Travail de fin d'études et stage[BR]- Travail de fin d'études : Développement et prototypage d'un système de tubage automatisé de séparateurs de faisceaux de tubes[BR]- Stage d'insertion professionnelle

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Annexe A

Code Arduino

```
#include <AccelStepper.h>

// Plus explicite que 0 ou 1
typedef enum{
  RIGHT = 1,
  LEFT  = 0
}side;

//Définition d'un nouveau type "plateType" pour décrire une plaque
typedef void (*plateType)();

/*
 * Plaque d'interface courte
 * Distance en mm
 */
#define DIST_BTW_HOLE_X1 2
#define DIST_BTW_HOLE_Z1 2
#define LENGTH_X1 24
#define LENGTH_Z1 8

/*
 * Plaque d'interface large
 * Distance en mm
 */
#define DIST_BTW_HOLE_X2 2.0
#define DIST_BTW_HOLE_Z2 2
#define LENGTH_X2 48
#define LENGTH_Z2 4

/*
 * Mricrostepping du driver
 */
#define MICROSTEP_X 8.0
#define MICROSTEP_Y 8.0
#define MICROSTEP_Z 4.0
#define MICROSTEP_WHEEL 4.0

/*
 * Pas de la vis
 * Distance en mm
 */
#define LEAD_X 15.0
#define LEAD_Y 15.0
#define LEAD_Z 1.0
#define LEAD_WHEEL 87.0 //Diamètre de la roue * pi

/*
 * Définition des entrées et sorties
 * Adapté pour un arduino Mega
 */
const byte ENAX = 35;
const byte DIRX = 37;
const byte PULX = 39;

const byte ENAY = 34;
const byte DIRY = 36;
const byte PULY = 38;

const byte ENAZ = 47;
const byte DIRZ = 49;
const byte PULZ = 51;

const byte ENAEXT = 41;
const byte DIREXT = 43;
const byte PULEXT = 45;

const byte button1 = 23;
const byte button2 = 24;
const byte button3 = 25;
```

```
const byte magnetRelay = 53;
const byte gripRelay = 32;
const byte pullRelay = 33;

const byte isTubeLeft = A3;
const byte isTubeRight = A7;
const byte wheelInterrupt = A11;

const byte switchX = 46;
const byte switchZ = 48;
const byte switchY = 44;

const byte led = 22;

//Définition des steppers du mécanisme
AccelStepper xAxis(1,PULX,DIRX);
AccelStepper yAxis(1,PULY,DIRY);
AccelStepper zAxis(1,PULZ,DIRZ);
AccelStepper extMotor(1,PULEXT,DIREXT);

//Définition des prochaines plaques à tuber
plateType nextHole1;
plateType nextHole2;

byte state = 0;

//Valeur du capteur photoélectrique dans le canal d'acheminement
short tubeRefLeft = 0;

//Valeur du capteur photoélectrique dans le canal de gauche
short tubeRefRight = 0;

//Valeur du capteur photoélectrique derrière la roue
short wheelRef = 0;

//Nombre de raté sur un seul trou et remis à 0 à chaque trou
byte nbrFail = 0;

/*
 * Conversion des distances en mm vers une valeur en pas moteur
 * 200 pas pour un tour complet dans les stepper utilisés
 */
float mm2stepX = 200.0*MICROSTEP_X/LEAD_X;
float mm2stepY = 200.0*MICROSTEP_Y/LEAD_Y;
float mm2stepZ = 200.0*MICROSTEP_Z/LEAD_Z;
float mm2stepWheel = 200.0*MICROSTEP_WHEEL/LEAD_WHEEL;

//Nombre d'orifices dans les plaques
const unsigned short nbrHole1 = LENGTH_X1 * LENGTH_Z1;
const unsigned short nbrHole2 = LENGTH_X2 * LENGTH_Z2;

//Etat d'avancement du tubage
unsigned short tubeNbr = 0;

//Coordonnées du premier orifices de la plaque d'interface courte en nombre de pas et placée à gauche
const long coordx1Ref = -9244;//-9091;//-9305
const long coordy1Ref = -19340;//-19330;//-19320
const long coordz1Ref = 18142;//7092;//10253 11:45

//Coordonnées du premier orifices de la plaque d'interface large en nombre de pas et placée à gauche
const long coordx2Ref = -12026;//-10049;//-10102
const long coordy2Ref = -3180;//-3124;//-3157 3074
const long coordz2Ref = 18065;//15038;//18238;

//Coordonnées du premier orifices de la plaque d'interface à tube fin
const long coordx3Ref = 0;
```

```
const long coordy3Ref = 0;
const long coordz3Ref = 0;

//Coordonnées de la position intermédiaire et d'attente
const long coordxVia = -1600;
const long coordyVia = -10000;
const long coordzVia = 4800;

//Nombre de pas entre la position initiale du mécanisme et les capteurs
//Utile pour l'ajout d'une nouvelle plaque d'interface
long x = 0;
long y = 0;
long z = 0;

//Coordonnées absolues de la prochaine position en pas
long coordx = 0;
long coordy = 0;
long coordz = 0;

//Valeur à 1 lorsque le tube est serti
volatile bool crimpedFlag = false;

bool enter = true;
int p = 0;


// Renvoie les informations (0-9) reçues sur le moniteur série
byte communication();

// Affectation du type en fonction du numéro de plaque
plateType plateAssignement();

// Définition de la positions d'une nouvelle plaque relatif aux capteurs
void savePlate();

// Mise à zéro du mécanisme
void calibration();

// Extrusion du tube jusqu'à ce le capteur change d'état
void extrudeUntilTrigger(bool tubeExtremity);

// Extrusion du tube en fonction d'une distance à parcourir en mm
void extrudeDist(int dist);

// Définition de la plaque d'interface courte
void plate1();

// Définition de la plaque d'interface large
void plate2();

// Définition de la plaque d'interface tube fin
void plate3();

// Séquence pour la plaque de droite
bool tubagePlaque1();

// Séquence pour la plaque de gauche
void tubagePlaque2();

// Commande pneumatique de sertissage
bool sertissage();

// dégagement du tube en dehors de la tête d'extrusion
void degagement();

// Routine d'interruption pour la détection du sertissage
ISR(TIMER1_COMPA_vect);

// Dégagement du tube lorsqu'il y a un problème de tubage
```

```
void ejection(side plaque);


void setup(){

  cli(); //All interruption disable

  TCCR1A = 0; //Set entire TCCR1A register to 0
  TCCR1B = 0; //Same for TCCR1B
  TCNT1  = 0; //Initialize counter value to 0

  OCR1A = 6249; // set compare match register :(16*10^6) / (10*256) - 1

  TCCR1B |= (1 << WGM12); // turn on CTC mode;
  TCCR1B |= (1 << CS12) | (0 << CS11) | (0 << CS10); //Prescaler 256x
  //TIMSK1 |= (1 << OCIE1A);//Enable timer compare interrupt

  sei(); //All interruption enable

  xAxis.setMaxSpeed(3000);
  xAxis.setAcceleration(2000);
  xAxis.setMinPulseWidth(20);
  xAxis.setPinsInverted(0,1,0);

  yAxis.setMaxSpeed(3500);
  yAxis.setAcceleration(2000);
  yAxis.setMinPulseWidth(20);
  yAxis.setPinsInverted(0,1,0);

  zAxis.setMaxSpeed(3500);
  zAxis.setAcceleration(2000);
  zAxis.setMinPulseWidth(20);
  zAxis.setPinsInverted(0,1,0);

  extMotor.setMaxSpeed(3000);
  extMotor.setAcceleration(2000);
  extMotor.setMinPulseWidth(20);
  extMotor.setPinsInverted(0,1,0);

  pinMode(ENAEXT,OUTPUT);
  digitalWrite(ENAEXT,HIGH);

  pinMode(ENAX,OUTPUT);
  digitalWrite(ENAX,HIGH);

  pinMode(ENAY,OUTPUT);
  digitalWrite(ENAY,HIGH);

  pinMode(ENAZ,OUTPUT);
  digitalWrite(ENAZ,HIGH);

  pinMode(gripRelay,OUTPUT);
  pinMode(pullRelay,OUTPUT);
  pinMode(magnetRelay,OUTPUT);

  pinMode(button1,INPUT_PULLUP);
  pinMode(button2,INPUT_PULLUP);
  pinMode(button3,INPUT_PULLUP);

  pinMode(switchX,INPUT_PULLUP);
  pinMode(switchY,INPUT_PULLUP);
  pinMode(switchZ,INPUT_PULLUP);

  pinMode(wheelInterrupt, INPUT);

  pinMode(led,OUTPUT);

  xAxis.setCurrentPosition(0);
  yAxis.setCurrentPosition(0);
```

```
  zAxis.setCurrentPosition(0);

  Serial.begin(9600);
  state = communication();
  if(state == 2){
    state = 6;
  }
  delay(2000);
}

void loop(){

  while(1){
    tubeRefLeft = analogRead(isTubeLeft);
    tubeRefRight = analogRead(isTubeRight);

    extMotor.setSpeed(1500);

    while(abs(analogRead(isTubeLeft) - tubeRefLeft) < 50){
    delay(250);
    }
    extrudeUntilTrigger(1);
    delay(100);

    extrudeDist(80);
    delay(2000);
    yAxis.move(-2133);
    yAxis.runToPosition();
    delay(500);

    extrudeUntilTrigger(0);
    delay(5000);


  }

  switch(state){

    case 1:

      nextHole1 = plateAssignement();
      delay(1000);

      nextHole2 = plateAssignement();
      delay(1000);

      state = 2;

    break;

    case 2:

      calibration();

      yAxis.runToNewPosition(coordyVia);
      delay(100);

      state = 3;

    break;

    case 3:

      while((tubeNbr >= 43 && tubeNbr <= 47) || (tubeNbr >= 90 && tubeNbr <= 95) || (tubeNbr >= 139 && tubeNbr <= 143) || (tubeNbr >= 186 && tubeNbr <= 191)){
        nextHole1();
        nextHole2();
        tubeNbr++;
      }
```

```
      if(tubeNbr == 192){
        state = 5;

      }else{
        tubeRefLeft = analogRead(isTubeLeft);
        tubeRefRight = analogRead(isTubeRight);

        nextHole1();

        nbrFail = 0;
        while(!tubagePlaque1()){
          nbrFail++;
          if(nbrFail == 2){
              digitalWrite(pullRelay, !digitalRead(pullRelay));
              delay(1500);

              break;
            }
        }
        state = 4;
      }

    break;

    case 4:

      tubagePlaque2();

      tubeNbr++;
      state = 3;

    break;

    case 5:
      yAxis.runToNewPosition(coordyVia);
      delay(100);

      state = 0;

    break;

    case 6:

      savePlate();
      state = 0;

    break;
  }
}

byte communication(){
  while(1){
    delay(500);
    if(!digitalRead(button1)){
      return 1;
    }
    if(!digitalRead(button2)){
      return 2;
    }
    if(!digitalRead(button3)){
      return 7;
    }
  }
}

plateType plateAssignement(){
  byte plate = 0;

```

```
  plate = communication();
  switch(plate){

    case 1:
      return &plate1;
    break;

    case 2:
      return &plate2;
    break;

  }
}


void savePlate(){
  byte plaque = communication();

  if(plaque == 1){ //right
    yAxis.move(-1600);
    yAxis.runToPosition();
  }else if(plaque == 2){ //left
    yAxis.move(1600);
    yAxis.runToPosition();
  }

  calibration();

  Serial.print("Distance X du couvercle en pas : ");
  Serial.println(x);

  Serial.print("Distance Y du couvercle en pas : ");
  Serial.println(y);

  Serial.print("Distance Z du couvercle en pas : ");
  Serial.println(z);

}

void calibration(){

  unsigned i = 1;

  xAxis.setSpeed(1000);//vers l'arriere
  yAxis.setSpeed(1000);//vers la droite
  zAxis.setSpeed(-2000);//vers le haut

  while(i>=0){
    xAxis.runSpeed();
    if(!(i%100)){
      if(!digitalRead(switchX)){
        xAxis.stop();
        break;
      }
    }
    i++;
  }
  i=1;
  xAxis.setSpeed(-100);
  delay(500);
  while(i>=0){
    xAxis.runSpeed();
      if(digitalRead(switchX)){
          x = xAxis.currentPosition();
          xAxis.setCurrentPosition(0);
          //Serial.println("X axis set");
          xAxis.stop();
          break;
      }
```

```
  }

  delay(1000);

  while(i>=0){
    zAxis.runSpeed();
    if(!(i%100)){
      if(!digitalRead(switchZ)){
        zAxis.stop();
        break;
      }
    }
    i++;
  }
  i=1;
  zAxis.setSpeed(200);
  delay(500);
  while(i>=0){
    zAxis.runSpeed();
      if(digitalRead(switchZ)){
          z = zAxis.currentPosition();
          zAxis.setCurrentPosition(0);
          //Serial.println("Z axis set");
          zAxis.stop();
          break;
      }
  }

  delay(1000);

  while(i>=0){
    yAxis.runSpeed();
    if(!(i%100)){
      if(!digitalRead(switchY)){
        yAxis.stop();
        break;
      }
    }
    i++;
  }
  i=1;
  yAxis.setSpeed(-100);
  delay(500);
  while(i>=0){
    yAxis.runSpeed();
      if(digitalRead(switchY)){
          y = yAxis.currentPosition();
          yAxis.setCurrentPosition(0);
          //Serial.println("Y Axis set");
          yAxis.stop();
          break;
      }
  }

  delay(1000);

}
void extrudeUntilTrigger(bool tubeExtremity){

  short wheelSpeed = 1500; //sens anti-horaire

  digitalWrite(ENAEXT, HIGH);
  extMotor.setSpeed(wheelSpeed);

  if(tubeExtremity){
    while(abs(analogRead(isTubeRight) - tubeRefRight) < 150){
      extMotor.runSpeed();
    }

```

```
  }else{
    while(abs(analogRead(isTubeLeft) - tubeRefLeft) > 50){
      extMotor.runSpeed();
    }
  }
  extMotor.stop();

  digitalWrite(ENAEXT, LOW);
}

void extrudeDist(int dist){

  digitalWrite(ENAEXT, HIGH);

  extMotor.move((long)(dist*mm2stepWheel));
  extMotor.runToPosition();

  digitalWrite(ENAEXT, LOW);
}

void plate1(){

  static short x1 = 0;
  static short y1 = 0;
  static short z1 = 0;

  //Si c'est le 1er tube dans la plaque
  if(tubeNbr == 0){
    x1 = 0;
    z1 = 0;

  //Si on est a la moitié de la plaque
  }else if(tubeNbr == (nbrHole1)/2){
    x1 -= DIST_BTW_HOLE_X1 * (LENGTH_X1-1);
    z1 += DIST_BTW_HOLE_Z1*2;

  }else{
    if(tubeNbr % LENGTH_X1){
      x1 += DIST_BTW_HOLE_X1;
    }else{
      z1 += DIST_BTW_HOLE_Z1;
      // A changer si on commence par la partie du bas ou du haut
      if(tubeNbr > nbrHole1/2){
        x1 -= DIST_BTW_HOLE_X1*(LENGTH_X1-1) - DIST_BTW_HOLE_X1/2;
      }else{
        x1 -= DIST_BTW_HOLE_X1*(LENGTH_X1-1) + DIST_BTW_HOLE_X1/2;
      }
    }
  }
  coordx = coordx1Ref + (long)(x1*mm2stepX);
  coordy = coordy1Ref + (long)(y1*mm2stepY);
  coordz = coordz1Ref - (long)(z1*mm2stepZ);
}

void plate2(){

  static float x2 = 0.0; //décalage de 0.5 mm à certaines rangées
  static short y2 = 0;
  static short z2 = 0;

  if(tubeNbr == 0){
    x2 = 0.0;
    z2 = 0;
  }else{
    if(tubeNbr % LENGTH_X2){
      x2 += DIST_BTW_HOLE_X2;
    }else{
      z2 += DIST_BTW_HOLE_Z2;
      if(tubeNbr/LENGTH_X2 == 1 || tubeNbr/LENGTH_X2 == 3){
```

```
        x2 -= DIST_BTW_HOLE_X2 * (LENGTH_X2-1) - DIST_BTW_HOLE_X2/2;
      }else{
        x2 -= DIST_BTW_HOLE_X2 * (LENGTH_X2-1) + 0.5;
      }
    }
  }
  Serial.println(x2);
  coordx = coordx2Ref + (long)(x2*mm2stepX);
  coordy = coordy2Ref + (long)(y2*mm2stepY);
  coordz = coordz2Ref - (long)(z2*mm2stepZ);
}


bool tubagePlaque1(){

  digitalWrite(pullRelay, !digitalRead(pullRelay));
  delay(2000);

  crimpedFlag = false;
  //nextHole1();

  xAxis.runToNewPosition(coordx + 1000);
  delay(50);
  zAxis.runToNewPosition(coordz);
  delay(50);
  xAxis.runToNewPosition(coordx);
  delay(50);
  yAxis.runToNewPosition(coordy);
  delay(50);

  while(abs(analogRead(isTubeLeft) - tubeRefLeft) < 50){
    delay(250);
  }
  extrudeUntilTrigger(1);
  delay(100);

  extrudeDist(80);
  //delay(100);

  if(!sertissage()){
    ejection(RIGHT);
    return 0;
  }

  //Mouvement de l'extrudeur vers la gauche de 9 cm
  yAxis.runToNewPosition(coordyVia);
  delay(50);

  extrudeUntilTrigger(0);
  //delay(100);

  //Avancement du chariot pour la découpe

  coordx -= 960;
  xAxis.runToNewPosition(coordx);
  delay(50);

  return 1;
}

void tubagePlaque2(){

  digitalWrite(pullRelay, !digitalRead(pullRelay));
  delay(2000);

  crimpedFlag = false;

  nextHole2();

