+HYEAR)
069D- 06 10             6035 BCDBI  LD   B,10H    ;BIT COUNT=16
069F- CB 3C             6040 BCDBI1 SRL  H
06A1- CB 1D             6045        RR   L
06A3- CB 1A             6050        RR   D
06A5- CB 1B             6055        RR   E
06A7- 7C                6060        LD   A,H
06A8- CD D3 06          6065        CALL BICOR1
06AB- 67                6070        LD   H,A      ;CORRECT H
06AC- 7D                6075        LD   A,L
06AD- CD CD 06          6080        CALL BICOR
06B0- 6F                6085        LD   L,A      ;CORRECT L
06B1- 10 EC             6090        DJNZ BCDBI1
06B3- 06 02             6095        LD   B,02H ;DIVISION BY 4
06B5- AF                6100 PREC1  XOR  A
06B6- CB 1A             6105        RR   D
06B8- CB 1B             6110        RR   E
06BA- 38 08             6115        JR   C,PREC2
06BC- 10 F7             6120        DJNZ PREC1
06BE- FD CB 09
06C1- FE                6125        SET  7,(IY+TIME) ;SPEC.YR
06C2- 18 04             6130        JR   PREC3
06C4- FD CB 09
06C7- BE                6135 PREC2  RES  7,(IY+TIME) ;NOR.YR
06C8- FD CB 09
06CB- F6                6140 PREC3  SET  6,(IY+TIME) ;CAL.RDY
06CC- C9                6145        RET
                        6150 *-------------------------------
                        6155 *       BINARY   CORRECT
                        6160 *-------------------------------
06CD- CB 7F             6165 BICOR  BIT  7,A
06CF- 28 02             6170        JR   Z,BICOR1
06D1- D6 30             6175        SUB  30H      ;ADJ. HI-BCD
06D3- CB 5F             6180 BICOR1 BIT  3,A
06D5- 28 02             6185        JR   Z,BICOR2
06D7- D6 03             6190        SUB  03H      ;ADJ. LO-BCD
06D9- C9                6195 BICOR2 RET
                        6200 *-------------------------------
                        6205 *    COMPARE.GE.MAX  2  BCD
                        6210 *-------------------------------
06DA- 06 02             6215 GEBCD  LD   B,02H  ;GET 2 ARRAY
06DC- 1A                6220 GEBCD1 LD   A,(DE) ;LOAD MAX TIME
06DD- 96                6225        SUB  (HL)   ;COMPARE REAL
06DE- 27                6230        DAA
06DF- 38 07             6235        JR   C,ENDBCD
06E1- 20 05             6240        JR   NZ,ENDBCD
06E3- 13                6245        INC  DE
06E4- 23                6250        INC  HL
06E5- 10 F5             6255        DJNZ GEBCD1
06E7- C9                6260        RET
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06E8- 13          6265 ENDBCD INC  DE
06E9- 23          6270        INC  HL
06EA- 10 FC       6275        DJNZ ENDBCD
06EC- C9          6280        RET
                  6285 *-------------------------------
                  6290 *    COMPARE.LE.MAX  2  BCD
                  6295 *-------------------------------
06ED- 06 02       6300 LEBCD  LD   B,02H  ;GET 2 ARRAY
06EF- 1A          6305 LEBCD1 LD   A,(DE) ;LOAD MAX TIME
06F0- 96          6310        SUB  (HL)   ;COMPARE REAL
06F1- 27          6315        DAA         ;DEC. ADJUST
06F2- 38 F4       6320        JR   C,ENDBCD
06F4- 13          6325        INC  DE
06F5- 23          6330        INC  HL
06F6- 10 F7       6335        DJNZ LEBCD1
06F8- C9          6340        RET
                  6345 *-------------------------------
                  6350 *    CONVERT 1 BCD TO BINARY
                  6355 *-------------------------------
06F9- E5          6360 CONV   PUSH HL
06FA- D6 10       6365        SUB  10H
06FC- 38 06       6370        JR   C,CONV1
06FE- 21 60 00    6375        LD   HL,CONTAB
0701- 85          6380        ADD  A,L
0702- 6F          6385        LD   L,A
0703- 7E          6390        LD   A,(HL)
0704- C6 10       6395 CONV1  ADD  A,10H
0706- E1          6400        POP  HL
0707- C9          6405        RET
                  6410 *-------------------------------
