

เอกสารอ้างอิง

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ภาคผนวก

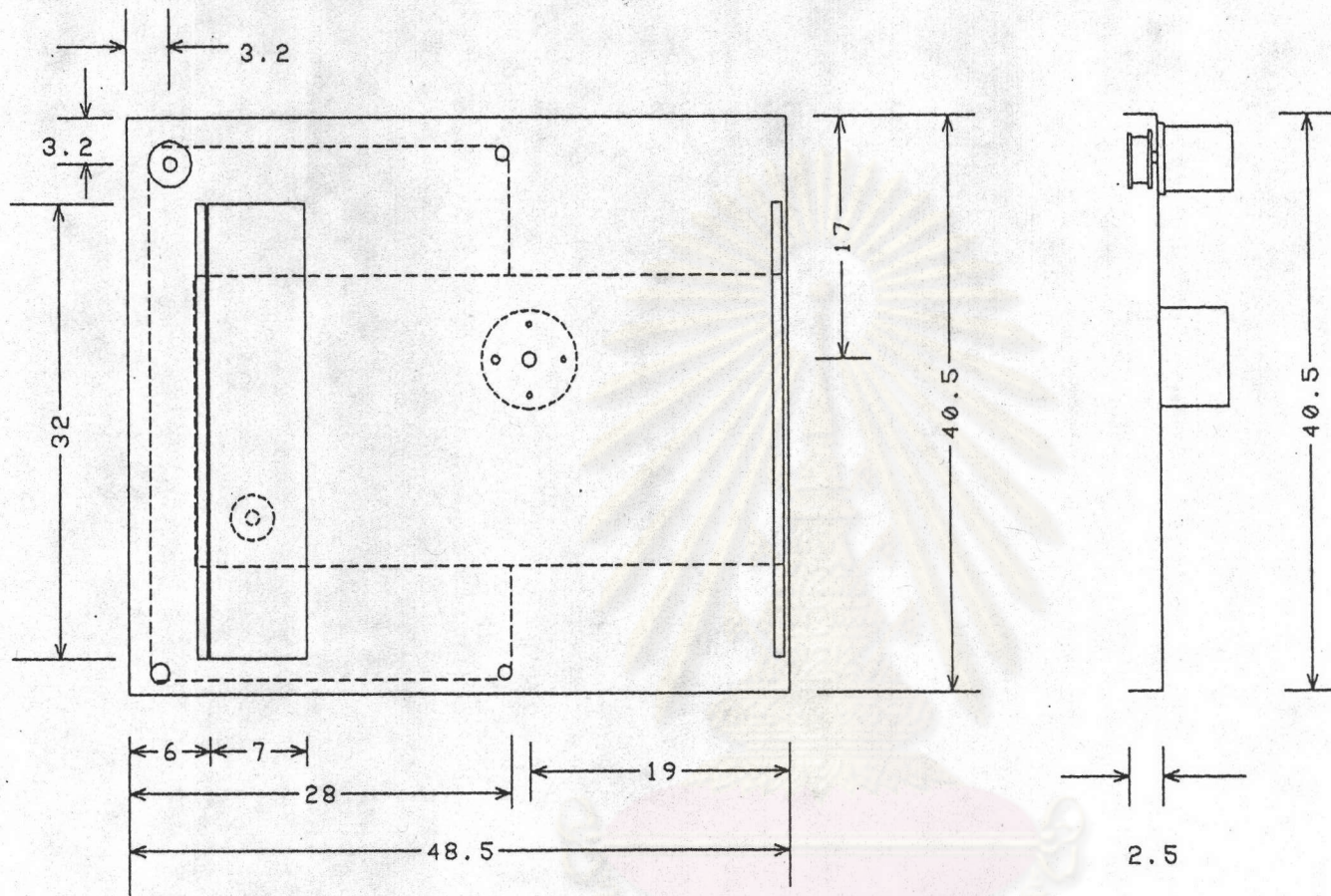
ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