```

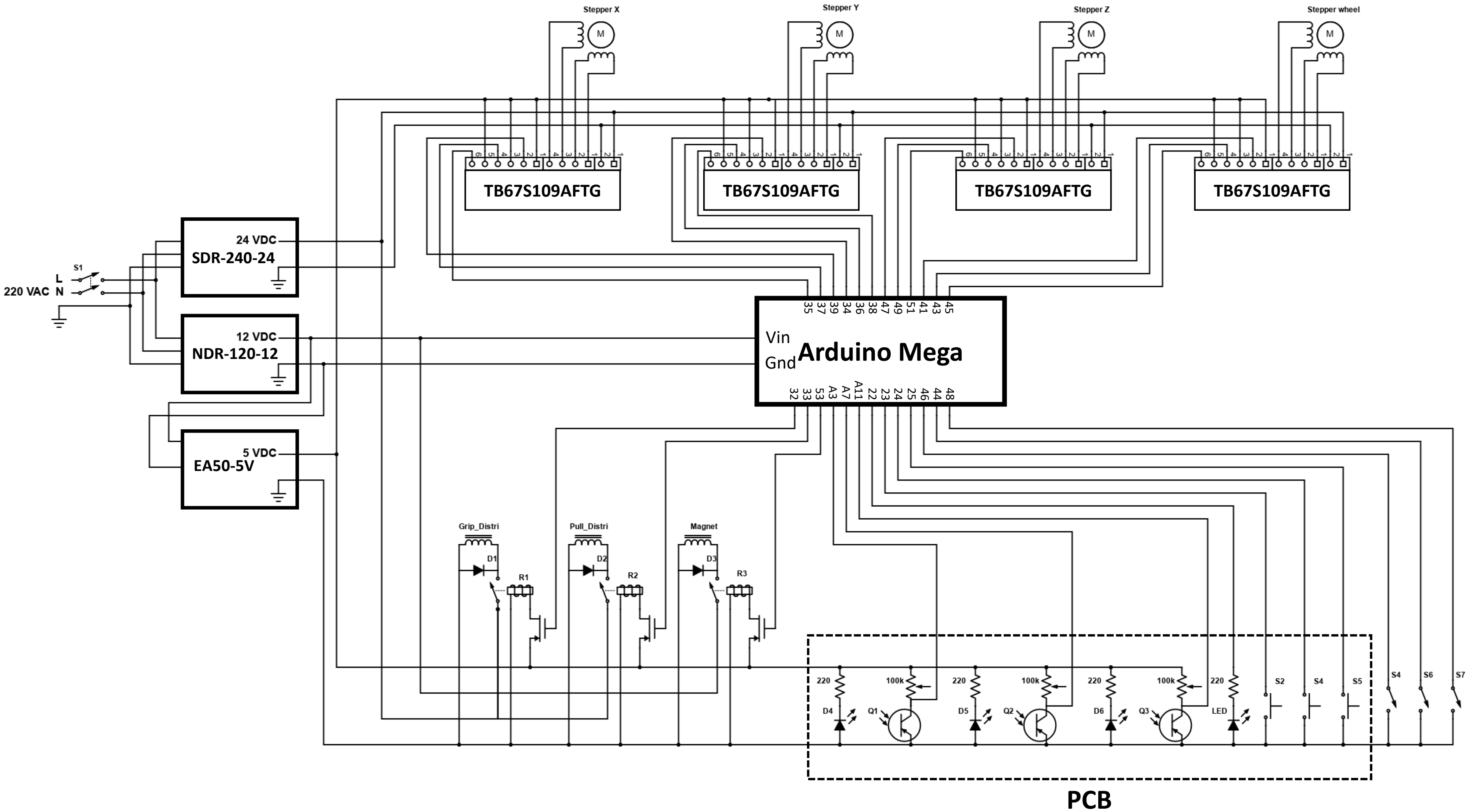
```
  xAxis.runToNewPosition(coordx + 1000);
  delay(50);
  zAxis.runToNewPosition(coordz);
  delay(50);
  xAxis.runToNewPosition(coordx);
  delay(50);
  yAxis.runToNewPosition(coordy);
  delay(50);

  extrudeDist(30);
  delay(100);

  extrudeDist(-100);
  //delay(100);

  if(!sertissage()){
    ejection(LEFT);
    return;
  }

  degagement();
  delay(100);

  yAxis.runToNewPosition(coordyVia);
  delay(50);

  //Avancement du chariot pour la découpe
  coordx -= 4500;
  xAxis.runToNewPosition(coordx);
  delay(100);

}

bool sertissage(){
  wheelRef = analogRead(wheelInterrupt);

  TIMSK1 |= (1 << OCIE1A); //Enable interrupt depending on timer1

  digitalWrite(gripRelay,HIGH);
  delay(500);

  digitalWrite(pullRelay, !digitalRead(pullRelay));
  delay(2000);

  digitalWrite(gripRelay,LOW);
  delay(500);

  digitalWrite(pullRelay, !digitalRead(pullRelay));
  delay(2000);

  TIMSK1 &= ~(1 << OCIE1A); //Disable interrupt depending on timer1

  if(!crimpedFlag){
    return 0;
  }else{
    return 1;
  }
}

void degagement(){
  //distance de recul en pas
  long distRecul = 3000;

  digitalWrite(magnetRelay,HIGH);

  coordx += distRecul;
  xAxis.runToNewPosition(coordx);
  delay(500);

```

```
  digitalWrite(magnetRelay,LOW);

}

ISR(TIMER1_COMPA_vect){
  if(abs(analogRead(wheelInterrupt) - wheelRef) > 300){
    crimpedFlag = true;
  }
}

void ejection(side plaque){

    digitalWrite(ENAEXT,HIGH);

    if(plaque){

      digitalWrite(pullRelay, !digitalRead(pullRelay));
      delay(2000);

      yAxis.runToNewPosition(coordyVia);
      delay(500);
      extMotor.setSpeed(1500);

      while(abs(analogRead(isTubeRight) - tubeRefRight) > 30){
        extMotor.runSpeed();
      }

      delay(500);

      while(1){
        digitalWrite(led,!digitalRead(led));
        delay(1000);
        if(!digitalRead(button1)){
          digitalWrite(ENAEXT,LOW);
          return;
        }
      }
    }else{
      extMotor.setSpeed(1500);
      while(abs(analogRead(isTubeRight) - tubeRefRight) > 30){
        extMotor.runSpeed();
      }
      delay(500);

      yAxis.runToNewPosition(coordyVia);
      delay(500);

      while(1){
        digitalWrite(led,!digitalRead(led));
        delay(1000);
        if(!digitalRead(button1)){
          digitalWrite(ENAEXT,LOW);
          return;
        }
      }
    }
}

void plate3(){
  static float x3 = 0.0;
  static float y3 = 0.0;
  static short z3 = 0;

  if(tubeNbr == 0){
    x3 = 0;
    z3 = 0;
  }else if(tubeNbr % 15){
    x3 += 1.5;
  }else{
```

```
    z3 += 1.5;
    x3 -= 22.5;
  }
  coordx = coordx3Ref + (long)(x3*mm2stepX);
  coordy = coordy3Ref + (long)(y3*mm2stepY);
  coordz = coordz3Ref - (long)(z3*mm2stepZ);
}
```

Annexe B

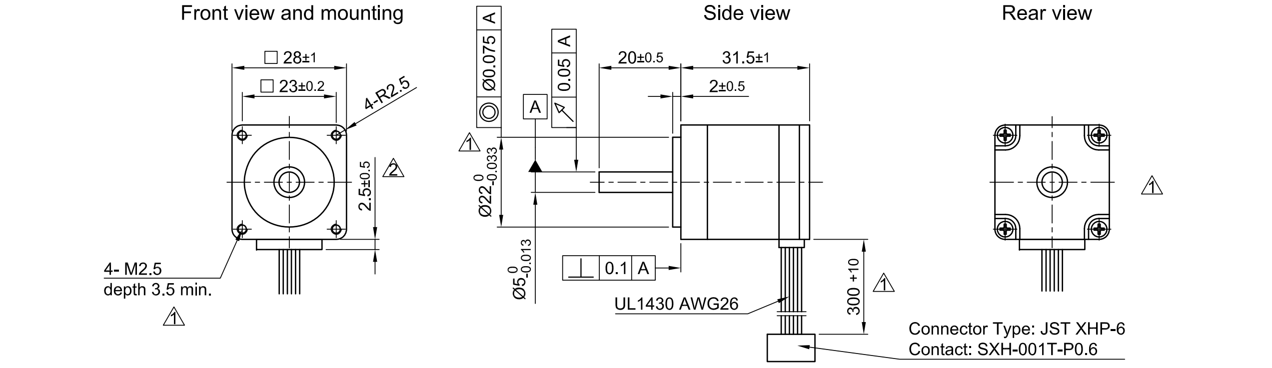
Schéma électrique


Stepper X
Stepper Y
Stepper Z
Stepper wheel
TB67S109AFTG
TB67S109AFTG
TB67S109AFTG
TB67S109AFTG
S1
L
N
220 VAC
24 VDC
SDR-240-24
12 VDC
NDR-120-12
5 VDC
EA50-5V
Vin
Gnd
Arduino Mega
35 37 39 34 36 38 47 49 51 41 43 45
32 33 53 A3 A7 A11 22 23 24 25 46 44 48
Grip_Distri
Pull_Distri
Magnet
D1
D2
D3
R1
R2
R3
220
100k
D4
Q1
D5
Q2
D6
Q3
LED
S2
S4
S5
S4
S6
S7
PCB

Annexe C

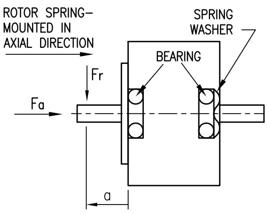
Fiches techniques

1 Stepper NEMA 11



CONNECTION / SPECIFICATION	UNIPOLAR OR BIPOLAR-1 WINDING	BIPOLAR SERIES
VOLTAGE (VDC)	2.66	3.75
AMPS/PHASE	0.95	0.67
RESISTANCE/PHASE (Ohms)@25°C	2.8±15%	5.6±15%
INDUCTANCE/PHASE (mH) @1KHz	1.0±20%	4.0±20%
HOLDING TORQUE (Nm) [lb-in]	0.043 [0.381]	0.061 [0.538]
DETENT TORQUE (Nm) [lb-in]	2.5×10^{-3} [0.0222]	
STEP ANGLE (°)	1.8	
STEP ACCURACY (NON-ACCUM)	±5%	
ROTOR INERTIA (Kg-m²) [lb-in²]	9×10^{-7} [3.074×10^{-3}]	
WEIGHT (Kg) [lb]	0.11 [0.242]	
TEMPERATURE RISE: MAX.80°C (MOTOR STANDSTILL; FOR 2 PHASE ENERGIZED)		
AMBIENT TEMPERATURE -10°~ 50°C [14°F ~ 122°F]		
INSULATION RESISTANCE 100 MOhm (UNDER NORMAL TEMPERATURE AND HUMIDITY)		
INSULATION CLASS B 130° [266°F]		
DIELECTRIC STRENGTH 500VAC FOR 1 MIN. (BETWEEN THE MOTOR COILS AND THE MOTOR CASE)		
AMBIENT HUMIDITY MAX. 85% (NO CONDENSATION)		

PERMISSIBLE RADIAL+AXIAL FORCE



AXIAL-FORCE Fa (N)	Fa=7			
DISTANCE a (mm)	5	10	15	20
RADIAL-FORCE Fr (N)	58	36	26	20
	AXIAL		RADIAL	
SHAFT PLAY (mm)	0.075		0.025	
AT LOAD MAX: (N)	10		5.0	

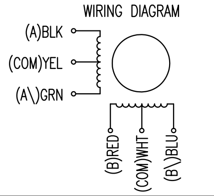
TYPE OF CONNECTION (EXTERN) UNIPOLAR	BIPOLAR 1WINDING	BIPOLAR SERIES	MOTOR CONNECTOR PIN NO.	LEADS	WINDING
A	A	A	1	BLK	A
COM	COM		5	YEL	COM
A\		A\	3	GRN	A\
B	B	B	2	RED	B
COM	COM		6	WHT	COM
B\		B\	4	BLU	B\

for >speed
for <speed

FULL STEP 2 PHASE-Ex.,
WHEN FACING MOUNTING END (X)

STEP	A	B	A\	B\	
1	+	+	-	-	CCW
2	-	+	+	-	
3	-	-	+	+	
4	+	-	-	+	CW

WIRING DIAGRAM



REV	DESCRIPTION	DATE	DRN
2	change tolerance/ revise drawing	11.01.17	A.S.
1	CHANGE TOL. M2.5/Ø22/ rework draw	16.12.15	A.S.