                  6415 *    BATCH CLEAR SUBROUTINE
                  6420 *-------------------------------
0708- FD 5E 0F    6425 BATCH  LD   E,(IY+LOW1)
070B- FD 56 10    6430        LD   D,(IY+LOW2)
070E- D5          6435        PUSH DE
070F- DD E1       6440        POP  IX
0711- DD E5       6445 BATCH1 PUSH IX       ;BACKUP DE
0713- D1          6450        POP  DE
0714- 12          6455        LD   (DE),A   ;STORE VALUE
0715- AF          6460        XOR  A        ;INITIAL HL
0716- 6F          6465        LD   L,A
0717- 67          6470        LD   H,A
0718- 39          6475        ADD  HL,SP    ;TR. SP->HL
0719- 2B          6480        DEC HL
071A- 2B          6485        DEC HL
071B- 37          6490 BATCH2 SCF           ;HL=LENGTH
071C- ED 52       6495        SBC  HL,DE    ;DE=LO MEM
071E- 4D          6500        LD   C,L      ;BE=LEN NOW
071F- 44          6505        LD   B,H
0720- 6B          6510        LD   L,E      ;HL=LOMEM NOW
0721- 62          6515        LD   H,D
0722- 13          6520        INC  DE       ;DE=HL+1
0723- E5          6525        PUSH HL
0724- 7E          6530        LD   A,(HL)   ;FIRST VALUE
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0725- ED B0     6535          LDIR
0727- E1        6540          POP   HL
0728- BE        6545          CP    (HL)      ;COMP. LAST
0729- C8        6550          RET   Z
                6555 *--------------------------------
                6560 *     ERROR DISPLAY AND HOLD
                6565 *--------------------------------
072A- FD 21 11
072D- 00        6570 ERRH     LD    IY,ERRTAB
072E- CD FE 05  6575 ERRH1    CALL  SCAN1
0731- 18 FB     6580          JR    ERRH1
                6585 *--------------------------------
                6590 *        ERROR   DISPLAY
                6595 *--------------------------------
0733- F5        6600 ERROR    PUSH  AF        ;SAVE ERROR
0734- 11 13 00  6605          LD    DE,ERRTAB+2H
0737- FD E5     6610          PUSH  IY
0739- E1        6615          POP   HL
073A- CD A3 07  6620          CALL  SHIFT
073D- F1        6625          POP   AF
073E- CD AD 07  6630          CALL  HEXSG1
0741- 06 3C     6635          LD    B,3CH     ;DISP .32 SEC
0743- CD FE 05  6640 ERROR1   CALL  SCAN1
0746- 10 FB     6645          DJNZ  ERROR1
0748- C9        6650          RET
                6655 *--------------------------------
                6660 *     DISPLAY   SUBROUTINE
                6665 *--------------------------------
0749- 06 02     6670 DISP     LD    B,02H     ;COUNTER LOOP
074B- C5        6675 DISP1    PUSH  BC
074C- CD E5 05  6680 DISP2    CALL  MOVE      ;MOVE & SCAN
074F- FE 0F     6685          CP    0FH       ;ENTER KEY ?
0751- 20 F9     6690          JR    NZ,DISP2
0753- CD D1 05  6695          CALL  SCAN
0756- C1        6700          POP   BC
0757- 0C        6705          INC   C         ;INC DISPLACE
0758- 0C        6710          INC   C
0759- 10 F0     6715          DJNZ  DISP1
075B- C9        6720          RET
                6725 *--------------------------------
                6730 *        DATA SCAN AND MOVE
                6735 *--------------------------------
075C- FD E5     6740 DATA     PUSH  IY
075E- D1        6745          POP   DE
075F- D5        6750          PUSH  DE
0760- E1        6755          POP   HL
0761- 23        6760          INC   HL
0762- 23        6765          INC   HL        ;HL=DISPBUF
0763- 3E 08     6770          LD    A,STEMP
0765- 83        6775 DATA1    ADD   A,E
0766- 5F        6780          LD    E,A       ;DE=TEMPBUF
0767- E5        6785 DATA2    PUSH  HL
0768- CD AC 07  6790          CALL  HEXSG     ;MOVE  DATA
076B- E1        6795          POP   HL
076C- CD D1 05  6800 DATA3    CALL  SCAN
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076F- FE 0A     6805          CP    0AH       ;DATA KEY ?