ภาคผนวก ก

แบบประกอบระบบขับเคลื่อนชิ้นงาน

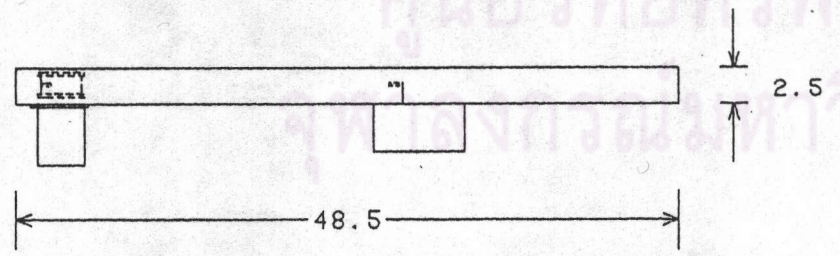


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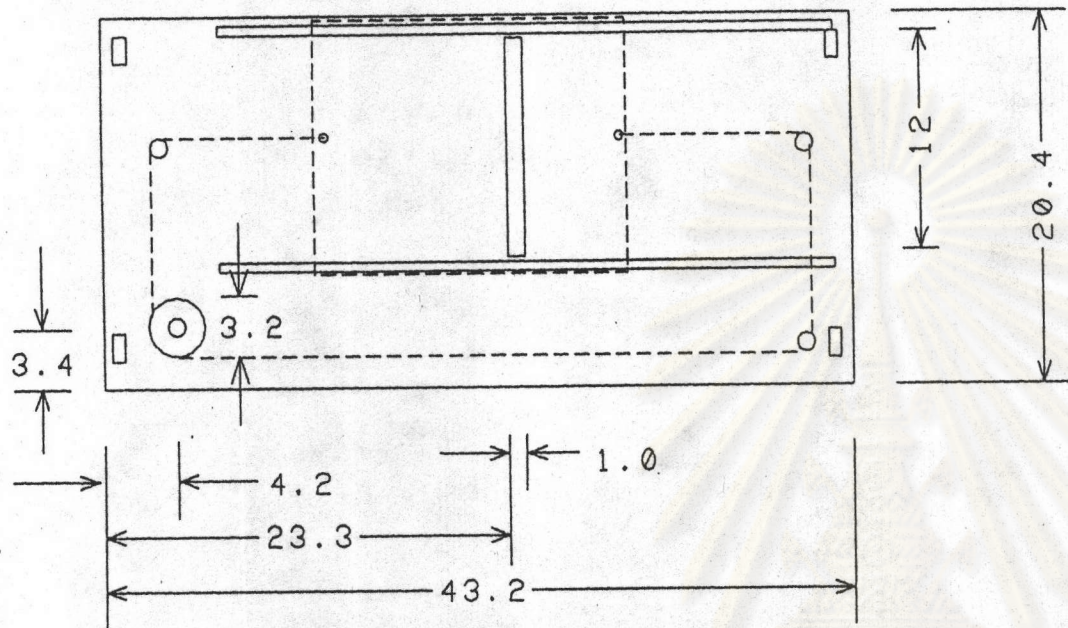
TOP VIEW