Nanotec® PLUG & DRIVE

Surface specification DIN ISO 1302	General tolerances DIN ISO 2768- cH	Work piece edge DIN ISO 13715

	SIGNATURE	DATE
APVD	G.S.	21.02.14
CHKD		
DRN	J.D.	21.02.14

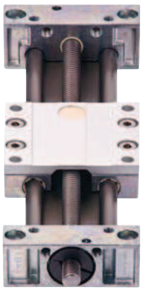
STEPPING MOTOR

DWG.NO ST2818S1006-A

Tables linéaires drylin® SLW

drylin® SLW | Tables linéaires | Gamme de produits

La compacte



- Faible hauteur de montage
- Grande rigidité
- Entièrement supporté
- Rail drylin® W, aluminium anodisé dur
- Accessoires ▶ **page 1303**
- Ecrous pour vis filetées disponibles séparément ▶ **page 1148**
- Moteur ▶ **page 1261**

Constitution de la référence

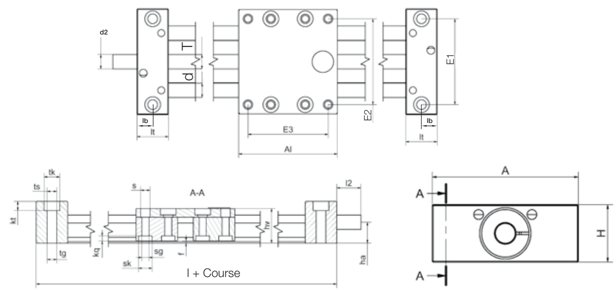
en entier ▶ page 1206

SLW-1040

Cotes

Version compacte

compatible avec drylin® E



Données techniques et cotes [mm]

Référence	Forme	Course maxi [mm]	Poids de l'arbre [kg]	supplém. (par 100 mm) [kg]	Capacité de charge stat. maxi axial [N]	radial [N]	Matériau bride
SLW-0630	■	300	0,2	0,08	50	200	Polymères
SLW-1040	●	750	0,7	0,10	700	2 800	Zamac
SLW-1080	●	750	0,9	0,20	700	2 800	Aluminium
SLW-10120	●	750	1,6	0,25	700	2 800	Aluminium
SLW-1660	●	750	1,5	0,30	1 200	4 600	Aluminium
SLW-2080	●	1 000	3,0	0,40	1 600	6 400	Aluminium
SLW-25120	●	1 250	5,9	0,90	2 500	10 000	Aluminium

Référence	A −0,3	Al[94] −0,3	H	E1 ±0,15	E2 ±0,15	E3 ±0,15	l	hw	f	lt	lb	tk	ts	tg
SLW-0630	54	60	20	40	45	51	100	18	1,2	20	8	11	6,6	–
SLW-1040	74	69	29	60	60	56	113	24	1,5	22	11	11	6,8	M8
SLW-1080	108	100	29	94	94	87	144	24	1,5	22	11	11	6,8	M8
SLW-10120	154	100	29	140	140	87	144	24	1,5	22	11	11	6,8	M8
SLW-1660	104	100	37	84	86	82	150	35	1,5	25	12,5	15	9,0	M10
SLW-2080	134	150	46	116	116	132	206	44	1,5	28	14	15	8,6	M10
SLW-25120	200	150	60	173	173	128	220	55	2,5	35	17,5	20	13,5	M16

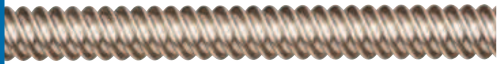
Référence	kt ±0,1	s	sk	sg	kq	d	T	l2	d2 Standard	ha
SLW-0630	8,0	4,5	7,0	M4	2,0	6	M8	15	M8	9,5
SLW-1040	6,4	6,6	9,5	M6	4,4	10	Tr10x2	17	Tr10x2[92]	14,5
SLW-1080	6,4	6,6	9,5	M6	4,4	10	Tr10x2	17	Tr10x2[92]	14,5
SLW-10120	M8	6,4	9,5	M6	4,4	10	Tr10x2	17	Tr10x2[92]	14,50
SLW-1660	8,6	9,0	11	M8	5,5	16	Tr14x4	20	Tr14x4[92]	18,5
SLW-2080	8,6	9,0	14	M8	5,5	20	Tr18x4	26	12h9	23,0
SLW-25120	12,6	11,0	15	M10	5,0	25	Tr24x5	38	14h9	30,0

[92] Sortie de vis, [94] Chariots d'une longueur de 100, 150, 200 et 250 mm disponibles sur demande

igus®

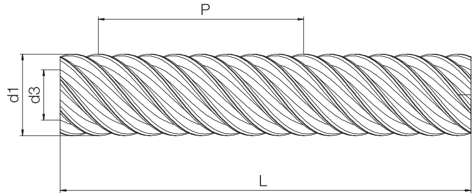
dryspin® technology | Lead screws | Product range

dryspin® high helix lead screws – corrosion-resistant



Stainless steel, rolled (1.4301)

Aluminium, rolled (EN AW 6082)



Technical data

Helix deviation	0.1 mm to 300 mm
Straightness (standard)	0.3 mm to 300 mm
Aligned	<0.1 mm to 300 mm

The tensile/compressive strength of the EN AW 6082 lead screw material is 160 MPa per mm² (elongation limit 0.2 mm).

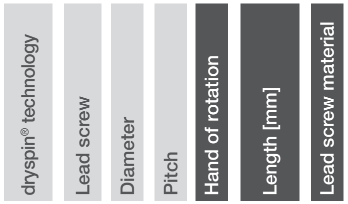
Technical data

Thread	Hand of rotation		Material		Pitch	Number of	Pitch	Weight	
	Right	Left	Stainless steel	Aluminium	P	threads	angle α	Stainless steel	Aluminium
			1.4301	EN AW 6082	[mm]		[°]	[kg/m]	[kg/m]
Ds6.35x2.54	●	–	●	●	2.54	2	7.26	0.25	0.09
Ds6.35x5.08	●	–	●	●	5.08	4	14.29	0.25	0.09
Ds6.35x12.7	●	–	●	●	12.7	4	32.48	0.25	0.09
Ds6.35x25.4	●	–	●	●	25.4	8	51.85	0.25	0.09
Ds8x10	●	●	●	●	10	4	21.70	0.40	0.14
Ds8x15	●	●	●	●	15	6	30.83	0.40	0.14
Ds10x12	●	●	●	●	12	4	21.54	0.62	0.21
Ds10x25	●	●	●	●	25	8	38.51	0.62	0.21
Ds10x50	●	●	●	●	50	10	57.86	0.62	0.21
Ds12x5	●	–	●	●	5	2	7.55	0.89	0.31
Ds12x25	●	–	●	●	25	8	33.55	0.89	0.31
Ds14x25	●	●	●	●	25	5	29.61	1.22	0.42
Ds14x30	●	–	●	●	30	6	34.30	1.22	0.42
Ds14x40.6	●	–	●	●	40.6	8	42.71	1.22	0.42
Ds16x35	●	–	●	●	35	7	34.85	1.59	0.54
Ds18x24	●	●	●	●	24	6	22.99	2.01	0.69
Ds18x40	●	●	●	●	40	8	35.55	2.01	0.69
Ds18x80	●	●	●	●	80	12	54.74	2.01	0.69
Ds18x100	●	●	●	●	100	12	60.51	2.01	0.69
Ds20x20	●	–	●	●	20	4	17.66	2.48	0.85
Ds20x60	●	●	●	●	60	8	43.68	2.48	0.85
Ds20x80	●	–	●	●	80	12	55.07	2.48	0.85
Dx20x90	●	●	●	●	90	12	55.08	2.48	0.85

Order key

Part number | Thread | Options

DST-LS-10X50-R-1000-ES



Options:
Hand of rotation
- **R**: Right
- **L**: Left

Length in mm: freely selectable (see table)

Lead screw material
- **ES**: Stainless steel, rolled
- **AL**: Aluminium, rolled

Talk to us!
All drylin® leads screws can be custom machined. Please send us your drawing.
We can then provide a quotation quickly.

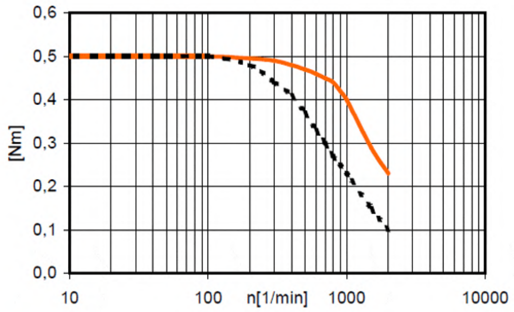
Dimensions [mm]

Outer Ø	Core Ø	Max. total length		Part No.
d1	d3	L		
-0.05	-0.05	Stainless steel	Aluminium	
6.35 -0.1	4.35 -0.1	1,000	1,000	DST-LS-6.35X2.54-R-▭-ES
6.35 -0.1	4.85 -0.1	1,000	1,000	DST-LS-6.35X5.08-R-▭-ES
6.35 -0.1	4.35 -0.1	1,000	1,000	DST-LS-6.35X12.7-R-▭-ES
6.35 -0.1	4.15 -0.1	1,000	1,000	DST-LS-6.35X25.4-R-▭-ES
8.0	5.63	1,000	1,000	DST-LS-8X10-□-▭-ES
8.0	5.63	1,000	1,000	DST-LS-8X15-□-▭-ES
10.0	6.95	3,000	1,000	DST-LS-10X12-□-▭-ES
10.0	7.10	3,000	1,000	DST-LS-10X25-□-▭-ES
10.0	7.35	3,000	1,000	DST-LS-10X50-□-▭-ES
12.0	9.60	3,000	1,500	DST-LS-12X5-R-▭-ES
12.0	8.95	3,000	1,500	DST-LS-12X25-R-▭-ES
14.0	9.60	3,000	1,500	DST-LS-14X25-□-▭-ES
14.0	9.60	3,000	1,500	DST-LS-14X30-R-▭-ES
14.0	9.65	3,000	1,500	DST-LS-14X40.6-R-▭-ES
16.0	11.60	3,000	1,500	DST-LS-16X35-R-▭-ES
18.0	14.40	3,000	1,500	DST-LS-18X24-□-▭-ES
18.0	13.60	3,000	1,500	DST-LS-18X40-□-▭-ES
18.0	14.00	3,000	1,500	DST-LS-18X80-□-▭-ES
18.0	13.55	3,000	1,500	DST-LS-18X100-□-▭-ES
20.0	15.60	3,000	1,500	DST-LS-20X20-R-▭-ES
20.0	15.55	3,000	1,500	DST-LS-20X60-□-▭-ES
20.0	15.98	3,000	1,500	DST-LS-20X80-R-▭-ES
20.0	15.55	3,000	1,500	DST-LS-20X90-□-▭-ES

drylin® step motor NEMA17

igus® stepper motors complement drylin® linear axes well. They distinguish themselves by their cost-efficiency, precision and simple control. They work reliably under varied environmental conditions (depending on the selected protection class IP). Due to the standardized power connection the igus® step motors can be connected to the most popular motor controls.

Characteristics



dashed: 24 V DC
orange: 48 V DC
characteristic based on quarter step mode

Technical data

Distance over hubs		**42mm (NEMA17)**
Motor		
Maximum voltage	[VDC]	60
Nominal voltage	[VDC]	24-48
Nominal current	[A]	1.8
Holding torque	[Nm]	0.5
Detent torque	[Nm]	0.022
Step angle	°	1.8
Resistance / phase	[Ω]	1.75±10%
Inductance / phase	[mH]	3.30±20%
Moment of inertia / rotor	[kgcm]^2]	0.08
Max load axial	[N]	7
Max load radial	[N]	20

Encoder		
Operating voltage	[VDC]	5
Impulse / turn	[1/min]	500
Zero impulse / index		Yes
Line-driver		RS422 protocol
brake		
Operating voltage	[VDC]	24±10%
Wattage	[W]	8
Holding torque	[Nm]	0.4
Moment of inertia	[kgcm]^2]	0.01
Weight		
Product weight	[kg]	0.32
With encoder	[kg]	0.34
With encoder and brake	[kg]	0.58
Operating data		
Ambient temperature	[°C]	-10...+50
Max temperature rise	[°C]	80
insulation class		B
humidity (not condensing)	%	85
protection class engine case		IP65 (shaft seal IP52)
CE		EMV guideline

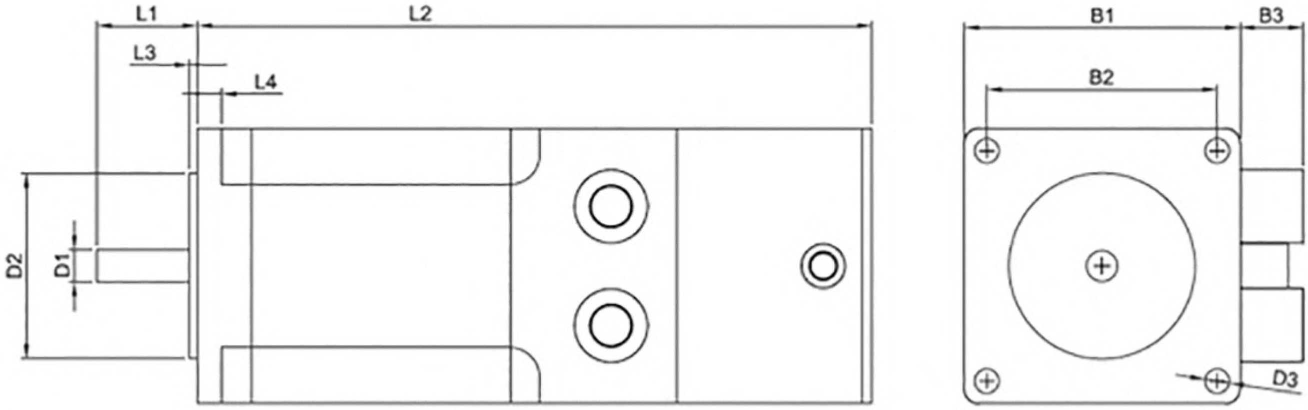
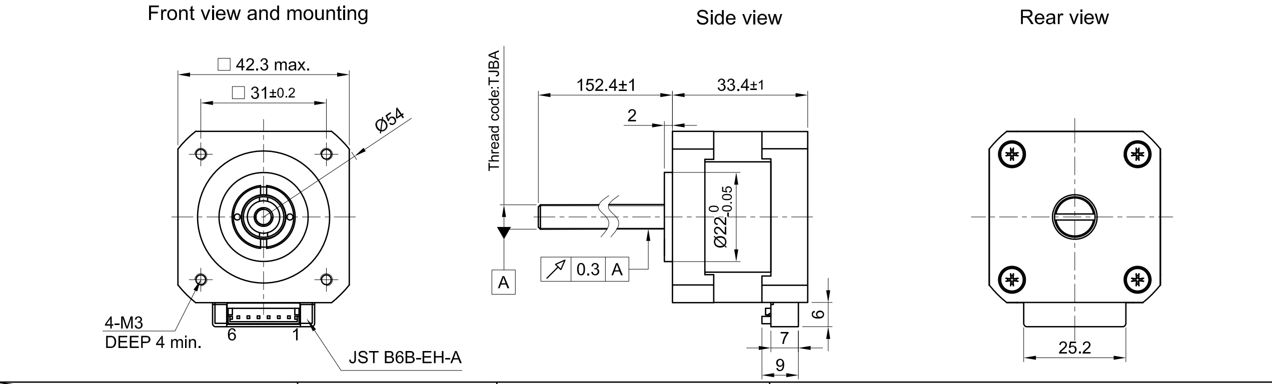


figure with encoder and brake

Dimensions

type	B1 [mm]	B2 [mm] ±0,2	B3 [mm]	ØD1 [mm] -0,013	ØD2 [mm] ±0,025	ØD3 [mm]	L1 [mm] ±1,0	L2 [mm] ±1,0	L3 [mm]	L4 [mm]	
MOT-AN-S-060-005-042-L-C-AAAC											
MOT-AN-S-060-005-042-L-A-AAAA	1.67	1.22	0	0.2	0.87	M3	0.94	1.93	0.08	0	

3 Actionneur axe Z



SPECIFICATION \ CONNECTION	BIPOLAR
AMPS/PHASE	1.4
RESISTANCE/PHASE (Ohms)@25°C	2.0±15%
INDUCTANCE/PHASE (mH) @1KHz	2.8±20%
THREAD DIAMETER (mm) [in]	6 [0.236]
THREAD LEAD(mm) [in]	1 [0.039]
THRUST (N)	469.8
RESOLUTION (mm/STEP)	0.005
MAX. SPEED (mm/sec.) AT 24V	26
WEIGHT (Kg) [lb]	0.26 [0.57]
TEMPERATURE RISE: MAX.80°C (MOTOR STANDSTILL; FOR 2 PHASE ENERGIZED)	
AMBIENT TEMPERATURE −10°~ 50°C [14°F ~ 122°F]	
INSULATION RESISTANCE 100 MOhm (UNDER NORMAL TEMPERATURE AND HUMIDITY)	
INSULATION CLASS B 130° [266°F]	
DIELECTRIC STRENGTH 500VAC FOR 1 MIN. (BETWEEN THE MOTOR COILS AND THE MOTOR CASE)	
AMBIENT HUMIDITY MAX. 85% (NO CONDENSATION)	

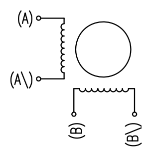
Please regard the application note at www.nanotec.com for further informations.

MOTOR	
CONNECTOR PIN NO.	WINDING
1 (NC)	
2	A
3	A\
4	B
5	B\
6 (NC)	

FULL STEP 2 PHASE−Ex.,
WHEN FACING MOUNTING END (X)

STEP	A	B	A\	B\	
1	+	+	−	−	CCW ↑
2	−	+	+	−	
3	−	−	+	+	
4	+	−	−	+	CW ↓

WIRING DIAGRAM



REV	DESCRIPTION	DATE	DRN	Nanotec PLUG & DRIVE			APVD	P.R.	16.04.18	LINEAR ACTUATOR
B	−	08.04.19	X T				CHKD	GYQ	16.04.18	
A	−	08.08.18	X T	Surface specification DIN ISO 1302	General tolerances DIN ISO 2768-cH	Work piece edge DIN ISO 13715	DRN	X T	16.04.18	DWG.NO
REV	DESCRIPTION	DATE	DRN				SIGNATURE		DATE	LSA421S14−A−TJBA−152

4 Rails de guidage

NEW Printed in Red

Guides linéaires miniatures

Blocs standard, précharge légère / jeu léger

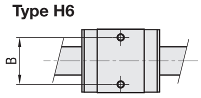
Points de comparaison avec les produits similaires | Le type le plus classique de toutes les spécifications aux normes industrielles. Choisir parmi les types à précharge légère présentant une précision et une rigidité supérieures.