0771- 30 06     6810          JR    NC,DATA4
0773- EB        6815          EX    DE,HL
0774- ED 6F     6820          RLD               ;SHIFT DATA
0776- EB        6825          EX    DE,HL
0777- 18 EE     6830          JR    DATA2
0779- FE 0F     6835 DATA4    CP    0FH
077B- 20 EF     6840          JR    NZ,DATA3
077D- FD 7E 08  6845          LD    A,(IY+STEMP)
0780- B7        6850          OR    A         ;CHK ZERO
0781- C9        6855          RET
                6860 *-------------------------------
                6865 *     CLEAR  DISPLAY  BUFFER
                6870 *-------------------------------
0782- 06 04     6875 CLEAR    LD    B,04H     ;COUNTER
0784- FD E5     6880 CLEAR1   PUSH  IY
0786- E1        6885          POP   HL        ;HL=DISPBUF
0787- AF        6890 CLEAR2   XOR   A
0788- 77        6895          LD    (HL),A    ;CLEAR ALL
0789- 23        6900          INC   HL
078A- 10 FB     6905          DJNZ  CLEAR2
078C- C9        6910          RET
                6915 *-------------------------------
                6920 *       KEEP  FOUR  DIGIT
                6925 *-------------------------------
078D- C5        6930 KEEP     PUSH  BC        ;SAVE STATE
078E- E5        6935          PUSH  HL        ;SAVE ACT.REAL
078F- D5        6940          PUSH  DE        ;SAVE ACT.SEG
0790- FD E5     6945          PUSH  IY
0792- E1        6950          POP   HL        ;HL=DISPBUF
0793- CD A3 07  6955          CALL  SHIFT
0796- D1        6960          POP   DE
0797- 4B        6965          LD    C,E       ;BC=ACT. TIME
0798- 42        6970          LD    B,D
0799- D1        6975          POP   DE
079A- D5        6980          PUSH  DE
079B- CD AC 07  6985          CALL  HEXSG
079E- 59        6990          LD    E,C       ;DE=ACT. TIME
079F- 50        6995          LD    D,B
07A0- E1        7000          POP   HL        ;HL=ACT. REAL
07A1- C1        7005          POP   BC        ;BC= STATE
07A2- C9        7010          RET
                7015 *-------------------------------
                7020 *       SHIFT   SUBROUTINE
                7025 *-------------------------------
07A3- 06 02     7030 SHIFT    LD    B,02H     ;2 BYTE SHIF
07A5- 1A        7035 SHIFT1   LD    A,(DE)    ;DE -> HL
07A6- 77        7040          LD    (HL),A    ;DE+1->HL+1
07A7- 23        7045          INC   HL
07A8- 13        7050          INC   DE
07A9- 10 FA     7055          DJNZ  SHIFT1
07AB- C9        7060          RET
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                        7065 *--------------------------------
                        7070 *     HEX SEGMENT SUBROUTINE
                        7075 *--------------------------------
07AC- 1A                7080 HEXSG  LD   A,(DE)  ;SOURCE DATA
07AD- F5                7085 HEXSG1 PUSH AF      ;SAVE DATA
07AE- E5                7090        PUSH HL
07AF- CD C2 07          7095        CALL HEX
07B2- E1                7100        POP  HL
07B3- 77                7105        LD   (HL),A  ;STORE UPPER
07B4- 23                7110        INC  HL
07B5- F1                7115        POP  AF
07B6- 0F                7120        RRCA         ;TRANSLATE
07B7- 0F                7125        RRCA        ;HIBYTE.-> HL
07B8- 0F                7130        RRCA        ;LOBYTE.->HL+1
07B9- 0F                7135        RRCA
07BA- E5                7140        PUSH HL
07BB- CD C2 07          7145        CALL HEX