SIDE VIEW

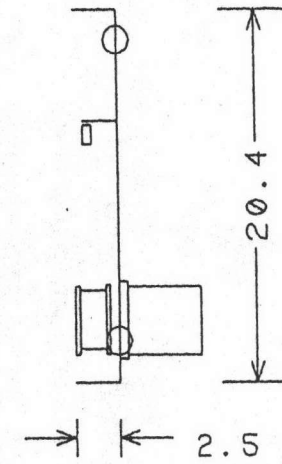


FRONT VIEW

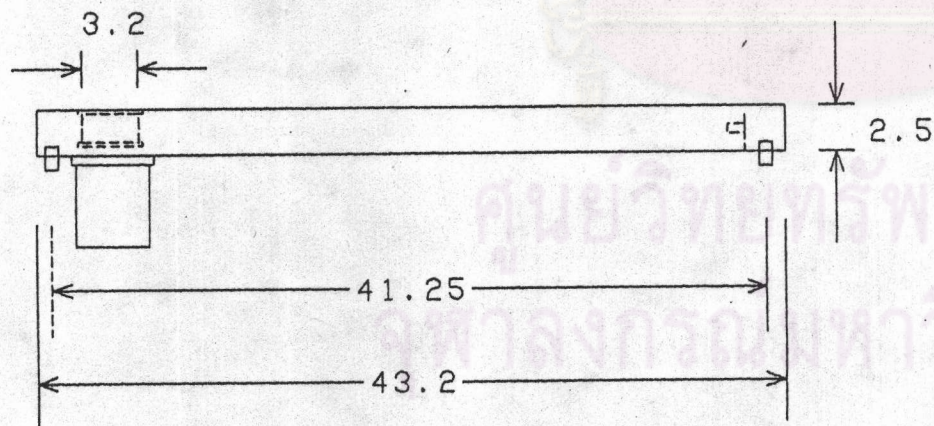
NUCLEAR TECHNOLOGY	
CHULALONGKORN UNIVERSITY	
MAIN SUPPORT	BUSSABA SAELIM



TOP VIEW



SIDE VIEW

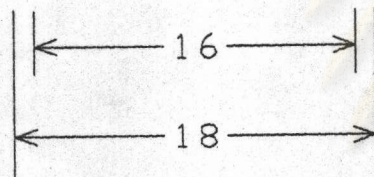
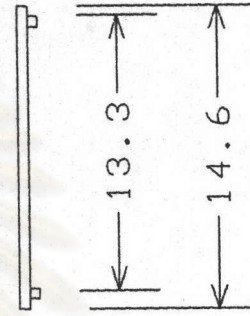
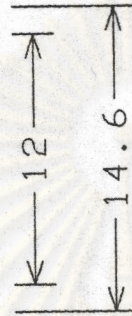
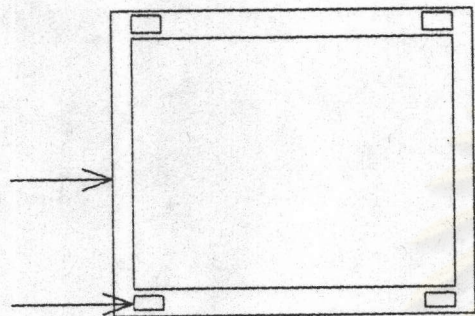


FRONT VIEW

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Y-TRAY	BUSSABA SAELIM

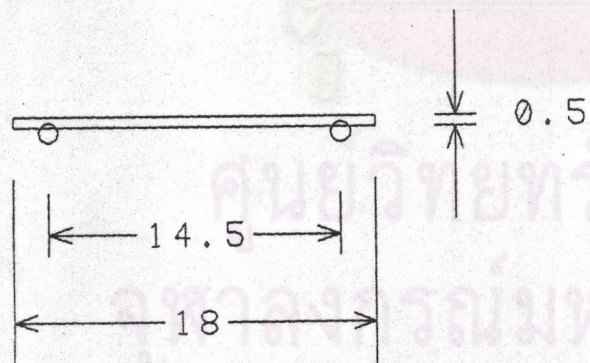
ACRYLIC
PLASTIC

WHEEL



TOP VIEW

SIDE VIEW



FRONT VIEW

NUCLEAR TECHNOLOGY CHULALONGKORN UNIVERSITY	
X-TRAY	BUSSABA SAELIM

ภาคผนวก ๓

โปรแกรมสร้างภาพฉายสองมิติ



ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

```

unit gamma2;
interface
uses crt,graph;

type
gammacount = array[1..160,1..120] of integer;

procedure resetxy;
procedure scanXF(y:integer; var Gammadata : Gammacount);
procedure scanXB ;
procedure scan_xy(var gdata :Gammacount);
procedure readinfi(var tdata :gammacount);
procedure creatinfi(fname : string; var testdat : Gammacount);
procedure OpenGraph;
procedure pic1(var testdat :gammacount);
procedure pic2(var testdat :gammacount);
procedure pic3(var testdat :gammacount);
procedure pic4(var testdat :gammacount);

implementation

procedure resetxy;

procedure resetX ;
const
    n : byte = 80;
var
    qreset ,x : byte ;
begin
    qreset := port [770];
    writeln( ' reset is ',qreset);
    if (qreset <> 0) and (qreset <> 1) then
    begin
        for x := 1 to n do
        begin
            { port[768]:=8; delay(10); }
            port[768]:=9;
            port[768]:=9;
            delay(10);
            { port[768]:=-1; delay(10); }
            port[768]:=-5;
            delay(10);
            qreset := port [770];
            { writeln( ' reset is ',qreset);}
            if (qreset <> 0) and (qreset <> 1) then
            begin
                { port[768]:=-4; delay(10); }
                port[768]:=-6;
                delay(10);
                { port[768]:=-2; delay(10); }
                port[768]:=-10;
                delay(10);
            end;
            qreset := port [770];
            { writeln( ' reset is ',qreset);}
            if (qreset = 0) or (qreset = 1)
            then x:=n;
            end ;
        end;
    end;

procedure resety ;
const
    n : byte = 60;
var
    qreset ,y : byte ;
begin
    qreset := port[770];
    { writeln( ' reset is ',qreset);}
    if (qreset <> 0) and (qreset <> 2) then
    begin
        for y := 1 to n do
        begin