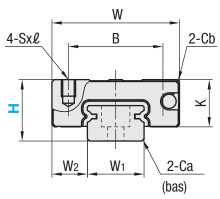
Ce type a les mêmes dimensions de montage que les produits concurrents, et peut ainsi les remplacer.
Les blocs et les glissières ne sont pas soudés séparément. Ce type présente des jeux radiaux et des précisions garantis pour les ensembles de blocs et de rails.

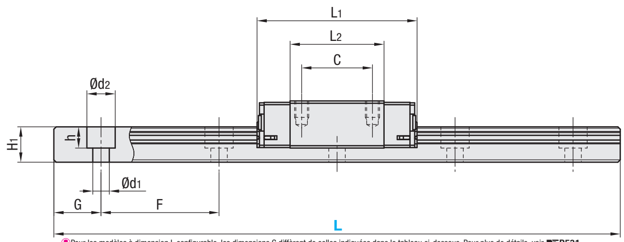
M Matériau / H Dureté	Type: Précharge légère – Niveau élevé	Type: Précharge légère – Taux de précision	Type: Jeu léger – Niveau standard	MX (unité de lubrification)	Dimension L	Nombre de blocs
Acier inoxydable 56HRC~	SSEB	SSEBV	SSEBZ	Obturation : aucune -MX : fournie	Sélectionnable	1
	SSE2B	SSE2BV	SSE2BZ			2
	SSEBL	SSEBLV	SSEBLZ		Configurable	1
	SSE2BL	SSE2BLV	SSE2BLZ			2

Résistance à la chaleur : -20 ~ 80°C
La hauteur H=6 (H6) n'est disponible que pour les types SSEB, SSE2B, SSEBL, SSE2BL.

Type H6







Pour les modèles à dimension L configurable, les dimensions G diffèrent de celles indiquées dans le tableau ci-dessous. Pour plus de détails, voir P.531.

Précautions d'utilisation

- Les blocs sont équipés de systèmes de retenue (fil) pour empêcher les billes de tomber. Pour savoir comment manipuler les blocs, voir P.525.
- Les écartements radiaux et les précisions ne sont pas garantis si les blocs et les glissières sont interchangés   partir des combinaisons d'ensembles d'origine.
- Les plans de référence sont équipés de rainures droites. Veiller à faire correspondre les lignes de référence lors de l'utilisation.
- Il est impossible de raccorder des rails bout à bout.
- La précision des guides linéaires est garantie après la fixation du rail (après avoir serré les vis sur le rail et poussé le rail sur le plan de référence). Une courbure mineure du rail s'ajustera après le montage et n'affectera pas les performances.

Accessoire

- Le modèle H6 est fourni avec des vis à tête ronde cruciformes de classe 1, numéro 0 (M2x6).
- Le modèle H8 est fourni avec des vis d'assemblage (M2x6).

Autres

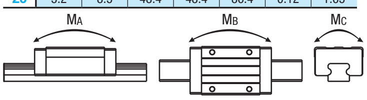
- Modèles remplis de graisse au savon de lithium (Multemp PS2 de Kyodo Yushi Co., Ltd.).
- Pour calculer la durée de fonctionnement, voir P.527.
- Pour calculer la durée de fonctionnement, utiliser notre logiciel de calcul gratuit disponible à la page : http://download.misumi.jp/mol/fa_soft.html.
- Le type MX est lubrifié avec une graisse au lithium complexe (TOUGHLIX GREASE MP2, fabriquée par JXTG Nippon Oil & Energy Corporation).

Référence pièce: Type	MX	H	L	Bloc: W	L_1	B	C	Sxℓ	L_2	K	Cb	Glissière: W_1	W_2	H_1	Ca	Trou contre-alésé d_1x$d_2$xh	F	G
SSEB SSEBV SSEBZ SSE2B SSE2BV SSE2BZ SSEBL SSEBLV SSEBLZ SSE2BL SSE2BLV SSE2BLZ	-	6	25~100 (70)	12	17.4	8	-	M2x1.5	9.7	4.5	0.3	5	3.5	4	0.3	2.4x3.5x1	15	5
		8	40~130 (70)	17	23.6	12	8	M2x2.5	13.6	6.5	0.3	7	5	4.7	0.3	2.4x4.2x2.3	15	5
	Obturation : aucune -MX : fournie	10	35~275 (75)	20	30	15	10	M3x3	19	7.8	0.3	9	5.5	5.5	0.3	3.5x6x3.5	20	7.5
		13	45~470 (95)	27	33.9	20	15	M3x3.5	19.9	10	0.5	12	7.5	7.5	0.5	3.5x6x4.5	25	10
		16	70~670 (110)	32	42.4	25	20	M3x4	27.4	12	0.5	15	8.5	9.5	0.5	3.5x6x4.5	40	15
		20	100~700 (160)	40	50	30	25	M4x6	34.6	15	0.5	20	10	11	0.5	6x9.5x5.5	60	20

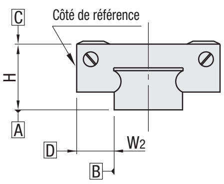
Les dimensions indiquées entre ( ) concernent le type à 2 blocs.

kgf=Nx0.101972

H	Capacité de charge de base: C (dynamique) kN	Co (statique) kN	Moment statique admissible: M_A N·m	M_B N·m	M_C N·m	Masse: Bloc (kg)	Rail de guidage kg/m
6	0.3	0.6	0.8	0.8	1.5	0.004	0.13
8	0.9	1.5	4.1	4.1	5.2	0.01	0.19
10	1.5	2.5	5.1	5.1	10.2	0.02	0.31
13	2.2	3.3	8.8	9.5	16.1	0.04	0.61
16	3.6	5.4	21.6	23.4	39.6	0.06	1.02
20	5.2	8.5	48.4	48.4	86.4	0.12	1.65



Normes de précharge et de précision

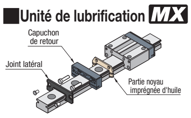


Unité : μm

Spécifications	Précharge légère, qualité élevée	Précharge légère, qualité de précision	Jeu léger, qualité standard
Jeu radial	-3~0		0~+15
Tolérance de hauteur H	±20	±10	±20
Écart de hauteur H des paires	15	7	40
Tolérance de largeur W_2	±25	±15	±25
Écart de largeur des paires W_2	20	10	40
Parallélisme de fonctionnement du plan C par rapport au plan A	Voir P.525		
Parallélisme de fonctionnement du plan D par rapport au plan A			

Le type à jeu léger présente un jeu (écart) entre les rails et les blocs. Si précision et rigidité sont requises, choisir le type à précharge légère.

Unité de lubrification MX



Même taille de bloc que les produits existants !

La partie noyau poreuse imprégnée d'huile est intégrée au produit.

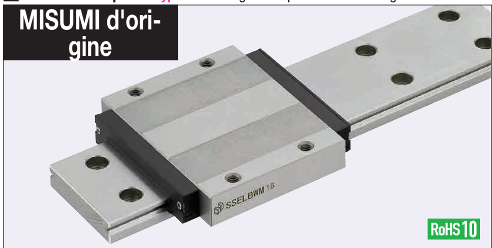
●Avantages de l'unité de lubrification MX : Permet une utilisation prolongée sans entretien. Réduit les coûts d'entretien.

Guides linéaires miniatures - Rails larges

Blocs larges et longs, précharge légère

■Caractéristiques : Type à bloc large aux spécifications d'origine MISUMI. La taille de vis plus large offre une force de serrage plus importante par rapport aux produits standard.

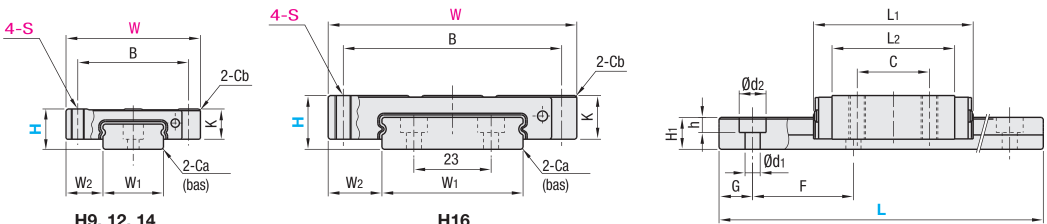
MISUMI d'origine



Les blocs et les glissières ne sont pas soudés séparément. Ce type présente des jeux radiaux et des précisions garantis pour les ensembles de blocs et de rails.

M Matériau / H Dureté	Type – Précharge légère – Niveau élevé	Dimension L	Nombre de blocs
Acier inoxydable 56HRC~	SSELBWM	Sélectionnable	1
	SSEL2BWM		2
	SSELBWML	Configurable	1
	SSEL2BWML		2

Résistance à la chaleur : -20 ~ 80°C



H9, 12, 14

H16

Pour les modèles à dimension L configurable, les dimensions G diffèrent de celles indiquées dans le tableau ci-dessous. Pour plus de détails, voir P. 531.

■Précautions d'utilisation
- Les blocs sont équipés de systèmes de retenue (fil) pour empêcher les billes de tomber. Pour savoir comment manipuler les blocs, voir **P.525.**
- Les écartements radiaux et les précisions ne sont pas garantis si les blocs et les glissières sont interchangés partir des combinaisons d'ensembles d'origine.
- Les plans de référence sont équipés de rainures droites. Veiller à faire correspondre les lignes de référence lors de l'utilisation.
- Il est impossible de raccorder des rails bout à bout.
- La précision des guides linéaires est garantie après la fixation du rail (après avoir serré les vis sur le rail et poussé le rail sur le plan de référence). Une courbure mineure du rail s'ajustera après le montage et n'affectera pas les performances.

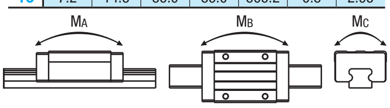
■Autres
- Modèles remplis de graisse au savon de lithium (Multemp PS2 de Kyodo Yushi Co., Ltd.).
- Pour calculer la durée de fonctionnement, voir **P.527**
- Pour calculer la durée de fonctionnement, utiliser notre logiciel de calcul gratuit disponible à la page : http://download.misumi.jp/mol/fa_soft.html.

Référence pièce – Type	H	L	Dimensions du bloc – W	L_1	B	C	S	L_2	K	Cb	Dimension de la glissière – W_1	W_2	H_1	Ca	Trou contre-alésé d_1x$d_2$xh	F	G
SSELBWM SSEL2BWM SSELBWML SSEL2BWML	9	80~290 (110)	36	43.5	29	19	M4	32.5	7	0.3	14	11	5.2	0.5	3.5x6x3.2	30	10
	12	80~290 (110)	40	51.6	33	24	M4	40.6	9	0.3	18	11	7.5	0.5	3.5x6x4.5	30	10
	14	110~470 (150)	51	61.6	44	28	M4	47.4	11	0.5	24	13.5	8	0.5	4.5x8x4.5	40	15
	16	110~670 (190)	74	74.9	65	35	M5	59.9	13	0.5	42	16	9.5	0.5	4.5x8x4.5	40	15

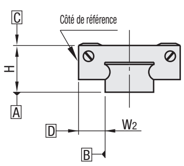
Les dimensions indiquées entre ( ) concernent le type à 2 blocs.

kgf=Nx0.101972

H	Capacité de charge de base – C (dynamique) kN	Co (statique) kN	Moment statique admissible – MA N・m	MB N・m	MC N・m	Masse – Bloc (kg)	Rail de guidage kg/m
9	1.7	4.0	12.1	12.1	28.8	0.05	0.50
12	2.6	5.3	20.2	20.2	49.5	0.09	0.96
14	3.9	8.5	38.6	38.6	104.6	0.16	1.40
16	7.2	14.3	86.0	86.0	305.2	0.3	2.95



■Normes de précharge et de précision

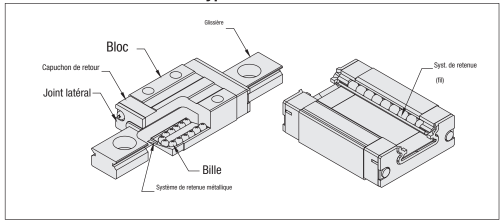


Unité : μm

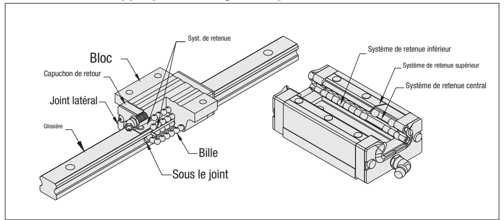
Spécifications	Précharge légère, qualité élevée
Jeu radial	-3~0
Tolérance de hauteur H	±20
Écart de hauteur H des paires	15
Tolérance de largeur W_2	±25
Écart de largeur des paires W_2	20
Parallélisme de fonctionnement du plan C par rapport au plan A	Voir P.525
Parallélisme de fonctionnement du plan D par rapport au plan A	

■Guides linéaires - Structure et caractéristiques

Type miniature



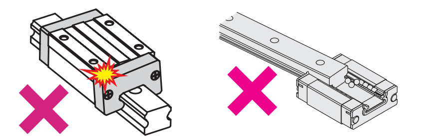
Type pour charges moyennes/lourdes



- Les guides linéaires utilisent des billes en acier qui roulent sur des rainures arrondies meulées avec précision et circulent à nouveau grâce aux capuchons de retour en plastique.
- Les joints d'extrémité empêchent l'intrusion de corps étrangers dans les blocs.
- Le type miniature comporte deux rangées de billes de contact en acier dans un contact en forme de rainure arrondie à 4 points.
- Les types pour charges moyennes/lourdes comportent quatre rangées de billes de contact en acier dans un contact en forme de rainure arrondie à 2 points.
- Les capacités de charge sont identiques dans les quatre sens (radial, radial inverse et sens latéraux). Elles sont utilisables dans n'importe quelle orientation.
- Précautions

Ne pas exercer de choc sur le capuchon de retour. Cela risquerait de nuire à la circulation des billes et d'entraîner des défauts de glissement.

Les billes ne tombent pas des guides linéaires MISUMI lors de leur retrait des rails car les blocs sont pourvus de systèmes de retenue des billes. Cependant, les billes peuvent chuter si les blocs sont retirés rapidement de la glissière ou si la glissière est insérée dans le bloc en position inclinée. Faire preuve de précautions pour retirer et mettre en place les blocs.



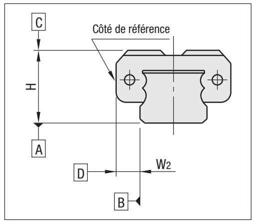
■Précision

• Précision des dimensions

Type	Normes de précision		Produits existants – Taux de précision	Produits existants – Niveau élevé	Produits existants – Niveau standard	Produit économique – Niveau standard
Miniature Type	Tolérance de hauteur H		±10	±20	±20	±40
	Écart de hauteur H des paires		7	15	40	30
	Tolérance de largeur W_2		±15	±25	±25	±40
	Écart de largeur des paires W_2		10	20	40	30
	Normes de précision		Niveau élevé	Interchangeable	Niveau standard	Niveau standard
Charges moyennes/ lourdes Type	Tolérance de hauteur H		±40	±20	±100	±120
	Écart de hauteur H des paires		15	15	20	40
	Tolérance de largeur W_2		±20	±30	±100	±100
	Écart de largeur des paires W_2	24, 28	15	25	20	40
		33, 42	15	25	30	40
		30, 36, 40, 42	-	25	-	40

[Ecart de hauteur H des paires]
Différence entre les valeurs min./max. de hauteur (dimension H) pour une combinaison de blocs sur un rail.

[Écart de largeur des paires W_2]
Différence entre les valeurs min./max. de largeur (dimension W) pour une combinaison de blocs sur un rail.