07BE- E1                7150        POP  HL
07BF- 77                7155        LD   (HL),A  ;STORE LOWER
07C0- 23                7160        INC  HL
07C1- C9                7165        RET
                        7170 *--------------------------------
                        7175 *     HEX  SEVEN  SUBROUTINE
                        7180 *--------------------------------
07C2- 21 25 00          7185 HEX    LD   HL,NUMTAB ;SEG. TABLE
07C5- E6 0F             7190        AND  0FH
07C7- 85                7195        ADD  A,L
07C8- 6F                7200        LD   L,A
07C9- 7E                7205        LD   A,(HL)    ;LOAD DATA
07CA- C9                7210        RET
                        7215 *--------------------------------
                        7220 *     STROBE  EMPLYEE  CODE
                        7225 *--------------------------------
07CB- CD E4 07          7230 STROBE CALL TURNO   ;TURN LAMP ON
07CE- CD F5 07          7235        CALL DELAY
07D1- 3A 00 58          7240        LD   A,(L245) ;LOAD LO-EMP
07D4- 4F                7245        LD   C,A
07D5- 3A 00 60          7250        LD   A,(H245) ;LOAD HI-EMP
07D8- 47                7255        LD   B,A
07D9- CD DD 07          7260        CALL TUROFF ;TURN LAMP OFF
07DC- C9                7265        RET
                        7270 *--------------------------------
                        7275 *     TURN ON/OFF LAMP
                        7280 *--------------------------------
07DD- 3E FE             7285 TUROFF LD   A,0FEH  ;RESET BITO
07DF- FD A6 0C          7290 TUROF1 AND  (IY+BELL)
07E2- 18 05             7295        JR   TURN
07E4- 3E 01             7300 TURNO  LD   A,01H   ;SET  BITO
07E6- FD B6 0C          7305 TURNO1 OR   (IY+BELL)
07E9- 32 00 68          7310 TURN   LD   (S373),A
07EC- C9                7315        RET
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                        7320 *------------------------------
                        7325 *     RAM  CHECK
                        7330 *------------------------------
07ED- 7E                7335 RAMCHK LD   A,(HL)
07EE- 2F                7340        CPL
07EF- 77                7345        LD   (HL),A
07F0- 7E                7350        LD   A,(HL)
07F1- 2F                7355        CPL
07F2- 77                7360        LD   (HL),A
07F3- BE                7365        CP   (HL)
07F4- C9                7370        RET
                        7375 *------------------------------
                        7380 *     DELAY SUBROUTINE
                        7385 *------------------------------
07F5- 06 40             7390 DELAY  LD   B,40H    ;OUTER LOOP
07F7- 0E 00             7395 DELAY1 LD   C,00H    ;INNER LOOP
07F9- 0D                7400 DELAY2 DEC C
07FA- 20 FD             7405        JR NZ,DELAY2
07FC- 10 F9             7410        DJNZ DELAY1
07FE- 00                7415 NOP    NOP
07FF- C9                7420 ZZZ    RET
```

SYMBOL TABLE

03BC- ADD1	0767- DATA2	00F8- INIT5	0000- ORIGIN	0308- RUN09
03CF- ADD2	076C- DATA3	0104- INKEY	064B- OUT	031F- RUN10
037D- ADDCHK	0779- DATA4	010E- INKEY1	0656- OUT1	0243- RUNCHK
000A- ALARM	0019- DAY	033A- INTIM	0663- OUT2	027A- RUNER1
001D- ALBUF	07F5- DELAY	0369- INTIM1	0669- OUT3	02C4- RUNER2
0039- ALBUF1	07F7- DELAY1	0373- INTIM2	0049- P8251	6800- S373
03F0- ALCHK	07F9- DELAY2	0375- INTIM3	0043- P8255	05D1- SCAN
03FC- ALCHK1	0041- DIGIT	0376- INTIM4	00FF- PACK	05FE- SCAN1
