BAB VI

PENUTUP DAN KESIMPULAN

Dari uraian-uraian pada bab-bab sebelumnya dapatlah disimpulkan bahwa penggunaan kunci dengan kartu ini lebih aman dari pada kunci konvensional biasa karena :

1. Kode yang berlaku untuk kunci tiap kamar dapat diubah setiap saat melalui komputer, sehingga memperkecil kemungkinan pemalsuan kartu kunci yang berlaku.
2. Jika komputer mendeteksi kartu kunci yang tidak berlaku, yang mungkin berasal dari oknum yang mencoba menggunakan kartu kunci palsu, maka software akan segera menampilkan peringatan pada layar komputer supaya dapat segera diambil tindakan lebih lanjut.

Alat ini masih dapat dikembangkan lagi dengan memanfaatkan Port B yang belum terpakai untuk digunakan seperti untuk pengontrol lampu kamar dengan memakai kode sensor yang sama. Jadi jika tamu keluar kamar, maka secara otomatis lampu kamar akan mati.

Akhirnya penulis mengharapkan agar alat yang telah dibuat ini dapat dikembangkan supaya mempunyai keandalan yang lebih baik sehingga dapat lebih berguna bagi yang memerlukannya.

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2. *Computer Interface Control Lab. CIC - 100 Application module experiments manual*, King Instrument electronics Co., Ltd.
3. Hall, Douglas V. *Microprocessor and interfacing programing and hardware.* Mc Graw Hill,Inc, 1986.
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5. *The IBM personal computer XT technical reference manual.*

LAMPIRAN A

LISTING PROGRAM

```
/*Program Pengontrol Kunci Dengan Kartu Menggunakan IBM PC*/
/* Oleh                        */
/* Yendi Esye                  */
/* NIM : 88210015              */
/* Universitas Darma Persada */
/* Jakarta                     */

#include <stdio.h>
#include <time.h>
#include <conio.h>
#include <ctype.h>
#include <dos.h>
#include <string.h>

char ch='0';
int i=0,no_kamar=0,bitawal=1; /*harga awal bit= 00000001*/
int kodekunci=0,kodesal=0,jmlkamar=15;
char far *porta1,far *portb1,far *portc1,far *control1,
    far *porta2,far *portb2,far *portc2,far *control2;

        struct data {
        int kode;
        int status;
        int statuskunci;
        } datakamar[15];

struct window_control_block *window_link;

struct window_control_block {
    int x1,y1,x2,y2; /* window bounderies */
    int x,y;         /* cursor location */
    struct window_control_block *back_link;
    int forecolor,backcolor;
    int screen_contents[2000];
 };

struct window_control_block *active_window;
unsigned char window_count=0;
char *title="";
int foreC,backC;

/* ------Prototype------*/

void setcolor(int fore,int back);

void setcursor(char toggle[3]);

void setboxcolor(int foregnd);

void box(int x1,int y1,int x2,int y2,int tipe);

void setwindowcolor(int foreground,int background);
```

```
void openwindow(int x1,int y1,int x2, int y2);

void closewindow(void);

void erasewindow(void);

void openwindowbox(int x1,int y1,int x2,int y2);

void header(void);

void tampilan(void);

void footer(void);

void pesan(void);

void tampilkode(void);

void gantikode(void);

void cekkeyboard(void);

void cekkarakter(void);

/* --------Function list------ */

void setcolor(int fore,int back)
{
  textcolor(fore);
  textbackground(back);
}


/* ---------------------------- */


void setcursor(char toggle[3])
{
  char count;
  union REGS r;
  r.x.ax =0x0100;
  for (count =0;count <strlen(toggle);count + +)
    toggle[count] = toupper(toggle[count]);

  r.x.cx =0x0607;
  if (!strcmp(toggle, "OFF")) r.x.cx=0x2000;
  int86(0x10,&r,&r);
}

/* ---------------------------------------- */
```

```
void setboxcolor(int foregnd)
{
 setcolor(foregnd,backC);
}

/* ------------------------------------- */

void box(int x1,int y1,int x2,int y2,int tipe)
{
 int i,TL,TR,BL,BR,H,V,center;

 center =0;
 if  (strcmp(title,"") && (strlen(title) < (x2-x1)))
   /* jika title != ""  */
   center=((x2-x1 + 1)/2)-(strlen(title)/2) +2;

   if (tipe== 1)
     { TL=218; TR=191; BL=192; BR =217; H= 196; V=179;}
   if (tipe==2)
     { TL=201; TR =187; BL=200; BR = 188; H =205; V = 186;}

  gotoxy(x1,y1); cprintf("%c",TL);
  gotoxy(x2,y1); cprintf(" %c",TR);
  gotoxy(x2,y2); cprintf("%c",BR);
  gotoxy(x1,y2); cprintf("%c",BL);

  for (i=x1+1;i < =x2-1;i+ +)
    {
        gotoxy(i,y1);

        if (i= =center)
     {
        cprintf(" %s",title);
        i=i+strlen(title)+2;
     }
     cprintf("%c",H);
    }

 for (i=x1 + 1;i <=x2-1;i++)
   {
     gotoxy(x1 +x2-i,y2);
     cprintf("%c",H);
   }

 for (i=y1+1;i<=y2-1;i+ +)
   {
     gotoxy(x1,i); cprintf("%c",V);
     gotoxy(x2,y1 +y2-i); cprintf("%c',V);
   }

 setcolor(foreC,backC);
```

```
}

/* ---------------------------------------- */

void setwindowcolor(int foreground,int background)
{
 setcolor(foreground,background);
 foreC=foreground;
 backC=background;
}

/* ---------------------------------------- */

void openwindow(int x1,int y1,int x2,int y2)
{
 struct window_control_block *block;
 int window_size;

 window_size=(x2-x1+1)*(y2-y1+1)*2+sizeof(struct window_control_block)-4000;
 block=(struct window_control_block *) malloc(window_size);
 block->x1=x1;
 block->x2=x2;
 block->y1=y1;
 block->y2=y2;
 block->x=wherex();
 block->y=wherey();
 block->back_link=active_window;
 block->forecolor=foreC;
 block->backcolor=backC;
 active_window=block;
 gettext(x1,y1,x2,y2,block->screen_contents);
 window(x1,y1,x2,y2);
 clrscr();
 gotoxy(1,1);
 window_count+=1;
}

 /* end of function open window() */

 /* ---------------------------------------- */

 void closewindow(void)
 {
  struct window_control_block *block;
  int window_size;

  if (active_window==0) window(1,1,80,20);
  else
   {
    block=active_window;
    puttext(block->x1,block->y1,block->x2,block->y2,block->screen_contents);
```

```
      active_window = block->back_link;
      if (active_window==0) window(1,1,80,25);
      else window(block->x1,block->y1,block->x2,block->y2);
      gotoxy(block->x,block->y);
      free(block);
      window_count-=1;
      setcolor(block->forecolor,block->backcolor);
   }
}

/* ------------------------------------------- */

void erasewindow(void)
{
   while(window_count) closewindow();
   normvideo();
   gotoxy(1,1);
}

/* ------------------------------------------- */

void openwindowbox(int x1,int y1,int x2,int y2)
{
  openwindow(x1,y1,x2,y2);
  box(2,1,x2-x1,y2-y1+1,1);
  window(x1+2,y1+1,x2-2,y2-1);
}

/* ------------------------------------------- */

void pesan()
{
  title="Pesan";
  erasewindow();
  setwindowcolor(WHITE,GREEN);
  openwindowbox(20,8,60,18);
  cprintf("    PENGONTROL KUNCI DENGAN KARTU\r\n");
  cprintf("          MENGGUNAKAN IBM PC     \r\n");
  cprintf("    ==================================\r\n");
  cprintf("    Program ini dibuat dengan \r\n");
  cprintf("    bahasa turbo C 2.0 oleh :\r\n");
  cprintf("             Yendi Esye\r\n");
  cprintf("      Teknik Elektro 88210015\r\n");
  cprintf("     Universitas Darma Persada\r\n");
  cprintf("               Jakarta\r\n");
  title=" ";
  cekkarakter();
  setcolor(WHITE,BLUE);
}

/* ------------------------------------------- */
```

```
void tampilkode(void)
{
  title= "Daftar Kode Kamar";
  erasewindow();
  openwindowbox(15,3,60,25);
  setwindowcolor(LIGHTBLUE,WHITE);
  cprintf("\r\n");
  for(i=1;i<=jmlkamar;i++)
    cprintf("      Kode Kamar no. %d = %d\r\n",i,datakamar[i].kode);
    cekkarakter();
    title="";
    setcolor(WHITE,BLUE);
}

/* ---------------------------------------- */

void gantikode(void)
{
  int no,kodebaru;

  title= "Pengganti Kode";
  erasewindow();
  set windowcolor(YELLOW,RED);
  openwindowbox(15,10,65,18);
  setcursor("on");
  cprintf("\r\n");
  cprintf("      Kamar yang akan diganti kodenya : ");
   cscanf("%d",&no);
  cprintf("\r\n");
  cprintf("      Kode kamar tersebut   =%d\r\n",datakamar[no].kode);
  cprintf("      Kode kamar yang baru  =");
   scanf("%d",&kodebaru);
  cprintf("\r\n");
  ch=getch();
  cprintf("      Apakah anda yakin <y/n>? ");
  ch=getch();
  if ((ch=='y')||(ch=='Y'))
     datakamar[no].kode =kodebaru;
  setcursor("off");
  closewindow();
  title="";
  setcolor(WHITE,BLUE);
}

/*------------------------------------------ */

void header(void)
{
  setcolor(RED, WHITE);
    cprintf("   F1");
    textcolor(BLACK);
```

```
      cprintf("  = Pesan    ");
    textcolor(RED);
      cprintf(" F2");
    textcolor(BLACK);
      cprintf("  = Tampilkan kode   ");
    textcolor(RED);
      cprintf(" F3");
    textcolor(BLACK);
      cprintf("  = Ganti kode   ");
    textcolor(RED);
      cprintf(" F5");
    textcolor(BLACK);
      cprintf("  = Keluar program    ");
    setcolor(WHITE,BLUE);
}

/* ---------------------------------- */

void tampilan(void)
{
  int k,l;
  setcolor(WHITE,BLUE);

  for (k=1;k<8;k++)
  {
    gotoxy((k-1)*8+1,2);
    cprintf("────────────────");
  }

  gotoxy(1,2); cprintf(" ┌");
  for (k=1;k<7;k++)
  {
    gotoxy((k-1)*8+9,2);
    cprintf("┬");
  }

  gotoxy(57,2); cprintf("┐ ");
  for (k=0;k<5;k++)
  {
    gotoxy(1,k+3);
    for (l=0;l<8;l++) cprintf("|         ");
  }

  for (k=1;k<8;k++)
  {
    gotoxy((k-1)*8+1,8);
    cprintf(" ────█───── ");
  }

  gotoxy(1,8); cprintf(" └");
  for (k=1;k<7;k++)
```

```
  {
    gotoxy((k-1)*8+9,8);
    cprintf("┴");
  }

  gotoxy(57,8); cprintf("┘ ");
  for (k=0;k <5;k+ +)
  {
    gotoxy(1,k + 14);
    for (l =0;l < 9;l+ +) cprintf(" │        ");
  }

  for (k= 1;k <9;k+ +)
  {
    gotoxy((k-1)*8+1,13);
    cprintf(" ────██──── ");
  }

  gotoxy(1,13); cprintf(" ┌");
  for (k=1;k<8;k+ +)
  {
    gotoxy((k-1)*8 +9,13);
    cprintf("┬");
  }
  gotoxy(65,13); cprintf("┐ ");
  for (k= 1;k<9;k+ +)
  {
    gotoxy((k-1)*8 + 1,19);
    cprintf("────────────────");
  }

  gotoxy(1,19); cprintf(" └");
  for (k= 1;k <8;k+ +)
  {
    gotoxy((k-1)*8 +9, 19);
    cprintf("┴");
  }

  gotoxy(65,19); cprintf("┘ ");
  for (k= 1;k<8;k+ +)
  {
    gotoxy(5 +(k-1)*8,6);
      cprintf("%d",k);
    gotoxy(3 +(k-1)*8,5);
      cprintf("KAMAR");
    textcolor(BLACK);
    gotoxy(5 +(k-1)*8,3);
      cprintf("");
    textcolor(WHITE);
  }
```

```
 for (k=1;k<9;k++)
 {
   gotoxy(3+(k-1)*8,15);
     cprintf("KAMAR");
   gotoxy(5+(k-1)*8,16);
     cprintf("%d",k+7);
   textcolor(BLACK);
   gotoxy(5+(k-1)*8,18);
     cprintf("");
   textcolor(WHITE);
 }

 for (l=1;l<=2;l++)
 {
  for (k=0;k<15;k++)
  {
   textcolor(YELLOW);
   gotoxy(k+65,l+2);
    cprintf("░");
  }
 }

 for (l=1;l<=4;l++)
 {
  for (k=0;k<5;k++)
  {
   gotoxy(k+75,l+4);
    cprintf("░");
  }
 }
 gotoxy(65,6);cprintf("LOBBY");
 gotoxy(65,7);cprintf("HOTEL");
 setcolor(LIGHTCYAN,BLUE);
 box(66,13,80,17,1);
 setcolor(LIGHTCYAN,BLUE);
 gotoxy(68,15);cprintf("RECEPTIONIST");

  for (k=0;k<13;k++)
  {
   setcolor(WHITE,BLUE);
   gotoxy(k+67,18);
    cprintf("░");
  }
 setcolor(WHITE,BLUE);
}

/* ---------------------------------------- */

void footer(void)
{
 int x,y;
```

```
 setcolor(WHITE,RED);

 gotoxy(1,20);cprintf("   PENGONTROL KUNCI DENGAN KARTU     ");
 gotoxy(1,21);cprintf("        MENGGUNAKAN IBM PC          ");
     gotoxy(1,22);cprintf("
▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒▒    ");
 gotoxy(1,23);cprintf("   Oleh       : Yendi Esye          ");
 gotoxy(1,24);cprintf("   NIM        : 88210015            ");
 gotoxy(1,25);cprintf("   Pembimbing : DR. Hamdani Zain    ");

 setcolor(WHITE,LIGHTGRAY);
 window(39,20,80,25);
 clrscr();
 textcolor(YELLOW);
   cprintf("        KETERANGAN STATUS KUNCI          ");
 textcolor(YELLOW);
   cprintf("       ============================          ");
 textcolor(LIGHTGREEN);
   gotoxy(1,3);
   cprintf("▒▒▒▒▒▒ = Kode diterima, kunci terbuka     ");
 textcolor(WHITE);
   cprintf("  ▒▒▒▒▒▒ = Kunci tertutup                ");
 textcolor(CYAN);
   cprintf("  ▒▒▒▒▒▒ = Kode tidak cocok              ");
 textcolor(RED);
   cprintf("  ▒▒▒▒▒▒ = Sensor belum disambung        ");
 window(1,1,80,25);
 setcolor(WHITE,BLUE);
}

/* ------------------------------------------------ */

void cekkarakter(void)
{
 ch =getch();

 if (ch= =27) closewindow();

 if (ch= =0)
  {
   ch =getch();
   switch(ch)
   {

   case 59 : /* F1 ditekan */
          pesan();
          break;

   case 60 : /* F2 ditekan */
          tampilkode();
```

```
            break;

    case 61 : /* F3 ditekan */
            gantikode();
            break;

    case 63: /* F5 ditekan */
             setwindowcolor(WHITE,BROWN);
             openwindowbox(20,21,60,25);
             cprintf("\r\n");
             cprintf("        Akhiri program <y/t> ?");
             ch=getch();
             if ((ch=='y')||(ch=='Y'))
             {
                erasewindow();
                *portal =0x00;
                *porta2 =0x00;
                *portb2 =0x00;
                setcursor("on");
                exit(0);
             }
             else
                closewindow();
      }
    }
}

/* ------------------------------------------ */

void cekkeyboard(void)
{
  if (kbhit()) cekkarakter();
  }

/* -------------Program Utama-------------*/

main()
{

  /* Inisialisasi PPI 8255A */


  portal =MK_FP(0xA000,0x0000);
  portbl =MK_FP(0xA000,0x0001);
  portc1 =MK_FP(0xA000,0x0002);
  control1 =MK_FP(0xA000,0x0003);
  porta2 =MK_FP(0xA000,0x0004);
  portb2 =MK_FP(0xA000,0x0005);
  portc2=MK_FP(0xA000,0x0006);
  control2 =MK_FP(0xA000,0x0007);
```

```
*control1 =0x89;
*control2=0x80;

/* Inisialisasi data-data kamar */

for (i=0;i< =jmlkamar;i+ +)
{
  datakamar[i].kode =i;
  datakamar[ i].status =0;
  datakamar[ i ].statuskunci =0;
}

setcursor("off");
setcolor(WHITE,BLUE);
clrscr();

header();
tampilan();
footer();

while(1)
{
  no_kamar + +;
  *porta1 =no_kamar;  /* beri enable ke sensor kunci */
  kodekunci =*portc1; /* baca kode dari sensor tsb */
  *porta1=0x00;

  *portb1=no_kamar; /* beri enable ke sensor sal. listrik */
  kodesal= *portc1; /* baca kode dari sensor tsb */
  *portb1 =0x00;
 /*kunci kamar cocok, sensor terhubung ke PC*/
 if (kodekunci= =datakamar[no_kamar].kode)
   {
    *porta2 =no_kamar;  /* aktifkan relay kunci */

    datakamar[no_kamar].statuskunci =0;
    if(kodekunci>0 && kodekunci < =15)
    {
        if (no_kamar < =7)
           gotoxy(4 +(no_kamar-1)*8,8);
        else
           gotoxy(4 +(no_kamar-8)*8,13);
        textcolor(GREEN);
        cprintf("███");

        datakamar[no_kamar].statuskunci  =  1;
    }


  }
 /* Sensor belum terhubung*/
```

```
        /*sensor terhubung tapi kodekunci salah*/
        else if(kodekunci> 0 && kodekunci < =15)
          {
           if (no_kamar < =7)
           gotoxy(4 +(no_kamar-1)*8,8);
          else
           gotoxy(4 +(no_kamar-8)*8,13);
           textcolor(CYAN +BLINK);
           cprintf("█████");
           /*datakamar[no_kamar].statuskunci= 1;*/

          }
          /*sensor belum terhubung*/
          else if (kodekunci<0 || kodekunci> 15)
              {
                 if (no_kamar < =7)
               gotoxy(4 +(no_kamar-1)*8,8);
              else
               gotoxy(4 +(no_kamar-8)*8,13);
               textcolor(RED +BLINK);
               cprintf("█████");
             }
    else
         {
          *porta2=0x00;  /* matikan lagi relay kunci */
          if (no_kamar <=7)
           gotoxy(4 +(no_kamar-1)*8,8);
           else
           gotoxy(4 +(no_kamar-8)*8,13);
           textcolor(WHITE);
           cprintf("█████");
         }


  if (no_kamar  ==jmlkamar) no_kamar=0;

  cekkeyboard();
 }
}
```