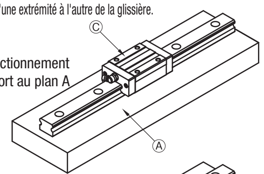


• Parallélisme de fonctionnement Unité : μm

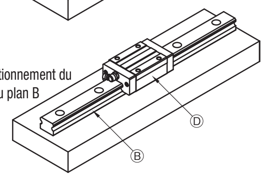
Longueur de la glissière (mm)		Miniature				Charges moyennes/lourdes			
		Produits existants			économique	Produits existants			économique
Sup.	ou inférieur	Taux de précision	Niveau élevé	Niveau standard	Niveau standard	Niveau élevé	Interchangeable	Niveau standard	Niveau standard
	50	2	3	13	13	7	6	7	10
50	80	2	3	13	13	7	6	7	10
80	125	3	7	15	15	7	6.5	7	10
125	200	3	7	15	15	7	7	7	10
200	250	3.5	9	17	17	7	8	7	10
250	315	4	11	18	18	8	9	12	10
315	400	5	11	18	18	8	11	12	12
400	500	5	12	19	19	9	12	14	13
500	630	6	13.5	21	21	11	14	18	15
630	800	6	14	21.5	21.5	13	16	21	17
800	1000	-				14.5	18	23	19
1000	1250	-				16	20	25	22
1250	1600	-				-	23	27	23
1600	2000	-				-	26	28.5	24

[Parallélisme de fonctionnement]
Mesuré lorsque le rail est fermement boulonné à une base de surface de référence standard.
Un écart relatif de la surface supérieure C du bloc par rapport à la surface inférieure A de la glissière, et un écart relatif de la surface de référence D du bloc et la surface de référence B de la glissière sont mesurés lorsque le bloc se déplace d'une extrémité à l'autre de la glissière.

- Parallélisme de fonctionnement du plan C par rapport au plan A



- Parallélisme de fonctionnement du plan D par rapport au plan B



■Sélection d'écartements radiaux (précharge)

Type		Précharge	Taille (dimension H)	Ecartement radial (μm)
Miniature	Produits existants	Précharge légère	6~20	-3~0
		Jeu léger		0~+15
	Produit économique	Ecartement normal		-3~+7
Charges moyennes/ lourdes	Produits existants	Ecartement normal	24	-4~+2
			28	-5~+2
			33	-6~+3
		Précharge légère, interchangeable	24, 28	-4~0
			30, 36, 40, 42	-5~0
			*42	-7~0
	Produit économique	Ecartement normal	24	-4~+4
			28, 30	-5~+5
			33, 36, 40	-6~+6
			45	-7~+7

Les dimensions marquées d'un * correspondent aux types pour charges très lourdes/ultra-lourdes.

- Le jeu et la précharge des guides linéaires MISUMI sont contrôlés par des réglages de la taille des billes.
- La rigidité accrue et la déformation élastique réduite sont obtenues au moyen de la précharge (jeu négatif).
- En général, la sélection de certaines précharges a un effet favorable sur la précision et la durée de vie des guides linéaires.
- Les blocs et rails fabriqués par MISUMI garantissent leurs propres jeux radiaux (précharge) et leurs propres précisions en tant qu'ensembles de blocs et de rails. Toujours utiliser les blocs et les rails en tant qu'ensembles.

■Force de friction (force de poussée requise)

La force de friction des guides linéaires (poussée requise) varie en fonction de la charge, de la vitesse et de la lubrification. La force de friction du type à précharge augmente, en particulier lorsqu'une charge de moment est appliquée.
Même si la résistance d'étanchéité varie en fonction de la tolérance d'ajustement forcé des lèvres des joints et de la lubrification, elle n'est pas proportionnelle à la charge et conserve une valeur constante.
La force de friction est obtenue par la formule suivante.

$$F = \mu \cdot W + f$$

F : friction (N)
μ : coefficient de friction dynamique
W : charge appliquée
f : résistance d'étanchéité (2N~5N)

Tableau 1. Coefficient de frottement dynamique

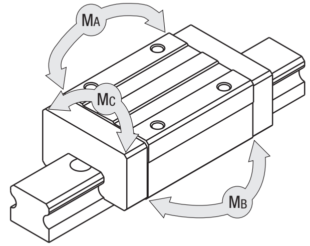
Type	Coefficient de friction dynamique (μ)
Guides linéaires miniatures	0.004~0.006
Guides linéaires pour charges moyennes et lourdes	0.002~0.003

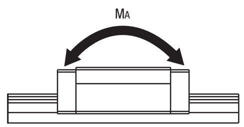
■Charge admissible

- Capacité de charge dynamique de base (C)
  Définition : charge appliquée dans une direction constante et actionnée sous condition identique dans un groupe de spécimen de guides linéaires où 90% du spécimen atteint 50×10^3m sans dommage causé par l'usure liée au roulement.
- Capacité de charge statique de base (Co)
  Définition : charge appliquée à des guides linéaires immobiles où la somme de la quantité de déformation du plastique des éléments de roulement et de la quantité de déformation du plastique des surfaces de roulement est égale à 0.0001 fois celle du diamètre de l'élément de roulement (billes).
- Moment statique admissible (M_A, M_B, M_C)
  Il s'agit d'une charge de moment statique critique définie par la valeur de déformation permanente identique au coefficient de capacité de charge statique de base.

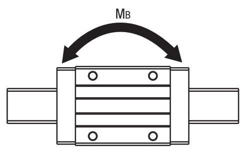
Charge admissible (N) ≤ Co/fs
Moment admissible (N · m) ≤ (M_A, M_B, M_C)/fs

fs : facteur de sécurité statique Co : capacité de charge statique de base (N)
M_A, M_B, M_C : moment statique admissible (N · m)

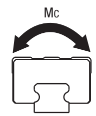




Sens du pas



Sens du lacet



Sens du roulement

- Facteur de sécurité statique (fs)
  La capacité de charge statique de base Co, à l'état statique ou à basse vitesse, est divisée par le facteur de sécurité statique fs dans le **Tableau 2** selon les conditions de fonctionnement.

Tableau 2. Facteur de sécurité statique (limite inférieure de fs)

Conditions d'utilisation	Limites inférieures de fs
Pour une utilisation normale	1~2
Pour des performances d'exécution régulières	2~4
En cas de vibrations et d'impacts	3~5

[Technical Data]
Calculation of Life Span of Linear Systems 1

Allowable Load

•Basic Dynamic Load Rating (C)
Basic dynamic load rating is a constant load applied in a constant direction that enables each linear system of the same series to travel 50×10^3m under the same conditions, without 90% of the material suffering damage from rolling contact fatigue.

•Basic Static Load Rating (Co)
Basic static load rating is the static load exerted on contacting parts under maximum stress, at which the sum of the permanent deformation in the rolling element and rolling contact surface equals 0.0001 times the diameter of the rolling element.

•Allowable Static Moment (M_P, M_Y, M_R)
Allowable static moment is a critical static moment load that acts upon a system at the loading moment. It is set in accordance with the permanent deformation as in basic static load rating Co.

•Static Safety Factor (fs)
Static safety factors are given in Table-1. When a linear system is still or moving at low speed, basic static load rating Co must be divided by fs in accordance with the conditions of use.

Table-1 Static Safety Factor(Lower Limit of f_S)

Condition of Use	Lower Limit of f_S
Under Normal Operating Conditions	1~2
When Smooth Travel is Required	2~4
When Subjected to Vibrations, Impacts	3~5

Allowable Load (N) ≤ Co/fs
Allowable Moment (N·m) ≤ (M_P, M_Y, M_R)/fs

f_S:Static Safety Factor   Co:Basic Static Load (N)
M_P, M_Y, M_R : Static Allowable Moment (N·m)

Life Span

When a load is applied to a linear system, the system moves back and forth in a linear direction. In the process, repeated stress acts upon rolling elements and rolling contact surfaces, causing damage referred to as flaking from material fatigue.
The life span of a linear system is measured in terms of the total travel distance covered by the system up until initial flaking occurs.
•Rated Life Span (L)
Rated life span is the total travel distance that each linear system of the same series can endure under the same conditions, without the occurrence of flaking in 90% of the system.

Rated life span can be obtained as follows from the basic dynamic load rating and various loads exerted on the linear system.

For Ball Bearings $L=\left(\frac{C}{P}\right)^3\cdot 50$

For Roller Bearings $L=\left(\frac{C}{P}\right)^{10/3}\cdot 50$

L: Rated Life Span (km)
C: Basic Dynamic Load Rating (N)
P: Acting Load (N)

•When actually using a linear system, the first thing you must do is to calculate the load. It is necessary to consider load also in terms of vibration and impact that occur during operation, as well as its distribution across the entire linear system as it moves back and forth in a linear direction. Calculations are not simple. Operating temperature also significantly influences useful life. When these parameters are taken into consideration, the above formula is transformed as follows:

For Ball Bearings $L=\left(\frac{f_H\cdot f_T\cdot f_C}{f_W}\cdot\frac{C}{P}\right)^3\cdot 50$

For Roller Bearings $L=\left(\frac{f_H\cdot f_T\cdot f_C}{f_W}\cdot\frac{C}{P}\right)^{10/3}\cdot 50$

L: Rated Life Span (km)
f_H: Hardness Coefficient (See Fig.1)
C: Basic Dynamic Load Rating (N)
f_T: Temperature Coefficient (See Fig.2)
P: Acting Load (N)
f_C: Contact Coefficient (See Table 3)
fw: Load Coefficient (See Table 4)

The Life span can be computed as a number of hours by obtaining the travel distance for a unit of time.
It can be obtained by using the following formula, in which stroke length and stroke cycles are assumed to be constant.

$$L_h=\frac{L\cdot10^3}{2\cdot\ell_s\cdot n_1\cdot60}$$

L_h: Life Span Hours (hr)
ℓ_s: Stroke Length (m)
L: Rated Life Span (km)
n_1: Reciprocating Times per Minute (cpm)

Friction Resistance and Required Thrust

Using the following formula, the friction resistance (required thrust) can be obtained from the load and the seal resistance specified by the system.

$$F=\mu\cdot W+f$$

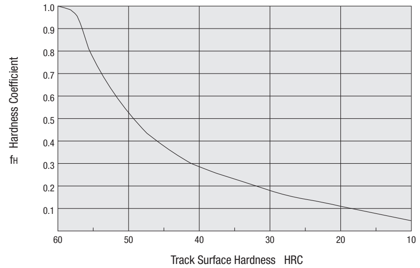
F: Friction Resistance (N)
μ: Dynamic Friction Coefficient
W: Weight Loaded
f: Seal Resistance (2N~5N)

Table-2 Dynamic Friction Coefficient

Type	Dynamic Friction Coefficient (μ)
Miniature Slide Guides	0.004~0.006
Medium Load Slide Guides	0.002~0.003
Slide Ways	0.001~0.003
Slide Tables	0.001~0.003
Linear Bushings	0.002~0.003
Linear Ball Bushings	0.0006~0.0012

•Hardness Coefficient(f_H)
In a linear system, the shaft must be hard enough to withstand contact with the ball bearings. Unless sufficient hardness is provided, the allowable load can decrease, resulting in a short useful life.
Compensate the rated life span with the hardness coefficient.

Fig-1. Hardness Coefficient



•Contact Coefficient (fc)
In general, two or more linear systems are used with each shaft. Depending on the machining precision, the load exerted on each of the respective systems can vary. In this case, the load applied on each linear system changes depending on the machining precision, therefore it cannot be uniformly applied. As a result, allowable load per linear system changes depending on the number of linear systems on one axis.
Compensate the rated life span with the contact coefficient in Table-3.
•Load Coefficient (fw)
When calculating the load that acts on a linear system, it is necessary to work with precise figures for material weight, the force of inertia resulting from operating speed, load moment, various changes that occur over time, and so on. However, it is difficult to have accurate calculation for oscillating movement as beside the normal repetition of start and stop, other factors such as vibration and impact also need to be considered.
Therefore, the life span calculation needs to be simplified using the load coefficient in Table-3.

Linear Bushings

Rated life span can be obtained as follows from the basic dynamic load rating and the load to the linear bushing.

$$L=\left(\frac{f_H\cdot f_T\cdot f_C}{f_W}\cdot\frac{C}{P}\right)^3\cdot 50$$

L: Rated Life Span (km)
f_H: Hardness Coefficient (See Fig.1)
C: Basic Dynamic Load Rating (N)
f_T: Temperature Coefficient (See Fig.2)
P: Working Load (N)
f_C: Contact Coefficient (See Table3)
fw: Load Coefficient (See Table4)

The Life span can be computed as a number of hours by obtaining the travel distance for a unit of time. It can be obtained using the following formula, in which stroke length and stroke cycles are assumed to be constant.

$$L_h=\frac{L\cdot10^3}{2\cdot\ell_s\cdot n_1\cdot60}$$

L_h: Life Span Hours (hr) ℓ_s: Stroke Length (m)   L: Rated Life Span (km)
n_1: Reciprocating Times per Minute (cpm)

•Temperature Coefficient (f_T)
When temperature in a linear system exceeds 100˚C, the hardness of the system and the shaft become degraded. This decreases the allowable load to a greater extent than when the system is used at ambient temperature, and can shorten the life span.
Compensate the rated life span with the temperature coefficient.

Fig.-2 Temperature Coefficient

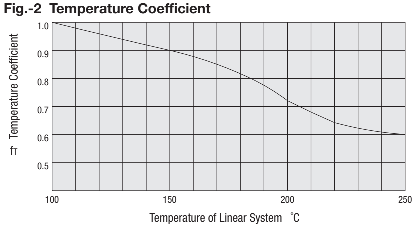


Table-3. Contact Coefficient

Number of Bearings per Shaft	Contact Coefficient fc
1	1.00
2	0.81
3	0.72
4	0.66
5	0.61

Table-4. Load Coefficients

Condition of Use	fw
Low speed with no external vibration or impact (Max. 15m/min)	1.0~1.5
Middle range speed with no exerted vibration or impact of considerable force(Max. 60m/min)	1.5~2.0
High speed with no external vibration or impact (Over 60m/min)	2.0~3.5

Linear Ball Bushings

Rated life span can be obtained as follows from the basic dynamic load rating and the load to the linear ball bushing.

$$L=\left(\frac{f_H\cdot f_T\cdot f_C}{f_W}\cdot\frac{C}{P}\right)^3\cdot 50$$

L: Rated Life Span (km)
f_H: Hardness Coefficient (See Fig.1)
C: Basic Dynamic Load Rating (N)
f_T: Temperature Coefficient (See Fig.2)
P: Working Load (N)
f_C: Contact Coefficient (See Table 3)
fw: Load Coefficient (See Table 4)

Life Span Hours
·For revolution and reciprocating motion

$$L_h=\frac{10^6\cdot L}{60\sqrt{(dm\cdot n)^2+(10\cdot S\cdot n_1)^2}/dm}$$

·For reciprocating motion

$$L_h=\frac{10^6\cdot L}{600\cdot S\cdot n_1/(\pi\cdot dm)}$$

L_h:Life Span Hours(hr)   S: Stroke Length(mm)   n: Revolutions per Minute(rpm)
n_1:Strokes Per Minute(cpm)
dm:Pitch Diameter of Ball(mm)≈1.15dr
·Revolution and reciprocal motion allowable values

$$DN\geq dm\cdot n+10\cdot S\cdot n_1$$

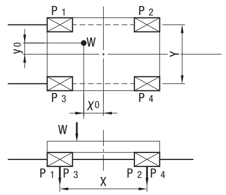
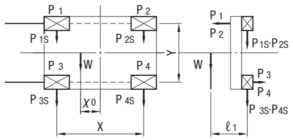
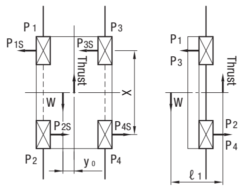
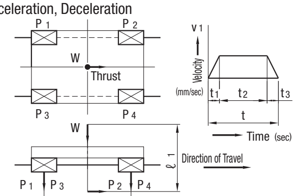
Calculation of Life Span of Linear Systems 2

•Load Calculations

Since a linear system bears the weight of the work while it performs a reciprocating linear motion, the load exerted on the system can vary depending on the work's center of gravity, thrust acting position change, and the speed changes by starting, stopping and acceleration, deceleration.

It is necessary to take these conditions into consideration when selecting a linear system.