0418- ALCHK2	0749- DISP	045C- JUER1	0004- PDELAY	0016- SEC
041A- ALCHK3	074B- DISP1	0494- JUER2	0015- POSTAB	0002- SECOND
042D- ALCHK4	074C- DISP2	04F8- JUER3	0069- POWER	0040- SEG
0432- ALCHK5	0012- DTR51	012E- JUERR1	06B5- PREC1	002F- SEGTAB
0010- ALENGH	0496- EMP1	0166- JUERR2	06C4- PREC2	000B- SET
03FF- ALSHF	04D8- EMP2	01AD- JUERR3	06C8- PREC3	07A3- SHIFT
0177- ALST	04FA- EMP3	0220- JUERR4	0697- PRECAL	07A5- SHIFT1
0182- ALST1	0492- EMPER1	025D- JUERR5	05D8- PRESS	0008- SRAM
0191- ALST2	0482- EMPLOY	027C- JUERR6	01FA- PRO1	0000- START
019F- ALST3	06E8- ENDBCD	02C6- JUERR7	0200- PRO2	0008- STEMP
0181- ALSTAC	0001- ER01	02D4- JUERR8	0204- PRO3	0010- STOP51
01AF- ALSTCL	0002- ER02	0131- JUMP1	0214- PRO4	07CB- STROBE
019B- ALSTDA	0003- ER03	0175- JUMP2	021A- PRO5	0442- TEST
01B6- ALSTEN	0004- ER04	01BC- JUMP3	0233- PRO6	0460- TEST1
0708- BATCH	0005- ER05	0228- JUMP4	023A- PRO7	0468- TEST2
0711- BATCH1	0006- ER06	0050- JUMTAB	023E- PRO8	045A- TESTER
071B- BATCH2	0007- ER07	060A- KCOL	01BE- PROG	0003- THIRD
069D- BCDBI	0008- ER08	078D- KEEP	0222- PROG1	0015- TIBUF
069F- BCDBI1	0009- ER09	0034- KEEP51	022A- PROG2	001C- TIBUF1
000C- BELL	0010- ER10	0042- KIN	0209- PROG3	00D0- TICTC0
0055- BIAS	0011- ER11	061A- KROW	01EF- PROG4	001A- TICTC1
06CD- BICOR	072A- ERRH	5800- L245	021E- PROGER	000D- TICTC2
06D3- BICOR1	072E- ERRH1	05DF- LEAVE	07ED- RAMCHK	008E- TICTC3
06D9- BICOR2	0733- ERROR	06ED- LEBCD	0685- RECV	0009- TIME
000F- BLKTAB	0743- ERROR1	06EF- LEBCD1	0689- RECV1	0133- TIST
000E- BUAD	0011- ERRTAB	04BD- LOOP	0013- RES1	013E- TIST1
0612- CDELAY	0800- EXPG	000F- LOW1	0014- RES2	014A- TIST2
0782- CLEAR	00FF- FILL	0010- LOW2	0528- RS232	0158- TIST3
0784- CLEAR1	0001- FIRST	000B- M88TAB	054F- RS232A	013D- TISTAC
0787- CLEAR2	0004- FTEMP	003D- MAXTAB	055D- RS232B	0168- TISTCL
0000- CLR	06DA- GEBCD	0017- MIN	058A- RS232C	016F- TISTEN
0040- CLR51	06DC- GEBCD1	001A- MONTH	0594- RS232D	0672- TRAN
0639- CMD	6000- H245	05E5- MOVE	053F- RSS1	067F- TRAN1
063B- CMD1	07C2- HEX	05ED- MOVE1	0545- RSS2	0011- TRAN51
0087- COLDEL	07AC- HEXSG	0038- MRAM	054A- RSS3	07E9- TURN
0671- COMMU	07AD- HEXSG1	0066- NMI	0599- RSS4	07E4- TURNO
0060- CONTAB	0011- HIGH1	0622- NOKEY	05A9- RSS5	07E6- TURNO1
06F9- CONV	0012- HIGH2	07FE- NOP	05B4- RSS6	07DF- TUROF1
0704- CONV1	0018- HOUR	0637- NOPOST	05BB- RSS7	07DD- TUROFF
0044- CTC0	0006- HTEMP	0058- NTCTC0	05C1- RSS8	000D- UNIT
0045- CTC1	001C- HYEAR	005A- NTCTC1	0250- RUN01	0055- UPCODE
0046- CTC2	0386- INCHK	005C- NTCTC2	0253- RUN02	001B- YEAR
0047- CTC3	039F- INCHKK	005E- NTCTC3	025F- RUN03	0000- ZERO
004D- CTRL51	0083- INIT	0025- NUMTAB	027E- RUN04	07FF- ZZZ
0089- CTRL55	0087- INIT1	0017- OPCTC0	02A1- RUN05	
0048- D8251	009B- INIT2	0017- OPCTC1	02B5- RUN06	
075C- DATA	009D- INIT3	0017- OPCTC2	02C8- RUN07	
0765- DATA1	00F6- INIT4	00B5- OPCTC3	02D6- RUN08	

ภาคผนวก จ. รายละเอียดคำสั่งโปรแกรมควบคุมติดต่อรับส่งข้อมูล

```
                1     * THIS IS CONTROL COMMUNICATION
                2     *
                3     * USER P8251 & P8253
                4     *
                5     * UP-DATE 15/01/86
                6     *
                7     KEYBD     EQU  $C000
                8     CLRKB     EQU  $C010
                9     SLOT      EQU  $4
                10    SLOT1     EQU  SLOT+$8
                11    SLOT2     EQU  SLOT1*$10
                12    ADDR      EQU  KEYBD+SLOT2
                13    CTRP      EQU  ADDR+$4
                14    CLRP      EQU  ADDR+$8