LAMPIRANB

DATA KOMPONEN

MOTOROLA

MOC7811 MOC7821
MOC7812 MOC7822
MOC7813 MOC7823

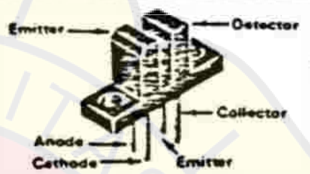
OPTO SLOTTED COUPLER/INTERRUPTER MODULES

These devices consist of a gallium arsenide infrared emitting diode facing a silicon NPN phototransistor in a molded plastic housing. A slot in the housing between the emitter and the detector provides a means of interrupting the signal. They are widely used in position and motion indicators, end of tape indicators, paper feed controls and OEM switches.

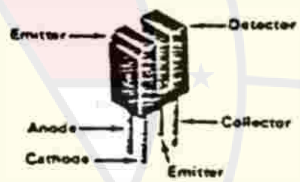
- 1.0 mm Aperture
- Easy PCB Mounting
- Cost Effective
- Industry Standard Configuration
- Uses Long-Lived LPE IRED

OPTO
SLOTTED COUPLER

TRANSISTOR OUTPUT



(MOC7811, 12, 13 only)
CASE 354A-01



(MOC7821, 22, 23 only)
CASE 354-01

ABSOLUTE MAXIMUM RATINGS: (25°C)

Rating	Symbol	Value	Unit
TOTAL DEVICE			
Storage Temperature	T_{stg}	−40 to +100	°C
Operating Temperature	T_J	−40 to +100	°C
Lead Soldering Temperature (5 seconds maximum)	T_L	260	°C
INFRARED EMITTING DIODE			
Power Dissipation	P_D	150*	mW
Forward Current (Continuous)	I_F	50	mA
Reverse Voltage	V_R	6.0	V
PHOTOTRANSISTOR			
Power Dissipation	P_D	150**	mW
Collector-Emitter Voltage	V_{CEO}	30	V

*Derate 2.0 mW/°C above 25°C ambient.
**Derate 2.0 mW/°C above 25° ambient.

INDIVIDUAL ELECTRICAL CHARACTERISTICS: (25°C) (See Note 1)

Characteristic	Symbol	Min	Typ	Max	Unit
EMITTER					
Reverse Breakdown Voltage (I_R = 100 μA)	$V_{(BR)R}$	6.0	—	—	V
Forward Voltage (I_F = 50 mA)	V_F	—	1.3	1.8	V
Reverse Current (V_R = 6.0 V, R_L = 1.0 MΩ)	I_R	—	50	—	nA
Capacitance (V = 0, f = 1 MHz)	C_I	—	25	—	pF
DETECTOR					
Breakdown Voltage (I_C = 10 mA, H ≈ 0)	$V_{(BR)CEO}$	30	—	—	V
Collector Dark Current (V_{CE} = 10 V, H ≈ 0)	I_{CEO}	—	—	100	nA

Note 1: Stray irradiation can alter values of characteristics. Adequate shielding should be provided.