```



```

delay(10);
( port[769]:=1; delay(10); )
port[769]:=5;
delay(10);
qreset := port[770];
( writeln( ' reset is ',qreset); )
if (qreset < 0) and
  (qreset < 2) then
  begin
  ( port[769]:=4; delay(10); )
  port[769]:=6;
  delay(10);
  ( port[769]:=2; delay(10); )
  port[769]:=10;delay(10);
  end;
qreset := port[770];
( writeln( ' reset is ',qreset);)
if (qreset = 0) or (qreset = 2)
  then y := n;
end ;
end;
end;

begin
port[771] := 137;
resetx;
resety;

end;

procedure scanXF(y:integer;
  var Gannadata : Gannacount) ;
const
  n = 80; d = 50; s = 10;
var
  pt : array [1..10] of integer;
  reserve,sump : integer;

  var
    pt : array [1..10] of integer;
    reserve,sump : integer;
    x,shdata,i : integer ;
    gannaindex : integer;
    min,max :integer;
    qreset : byte;
  begin
    gannaindex := 0;
    for x := 1 to n do
      begin
        sump := 0;
        gannaindex := gannaindex +1 ;
        max:=0; min:=-255;
        for i := 1 to 10 do
          begin
            reserve:=port[772];
            pt[i] := reserve;
            if reserve > max then
              max := reserve
            else if
              reserve<= min then
                min :=reserve;
            sump:= sump+pt[i];
          end;
          reserve := round((sump-min-max)/8.0);
          Gannadata [gannaindex,y] := reserve;
          ( shdata := Gannadata[gannaindex,y];)
          writeln(' testdata (' ,gannaindex,'
            ',y,')is ',reserve);
        port[768]:=6;
        delay(s);
        port[768]:=5;
        delay(d);
        sump := 0; min := 255; max := 0;
        gannaindex := gannaindex + 1 ;
      end;
    end;
  end;

```

```

if reserve > max then
    max := reserve
else if reserve <= min then
    min := reserve;
    sump:= sump+ptfil;
end;
reserve := round((sump-min-max)/8.0);
Gammadata [gammaindex,y] := reserve;
writeln(' testdata (' ,gammaindex,'
        ',y,')is ',reserve);
if gammaindex <160 then
begin
    port[768]:=9;
    delay(s);
    port[768]:=10;
    delay(d);
end;
end ;
end; {procedure scanxf}

procedure scanXB ;
const
    n = 80; s = 10;
var
    x : integer;
begin
    for x := 1 to n do
        begin
            port[768]:=9;
            delay(s);
            port[768]:=5;
            delay(s);
            port[768]:=6;
            delay(s);
            port[768]:=10;
            delay(s);
        end ;
    end; {procedure scanxb}

delay(s);
port[768]:=10;
delay(s);
end ;
end; {procedure scanxb}

procedure scan_xy(var gdata :Gammaccount);
var
    a , y : integer ;
begin
    port[771] := 137;
    a:=0; port[769] := 10;
    for y := 1 to 60 do
        begin
            a := a+1;
            scanXF(a,gdata );
            delay(10);scanXB;
            port[769] := 6 ;
            delay(10);
            port[769] := 5 ;
            delay(100);
            a := a+1;
            scanXF(a,gdata);
            delay(10);scanXB;
            port[769] := 9 ;
            delay(10);
            port[769] := 10 ;
            delay(100);
        end;
    end; {procedure scan_xy}

procedure creatinfi(fname : string;
                    var testdat : Gammaccount);
type
    { filename = string[40];
    infi = file of integer;