                15    D8251     EQU  ADDR
                16    P8251     EQU  ADDR+$1
                17    CHANO     EQU  ADDR
                18    P8253     EQU  ADDR+$3
                19    BUF1      EQU  SLOT1+$470
                20    BUF2      EQU  SLOT1+$4F0
                21    NUM       EQU  $13
                22    INP       EQU  $06
                23    OUT       EQU  $07
                24    COUNT     EQU  $E3
                25    DEFAULT   EQU  $E9
                26    BASL      EQU  $08
                27    BASH      EQU  $09
                28    BASE      EQU  $80
                29    BASS      EQU  $8000
                30    ORIGIN    EQU  $21A
                31    MONI      EQU  $FA59
                32    DISP      EQU  $FDDA
                33    WAIT      EQU  $FCA8
                34    UNIT      EQU  $00
                35    CTRL51    EQU  $4D
                36    CLR51     EQU  $40
                37    TRAN51    EQU  $11
                38    KEEP51    EQU  $34
                39    STOP51    EQU  $10
                40    DTR51     EQU  $12
                41              ORG  ORIGIN
                42    *================================
                43    *======INITIAL BUAD RATE=========
                44    *================================
021A: A9 02     45              LDA  #$02        ;TIME PORT
021C: 8D C4 C0  46              STA  CTRP
021F: A9 36     47              LDA  #$36
0221: 8D C3 C0  48              STA  P8253
0224: A9 52     49              LDA  #$52
0226: 8D C0 C0  50              STA  CHANO
0229: A9 03     51              LDA  #$03
022B: 8D C0 C0  52              STA  CHANO
```

```
                        53  *================================
                        54  *======INITIAL SERIAL PORT=======
                        55  *================================
022E: A9 01             56          LDA  #$01          ;SER.PORT
0230: 8D C4 C0          57          STA  CTRP
0233: A9 10             58          LDA  #STOP51
0235: 8D C1 C0          59          STA  P8251
0238: 8D C1 C0          60          STA  P8251
023B: 8D C1 C0          61          STA  P8251
023E: A9 40             62          LDA  #CLR51
0240: 8D C1 C0          63          STA  P8251
0243: 8D C1 C0          64          STA  P8251
0246: A9 4D             65          LDA  #CTRL51
0248: 8D C1 C0          66          STA  P8251
                        67  *================================
                        68  *======INITIAL PARAMETER=========
                        69  *================================
024B: A9 46             70  INIT    LDA  #$46
024D: 85 E9             71          STA  DEFAULT
024F: A9 00             72  INIT1   LDA  #$00
0251: AA                73          TAX
0252: 85 08             74          STA  BASL
0254: A9 80             75          LDA  #BASE
0256: 85 09             76          STA  BASH
                        77  *================================
                        78  *======FIRST COMMUNICATION=======
                        79  *================================
0258: A9 12             80  FIRST   LDA  #DTR51
025A: 8D C1 C0          81          STA  P8251
025D: 20 32 03          82          JSR  CHK80
0260: A9 00             83          LDA  #UNIT
0262: 8D C0 C0          84          STA  D8251
0265: A9 13             85          LDA  #$13
0267: 20 25 03          86          JSR  CHK01