COUPLED ELECTRICAL CHARACTERISTICS: (25°C)(See Note 1)

Characteristics	Symbol	MOC7811/7821			MOC7812/7822			MOC7813/7823			Unit
		Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
I_F = 5.0 mA, V_{CE} = 5.0 V	$I_{CE(on)}$	0.15	—	—	0.30	—	—	0.60	—	—	mA
I_F = 20 mA, V_{CE} = 5.0V	$I_{CE(on)}$	1.0	—	—	2.0	—	—	4.0	—	—	mA
I_F = 30 mA, V_{CE} = 5.0V	$I_{CE(on)}$	1.9	—	—	3.0	—	—	5.5	—	—	mA
I_F = 20 mA, I_C = 1.8 mA	$V_{CE(sat)}$	—	—	—	—	—	0.40	—	—	0.40	V
I_F = 30 mA, I_C = 1.8 mA	$V_{CE(sat)}$	—	—	0.40	—	—	—	—	—	—	V
V_{CC} = 5.0 V, I_F = 30 mA, R_L = 2.5 kΩ	t_{on}	—	12	—	—	12	—	—	12	—	µs
V_{CC} = 5.0 V, I_F = 30 mA, R_L = 2.5 kΩ	t_{off}	—	80	—	—	60	—	—	80	—	µs

Note 1: Stray irradiation can alter values of characteristics. Adequate shielding should be provided.

FIGURE 1 — OUTPUT CURRENT versus INPUT CURRENT

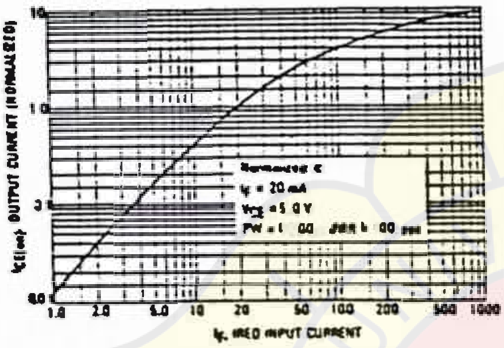


FIGURE 2 — t_{on}, t_{off} versus LOAD RESISTANCE

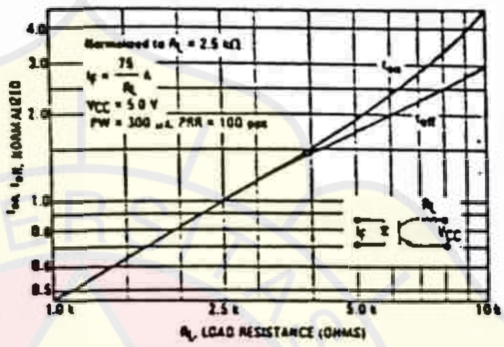
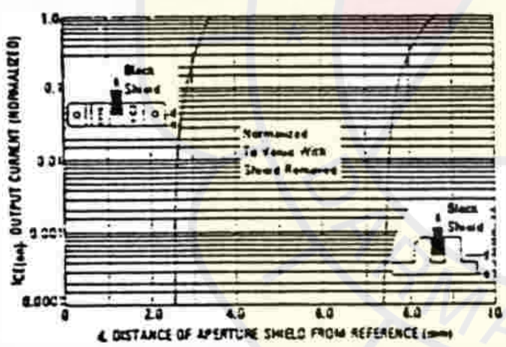
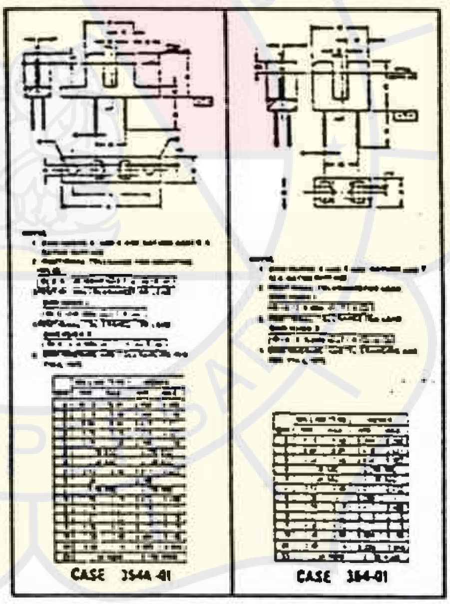


FIGURE 3 — OUTPUT CURRENT versus POSITION OF SHIELD COVERING APERTURE



POSITIVE-NAND GATES AND INVERTERS WITH TOTEM-POLE OUTPUTS

recommended operating conditions

	54 FAMILY / 74 FAMILY	SERIES 54 / SERIES 74 '00, '04, '10, '20, '30			SERIES 54H / SERIES 74H 'H00, 'H04, 'H10, 'H20, 'H30			SERIES 54L 'L00, 'L04, 'L10, 'L20, 'L30			SERIES 54LS / SERIES 74LS 'LS00, 'LS04, 'LS10, 'LS20, 'LS30			SERIES 54S / SERIES 74S 'S00, 'S04, 'S10, 'S20, 'S30, 'S133			UNIT
		MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	54 Family	4.5	5	5.5	4.5	5	5.5	4.5	5	5.5	4.5	5	5.5	4.5	5	5.5	V
	74 Family	4.75	5	5.25	4.75	5	5.25				4.75	5	5.25	4.75	5	5.25	
High-level output current, I_{OH}	54 Family			−400			−500			−100			−400			−1000	μA
	74 Family			−400			−500						−400			−1000	
Low-level output current, I_{OL}	54 Family			16			20			2			4			20	mA
	74 Family			16			20						8			20	
Operating free-air temperature, T_A	54 Family	−55		125	−55		125	−55		125	−55		125	−55		125	°C
	74 Family	0		70	0		70				0		70	0		70	

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER	TEST FIGURE	TEST CONDITIONS†		SERIES 54 / SERIES 74 '00, '04, '10, '20, '30			SERIES 54H / SERIES 74H 'H00, 'H04, 'H10, 'H20, 'H30			SERIES 54L 'L00, 'L04, 'L10, 'L20, 'L30			SERIES 54LS / SERIES 74LS 'LS00, 'LS04, 'LS10, 'LS20, 'LS30			SERIES 54S / SERIES 74S 'S00, 'S04, 'S10, 'S20, 'S30, 'S133			UNIT
				MIN	TYP‡	MAX	MIN	TYP‡	MAX	MIN	TYP‡	MAX	MIN	TYP‡	MAX	MIN	TYP‡	MAX	
V_{IH} High-level input voltage	1, 2			2			2			2			2			2			V
V_{IL} Low-level input voltage	1, 2		54 Family			0.8			0.8			0.7			0.7			0.8	V
			74 Family			0.8			0.8						0.8			0.8	
V_{IK} Input clamp voltage	3	V_{CC} = MIN, I_I = §				−1.5			−1.5						−1.5			−1.2	V
V_{OH} High-level output voltage	1	V_{CC} = MIN, V_{IL} = V_{IL} max, I_{OH} = MAX	54 Family	2.4	3.4		2.4	3.5		2.4	3.3		2.5	3.4		2.5	3.4		V
			74 Family	2.4	3.4		2.4	3.5					2.7	3.4		2.7	3.4		
V_{OL} Low-level output voltage	2	V_{CC} = MIN, V_{IH} = 2 V, I_{OL} = MAX	54 Family		0.2	0.4		0.2	0.4		0.15	0.3		0.25	0.4			0.5	V
			74 Family		0.2	0.4		0.2	0.4					0.25	0.5			0.5	
		I_{OL} = 4 mA	Series 74LS												0.4				
I_I Input current at maximum input voltage	4	V_{CC} = MAX	V_I = 5.5 V			1			1			0.1						1	mA
			V_I = 7 V												0.1				
I_{IH} High-level input current	4	V_{CC} = MAX	V_{IH} = 2.4 V			40			50			10							μA
			V_{IH} = 2.7 V												20			50	
I_{IL} Low-level input current	5	V_{CC} = MAX	V_{IL} = 0.3 V									−0.18							mA
			V_{IL} = 0.4 V			−1.6			−2						−0.4				
			V_{IL} = 0.5 V															−2	
I_{OS} Short-circuit output current¶	6	V_{CC} = MAX	54 Family	−20		−55	−40		−100	−3		−15	−20		−100	−40		−100	mA
			74 Family	−18		−55	40		−100				−20		−100	−40		−100	
I_{CC} Supply current	7	V_{CC} = MAX		See table on next page															mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

§ I_I = −12 mA for SN54'/SN74', −8 mA for SN54H'/SN74H', and −18 mA for SN54LS'/SN74LS' and SN54S'/SN74S'.

¶ Not more than one output should be shorted at a time, and for SN54H'/SN74H', SN54LS'/SN74LS', and SN54S'/SN74S', duration of short-circuit should not exceed 1 second.

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POSITIVE-NAND GATES AND INVERTERS WITH TOTEM-POLE OUTPUTS

supply current¶

TYPE	I_{CCH} (mA) Total with outputs high		I_{CCL} (mA) Total with outputs low		I_{CC} (mA) Average per gate (50% duty cycle)
	TYP	MAX	TYP	MAX	TYP
'00	4	8	12	22	2
'04	6	12	18	33	2
'10	3	6	9	16.5	2
'20	2	4	6	11	2
'30	1	2	3	5.5	2
'H00	10	16.8	26	40	4.5
'H04	16	26	40	58	4.5
'H10	7.5	12.6	19.5	30	4.5
'H20	5	8.4	13	20	4.5
'H30	2.5	4.2	6.5	10	4.5
'L00	0.44	0.8	1.16	2.04	0.20
'L04	0.66	1.2	1.74	3.06	0.20
'L10	0.33	0.6	0.87	1.53	0.20
'L20	0.22	0.4	0.58	1.02	0.20
SN54L30	0.11	0.33	0.29	0.51	0.20
'LS00	0.8	1.6	2.4	4.4	0.4
'LS04	1.2	2.4	3.6	6.6	0.4
'LS10	0.6	1.2	1.8	3.3	0.4
'LS20	0.4	0.8	1.2	2.2	0.4
'LS30	0.35	0.5	0.6	1.1	0.48
'S00	10	16	20	36	3.75
'S04	15	24	30	54	3.75
'S10	7.5	12	15	27	3.75
'S20	5	8	10	18	3.75
'S30	3	5	5.5	10	4.25
'S133	3	5.5	5.5	10	4.25