```

```

begin
  clrscr;
  gotoxy(27,12);
  write('enter file''sname ');
  read(fname);
  assign (inputfi,fname);
  rewrite ( inputfi);
  for y := 1 to 120 do
    for x := 1 to 160 do
      begin
        write ( inputfi,testdat[x,y] );
      end;
    close ( inputfi);
  end;

procedure read_infi;
type
  infi = file of integer;
var
  ffi : infi;
  cntr : byte;

  fname : string[40];
  tdata : integer;

function made(var fi :infi):boolean;
begin
  {$i-} reset(fi) ; {$i+}
  made := (IOresult = 0);
end;

begin
  write( ' enter file''sname: ');
  readln (fname);
  assign (ffi,fname);
  if made(ffi) then
    begin
      cntr := 0;

      while not eof(ffi) do
        begin
          cntr := cntr+1;
          read (ffi,tdata);
          writeln('data (',cntr,') is ',
            tdata);
        end;
      close (ffi);
    end
    else writeln('file not found');
  end;

procedure OpenGraph ;
var
  Gd,Gm,errorcode : integer;
begin
  clrscr;
  Gd := detect;
  initgraph(Gd,Gm, '');
  errorcode := graphresult;
  if errorcode <> grOK then

begin
  writeln('Graphics error: ',
  Grapherrormsg(errorcode));
  readln;
  halt(1);
end;
end;
end;

```

```

begin
  for y := 1 to 120 do
    begin
      for x := 1 to 160 do
        begin
          n := n+1;
          dat := testdat[x,y] ;
        case dat of
          0..15 : col := 0;
          16..31 : col := 1;
          32..47 : col := 2;
          48..63 : col := 3;
          64..79 : col := 4;
          80..95 : col := 5;
          96..111 : col := 6;
          112..127 : col := 7;
          128..143 : col := 8;
          144..159 : col := 9;
          160..175 : col := 10;
          176..191 : col := 11;
          192..207 : col := 12;
          208..223 : col := 13;
          224..239 : col := 14;
          240..255 : col := 15;
        end; {case}
        for p := 1 to k do
          begin
            for q := 1 to k do
              begin
                xp := k*x - (k-p) ;
                yq := k*y -(k-q) ;
                putpixel (xp,yq,col);
              end;
            end;
          end; {x}
        end; {y}
      end;
    end;
  end;
end;

xp := k*x - (k-p) ;
yq := k*y -(k-q) ;
putpixel (xp,yq,col);
end;
end;
end;
end;

end; {x}
end; {y}
end;

procedure pic2(var testdat:Gammaccount);
var
  col : word;
  x,y,dat : integer;
  p,q,xp,yq : integer;
begin
  for y := 1 to 120 do
    begin
      for x := 1 to 160 do
        begin
          n := n+1;
          dat := testdat[x,y] ;
        case dat of
          0..15 : col := 0;
          16..30 : col := 0;
          31..45 : col := 1;
          46..60 : col := 8;
          61..75 : col := 7;
          76..90 : col := 9;
          91..105 : col := 2;
          106..120 : col := 10;
          121..135 : col := 3;
          136..150 : col := 11;
          151..165 : col := 11;
          166..180 : col := 14;
          181..195 : col := 15;
          196..210 : col := 15;

```

```

for p := 1 to k do
  begin
    for q := 1 to k do
      begin
        xp := (k*x - (k-p))+320;
        yq := k*y - (k-q) ;
        putpixel (xp,yq,col);
      end;
    end;
  end; {x}
end; {y}
end;

procedure pic3(var testdat:Gannaccount);
var
  col : word;
  x,y,dat : integer;
  p,q,xp,yq : integer;
begin
  for y := 1 to 120 do
    begin
      for x := 1 to 160 do
        begin
          n := n+1;
          dat := testdat[x,y] ;
          case dat of
            0..5 : col := 0;
            6..12 : col := 1;
            13..19 : col := 2;
            20..26 : col := 3;
            27..34 : col := 4;
            35..43 : col := 5;
            44..52 : col := 6;
            53..62 : col := 7;
            63..73 : col := 8;
            74..86 : col :=9;
            87..101 : col :=10;
            102..118 : col := 11;
            119..139 : col := 12;
            140..165 : col := 13;
            166..202 : col := 14;
            203..255 : col := 15;
          end; {case}
          for p := 1 to k do
            begin
              for q := 1 to k do
                begin
                  xp := k*x - (k-p);
                  yq :=( k*y - (k-q))+ 240 ;
                  putpixel (xp,yq,col);
                end;
              end;
            end; {x}
          end; {y}
        end;
      end;
    end;
  end;

procedure pic4(var testdat:Gannaccount);
var
  col : word;
  x,y,dat : integer;
  p,q,xp,yq : integer;