Table-5. Use Conditions and Load Calculation Formulas

Type	Condition of Use and Load	Type	Condition of Use and Load
1	Horizontal Axis  $P_1=\frac{1}{4}W+\frac{x_0}{2X}W+\frac{y_0}{2Y}W$ $P_2=\frac{1}{4}W-\frac{x_0}{2X}W+\frac{y_0}{2Y}W$ $P_3=\frac{1}{4}W+\frac{x_0}{2X}W-\frac{y_0}{2Y}W$ $P_4=\frac{1}{4}W-\frac{x_0}{2X}W-\frac{y_0}{2Y}W$	3	Perpendicular to Horizontal Axis  $P_1=P_2=P_3=P_4=\frac{\ell_1}{2X}W$ $P_{1S}=P_{3S}=\frac{1}{4}W+\frac{x_0}{2X}W$ $P_{2S}=P_{4S}=\frac{1}{4}W-\frac{x_0}{2X}W$
2	Vertical Axis  $P_1=P_2=P_3=P_4=\frac{\ell_1}{2X}W$ $P_{1S}=P_{2S}=P_{3S}=P_{4S}=\frac{y_0}{2X}W$	4	In Acceleration, Deceleration  •Acceleration at Starting $P_1=P_3=\frac{1}{4}W\left(1+\frac{2V_1\cdot\ell_1}{g\cdot t_1\cdot X}\right)$ $P_2=P_4=\frac{1}{4}W\left(1-\frac{2V_1\cdot\ell_1}{g\cdot t_1\cdot X}\right)$ •Deceleration at Stopping $P_1=P_3=\frac{1}{4}W\left(1-\frac{2V_1\cdot\ell_1}{g\cdot t_3\cdot X}\right)$ $P_2=P_4=\frac{1}{4}W\left(1+\frac{2V_1\cdot\ell_1}{g\cdot t_3\cdot X}\right)$ •Constant Speed $P_1=P_2=P_3=P_4=\frac{1}{4}W$ g:Gravitational Acceleration=9.8×10^3mm/sec^2

W :Acting Load(N) P_1,P_2,P_3,P_4:Load applied to the Linear System(N)
X,Y: Linear System Span(mm) V:Moving Speed(mm/sec)
t_1 :Acceleration Time(sec) t_3:Deceleration Time(sec)

Fig-3. Stepped Load Fluctuation

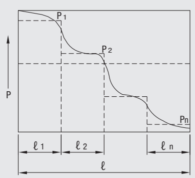


Fig-4. Flat Fluctuation Load

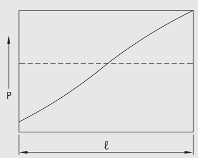
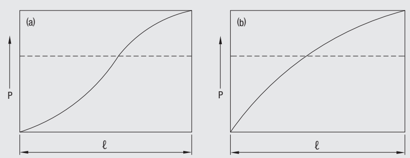


Fig-5. Sinusoidal Load Fluctuation



•Mean Load Derived from Fluctuating Loads

In general, the load acting upon a linear system can change according to how the system is used.This happens for example when the reciprocating motion is started, stopped as compared to constant speed motion, and whether or not work is present during transfer, etc. Therefore, in order to correctly design the life span under various conditions and fluctuating loads, it is necessary to obtain a mean load and apply it to the life span calculations.

(1) When load changes in steps by a travel distance(Fig-3)

Travel distance ℓ_1 subjected to load P_1
Travel distance ℓ_2 subjected to load P_2
⋮ ⋮
Travel distance ℓ_n subjected to load Pn

Mean load Pm can be obtained by using the following formula:

$$P_m=\sqrt[3]{\frac{1}{\ell}(P_1^3\,\ell_1+P_2^3\,\ell_2\cdots+P_n^3\,\ell_n)}$$

P_m : Mean Load Derived from Fluctuating Loads(N) ℓ : Total Travel Distance(m)

(2) When load changes almost linearly(Fig-4)

Mean load P_m can be approximated by the following formula:

$$P_m\approx\frac{1}{3}(P_{min}+2\cdot P_{max})$$

P_{min} : Min. Fluctuating Load (N)
P_{max}: Max. Fluctuating Load(N)

(3) When the load change resembles a sinusoidal curve as shown in Fig-5 (a), (b), Mean Load Pm can be approximated by the following formula:

Fig-5(a) $P_m\approx0.65P_{max}$
Fig-5(b) $P_m\approx0.75P_{max}$

Slide Guides

Rated life span is the total travel distance each linear guide of the same series can endure under the same conditions, without the occurrence of flaking in 90% of the system.

Rated life span can be obtained as follows from the basic dynamic load rating and the load to the slide guide.

$$L=\left(\frac{f_T}{f_W}\cdot\frac{C}{P}\right)^3\cdot50 \quad\text{———}(1)$$

L : Rated Life Span(km) C : Basic dynamic load rating(N)
f_T : Temperature Coefficient(See Fig-2) P : Acting Load(N)
fw : Load Coefficient(See Fig-4)

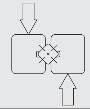
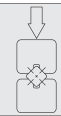
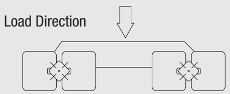
The life span hours can be computed as a number of hours by obtaining the travel distance for a unit of time.It can be obtained by using the following formula, in which stroke length and stroke cycles are assumed to be constant.

$$L_h=\frac{L\cdot10^3}{2\cdot\ell_s\cdot n_1\cdot60} \quad\text{———}(2)$$

Lh : Life Span Hours(hr) ℓs : Stroke Length(m)
L : Rated Life Span(km) n_1 : Reciprocating Times per Minute(cpm)

Slide Ways

Rated load for slide ways is determined by the rolling elements(numbers of rollers). It can be calculated by using the following formulas:

One shaft is used	Load Direction	
	Dynamic Load Rating (N)	$C=\left(\frac{Z}{2}\right)^{3/4}\cdot C_1$
	Static Load Rating (N)	$C_0=\left(\frac{Z}{2}\right)\cdot C_{01}$
One shaft is used vertically	Load Direction	
	Dynamic Load Rating (N)	$C=\left(\frac{Z}{2}\right)^{3/4}\cdot C_1\cdot2^{7/9}$
	Static Load Rating (N)	$C_0=\left(\frac{Z}{2}\right)\cdot C_{01}\cdot2$
Two shafts are used in parallel	Load Direction	
	Dynamic Load Rating (N)	$C=\left(\frac{Z}{2}\right)^{3/4}\cdot C_1\cdot2^{7/9}$
	Static Load Rating (N)	$C_0=\left(\frac{Z}{2}\right)\cdot C_{01}\cdot2$

C_1 : Basic Dynamic Load Rating per Roller(N)
C_{01}: Basic Static Load Rating per Roller(N)
Z : Number or Rolling Elements

The life span for slide ways is calculated by using the following formula.

$$L=\left(\frac{f_T\cdot C}{f_W\cdot P}\right)^{10/3}\cdot50$$

L : Life Span Hours(km) C : Dynamic Load Rating(N)
f_T : Temperature Coefficient(See Fig-2) P : Acting Load(N)
fw : Load Coefficient(See Fig-4)

Life Span Hours

$$L_h=\frac{L\cdot10^3}{2\cdot\ell_s\cdot n_1\cdot60}$$

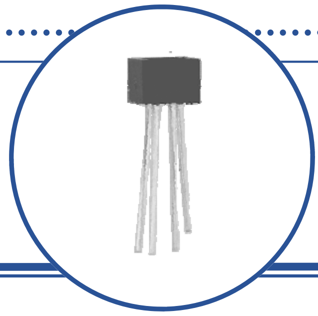
L_h : Life Span Hours(hr) ℓs: Stroke Length(m)
L : Life Span Hours(km) n_1: Reciprocating Times per Minute(cpm)

5 Capteur photoélectrique

Reflective Object Sensor

OPB706A, OPB706B, OPB706C
OPB707A, OPB707B, OPB707C

TT electronics
OPTEK Technology



Features:

- Choice of Phototransistor (OPB706) or Photodarlington (OPB707) output
- Unfocused for sensing diffuse surface
- Low cost plastic housing
- Designed for use with PCBoards or connectors

Description:

The **OPB706** consists of an infrared Light Emitting Diode (LED) and an NPN silicon Phototransistor mounted "side-by-side" on parallel axes in a black plastic housing. The **OPB707** consists of an infrared LED and an NPN silicon Photodarlington mounted "side-by-side" on parallel axes in a black plastic housing.

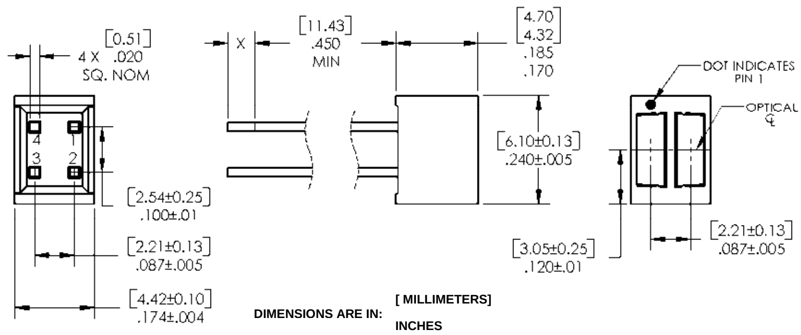
On both **OPB706** and **OPB707**, the LED and Phototransistor / Photodarlington are molded using dark infrared transmissive plastic to reduce ambient light noise. The Phototransistor / Photodarlington responds to light from the emitter when a reflective object passes within its field of view of the device.

Custom electrical, wire and cabling and connectors are available. Contact your local representative or OPTEK for more information.

Applications:

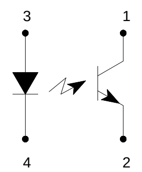
- Non-contact reflective object sensor
- Assembly line automation
- Machine automation
- Machine safety
- End of travel sensor
- Door sensor

Part Number	LED Peak Wavelength	Sensor	Reflection Distance	Lead Length / Spacing
OPB706A	935 nm	Transistor	0.050" (1.27mm)	0.45" / 0.087", 0.100"
OPB706B				
OPB706C				
OPB707A		Darlington		
OPB707B				
OPB707C				

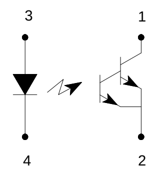


DIMENSIONS ARE IN: [MILLIMETERS] INCHES

OPB706



OPB707



Pin #	LED	Pin #	Transistor
3	Anode	1	Collector
4	Cathode	2	Emitter

RoHS

OPTEK reserves the right to make changes at any time in order to improve design and to supply the best product possible.

Absolute Maximum Ratings (T_A=25°C unless otherwise noted)

Storage and Operating Temperature Range	-40° C to +85° C
Lead Soldering Temperature [1/16 inch (1.6mm) from the case for 5 sec. with soldering iron][(1)]	260° C

Input Diode

Forward DC Current	50 mA
Peak Forward Current (1 µs pulse width, 300 pps)	3 A
Reverse DC Voltage	2 V
Power Dissipation[(2)]	75 mW

Output Phototransistor (OPB706) | Output Photodarlington (OPB707)

Collector-Emitter Voltage OPB706 OPB707	 24 V 15 V
Emitter-Collector Voltage	5 V
Collector DC Current OPB706 OPB707	 25 mA 125 mA
Power Dissipation OPB706[(2)] OPB707[(3)]	 75 mW 100 mW

Notes:
(1) RMA flux is recommended. Duration can be extended to 10 seconds maximum when flow soldering.
(2) Derate linearly 1.25 mW/°C above 25 ° C.
(3) Derate linearly 1.67 mW/°C above 25 ° C.

OPTEK Technology Inc. — 1645 Wallace Drive, Carrollton, Texas 75006
Phone: (972) 323-2200 or (800) 341-4747 FAX: (972) 323-2396 sensors@optekinc.com www.optekinc.com

Electrical Characteristics (T_A=25°C unless otherwise noted)

SYMBOL	PARAMETER	MIN	TYP	MAX	UNITS	TEST CONDITIONS
Input Diode (see OP165W for additional information)						
V_F	Forward Voltage	-	-	1.7	V	I_F = 20 mA
I_R	Reverse Current	-	-	100	µA	V_R = 2 V
Output Phototransistor (see OP505W for additional information) | **Photodarlington** (see OP535 for additional information)						
$V_{(BR)CEO}$	Collector-Emitter Brealdown Voltage OPB706 OPB707	 24 15	 - -	 - -	V	I_C = 100 µA
$V_{(BR)ECO}$	Emitter-Collector Breakdown Voltage	5	-	-	V	I_E = 100 µA
I_{CEO}	Collector Dark Current OPB706 OPB707	 - -	 - -	 100 250	nA	V_{CE} = 5 V, I_F = 0, E_E ≤ 0.1 µW/cm^2
Combined						
I_{CX}	Crosstalk OPB706 OPB707	 - -	 - -	 200 10	 nA µA	I_F = 20 mA, V_{CE} = 5 V, No reflecting surface(1)
$I_{C(ON)}$	On-State Collector Current OPB706A OPB706B OPB706C	 500 350 250	 - - -	 - - -	µA	I_F = 20 mA, V_{CE} = 5V , d = 0.05" (1.27 mm)(2) (3)
	OPB707A OPB707B OPB707C	25 17 10	- - -	- - -	mA	
$V_{CE(SAT)}$	Collector-Emitter Saturation Voltage OPB706 OPB707	 0.4 1.1	 - -	 - -	V	I_F = 20 mA, d = 0.05" (1.27 mm)(2) (3) $I_{C(ON)}$ = 100µA $I_{C(ON)}$ = 2 mA

Notes:
(1) Crosstalk (I_{CX}) is the collector current measured with the indicated current in the input diode and with no reflecting surface.
(2) The distance from the assembly face to the reflective surface is "d".
(3) Measured using Eastman Kodak neutral white test card with 90% diffuse reflectance as a reflecting surface. Reference: Eastman Kodak, Catalog #E 152 7795.
(4) Lower curve is a calculated worst case condition rather than the conventional -2 Ω limit.
(5) All parameters tested using pulse techniques.

6 Vérin compact de la pince

Compact Cylinder: Standard Type Single Acting, Single Rod

CQS Series

ø12, ø16, ø20, ø25

How to Order

CQS B 20 – 10 S [ ] – [ ]

With auto switch CDQS B 20 – 10 S [ ] – M9BWV [ ] – [ ]

With auto switch (Built-in magnet)

Mounting type

B	Through-hole/Both ends tapped common (Standard)
L	Foot type
LC	Compact foot type
F	Rod side flange type
G	Head side flange type
D	Double clevis type

* Mounting brackets are shipped together (but not assembled).
* Cylinder mounting bolts are not included. Order them separately referring to "Mounting Bolt for CQS" on page 716.

Bore size

12	12 mm
16	16 mm
20	20 mm
25	25 mm

Cylinder stroke (mm)

Standard Stroke

Bore size (mm)	Standard stroke (mm)
12, 16, 20, 25	5, 10

For "Manufacture of Intermediate Strokes", refer to page 715.

Action

S	Single acting, Spring return
T	Single acting, Spring extend

Body option

Nil	Standard (Rod end female thread)
M	Rod end male thread
F	Boss on head end

* Combination of body options is available. FM

Auto switch

Nil	Without auto switch

* Refer to the table below for the applicable auto switch model.

Number of auto switches

Nil	2 pcs.
S	1 pc.
n	"n" pcs.

Made to Order
Refer to page 715 for details.

Built-in Magnet Cylinder Model

If a built-in magnet cylinder without an auto switch is required, there is no need to enter the symbol for the auto switch.
(Example) CDQSL25-10T

Applicable Auto Switches/Refer to pages 1575 to 1701 for further information on auto switches.

Type	Special function	Electrical entry	Indicator light	Wiring (Output)	Load voltage DC		Load voltage AC	Auto switch model Perpendicular	Auto switch model In-line	Lead wire length (m) 0.5 (Nil)	1 (M)	3 (L)	5 (Z)	Pre-wired connector	Applicable load	
Solid state auto switch	—	Grommet	Yes	3-wire (NPN)	24 V	5 V, 12 V	—	**M9NV**	**(M9N)**	●	●	●	○	○	IC circuit	Relay, PLC
				3-wire (PNP)				**M9PV**	**(M9P)**	●	●	●	○	○		
				2-wire		12 V		**M9BV**	**(M9B)**	●	●	●	○	○	—	
	Diagnostic indication (2-color indicator)			3-wire (NPN)		5 V, 12 V		**M9NWV**	**(M9NW)**	●	●	●	○	○	IC circuit	
				3-wire (PNP)				**M9PWV**	**(M9PW)**	●	●	●	○	○		
				2-wire		12 V		**M9BWV**	**(M9BW)**	●	●	●	○	○	—	
	Water resistant (2-color indicator)			3-wire (NPN)		5 V, 12 V		**M9NAV***1	**(M9NA)***1	○	○	●	○	○	IC circuit	
				3-wire (PNP)				**M9PAV***1	**(M9PA)***1	○	○	●	○	○		
				2-wire		12 V		**M9BAV***1	**(M9BA)***1	○	○	●	○	○	—	
Reed auto switch	—	Grommet	Yes	3-wire (NPN equivalent)	—	5 V	—	**A96V**	**A96**	●	—	●	—	—	IC circuit	—
				2-wire	24 V	12 V	100 V	**A93V***2	**A93**	●	●	●	●	—	—	Relay, PLC
			No				100 V or less	**A90V**	**A90**	●	—	●	—	—	IC circuit	

*1 Water resistant type auto switches can be mounted on the above models, but in such case SMC cannot guarantee water resistance.
Consult with SMC regarding water resistant types with the above model numbers.
*2 1 m type lead wire is only applicable to D-A93.