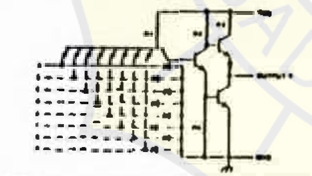
¶ Maximum values of I_{CC} are over the recommended operating ranges of V_{CC} and T_A; typical values are at V_{CC} = 5 V, T_A = 25°C.

switching characteristics at V_{CC} = 5 V, T_A = 25°C

TYPE	TEST CONDITIONS#	t_{PLH} (ns) Propagation delay time, low-to-high-level output			t_{PHL} (ns) Propagation delay time, high-to-low-level output		
		MIN	TYP	MAX	MIN	TYP	MAX
'00, '10	C_L = 15 pF, R_L = 400 Ω		11	22		7	15
'04, '20			12	22		8	15
'30			13	22		8	15
'H00	C_L = 25 pF, R_L = 280 Ω		5.9	10		6.2	10
'H04			6	10		6.5	10
'H10			5.9	10		6.3	10
'H20			6	10		7	10
'H30			6.8	10		8.9	12
'L00, 'L04, 'L10, 'L20	C_L = 50 pF, R_L = 4 kΩ		35	60		31	60
'L30			35	60		70	100
'LS00, 'LS04 'LS10, 'LS20	C_L = 15 pF, R_L = 2 kΩ		9	15		10	15
'LS30			8	15		13	20
'S00, 'S04	C_L = 15 pF, R_L = 280 Ω		3	4.5		3	5
'S10, 'S20	C_L = 50 pF, R_L = 280 Ω		4.5			5	
'S30, 'S133	C_L = 15 pF, R_L = 280 Ω		4	6		4.5	7
	C_L = 50 pF, R_L = 280 Ω		5.5			6.5	

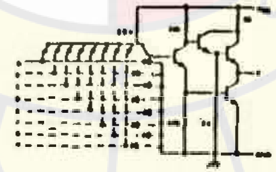
#Load circuits and voltage waveforms are shown on pages 3-10 and 3-11.

schematics (each gate)

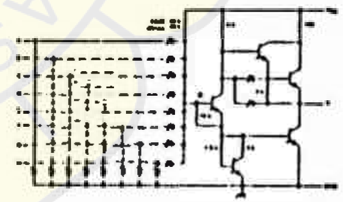


CIRCUIT	R1	R2	R3	R4
'00, '04, '10, '20, '30	4 k	1.6 k	130	1 k
'L00, 'L04, 'L10, 'L20, 'L30	40 k	20 k	500	12 k

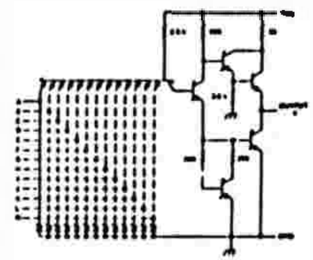
'00, '04, '10, '20, '30
'L00, 'L04, 'L10, 'L20, 'L30, CIRCUITS
Input clamp diodes not on SN54L' circuits.



'H00, 'H04, 'H10, 'H20, 'H30 CIRCUITS



'LS00, 'LS04, 'LS10, 'LS20, 'LS30 CIRCUITS
*The 12-kΩ resistor is not on 'LS30.



'S00, 'S04, 'S10, 'S20, 'S30, 'S133 CIRCUITS

Resistor values shown are nominal and in ohms.

POSITIVE-AND GATES WITH TOTEM-POLE OUTPUTS

recommended operating conditions

	54 FAMILY / 74 FAMILY	SERIES 54 / SERIES 74 '08 MIN	NOM	MAX	SERIES 54H / SERIES 74H 'H11, 'H21 MIN	NOM	MAX	SERIES 54LS / SERIES 74LS 'LS08, 'LS11, 'LS21 MIN	NOM	MAX	SERIES 54S / SERIES 74S 'S08, 'S11 MIN	NOM	MAX	UNIT
Supply Voltage, V_{CC}	54 Family	4.5	5	5.5	4.5	5	5.5	4.5	5	5.5	4.5	5	5.5	V
	74 Family	4.75	5	5.25	4.75	5	5.25	4.75	5	5.25	4.75	5	5.25	V
High-level output current, I_{OH}				800			500			-400			-1000	μA
Low-level output current, I_{OL}	54 Family			16			20			4			20	mA
	74 Family			16			20			8			20	mA
Operating free-air temperature, T_A	54 Family	-55		125	-55		125	-55		125	-55		125	°C
	74 Family	0		70	0		70	0		70	0		70	°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST FIGURE	TEST CONDITIONS†			SERIES 54 / SERIES 74 '08 MIN	TYP‡	MAX	SERIES 54H / SERIES 74H 'H11, 'H21 MIN	TYP‡	MAX	SERIES 54LS / SERIES 74LS 'LS08, 'LS11, 'LS21 MIN	TYP‡	MAX	SERIES 54S / SERIES 74S 'S08, 'S11 MIN	TYP‡	MAX	UNIT
V_{IH}	High-level input voltage	1, 2				2			2			2			2			V
V_{IL}	Low-level input voltage	1, 2			54 Family			0.8			0.8			0.7			0.8	V
					74 Family			0.8			0.8			0.8			0.8	V
V_{IK}	Input clamp voltage	3	V_{CC} = MIN, I_I = §					-1.5			-1.5			-1.5			-1.2	V
V_{OH}	High-level output voltage	1	V_{CC} = MIN, V_{IH} = 2 V, I_{OH} = MAX		54 Family	2.4	3.4		2.4	3.4		2.5	3.4		2.5	3.4		V
					74 Family	2.4	3.4		2.4	3.4		2.7	3.4		2.7	3.4		V
V_{OL}	Low-level output voltage	2	V_{CC} = MIN, V_{IL} = MAX	I_{OL} = MAX	54 Family		0.2	0.4		0.2	0.4		0.25	0.4			0.5	V
					74 Family		0.2	0.4		0.2	0.4		0.35	0.5			0.5	V
				I_{OL} = 4 mA	Series 74LS								0.25	0.4				V
I_I	Input current at maximum input voltage	4	V_{CC} = MAX		V_I = 5.5 V			1			1						1	mA
					V_I = 7 V									0.1				mA
I_{IH}	High-level input current	4	V_{CC} = MAX		V_{IH} = 2.4 V			40			50							μA
					V_{IH} = 2.7 V									20			50	μA
I_{IL}	Low-level input current	5	V_{CC} = MAX		V_{IL} = 0.4 V			-1.6			-2			-0.4				mA
					V_{IL} = 0.5 V												-2	mA
I_{OS}	Short-circuit output current¶	6	V_{CC} = MAX		54 Family	-20		-55	-40		-100	-20		-100	-40		-100	mA
					74 Family	-18		-55	-40		-100	-20		-100	-40		-100	mA
I_{CC}	Supply current	7	V_{CC} = MAX			See table on next page												mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

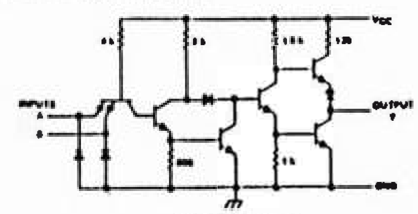
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

§ I_I = -12 mA for SN54'/SN74', -8 mA for SN54H'/SN74H', and -18 mA for SN54LS'/SN74LS' and SN54S'/SN74S'.

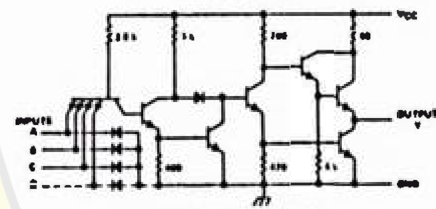
¶ Not more than one output should be shorted at a time, and for SN54H'/SN74H', SN54LS'/SN74LS' and SN54S'/SN74S', duration of output short circuit should not exceed one second.

POSITIVE-AND GATES WITH TOTEM-POLE OUTPUTS

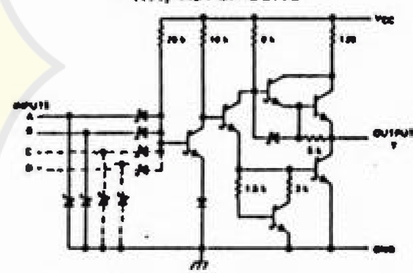
schematics (each gate)



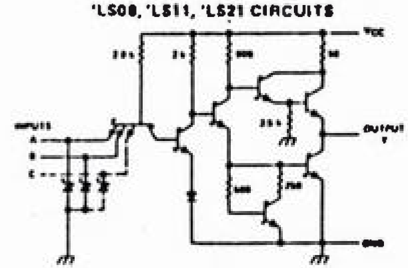
'08 CIRCUITS



'H11, 'H21 CIRCUITS



'LS08, 'LS11, 'LS21 CIRCUITS



'S08, 'S11 CIRCUITS

Resistor values shown are nominal and in ohms.

supply current¶

TYPE	I_{CCH} (mA) Total with outputs high		I_{CCL} (mA) Total with outputs low		I_{CC} (mA) Average per gate (50% duty cycle)
	TYP	MAX	TYP	MAX	TYP
'08	11	21	20	33	3.88
'H11	18	30	30	48	8
'H21	12	20	20	32	8
'LS08	2.4	4.8	4.4	8.8	0.85
'LS11	1.8	3.6	3.3	6.6	0.85
'LS21	1.2	2.4	2.2	4.4	0.85
'S08	18	32	32	57	6.25
'S11	13.5	24	24	42	6.25

¶Maximum values of I_{CC} are over the recommended operating ranges of V_{CC} and T_A; typical values are at V_{CC} = 5 V, T_A = 25°C.

switching characteristics at V_{CC} = 5 V, T_A = 25°C

TYPE	TEST CONDITIONS#	t_{PLH} (ns) Propagation delay time, low-to-high-level output			t_{PHL} (ns) Propagation delay time, high-to-low-level output		
		MIN	TYP	MAX	MIN	TYP	MAX
'08	C_L = 15 pF, R_L = 400 Ω		17.5	27		12	19
'H11, 'H21	C_L = 25 pF, R_L = 280 Ω		7.6	12		8.8	12
'LS08, 'LS11 'LS21	C_L = 15 pF, R_L = 2 kΩ		8	15		10	20
'S08, 'S11	C_L = 15 pF, R_L = 280 Ω		4.5	7		5	7.5
	C_L = 50 pF, R_L = 280 Ω		6			7.5	

#Load circuit and voltage waveforms are shown on pages 3-10 and 3-11.