026A: 20 32 03          87          JSR  CHK80
026D: A9 10             88          LDA  #STOP51
026F: 8D C1 C0          89          STA  P8251
                        90  *================================
                        91  *=======EXECTED  ROUTINE=========
                        92  *================================
0272: 20 EF 02          93  EXEC    JSR  ECHO
0275: C9 00             94          CMP  #$00
0277: D0 F9             95          BNE  EXEC
0279: 20 EF 02          96          JSR  ECHO
027C: C9 FF             97          CMP  #$FF
027E: D0 F2             98          BNE  EXEC
0280: 20 EF 02          99          JSR  ECHO
0283: C9 43            100          CMP  #$43
0285: D0 0C            101          BNE  EXEC3
0287: A9 04            102          LDA  #$4
0289: AA               103          TAX
028A: C6 08            104  EXEC1   DEC  BASL
028C: 10 02            105          BPL  EXEC2
028E: C6 09            106          DEC  BASH
```

```
0290: CA          107  EXEC2    DEX
0291: D0 F7       108           BNE  EXEC1
0293: C9 46       109  EXEC3    CMP  #$46
0295: D0 DB       110           BNE  EXEC
                  111  *================================
                  112  *=======SEND    COMMAND==========
                  113  *================================
0297: C5 E9       114  SEND     CMP  DEFAULT
0299: D0 2D       115           BNE  SEND2
029B: A5 08       116           LDA  BASL
029D: 38          117           SEC
029E: E9 13       118           SBC  #NUM
02A0: 85 06       119           STA  INP
02A2: A5 09       120           LDA  BASH
02A4: E9 80       121           SBC  #BASE
02A6: 85 07       122           STA  OUT
02A8: A5 06       123           LDA  INP
02AA: 38          124           SEC
02AB: ED 0B 80    125           SBC  BASS+$0B
02AE: 85 06       126           STA  INP
02B0: A5 07       127           LDA  OUT
02B2: ED 0C 80    128           SBC  BASS+$0C
02B5: 85 07       129           STA  OUT
02B7: 05 06       130           ORA  INP
02B9: F0 08       131           BEQ  SEND1
02BB: A9 45       132           LDA  #$45
02BD: 20 CB 02    133           JSR  CMD1
02C0: 38          134           SEC
02C1: B0 8C       135           BCS  INIT1
02C3: A9 46       136  SEND1    LDA  #$46
02C5: 20 CB 02    137           JSR  CMD1
02C8: 60          138  SEND2    RTS
                  139  *================================
                  140  *========SEND   COMMAND==========
                  141  *================================
02C9: A9 43       142  CMD      LDA  #$43
02CB: 48          143  CMD1     PHA
02CC: A9 00       144           LDA  #$00
02CE: 20 E2 02    145           JSR  OUTPUT
02D1: A9 FF       146           LDA  #$FF
02D3: 20 E2 02    147           JSR  OUTPUT
02D6: 68          148           PLA
02D7: 20 E2 02    149           JSR  OUTPUT
02DA: 60          150           RTS
                  151  *================================
                  152  *=======OUTPUT   ROUTINE=========
                  153  *================================
02DB: A5 07       154  OUTPUT1  LDA  OUT
02DD: 48          155           PHA
02DE: 20 C9 02    156           JSR  CMD
02E1: 68          157           PLA
02E2: 85 07       158  OUTPUT   STA  OUT
02E4: 20 04 03    159           JSR  RECV
02E7: 20 1B 03    160           JSR  TRANS
02EA: C5 07       161           CMP  OUT
02EC: D0 ED       162           BNE  OUTPUT1