* Lead wire length symbols: 0.5 m········ Nil (Example) M9NWV
1 m········ M (Example) M9NWVM
3 m········ L (Example) M9NWVL
5 m········ Z (Example) M9NWVZ

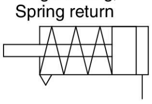
* Solid state auto switches marked with "○" are produced upon receipt of order.

* Since there are other applicable auto switches than listed, refer to page 749 for details.
* For details about auto switches with pre-wired connector, refer to pages 1648 and 1649.
* Auto switches are shipped together (not assembled).

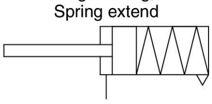
Note 1) There is the case D-A9□V/M9□V/M9□WV/M9□AV type auto switches cannot be mounted on the port surface, depending on the cylinder's stroke and the fitting size for piping. Consult with SMC for details.
Note 2) The D-M9□□□ (in-line entry) type auto switch in ( ) cannot be mounted due to the manufacturable stroke. When this auto switch satisfies the conditions stated in Note 3) on page 749, it can be ordered separately.

Symbol

Single acting, Spring return



Single acting, Spring extend



Made to Order: Individual Specifications

(For details, refer to pages 750 and 752.)

Symbol	Specifications
-X271	Fluororubber seals
-X1876	With concave shape end boss on the cylinder tube head side

Made to Order Specifications

Click here for details

Symbol	Specifications
-XA□	Change of rod end shape
-XB10	Intermediate stroke (Using exclusive body), Extension type only
-XC6	Piston rod, retaining ring, rod end nut made of stainless steel
-XC36	With boss on rod side, ø12 and ø16 only
-XC85	Grease for food processing equipment

Body Option

Description	Application
Rod end male thread	Available for all standard models of single acting, single rod.

Mounting Bracket Part No.

Bore size (mm)	Foot (1)	Compact foot (1)	Flange	Double clevis
12	CQS-L012	CQS-LC012	CQS-F012	CQS-D012
16	CQS-L016	CQS-LC016	CQS-F016	CQS-D016
20	CQS-L020	CQS-LC020	CQS-F020	CQS-D020
25	CQS-L025	CQS-LC025	CQS-F025	CQS-D025

Note 1) When ordering foot and compact foot brackets, order 2 pieces per cylinder.
Note 2) Parts belonging to each bracket are as follows.
Foot, Compact foot, Flange type: Body mounting bolt
Double clevis type: Clevis pin, Type C retaining ring for axis, Body mounting bolt.

Moisture Control Tube IDK Series

When operating an actuator with a small diameter and a short stroke at a high frequency, the dew condensation (water droplet) may occur inside the piping depending on the conditions.
Simply connecting the moisture control tube to the actuator will prevent dew condensation from occurring. For details, refer to the IDK series in the Best Pneumatics No. 6.

Standard Specifications

Bore size (mm)	12	16	20	25
Action	Single acting, Single rod			
Fluid	Air			
Lubrication	Not required (Non-lube)			
Proof pressure	1.5 MPa			
Maximum operating pressure	1.0 MPa			
Minimum operating pressure	0.25 MPa		0.18 MPa	
Ambient and fluid temperature	Without auto switch: –10 to 70°C (No freezing) With auto switch: –10 to 60°C (No freezing)			
Cushion	None			
Rod end thread	Female thread			
Stroke length tolerance	$^{+1.0}_{0}$ mm			
Piston speed	50 to 500 mm/s			
Allowable kinetic energy (J)	0.022	0.038	0.055	0.09

Theoretical Output

(N)

Action	Bore size (mm)	Rod size (mm)	Operating direction	Piston area (mm^2)	Operating pressure (MPa) 0.3	0.5	0.7	Retracted side	Extended side
Spring return	**12**	6	IN	–	20	43	65	14	4
			OUT	113					
	16	8	IN	–	45	86	126	15	6
			OUT	201					
	20	10	IN	–	78	141	204	15	6
			OUT	314					
	25	12	IN	–	126	224	323	21	11
			OUT	491					
Spring extend	**12**	6	IN	84.8	14	31	48	10	3
			OUT	–					
	16	8	IN	151	24	54	85	19	4
			OUT	–					
	20	10	IN	236	44	91	138	27	5
			OUT	–					
	25	12	IN	378	84	160	235	29	10
			OUT	–					

Manufacture of Intermediate Stroke (Single acting, Spring retract type is excluded.)

Description	Spacer is installed in the standard stroke body.	
Part no.	Refer to "How to Order" for the standard model no. (page 714).	
Description	Intermediate strokes in 1 mm increments are available by using spacers with standard stroke cylinders.	
Stroke range	Bore size	Stroke range
	12 to 25	1 to 9
Example	Part no.: CQSB20-3T CQSB20-5T with 2 mm width spacer inside. B dimension is 24.5 mm.	

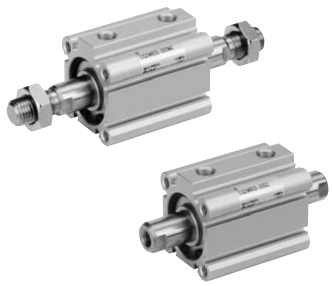
Refer to pages 747 to 749 for cylinders with auto switches.

- Minimum auto switch mounting stroke
- Proper auto switch mounting position (detection at stroke end) and mounting height
- Operating range

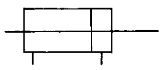
CUJ
CU
CQS
JCQ
CQ2
RQ
CQM
CQU
MU
D-□
-X□
Technical Data

7 Vérin double effet central

Series CQ2W



JIS Symbol
Double acting,
Double rod



Made to Order
(For details, refer to pages 177 to 207.)

Symbol	Specifications
-XA□	Special rod end shape
-XB6	Heat resistant cylinder (–10 to 150°C) w/o auto switch only
-XB7	Heat resistant cylinder (–40 to 70°C) w/o auto switch only
-XB9	Low-speed cylinder (10 to 50 mm/s)
-XB10	Intermediate stroke (Exclusive body type)
-XB13	Low-speed cylinder (5 to 50 mm/s)
-XC4	With heavy-duty scraper, ø40 to ø100 only
-XC6	Piston rod/Retaining ring/Rod end nut material: Stainless steel
-XC35	With coil scraper, ø32 to ø100 only
-XC36	With boss on rod end
-X144	Special port location, with auto switch ø12 to ø25 only
-X235	Special rod end for double rod cylinder
-X271	Fluororubber seals
-X293	Full length dimension is the same as Series CQ1W.
-X633	Intermediate stroke of double rod cylinder

Refer to pages 169 to 175 for the specifications of cylinders with auto switches.
• Auto switch proper mounting position (detection at stroke end) and its mounting height • Minimum stroke for auto switch mounting • Operating range • Auto switch mounting brackets/Part no.

Specifications

Pneumatic type

Bore size (mm)		12	16	20	25	32	40	50	63	80	100
Action		Double acting, Double rod									
Fluid		Air									
Proof pressure		1.5 MPa									
Maximum operating pressure		1.0 MPa									
Minimum operating pressure		0.07 MPa		0.05 MPa							
Ambient and fluid temperature		Without auto switch: –10 to 70°C (No freezing) With auto switch: –10 to 60°C (No freezing)									
Lubrication		Not required (Non-lube)									
Piston speed		50 to 500 mm/s									
Allowable kinetic energy (J)	**Standard**	0.022	0.038	0.055	0.09	0.15	0.26	0.46	0.77	1.36	2.27
	With rubber bumper	0.043	0.075	0.11	0.18	0.29	0.52	0.91	1.54	2.71	4.54
Stroke length tolerance		$^{+1.0}_{0}$ mm Note)									

Note) Stroke length tolerance does not include the amount of bumper change.

Air-hydro type

Bore size (mm)	20	25	32	40	50	63	80	100
Action	Double acting, Double rod							
Fluid	Turbine oil Note)							
Proof pressure	1.5 MPa							
Maximum operating pressure	1.0 MPa							
Minimum operating pressure	0.18 MPa			0.1 MPa				
Ambient and fluid temperature	5 to 60°C							
Piston speed	5 to 50 mm/s							
Cushion	None							
Stroke length tolerance	$^{+1.0}_{0}$ mm							

Note) Refer to "Handling Precautions for SMC Products" (M-E03-3) for Actuator Precautions (5).

Standard Strokes

Pneumatic type (Non-lube) (mm)

Bore size	Standard stroke
12, 16	5, 10, 15, 20, 25, 30
20, 25	5, 10, 15, 20, 25, 30 35, 40, 45, 50
32, 40	5, 10, 15, 20, 25, 30 35, 40, 45, 50, 75, 100
50, 63 80, 100	10, 15, 20, 25, 30 35, 40, 45, 50, 75, 100

Air-hydro type (mm)

Bore size	Standard stroke
20, 25	5, 10, 15, 20, 25, 30 35, 40, 45, 50
32, 40	5, 10, 15, 20, 25, 30 35, 40, 45, 50, 75, 100
50, 63 80, 100	10, 15, 20, 25, 30 35, 40, 45, 50, 75, 100

Manufacture of Intermediate Strokes

Type	A spacer is installed in the standard stroke body. (5 mm intervals)		A spacer is installed in the standard stroke body. (1 mm intervals)		Exclusive body (-XB10)	
Part no.	Refer to "How to Order" for the standard model number. (P. 22)		Suffix "-X633" (P. 205) to the end of standard model number. (P. 22)		Suffix "-XB10" to the end of standard model number. (P. 22)	
Description	Strokes in 5 mm intervals are available by installing a spacer in the standard stroke cylinder.		Strokes in 1 mm intervals are available by installing a spacer in the standard stroke cylinder.		Strokes in 1 mm intervals are available by using an exclusive body with the specified stroke.	
Stroke range	Bore size	Stroke range	Bore size	Stroke range	Bore size	Stroke range
	—	—	12, 16	6 to 29	12, 16	6 to 29
			20, 25	6 to 49	20, 25	6 to 49
	32 to 100	55 to 95	32, 40	6 to 99	32, 40	6 to 99
			50 to 100	11 to 99	50 to 100	11 to 99
Example	Part no.: CQ2WB50-65DZ CQ2WB50-75DZ with 10 mm width spacer inside The B dimension is 125.5 mm.		Part no.: CQ2WB50-72DZ-X633 CQ2WB50-75DZ with 3 mm width spacer inside The B dimension is 125.5 mm.		Part no.: CQ2WB50-65DZ-XB10 Makes 65 mm stroke tube. The B dimension is 115.5 mm.	

• Except air-hydro type
• In the case of spacer type, intermediate strokes with bumper for ø40 to ø100, "-X633" is not available.
• In the case of exclusive body type with ø32 to ø100 (-XB10) with the stroke length exceeding 50 mm, reference values of the longitudinal dimension will be changed.
Calculate length dimensions by deducting from those of 75 or 100 mm stroke models.

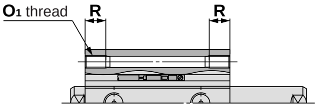
Dimensions

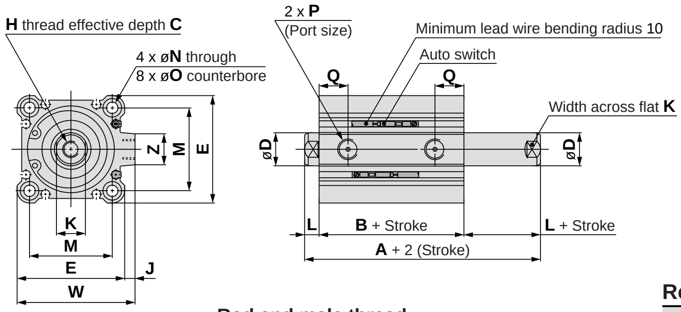
ø32 to ø50/With Auto Switch

(In the case of without auto switches, the A, B and P dimensions will be only changed. Refer to the dimension table.)

Standard (Through-hole): CQ2WB/CDQ2WB

Both ends tapped: CQ2WA/CDQ2WA



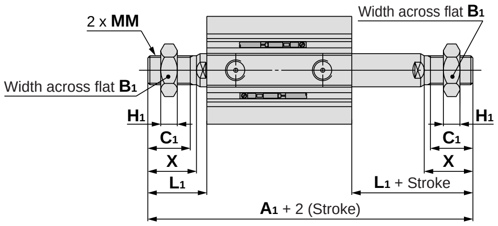


Both Ends Tapped (mm)

Bore size (mm)	O_1	R
32	M6 x 1.0	10
40	M6 x 1.0	10
50	M8 x 1.25	14

Note 1) The positions of left and right width across flats are not constant.

Rod end male thread

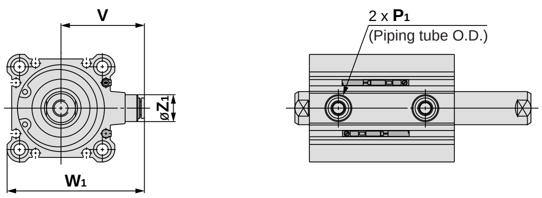


Rod End Male Thread (mm)

Bore size (mm)	Stroke range (mm)	Without auto switch A_1	With auto switch A_1
32	5	87.5	97.5
	10 to 50		
	75, 100	97.5	
40	5 to 50	97	107
	75, 100	107	
50	10 to 50	107.5	117.5
	75, 100	117.5	

Bore size (mm)	B_1	C_1	H_1	L_1	MM	X
32	22	20.5	8	28.5	M14 x 1.5	23.5
40	22	20.5	8	28.5	M14 x 1.5	23.5
50	27	26	11	33.5	M18 x 1.5	28.5

Built-in one-touch fittings: ø32 to ø50



Built-in One-touch Fittings (mm)

Bore size (mm)	Without auto switch V	Without auto switch W_1	With auto switch V	With auto switch W_1	Z_1	P_1
32	38	60.5	36.5	59	13	6
40	42	68	40.5	66.5	13	6
50	50	82	50	82	16	8

Standard For auto switch proper mounting position and its mounting height, refer to pages 169 to 175. (mm)

Bore size (mm)	Stroke range (mm)	Without auto switch A	Without auto switch B	Without auto switch P	With auto switch A	With auto switch B	With auto switch P
32	5	44.5	30.5	M5	54.5	40.5	1/8
	10 to 50			1/8			
	75, 100	54.5	40.5				
40	5 to 50	54	40	1/8	64	50	1/8
	75, 100	64	50				
50	10 to 50	56.5	40.5	1/4	66.5	50.5	1/4
	75, 100	66.5	50.5				

Bore size (mm)	C	D	E	H	J	K	L	M	N	O	Q	W	Z
32	13	16	45	M8 x 1.25	4.5	14	7	34	5.5	9 depth 7	12.5	49.5	14
40	13	16	52	M8 x 1.25	5	14	7	40	5.5	9 depth 7	14	57	15
50	15	20	64	M10 x 1.5	7	17	8	50	6.6	11 depth 8	14	71	19

Note 2) The external dimensions with rubber bumper are same as those of the standard, as shown above.

* For details about the rod end nut and accessory brackets, refer to page 19.

8 Drivers des stepper

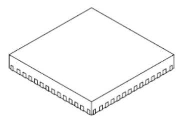
TOSHIBA BiCD Integrated Circuit Silicon Monolithic

TB67S109AFTG, TB67S109AFNG

CLOCK-in controlled Bipolar Stepping Motor Driver

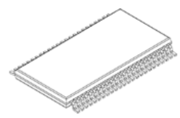
The TB67S109A is a two-phase bipolar stepping motor driver using a PWM chopper. The clock in decoder is built in. Fabricated with the BiCD process, rating is 50 V/4.0 A .

FTG



P-WQFN48-0707-0.50-003
Weight 0.10g (typ.)

FNG



HTSSOP48-P-300-0.50
Weight 0.21g (typ.)