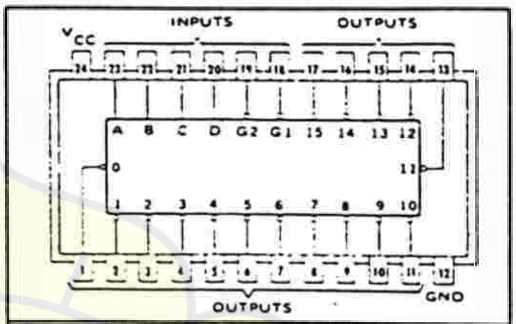
TTL
MSI

TYPES SN54154, SN54L154, SN74154
4-LINE-TO-16-LINE DECODERS/DEMULTIPLEXERS

BULLETIN NO DL S 7211805, DECEMBER 1972

- '154 is Ideal for High-Performance Memory Decoding
- 'L154 is Designed for Power-Critical Applications
- Decodes 4 Binary-Coded Inputs into One of 16 Mutually Exclusive Outputs
- Performs the Demultiplexing Function by Distributing Data From One Input Line to Any One of 16 Outputs
- Input Clamping Diodes Simplify System Design
- High Fan-Out, Low-Impedance, Totem-Pole Outputs
- Fully Compatible with Most TTL, DTL, and MSI Circuits

SN54154 . . . J OR W PACKAGE
SN54L154 . . J PACKAGE
SN74154 . . . J OR N PACKAGE
(TOP VIEW)



positive logic: see function table

TYPE	TYPICAL AVERAGE PROPAGATION DELAY 3 LEVELS OF LOGIC	STROBE	TYPICAL POWER DISSIPATION
'154	23 ns	19 ns	170 mW
'L154	46 ns	38 ns	85 mW

description

Each of these monolithic, 4-line-to-16-line decoders utilizes TTL circuitry to decode four binary-coded inputs into one of sixteen mutually exclusive outputs when both the strobe inputs, G1 and G2, are low. The demultiplexing function is performed by using the 4 input lines to address the output line, passing data from one of the strobe inputs with the other strobe input low. When either strobe input is high, all outputs are high. These demultiplexers are ideally suited for implementing high-performance memory decoders. For ultra-high-speed systems, SN54S138/SN74S138 and SN54S139/SN74S139 are recommended.

These circuits are fully compatible for use with most other TTL and DTL circuits. All inputs are buffered and input clamping diodes are provided to minimize transmission-line effects and thereby simplify system design.

Series 54 and 54L devices are characterized for operation over the full military temperature range of −55°C to 125°C; Series 74 devices are characterized for operation from 0°C to 70°C.

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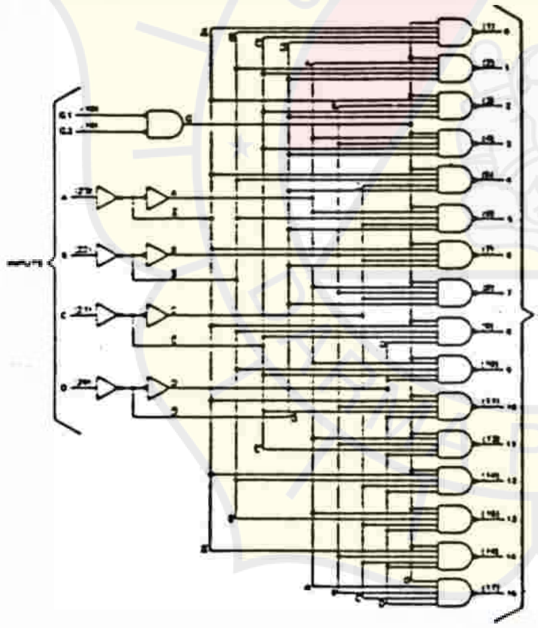
logic

FUNCTION TABLE

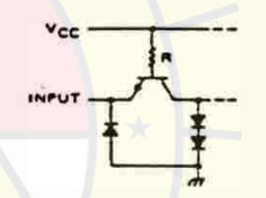
INPUTS						OUTPUTS															
G1	G2	D	C	B	A	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
L	L	L	L	L	L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	L	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	L	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H
L	L	L	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H	H
L	L	L	H	H	L	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H	H
L	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H	H
L	L	H	L	L	L	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H	H
L	L	H	L	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H	H
L	L	H	L	H	L	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H	H
L	L	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H	H
L	L	H	H	L	L	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H	H
L	L	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H	H
L	L	H	H	H	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L	H
L	L	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	L
L	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	L	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
H	H	X	X	X	X	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H

H = high level, L = low level, X = irrelevant

functional block diagram and schematics of inputs and outputs

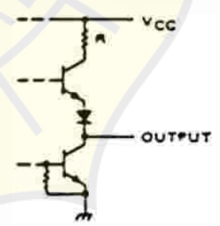


EQUIVALENT OF EACH INPUT



'154: R = 6 kΩ NOM
'L154: R = 8 kΩ NOM

TYPICAL OF ALL OUTPUTS



'154: R = 130 Ω NOM
'L154: R = 260 Ω NOM

TYPES SN54154, SN74154
4-LINE-TO-16-LINE DECODER/ DEMULTIPLEXERS

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC} (see Note 1)	7 V
Input voltage	5.5 V
Operating free-air temperature range: SN54154 Circuits	−55°C to 125°C
SN74154 Circuits	0°C to 70°C
Storage temperature range	−65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

	SN54154			SN74154			UNIT
	MIN	NOM	MAX	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}			−800			−800	µA
Low-level output current, I_{OL}			16			16	mA
Operating free-air temperature, T_A	−55		125	0		70	°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS†	SN54154			SN74154			UNIT
			MIN	TYP	MAX	MIN	TYP‡	MAX	
V_{IH}	High-level input voltage		2			2			V
V_{IL}	Low-level input voltage				0.8			0.8	V
V_{IK}	Input clamp voltage	V_{CC} = MIN, I_I = −12 mA			−1.5			−1.5	V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = −800 µA	2.4	3.4		2.4	3.4		V
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OL} = 16 mA		0.2	0.4		0.2	0.4	V
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 5.5 V			1			1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.4 V			40			40	µA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.4 V			−1.6			−1.6	mA
I_{OS}	Short-circuit output current§	V_{CC} = MAX	−20		−55	−18		−57	mA
I_{CC}	Supply current	V_{CC} = MAX, See Note 2		34	49		34	56	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.
§ Not more than one output should be shorted at a time.
NOTE 2: I_{CC} is measured with all inputs grounded and all outputs open.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low-to-high-level output, from A, B, C, or D inputs through 3 levels of logic	C_L = 15 pF, R_L = 400 Ω, See Note 3		24	36	ns
t_{PHL}	Propagation delay time, high-to-low-level output, from A, B, C, or D inputs through 3 levels of logic			22	33	ns
t_{PLH}	Propagation delay time, low-to-high-level output, from either strobe input			20	30	ns
t_{PHL}	Propagation delay time, high-to-low-level output, from either strobe input			18	27	ns

NOTE 3: Load circuit and voltage waveforms are shown on page 3-10.

TEXAS INSTRUMENTS
INCORPORATED
POST OFFICE BOX 5012 • DALLAS, TEXAS 75222

TYPE SN54L154
4-LINE-TO-16-LINE DECODER/ DEMULTIPLEXERS

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC} (see Note 1) . . . . 7 V
Input voltage 5.5V
Operating free-air temperature range: SN54L154 Circuits . . . . −55°C to 125°C
Storage temperature range . . . . −65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

	SN54L154			UNIT
	MIN	NOM	MAX	
Supply voltage, V_{CC}	4.5	5	5.5	V
High-level output current, I_{OH}			−400	μA
Low-level output current, I_{OL}			8	mA
Operating free-air temperature, T_A	−55		125	°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER		TEST CONDITIONS†	MIN	TYP‡	MAX	UNIT
V_{IH}	High-level input voltage		2			V
V_{IL}	Low-level input voltage				0.8	V
V_{IK}	Input clamp voltage	V_{CC} = MIN, I_I = −12 mA			−1.5	V
V_{OH}	High-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OH} = −400 μA	2.4	3.4		V
V_{OL}	Low-level output voltage	V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = 0.8 V, I_{OL} = 8 mA		0.2	0.4	V
I_I	Input current at maximum input voltage	V_{CC} = MAX, V_I = 5.5 V			1	mA
I_{IH}	High-level input current	V_{CC} = MAX, V_I = 2.4 V			20	μA
I_{IL}	Low-level input current	V_{CC} = MAX, V_I = 0.4 V			−0.8	mA
I_{OS}	Short-circuit output current§	V_{CC} = MAX	−9		−29	mA
I_{CC}	Supply current	V_{CC} = MAX, See Note 2		17	25	mA

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions for the applicable type.
‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.
§ Not more than one output should be shorted at a time.
NOTE 2: I_{CC} is measured with all inputs grounded and all outputs open.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

PARAMETER		TEST CONDITIONS	MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low-to-high-level output, from A, B, C, or D inputs through 3 levels of logic	C_L = 15 pF, R_L = 800 Ω, See Note 3		44	72	ns
t_{PHL}	Propagation delay time, high-to-low-level output, from A, B, C, or D inputs through 3 levels of logic			44	66	ns
t_{PLH}	Propagation delay time, low-to-high-level output, from either strobe input			40	60	ns
t_{PHL}	Propagation delay time, high-to-low-level output, from either strobe input			36	54	ns

NOTE 3: Load circuit and voltage waveforms are shown on page 3-10.

TTL
MSI

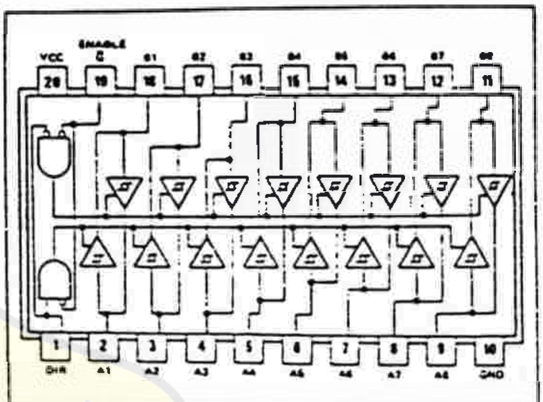
TYPES SN54LS245, SN74LS245
OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

BULLETIN NO. DL-S7712471, OCTOBER 1976—REVISED FEBRUARY 1979

- Bi-directional Bus Transceiver in a High-Density 20-Pin Package
- 3-State Outputs Drive Bus Lines Directly
- P-N-P Inputs Reduce D-C Loading on Bus Lines
- Hysteresis at Bus Inputs Improve Noise Margins
- Typical Propagation Delay Times, Port-to-Port...8 ns
- Typical Enable/Disable Times...17 ns

TYPE	I_{OL} (SINK CURRENT)	I_{OH} (SOURCE CURRENT)
SN54LS245	12 mA	−12 mA
SN74LS245	24 mA	−15 mA

SN54LS245 . . . J PACKAGE
SN74LS245 . . . J OR N PACKAGE
(TOP VIEW)



positive logic: see function table

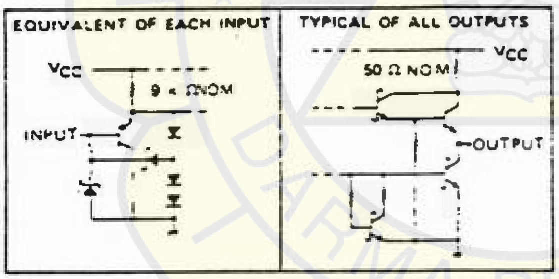
description

These octal bus transceivers are designed for asynchronous two-way communication between data buses. The control function implementation minimizes external timing requirements.