02EE: 60          163           RTS
```

```
                        164  *================================
                        165  *=======ECHO   SUBROUTINE========
                        166  *================================
02EF: 20 04 03          167  ECHO     JSR  RECV
02F2: 81 08             168           STA  (BASL,X)
02F4: E6 08             169           INC  BASL
02F6: D0 02             170           BNE  ECHO1
02F8: E6 09             171           INC  BASH
02FA: A9 FF             172  ECHO1    LDA  #$FF
02FC: 45 06             173           EOR  INP
02FE: 85 07             174           STA  OUT
0300: 20 1B 03          175           JSR  TRANS
0303: 60                176           RTS
                        177  *================================
                        178  *======RECIVE  SUBROUTINE========
                        179  *================================
0304: A9 34             180  RECV     LDA  #KEEP51
0306: 8D C1 C0          181           STA  P8251
0309: AD C1 C0          182  RECV1    LDA  P8251
030C: 29 02             183           AND  #$02
030E: F0 F9             184           BEQ  RECV1
0310: A9 10             185           LDA  #STOP51
0312: 8D C1 C0          186           STA  P8251
0315: AD C0 C0          187           LDA  D8251
0318: 85 06             188           STA  INP
031A: 60                189           RTS
                        190  *================================
                        191  *  TRANSMITION  SUBROUTINE
                        192  *================================
031B: 20 39 03          193  TRANS    JSR  CHK04
031E: A5 07             194           LDA  OUT
0320: 8D C0 C0          195           STA  D8251
0323: A9 11             196           LDA  #TRAN51
                        197  *================================
                        198  *======CHECK TRANSMIT READY======
                        199  *================================
0325: 8D C1 C0          200  CHK01    STA  P8251
0328: AD C1 C0          201  TRANS1   LDA  P8251
032B: 29 01             202           AND  #$01
032D: F0 F9             203           BEQ  TRANS1
032F: A5 06             204           LDA  INP
0331: 60                205           RTS
                        206  *================================
                        207  *======CHECK DATA SET READY======
                        208  *================================
0332: AD C1 C0          209  CHK80    LDA  P8251
0335: 29 80             210           AND  #$80
0337: F0 F9             211           BEQ  CHK80
                        212  *================================
                        213  *======CHECK TRANSMIT EMTRY======
                        214  *================================
0339: AD C1 C0          215  CHK04    LDA  P8251
033C: 29 04             216           AND  #$04
033E: F0 F9             217           BEQ  CHK04
0340: 60                218           RTS
```

ประวัติผู้เขียน

นาย มงคล ลี้ประกอบบุญ เกิดเมื่อวันที่ 6 มิถุนายน พ.ศ. 2499 ที่ อ.เมือง จ.จันทบุรี จบการศึกษาระดับปริญญาวิศวกรรมศาสตร์บัณฑิต สาขาวิศวกรรมไฟฟ้า มหาวิทยาลัยขอนแก่น เมื่อปี พ.ศ. 2523 เคยรับราชการในตำแหน่งอาจารย์ ประจำภาควิชาวิศวกรรมไฟฟ้า คณะวิศวกรรมศาสตร์ มหาวิทยาลัยขอนแก่น เมื่อปี พ.ศ. 2523 ปัจจุบันรับราชการในตำแหน่งอาจารย์ ประจำภาควิชาวิศวกรรมไฟฟ้า คณะวิศวกรรมศาสตร์ มหาวิทยาลัยสงขลานครินทร์ โดยโอนย้ายจากหน่วยงานเดิม เมื่อปี พ.ศ. 2525