```

```

( case dat of
  0..5   : col := 0;
  6..12  : col := 1;
  13..19 : col := 8;
  20..26 : col := 7;
  27..34 : col := 9;
  35..43 : col := 2;
  44..52 : col := 10;
  53..62 : col := 3;
  63..73 : col := 11;
  74..86 : col := 14;
  87..101 : col := 15;
  102..118 : col := 6;
  119..139 : col := 5;
  140..165 : col := 13;
  166..202 : col := 12;
  203..255 : col := 4;
end; )

case dat of
  0..5   : col := 0;
  6..12  : col := 0;
  13..19 : col := 1;
  20..26 : col := 1;
  27..34 : col := 8;
  35..43 : col := 9;
  44..52 : col := 3;
  53..62 : col := 2;
  63..73 : col := 11;
  74..86 : col := 10;
  87..101 : col := 14;
  102..118 : col := 14;
  119..139 : col := 14;
  140..165 : col := 15;
  166..202 : col := 15;
  203..255 : col := 15;
end; {case}

  35..43 : col := 9;
  44..52 : col := 3;
  53..62 : col := 2;
  63..73 : col := 11;
  74..86 : col := 10;
  87..101 : col := 14;
  102..118 : col := 14;
  119..139 : col := 14;
  140..165 : col := 15;
  166..202 : col := 15;
  203..255 : col := 15;
end; {case}

  for p := 1 to k do
  begin
    for q := 1 to k do
    begin
      xp := k*x - (k-p)+320;
      yq := (k*y - (k-q))+ 240 ;
      putpixel (xp,yq,col);
    end;
  end; {x}
end; {y}
end;
end.

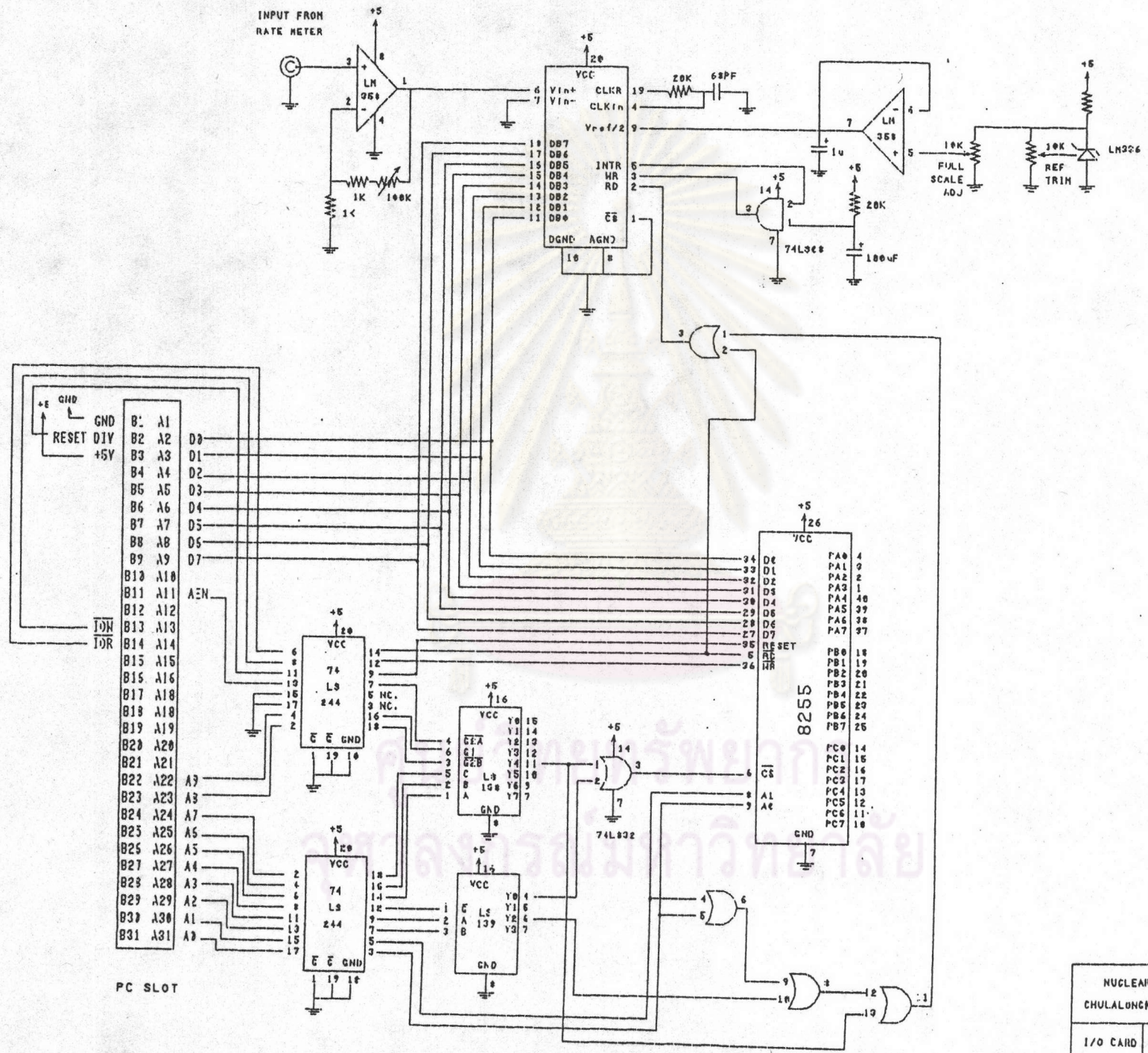
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ภาคผนวก ค

รายละเอียดวงจรเชื่อมโยงสัญญาณ



ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย



ภาคผนวก ง

ตัวชี้บอกคุณภาพของภาพถ่าย



ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

ภาคผนวก ง.

ตัวชี้บอกคุณภาพของภาพถ่าย

Image Quality Indicator



DIN 1/7

DIN 6/12

DIN 10/16

ตารางหมายเลขและขนาดของ IQI แบบเส้นลาด DIN 54 109(1962)

หมายเลข	เส้นผ่าศูนย์กลาง(มม.)	หมายเลข	เส้นผ่าศูนย์กลาง(มม.)
1	3.20	9	0.50
2	2.50	10	0.40
3	2.00	11	0.32
4	1.60	12	0.25
5	1.25	13	0.20
6	1.00	14	0.16
7	0.80	15	0.125
8	0.63	16	0.100

ภาคผนวก จ

รายละเอียดแห่งกำเนิดรังสีแกมมา