The device allows data transmission from the A bus to the B bus or from the B bus to the A bus depending upon the logic level at the direction control (DIR) input. The enable input ($\overline{G}$) can be used to disable the device so that the buses are effectively isolated.

The SN54LS245 is characterized for operation over the full military temperature range of −55°C to 125°C. The SN74LS245 is characterized for operation from 0°C to 70°C.

schematics of inputs and outputs



FUNCTION TABLE

ENABLE $\overline{G}$	DIRECTION CONTROL DIR	OPERATION
L	L	B data to A bus
L	H	A data to B bus
H	X	Isolation

H = high level, L = low level, X = irrelevant

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

Supply voltage, V_{CC} (see Note 1)		7 V
Input voltage		7 V
Off-state output voltage		5.5 V
Operating free-air temperature range:	SN54LS245	−55°C to 125°C
	SN74LS245	0°C to 70°C
Storage temperature range		−65°C to 150°C

NOTE 1: Voltage values are with respect to network ground terminal.

recommended operating conditions

PARAMETER	SN54LS245 MIN	SN54LS245 NOM	SN54LS245 MAX	SN74LS245 MIN	SN74LS245 NOM	SN74LS245 MAX	UNIT
Supply voltage, V_{CC}	4.5	5	5.5	4.75	5	5.25	V
High-level output current, I_{OH}			−12			−15	mA
Low-level output current, I_{OL}			12			24	mA
Operating free-air temperature, T_A	−55		125	0		70	°C

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

PARAMETER			TEST CONDITIONS†		SN54LS245 MIN	SN54LS245 TYP‡	SN54LS245 MAX	SN74LS245 MIN	SN74LS245 TYP‡	SN74LS245 MAX	UNIT
V_{IH}	High-level input voltage				2			2			V
V_{IL}	Low-level input voltage						0.7			0.8	V
V_{IK}	Input clamp voltage		V_{CC} = MIN,	$I_I = -18$ mA			−1.5			−1.5	V
	Hysteresis ($V_{T+} - V_{T-}$) A or B input		V_{CC} = MIN		0.2	0.4		0.2	0.4		V
V_{OH}	High-level output voltage		V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = V_{IL} max	I_{OH} = −3 mA	2.4	3.4		2.4	3.4		V
				I_{OH} = MAX	2			2			
V_{OL}	Low-level output voltage		V_{CC} = MIN, V_{IH} = 2 V, V_{IL} = V_{IL} max	I_{OL} = 12 mA			0.4			0.4	V
				I_{OL} = 24 mA						0.5	
I_{OZH}	Off-state output current, high-level voltage applied		V_{CC} = MAX, $\bar{G}$ at 2 V	V_O = 2.7 V			20			20	μA
I_{OZL}	Off-state output current, low-level voltage applied			V_O = 0.4 V			−200			−200	
I_I	Input current at maximum input voltage	A or B	V_{CC} = MAX,	V_I = 5.5 V			0.1			0.1	mA
		DIR or $\bar{G}$		V_I = 7 V			0.1			0.1	
I_{IH}	High-level input current		V_{CC} = MAX,	V_{IH} = 2.7 V			20			20	μA
I_{IL}	Low-level input current		V_{CC} = MAX,	V_{IL} = 0.4 V			−0.2			−0.2	mA
I_{OS}	Short-circuit output current¶		V_{CC} = MAX		−40		−225	−40		−225	mA
I_{CC}	Supply current	Total, outputs high	V_{CC} = MAX,	Outputs open		48	70		48	70	mA
		Total, outputs low				62	90		62	90	
		Outputs at Hi-Z				64	95		64	95	

†For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.
‡All typical values are at V_{CC} = 5 V, T_A = 25°C.
¶Not more than one output should be shorted at a time, and duration of the short-circuit should not exceed one second.

switching characteristics, V_{CC} = 5V, T_A = 25°C

PARAMETER		TEST CONDITIONS			MIN	TYP	MAX	UNIT
t_{PLH}	Propagation delay time, low-to-high-level output	C_L = 45 pF,	R_L = 667 Ω,	See Note 2		8	12	ns
t_{PHL}	Propagation delay time, high-to-low-level output					8	12	ns
t_{PZL}	Output enable time to low level					27	40	ns
t_{PZH}	Output enable time to high level					25	40	ns
t_{PLZ}	Output disable time from low level	C_L = 5 pF,	R_L = 667 Ω,	See Note 2		15	25	ns
t_{PHZ}	Output disable time from high level					15	28	ns

NOTE 2: Load circuit and waveforms are shown on page 3-11.

8255A/8255A-5
PROGRAMMABLE PERIPHERAL INTERFACE

- MCS-85™ Compatible 8255A-5
- 24 Programmable I/O Pins
- Completely TTL Compatible
- Fully Compatible with Intel® Microprocessor Families
- Improved Timing Characteristics
- Direct Bit Set/Reset Capability Easing Control Application Interface
- 40-Pin Dual In-Line Package
- Reduces System Package Count
- Improved DC Driving Capability

The Intel® 8255A is a general purpose programmable I/O device designed for use with Intel® microprocessors. It has 24 I/O pins which may be individually programmed in 2 groups of 12 and used in 3 major modes of operation. In the first mode (MODE 0), each group of 12 I/O pins may be programmed in sets of 4 to be input or output. In MODE 1, the second mode, each group may be programmed to have 8 lines of input or output. Of the remaining 4 pins, 3 are used for handshaking and interrupt control signals. The third mode of operation (MODE 2) is a bidirectional bus mode which uses 8 lines for a bidirectional bus, and 5 lines, borrowing one from the other group, for handshaking.

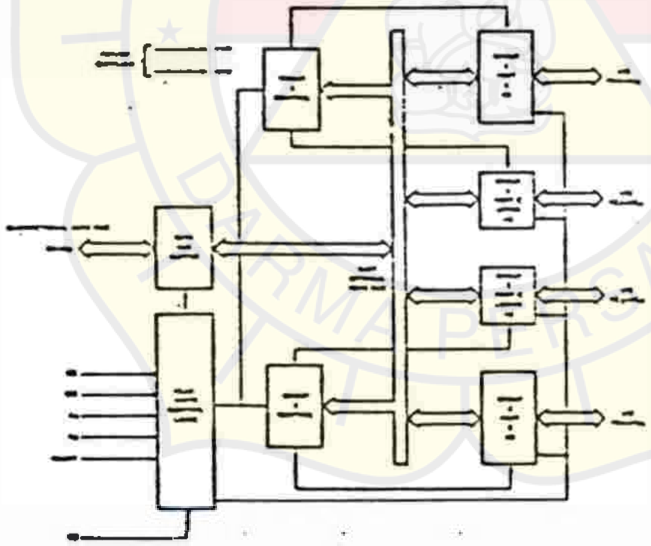


Figure 1. 8255A Block Diagram

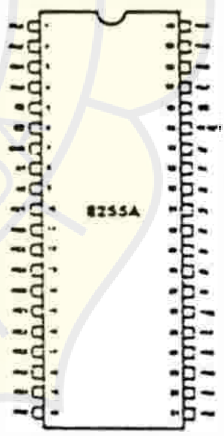


Figure 2. Pin Configuration

8255A/8255A-5
PROGRAMMABLE PERIPHERAL INTERFACE

8255A FUNCTIONAL DESCRIPTION

General

The 8255A is a programmable peripheral interface (PPI) device designed for use in Intel® microcomputer systems. Its function is that of a general purpose I/O component to interface peripheral equipment to the microcomputer system bus. The functional configuration of the 8255A is programmed by the system software so that normally no external logic is necessary to interface peripheral devices or structures.

Data Bus Buffer

This 3-state bidirectional 8-bit buffer is used to interface the 8255A to the system data bus. Data is transmitted or received by the buffer upon execution of input or output instructions by the CPU. Control words and status information are also transferred through the data bus buffer.

Read/Write and Control Logic

The function of this block is to manage all of the internal and external transfers of both Data and Control or Status words. It accepts inputs from the CPU Address and Control busses and in turn, issues commands to both of the Control Groups.

($\overline{CS}$)

Chip Select. A "low" on this input pin enables the communication between the 8255A and the CPU.

($\overline{RD}$)

Read. A "low" on this input pin enables the 8255A to send the data or status information to the CPU on the data bus. In essence, it allows the CPU to "read from" the 8255A.

($\overline{WR}$)

Write. A "low" on this input pin enables the CPU to write data or control words into the 8255A.

(A_0 and A_1)

Port Select 0 and Port Select 1. These input signals, in conjunction with the RD and WR inputs, control the selection of one of the three ports or the control word registers. They are normally connected to the least significant bits of the address bus (A_0 and A_1).

8255A BASIC OPERATION

A_1	A_0	$\overline{RD}$	$\overline{WR}$	$\overline{CS}$	INPUT OPERATION (READ)
0	0	0	1	0	PORT A → DATA BUS
0	1	0	1	0	PORT B → DATA BUS
1	0	0	1	0	PORT C → DATA BUS
					OUTPUT OPERATION (WRITE)
0	0	1	0	0	DATA BUS → PORT A
0	1	1	0	0	DATA BUS → PORT B
1	0	1	0	0	DATA BUS → PORT C
1	1	1	0	0	DATA BUS → CONTROL
					DISABLE FUNCTION
X	X	X	X	1	DATA BUS → 3-STATE
1	1	0	1	0	ILLEGAL CONDITION
X	X	1	1	0	DATA BUS → 3-STATE

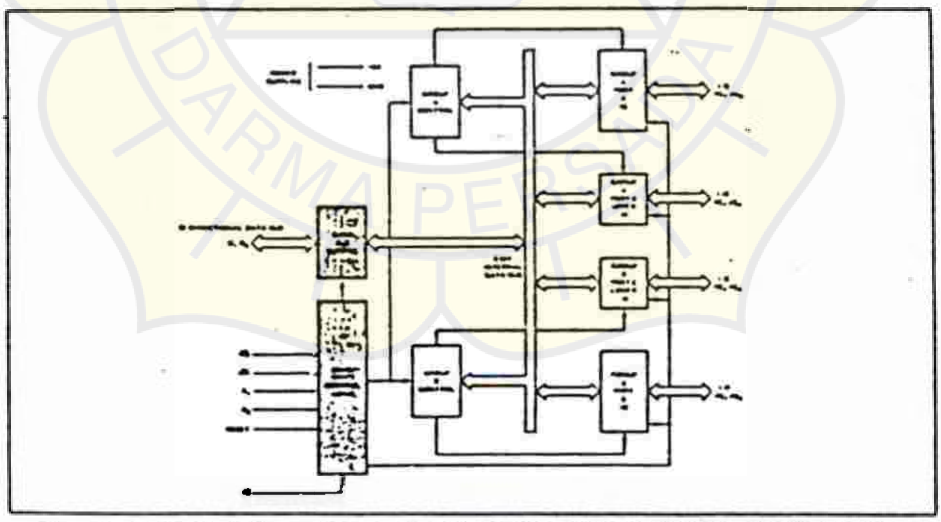


Figure 3. 8255A Block Diagram Showing Data Bus Buffer and Read/Write Control Logic Functions

8255A/8255A-5
PROGRAMMABLE PERIPHERAL INTERFACE

(RESET)

Reset. A "high on this input clears the control register and all ports (A, B, C) are set to the input mode.

Group A and Group B Controls

The functional configuration of each port is programmed by the systems software. In essence, the CPU "outputs" a control word to the 8255A. The control word contains information such as "mode", "bit set", "bit reset", etc., that initializes the functional configuration of the 8255A.

Each of the Control blocks (Group A and Group B) accepts "commands" from the Read/Write Control Logic, receives "control words" from the internal data bus and issues the proper commands to its associated ports.

Control Group A – Port A and Port C upper (C7-C4)
Control Group B – Port B and Port C lower (C3-C0)

The Control Word Register can Only be written into. No Read operation of the Control Word Register is allowed.

Ports A, B, and C

The 8255A contains three 8-bit ports (A, B, and C). All can be configured in a wide variety of functional characteristics by the system software but each has its own special features or "personality" to further enhance the power and flexibility of the 8255A.

Port A. One 8-bit data output latch/buffer and one 8-bit data input latch.

Port B. One 8-bit data input/output latch/buffer and one 8-bit data input buffer.

Port C. One 8-bit data output latch/buffer and one 8-bit data input buffer (no latch for input). This port can be divided into two 4-bit ports under the mode control. Each 4-bit port contains a 4-bit latch and it can be used for the control signal outputs and status signal inputs in conjunction with ports A and B.

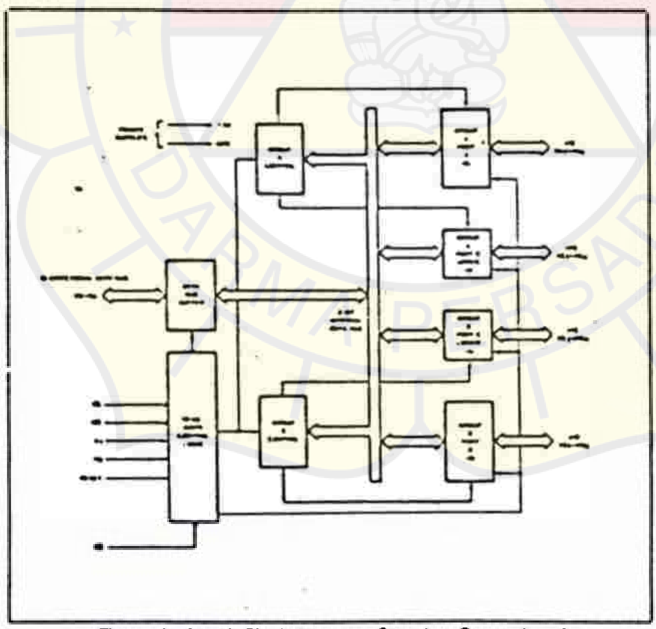
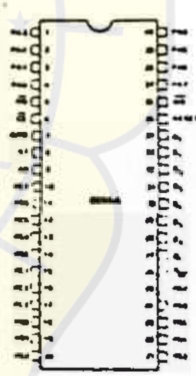


Figure 4. 8225A Block Diagram Showing Group A and Group B Control Functions

PIN CONFIGURATION



PIN NAMES

D7-D0	DATA BUS (BI-DIRECTIONAL)
RESET	RESET INPUT
CS	CHIP SELECT
RD	READ INPUT
WR	WRITE INPUT
A0, A1	PORT ADDRESS
PA7-PA0	PORT A (BIT)
PB7-PB0	PORT B (BIT)
PC7-PC0	PORT C (BIT)
Vcc	+5 VOLTS
GND	0 VOLTS

8255A/8255A-5
PROGRAMMABLE PERIPHERAL INTERFACE

8255A OPERATIONAL DESCRIPTION

Mode Selection

There are three basic modes of operation that can be selected by the system software:

Mode 0 — Basic Input/Output
Mode 1 — Strobed Input/Output
Mode 2 — Bi-Directional Bus

When the reset input goes "high" all ports will be set to the input mode (i.e., all 24 lines will be in the high impedance state). After the reset is removed the 8255A can remain in the input mode with no additional initialization required. During the execution of the system program any of the other modes may be selected using a single output instruction. This allows a single 8255A to service a variety of peripheral devices with a simple software maintenance routine.

The modes for Port A and Port B can be separately defined, while Port C is divided into two portions as required by the Port A and Port B definitions. All of the output registers, including the status flip-flops, will be reset whenever the mode is changed. Modes may be combined so that their functional definition can be "tailored" to almost any I/O structure. For instance; Group B can be programmed in Mode 0 to monitor simple switch closings or display computational results, Group A could be programmed in Mode 1 to monitor a keyboard or tape reader on an interrupt-driven basis.

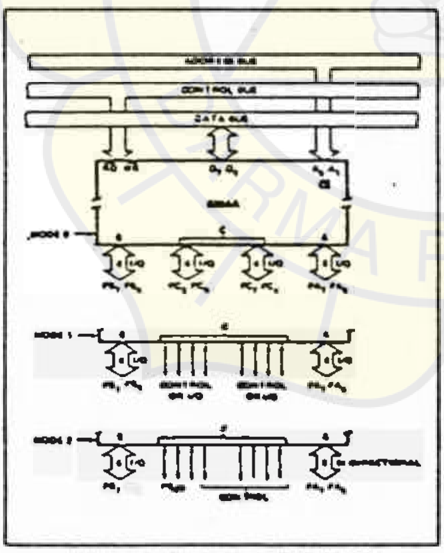


Figure 5. Basic Mode Definitions and Bus Interface

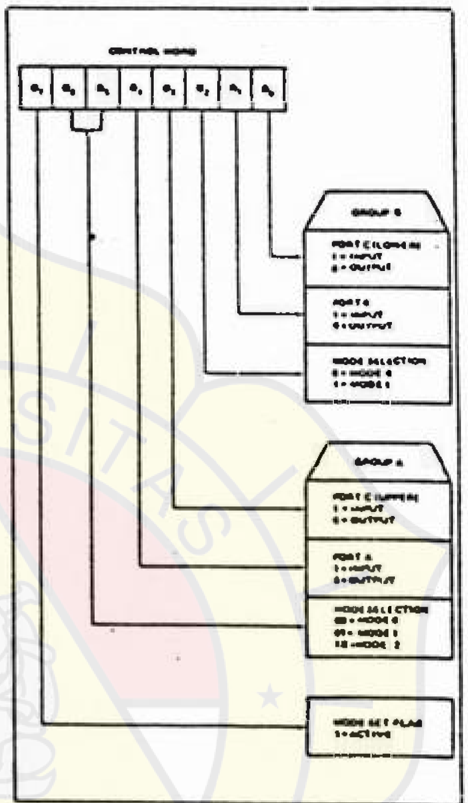


Figure 6. Mode Definition Format

The mode definitions and possible mode combinations may seem confusing at first but after a cursory review of the complete device operation a simple, logical I/O approach will surface. The design of the 8255A has taken into account things such as efficient PC board layout, control signal definition vs PC layout and complete functional flexibility to support almost any peripheral device with no external logic. Such design represents the maximum use of the available pins.

Single Bit Set/Reset Feature

Any of the eight bits of Port C can be Set or Reset using a single OUTput instruction. This feature reduces software requirements in Control-based applications.

8255A/8255A-5
PROGRAMMABLE PERIPHERAL INTERFACE

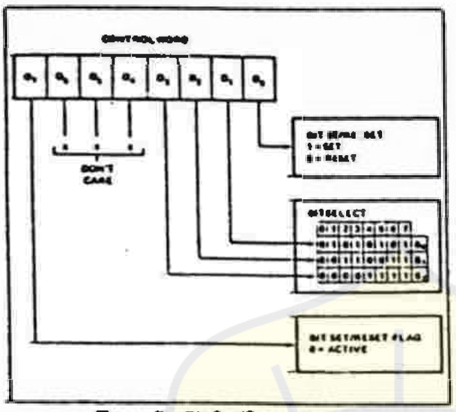


Figure 7. Bit Set/Reset Format

When Port C is being used as status/control for Port A or B, these bits can be set or reset by using the Bit Set/Reset operation just as if they were data output ports.

Interrupt Control Functions

When the 8255A is programmed to operate in mode 1 or mode 2, control signals are provided that can be used as interrupt request inputs to the CPU. The interrupt request signals, generated from port C, can be inhibited or enabled by setting or resetting the associated INTE flip-flop, using the bit set/reset function of port C.

This function allows the Programmer to disallow or allow a specific I/O device to interrupt the CPU without affecting any other device in the interrupt structure.

INTE flip-flop definition:

(BIT-SET) — INTE is SET — Interrupt enable
(BIT-RESET) — INTE is RESET — Interrupt disable

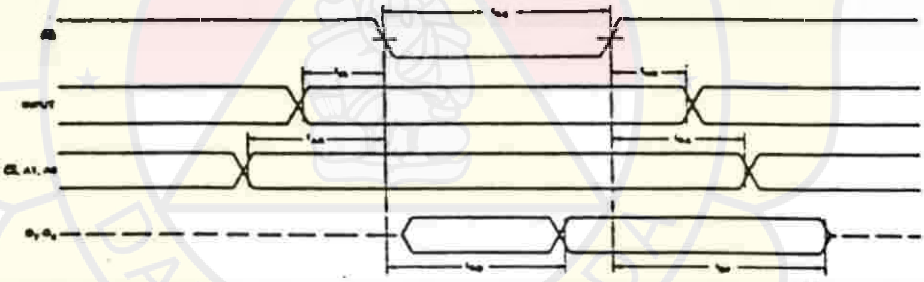
Note: All Mask flip-flops are automatically reset during mode selection and device Reset.

Operating Modes

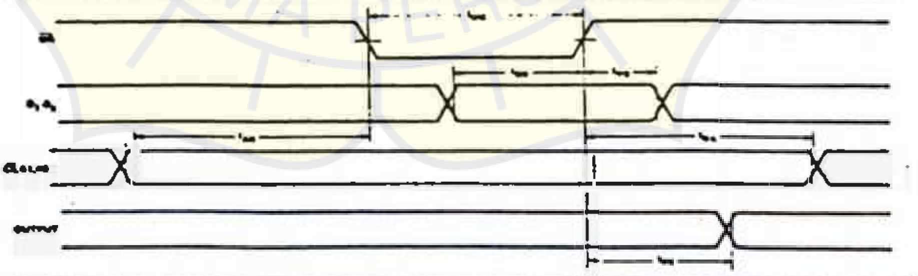
MODE 0 (Basic Input/Output). This functional configuration provides simple input and output operations for each of the three ports. No "handshaking" is required, data is simply written to or read from a specified port.