ศูนย์วิทยุทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย

Americium-241

γ and primary X-ray sources

Disc sources, stainless steel window

Americium-241 incorporated in a ceramic enamel sealed in a welded stainless steel capsule.

Sources codes AMC.62-66 are designed for backscatter applications; the active area is recessed into a tungsten alloy backing.

Nominal activity*		Capsule	Typical photon output in photons/sec per steradian		Code
mCi	MBq		59.5keV	59.5keV	
1	37	X.10	8×10^5		AMC.62
3	111	X.10	2.5×10^6		AMC.63
10	370	X.10	8×10^6		AMC.64
30	1110	X.11	2.4×10^7		AMC.65
100	3700	X.11/1	5.3×10^7		AMC.66

*Tolerance $\pm 10\%$

Availability: within 10 days

Recommended working life: 15 years

Nominal activity*		Capsule	Typical photon output in photons/sec per steradian		Code
mCi	GBq		59.5keV	59.5keV	
100	3.7	X.91	5.3×10^7		AMC.16
300	11.1	X.92	1.5×10^8		AMC.17
500	18.5	X.97	2.8×10^8		AMC.18
1000	37	X.93	5×10^8		AMC.19
3000	111	X.94	1.2×10^9		AMC.30
5000	185	X.95	2×10^9		AMC.50

*Tolerance $\pm 10\%$

Availability: within 10 days

Recommended working life: 15 years

Disc sources, beryllium window

Americium-241 incorporated in a ceramic enamel, sealed in a welded monel capsule with brazed beryllium window; the active component is recessed into a stainless steel support with tungsten alloy backing.

These sources are designed for applications where the Np L X-rays are also required.

Nominal activity*		Capsule	Typical photon output in photons/sec per steradian		Code
mCi	GBq		17.7keV	59.5keV	
10	0.37	X.130/4	1.9×10^6	8.6×10^6	AMC.13044
30	1.11	X.131/4	7×10^6	2.6×10^7	AMC.13145
100	3.7	X.131/4	1×10^7	6.7×10^7	AMC.13146
100	3.7	X.134/4	1.8×10^7	7.8×10^7	AMC.13446

*Tolerance $\pm 10\%$

Availability: within 10 days

Recommended working life: 10 years

Quality control, see page 14

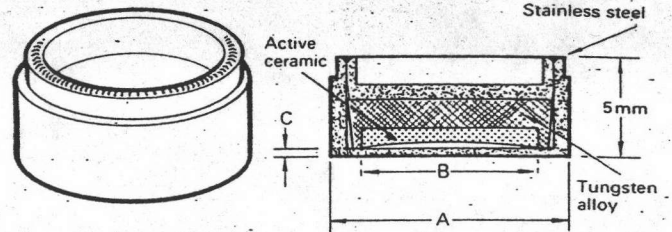
Specifications:

Only typical sources are listed.

Enquiries invited for sources to other specifications.

Recommended working life, see page 60

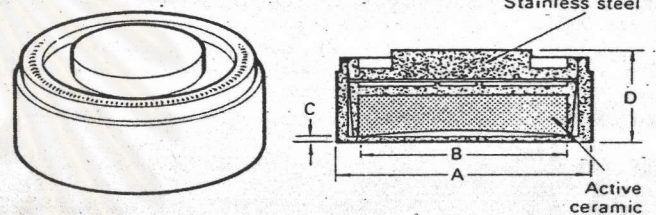
X.10,11



Capsule dimensions and Safety performance testing

Capsule	Overall diam. 'A' mm	Active diam. 'B' mm	Window thickness 'C' mm	Safety performance testing	
				ISO classification	IAEA special form
X.10	8	4.2	0.2-0.25	C64545	GB/3/S
X.11	10.8	7.2	0.2-0.25	C64444	GB/4/S
X.11/1	10.8	8.0	0.2-0.25	C64444	GB/4/S

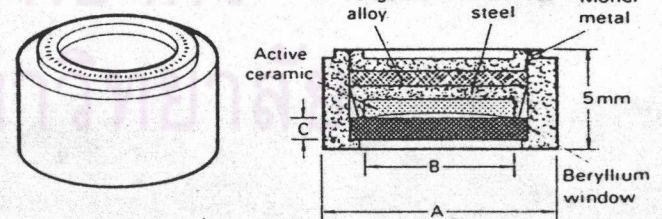
X.91-95,97



Capsule dimensions and Safety performance testing

Capsule	Overall diam. 'A' mm	Active diam. 'B' mm	Window thickness 'C' mm	Overall thickness 'D' mm	Safety performance testing	
					ISO classification	IAEA special form
X.91	10.8	7.5	0.2-0.25	6	C64444	GB/38/S
X.92	15	12	0.2-0.25	6	C64444	GB/39/S
X.93	30	25	0.2-0.25	6	C64444	GB/40/S
X.94	36	31	0.25-0.3	8	E64444	GB/107/S
X.95	45	40	0.25-0.3	8	E64444	GB/121/S
X.97	22	16	0.2-0.25	6	C64444	GB/41/S

X.130,131,134



Capsule dimensions and Safety performance testing

Capsule	Overall diam. 'A' mm	Active diam. 'B' mm	Window thickness 'C' mm	Safety performance testing	
				ISO classification	IAEA special form
X.130/4	8	4.2	0.95-1.05	C64344	GB/145/S
X.131/4	10.8	7.2	0.95-1.05	C64344	GB/144/S
X.134/4	15	10.6	0.95-1.05	C64344	GB/146/S

Neutron emission, see page 14

Safety performance testing, see page 59

Dimensions in mm

ประวัติผู้เขียน

นางสาวบุษบา แซ่ลิ้ม เกิดวันที่ 16 มิถุนายน พ.ศ. 2506 ที่จังหวัดเชียงใหม่ สำเร็จการศึกษาระดับปริญญาวิทยาศาสตรบัณฑิต สาขาฟิสิกส์ จากคณะวิทยาศาสตร์ มหาวิทยาลัยเชียงใหม่ ปีการศึกษา 2528 จากนั้นได้เข้าศึกษาต่อที่ ภาควิชานิวเคลียร์เทคโนโลยี คณะวิศวกรรมศาสตร์ จุฬาลงกรณ์มหาวิทยาลัยใน ปี พ.ศ. 2530



ประวัติการทำงาน

- พ.ศ. 2528 บริษัท เอ็มแอนด์อี จำกัด ในตำแหน่ง ผู้ช่วยบรรณาธิการวารสารเทคนิค
- พ.ศ. 2531 รัฐบาลที่ สำนักงานมาตรฐานผลิตภัณฑ์อุตสาหกรรม
- กระทรวงอุตสาหกรรม ในตำแหน่ง นักวิชาการมาตรฐาน

ศูนย์วิทยทรัพยากร
จุฬาลงกรณ์มหาวิทยาลัย