Mode 0 Basic Functional Definitions:

- Two 8-bit ports and two 4-bit ports.
- Any port can be input or output.
- Outputs are latched.
- Inputs are not latched.
- 16 different Input/Output configurations are possible in this Mode.



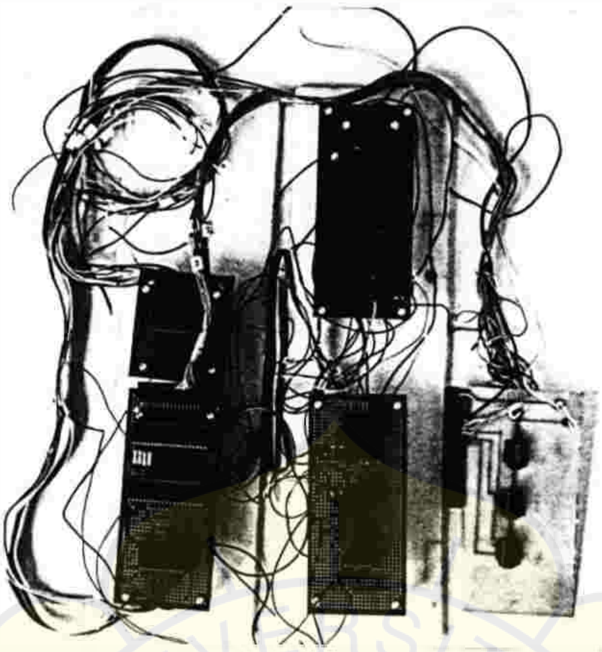
MODE 0 (Basic Input)



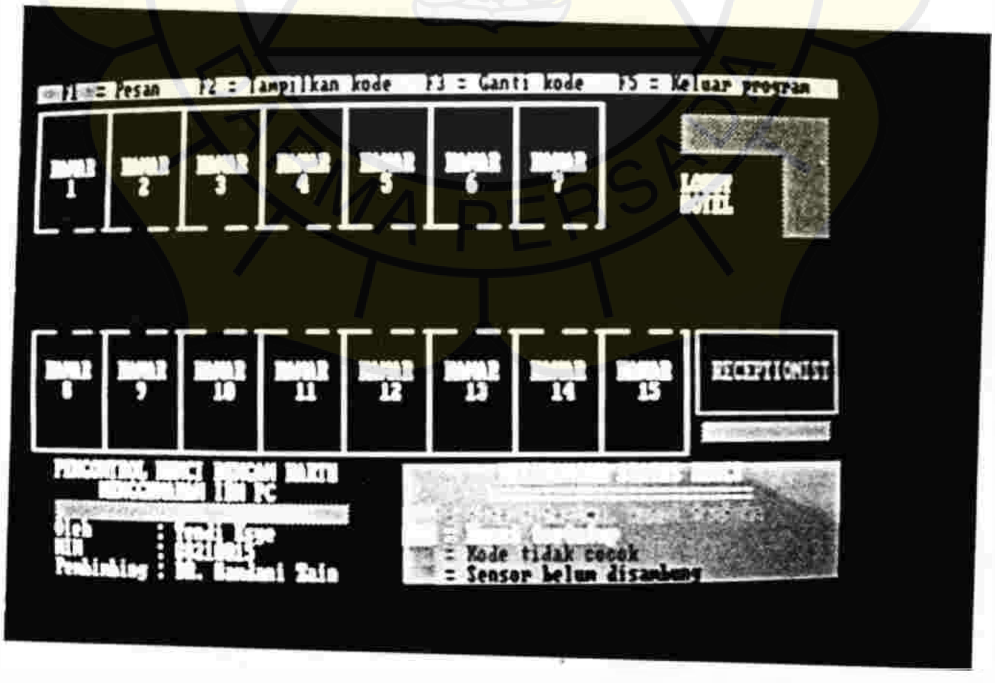
MODE 0 (Basic Output)

LAMPIRAN C

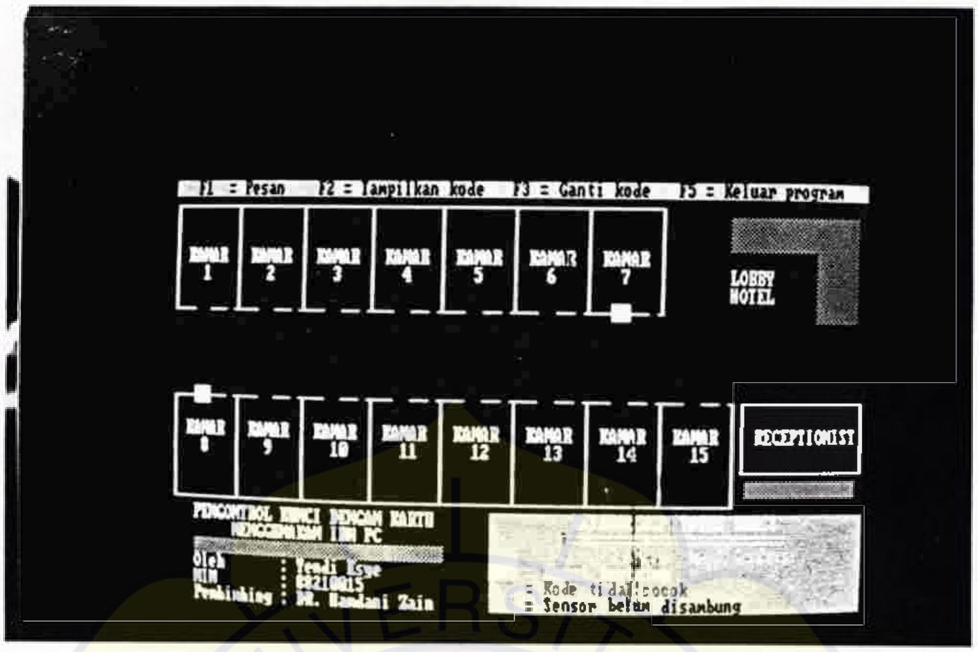
GAMBAR ALAT DAN TAMPILAN LAYAR MONITOR HASIL PERCOBAAN



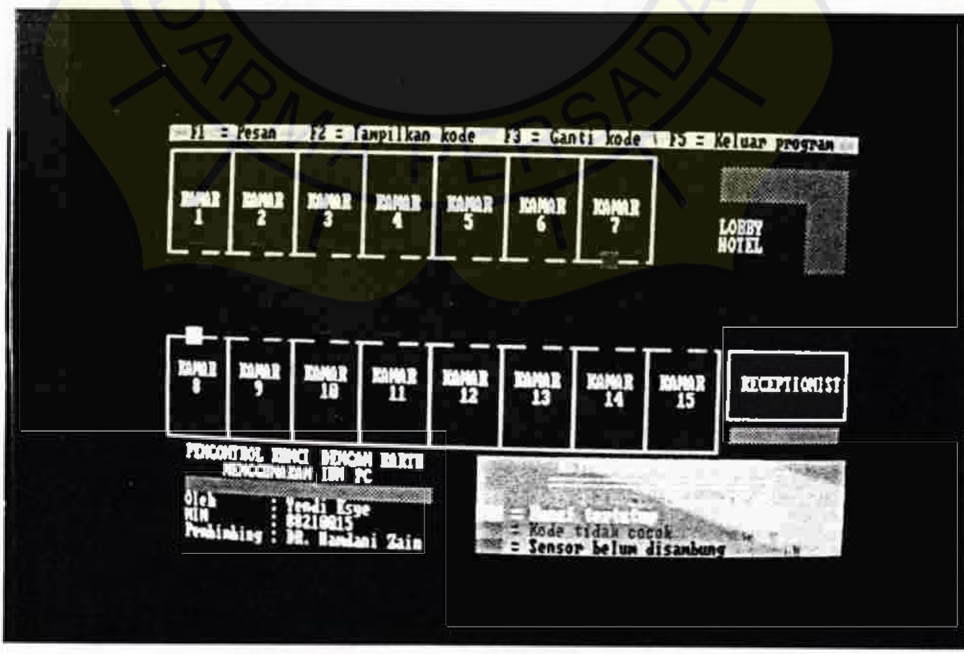
Perangkat Keras Sistem



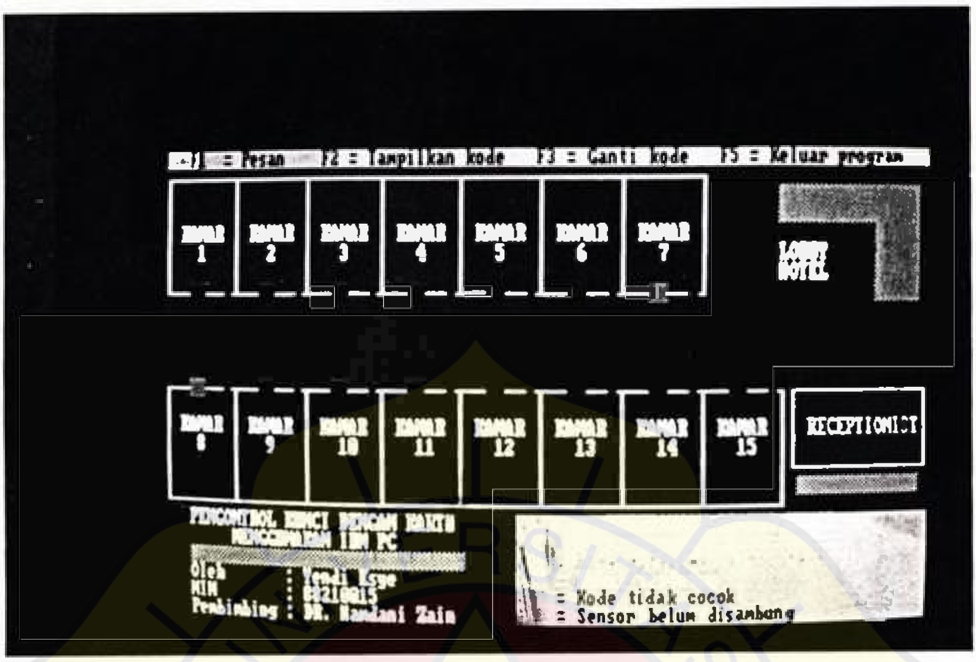
Tampilan layar monitor pada saat sensor belum dipasang



Tampilan layar monitor pada saat sensor telah dipasang



Tampilan layar monitor pada saat kode sensor benar



Tampilan layar monitor pada saat sensor salah

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