Features

- BiCD process integrated monolithic IC.
- Capable of controlling 1 bipolar stepping motor.
- PWM controlled constant-current drive.
- Allows full, half, quarter, 1/8, 1/16, 1/32 step operation.
- Low on-resistance (High + Low side=0.49Ω(typ.)) MOSFET output stage.
- High efficiency motor current control mechanism (Advanced Dynamic Mixed Decay)
- High voltage and current (For specification, please refer to absolute maximum ratings and operation ranges)
- Error detection (TSD/ISD) signal output function
- Built-in error detection circuits (Thermal shutdown (TSD), over-current shutdown (ISD), and power-on reset (POR))
- Built-in VCC regulator for internal circuit use.
- Chopping frequency of a motor can be customized by external resistance and capacitor.
- Multi package lineup
  TB67S109AFTG: P-WQFN48-0707-0.50-003
  TB67S109AFNG: HTSSOP48-P-300-0.50

Note) Please be careful about thermal conditions during use.

Function explanation (Stepping motor)

CLK Function

Each up-edge of the CLK signal will shift the motor's electrical angle per step.

CLK Input	Function
Up-edge	Shifts the electrical angle per step.
Down-edge	(State of the electrical angle does not change.)

ENABLE function

The ENABLE pin controls the ON and OFF of the corresponding output stage. This pin serves to select if the motor is stopped in OFF mode (High impedance) or activated. Please set the ENABLE pin to 'L' during VM power-on and power-off sequence.

ENABLE Input	Function
H	Output stage='ON' (Normal operation mode)
L	Output stage='OFF (High impedance mode)

CW/CCW function and the output pin function (Output logic at the time of a charge start)

The CW/CCW pin controls the rotation direction of the motor. When set to 'Clockwise', the current of OUTA is output first, with a phase difference of 90°. When set to 'Counterclockwise", the current of OUTB is output first with a phase difference of 90°.

CW/CCW Input	OUT (+)	OUT (-)
H: Clockwise operation(CW)	H	L
L: Counterclockwise operation(CCW)	L	H

Step resolution select function

DMODE0	DMODE1	DMODE2	Function
L	L	L	Standby mode (the OSCM is disabled and the output stage is set to 'OFF' status)
L	L	H	Full step resolution
L	H	L	Half step resolution(Type A)
L	H	H	Quarter step resolution
H	L	L	Half step resolution(Type B)
H	L	H	1/8 step resolution
H	H	L	1/16 step resolution
H	H	H	1/32 step resolution

When switching the DMODE0,1,2; setting the RESET signal to Low (will set the electrical angle to the initial status), is recommended.

Absolute Maximum Ratings (Ta = 25°C)

Characteristics		Symbol	Rating	Unit	Remarks
Motor power supply		VM	50	V	—
Motor output voltage		Vout	50	V	—
Motor output current		Iout	4.0	A	(Note 1)
Internal Logic power supply		VCC	6.0	V	When externally applied.
Logic input voltage		VIN(H)	6.0	V	—
		VIN(L)	-0.4	V	—
MO output voltage		VMO	6.0	V	—
LO output voltage		VLO	6.0	V	—
MO Inflow current		IMO	30	mA	—
LO Inflow current		ILO	30	mA	—
Power dissipation	WQFN48	PD	1.3	W	(Note 2)
	HTSSOP48	PD	1.3	W	(Note 2)
Operating temperature		TOPR	-20 to 85	°C	—
Storage temperature		TSTR	-55 to 150	°C	—
Junction temperature		Tj(max)	150	°C	—

Note 1: Usually, the maximum current value at the time should use 70% or less of the absolute maximum ratings for a standard on thermal rating. The maximum output current may be further limited in view of thermal considerations, depending on ambient temperature and board conditions.

Note 2: Device alone (Ta =25°C)
Ta: Ambient temperature
Topr: Ambient temperature while the IC is active
Tj: Junction temperature while the IC is active. Tj(max) is limited by the thermal shutdown (TSD) circuitry. It is advisable to keep the maximum current below a certain level so that the maximum junction temperature, Tj (max), will not exceed 120°C.

Caution) Absolute maximum ratings

The absolute maximum ratings of a semiconductor device are a set of ratings that must not be exceeded, even for a moment. Do not exceed any of these ratings.
Exceeding the rating (s) may cause device breakdown, damage or deterioration, and may result in injury by explosion or combustion.
The value of even one parameter of the absolute maximum ratings should not be exceeded under any circumstances. The TB67S109A does not have overvoltage detection circuit. Therefore, the device is damaged if a voltage exceeding its rated maximum is applied.
All voltage ratings, including supply voltages, must always be followed. The other notes and considerations described later should also be referred to.

Operation Ranges (Ta=-20 to 85°C)

Characteristics	Symbol	Min	Typ.	Max	Unit	Remarks
Motor power supply	VM	10	24	47	V	—
Motor output current	Iout	—	1.5	3.0	A	(Note 1)
Logic input voltage	VIN(H)	2.0	—	5.5	V	Logic input High Level
	VIN(L)	0	—	0.8	V	Logic input Low Level
MO output pin voltage	VMO	—	3.3	5.0	V	—
LO output pin voltage	VLO	—	3.3	5.0	V	—
Clock input frequency	fCLK	—	—	100	kHz	—
Chopper frequency	fchop(range)	40	70	150	kHz	—
Vref input voltage	Vref	GND	2.0	3.6	V	—

Note 1: Maximum current for actual usage may be limited by the operating circumstances such as operating conditions (exciting mode, operating time, and so on), ambient temperature, and heat conditions (board condition and so on).

Electrical Specifications 1 (Ta = 25°C, VM = 24 V, unless otherwise specified)

Characteristics		Symbol	Test condition	Min	Typ.	Max	Unit
Logic input voltage	HIGH	VIN(H)	Logic input	2.0	—	5.5	V
	LOW	VIN(L)	Logic input	0	—	0.8	V
Logic input hysteresis voltage		VIN(HYS)	Logic input (Note 1)	100	—	300	mV
Logic input current	HIGH	IIN(H)	VIN(H)=3.3V	—	33	—	μA
	LOW	IIN(L)	VIN(L)=0V	—	—	1	μA
MO output pin voltage	LOW	VOL(MO)	IOL=24mA output=Low	—	0.2	0.5	V
LO output pin voltage	LOW	VOL(LO)	IOL=24mA output=Low	—	0.2	0.5	V
Current consumption		IM1	Output pins=open Standby mode	—	2	3.5	mA
		IM2	Output pins=open Standby release ENABLE=Low	—	3.5	5.5	mA
		IM3	Output pins=open Full step resolution	—	5.5	7	mA
Output leakage current	High-side	IOH	VRS=VM=50V,Vout=0V	—	—	1	μA
	Low-side	IOL	VRS=VM=Vout=50V	-1	—	—	μA
Motor current channel differential		ΔIout1	Current differential between Ch	-5	0	5	%
Motor current setting accuracy		ΔIout2	Iout=1.5A	-5	0	5	%
RS pin current		IRS	VRS=VM=24V	0	—	10	μA
Motor output ON-resistance (High-side+Low-side)		Ron(H+L)	Tj=25°C, Forward direction (High-side+Low-side)	—	0.49	0.6	Ω

Note 1: VIN (H) is defined as the VIN voltage that causes the outputs (OUTA,OUTB) to change when a pin under test is gradually raised from 0 V. V IN (L) is defined as the V IN voltage that causes the outputs (OUTA, OUTB) to change when the pin is then gradually lowered. The difference between V IN (H) and V IN (L) is defined as the V IN (HYS).

Note: When the logic signal is applied to the device whilst the VM power supply is not asserted; the device is designed not to function, but for safe usage, please apply the logic signal after the VM power supply is asserted and the VM voltage reaches the proper operating range.

9 Blocs d'alimentation

120W Single Output Industrial DIN RAIL **NDR-120 series**

User's Manual

TPTC004 BS EN/EN62368-1 IEC62368-1

Features

- Universal AC input / Full range
- Protections: Short circuit / Overload / Over voltage / Over temperature
- Cooling by free air convection
- Can be installed on DIN rail TS-35/7.5 or 15
- UL 508 (industrial control equipment) approved
- BS EN/EN61000-6-2(BS EN/EN50082-2) industrial immunity level
- 100% full load burn-in test
- 3 years warranty

Applications

- Industrial control system
- Semiconductor fabrication equipment
- Factory automation
- Electro-mechanical apparatus

GTIN CODE

MW Search: https://www.meanwell.com/serviceGTIN.aspx

Description

NDR-120 is one economical slim 120W DIN rail power supply series, adapt to be installed on TS-35/7.5 or TS-35/15 mounting rails. The body is designed 40mm in width, which allows space saving inside the cabinets. The entire series adopts the full range AC input from 90VAC to 264VAC and conforms to BS EN/EN61000-3-2, the norm the European Union regulates for harmonic current.
NDR-120 is designed with metal housing that enhances the unit's power dissipation. With working efficiency up to 89%, the entire series can operate at the ambient temperature between -20℃ and 70℃ under air convection. It is equipped with constant current mode for over-load protection, fitting various inductive or capacitive applications. The complete protection functions and relevant certificates for industrial control apparatus (UL508, TUV BS EN/EN62368-1, and etc.) make NDR-120 a very competitive power supply solution for industrial applications.

Model Encoding

NDR - 120 - 12

- 12: Output voltage
- 120: Output wattage
- NDR: Series name

MEAN WELL

120W Single Output Industrial DIN RAIL

NDR-120 series

SPECIFICATION

MODEL		NDR-120-12	NDR-120-24	NDR-120-48
OUTPUT	DC VOLTAGE	12V	24V	48V
	RATED CURRENT	10A	5A	2.5A
	CURRENT RANGE	0 ~ 10A	0 ~ 5A	0 ~ 2.5A
	RATED POWER	120W	120W	120W
	RIPPLE & NOISE (max.) Note.2	100mVp-p	120mVp-p	150mVp-p
	VOLTAGE ADJ. RANGE	12 ~ 14V	24 ~ 28V	48 ~ 55V
	VOLTAGE TOLERANCE Note.3	±2.0%	±1.0%	±1.0%
	LINE REGULATION	±0.5%	±0.5%	±0.5%
	LOAD REGULATION	±1.0%	±1.0%	±1.0%
	SETUP, RISE TIME	1200ms, 60ms/230VAC 2500ms, 60ms/115VAC at full load		
	HOLD UP TIME (Typ.)	16ms/230VAC 10ms/115VAC at full load		
INPUT	VOLTAGE RANGE Note.6	90 ~ 264VAC 127 ~ 370VDC [DC input operation possible by connecting AC/L(+), AC/N(-)]		
	FREQUENCY RANGE	47 ~ 63Hz		
	EFFICIENCY (Typ.)	85.5%	88%	89%
	AC CURRENT (Typ.)	2.25A/115VAC 1.3A/230VAC		
	INRUSH CURRENT (Typ.)	20A/115VAC 35A/230VAC		
	LEAKAGE CURRENT	<1mA / 240VAC		
PROTECTION	OVERLOAD	105 ~ 130% rated output power		
		Protection type : Constant current limiting, recovers automatically after fault condition is removed		
	OVER VOLTAGE	14 ~ 17V	29 ~ 33V	56 ~ 65V
		Protection type : Shut down o/p voltage, re-power on to recover		
	OVER TEMPERATURE	Shut down o/p voltage, re-power on to recover		
ENVIRONMENT	WORKING TEMP.	-20 ~ +70℃ (Refer to "Derating Curve")		
	WORKING HUMIDITY	20 ~ 95% RH non-condensing		
	STORAGE TEMP., HUMIDITY	-40 ~ +85℃, 10 ~ 95% RH		
	TEMP. COEFFICIENT	±0.03%/℃ (0 ~ 50℃)		
	VIBRATION	Component:10 ~ 500Hz, 2G 10min./1cycle, 60min. each along X, Y, Z axes; Mounting: Compliance to IEC60068-2-6		
SAFETY & EMC (Note 4)	SAFETY STANDARDS	UL508, TUV BS EN/EN62368-1, EAC TP TC 004 approved;(meet BS EN/EN60204-1)		
	WITHSTAND VOLTAGE	I/P-O/P:3KVAC I/P-FG:2KVAC O/P-FG:0.5KVAC		
	ISOLATION RESISTANCE	I/P-O/P, I/P-FG, O/P-FG:>100M Ohms / 500VDC / 25℃/ 70% RH		
	EMC EMISSION	Compliance to BS EN/EN55032 (CISPR32), BS EN/EN61204-3 Class B, BS EN/EN61000-3-2,-3, EAC TP TC 020		
	EMC IMMUNITY	Compliance to BS EN/EN61000-4-2,3,4,5,6,8,11, BS EN/EN55024, BS EN/EN61000-6-2 (BS EN/EN50082-2), BS EN/EN61204-3, heavy industry level, EAC TP TC 020		
OTHERS	MTBF	2636.8K hrs min. Telcordia SR-332 (Bellcore) ; 453.3K hrs min. MIL-HDBK-217F (25℃)		
	DIMENSION	40*125.2*113.5mm (W*H*D)		
	PACKING	0.6Kg; 20pcs/13Kg/1.16CUFT		
NOTE	1. All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25℃ of ambient temperature. 2. Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf & 47uf parallel capacitor. 3. Tolerance : includes set up tolerance, line regulation and load regulation. 4. The power supply is considered a component which will be installed into a final equipment. The final equipment must be re-confirmed that it still meets EMC directives. 5. Installation clearances : 40mm on top, 20mm on the bottom, 5mm on the left and right side are recommended when loaded permanently with full power. In case the adjacent device is a heat source, 15mm clearance is recommended. 6. Derating may be needed under low input voltage. Please check the derating curve for more details. 7. The ambient temperature derating of 3.5℃/1000m with fanless models and of 5℃/1000m with fan models for operating altitude higher than 2000m(6500ft). ※ Product Liability Disclaimer：For detailed information, please refer to https://www.meanwell.com/serviceDisclaimer.aspx			

MEAN WELL

240W Single Output Industrial DIN RAIL with PFC Function

SDR-240 series

■ Features :

- High efficiency 94% and low power dissipation
- 150% peak load capability
- Built-in active PFC function, PF>0.93
- Protections: Short circuit / Overload / Over voltage / Over temperature
- Cooling by free air convection
- Can be installed on DIN rail TS-35/7.5 or 15
- UL 508 (industrial control equipment) approved
- BS EN/EN61000-6-2(BS EN/EN50082-2) industrial immunity level
- Built-in DC OK relay contact
- 100% full load burn-in test
- 3 years warranty

User's Manual

GTIN CODE

MW Search: https://www.meanwell.com/serviceGTIN.aspx

AS/NZS62368-1 TPTC004 UL508 BS EN/EN62368-1 IEC62368-1

SPECIFICATION

MODEL		SDR-240-24	SDR-240-48
OUTPUT	DC VOLTAGE	24V	48V
	RATED CURRENT	10A	5A
	CURRENT RANGE	0 ~ 10A	0 ~ 5A
	RATED POWER	240W	240W
	PEAK CURRENT	15A	7.5A
	PEAK POWER Note.6	360W (3sec.)	
	RIPPLE & NOISE (max.) Note.2	50mVp-p	50mVp-p
	VOLTAGE ADJ. RANGE	24 ~ 28V	48 ~ 55V
	VOLTAGE TOLERANCE Note.3	±1.0%	±1.0%
	LINE REGULATION	±0.5%	±0.5%
	LOAD REGULATION	±1.0%	±1.0%
	SETUP, RISE TIME	650ms, 60ms/230VAC 1300ms, 60ms/115VAC at full load	
	HOLD UP TIME (Typ.)	20ms/230VAC 20ms/115VAC at full load	
INPUT	VOLTAGE RANGE	88 ~ 264VAC 124 ~ 370VDC	
	FREQUENCY RANGE	47 ~ 63Hz	
	POWER FACTOR (Typ.)	0.94/230VAC 0.99/115VAC at full load	
	EFFICIENCY (Typ.) Note.8	94%	
	AC CURRENT (Typ.)	2.6A/115VAC 1.3A/230VAC	
	INRUSH CURRENT (Typ.)	33A/115VAC 55A/230VAC	
	LEAKAGE CURRENT	<1mA / 240VAC	
PROTECTION	OVERLOAD	Normally works within 110 ~ 150% rated output power for more than 3 seconds and then shut down o/p voltage with auto-recovery	
		>150% rated power, constant current limiting with auto-recovery within 2 seconds and may cause to shut down if over 2 seconds	
	OVER VOLTAGE	29 ~ 33V	56 ~ 65V
		Protection type : Shut down o/p voltage with auto-recovery	
	OVER TEMPERATURE	95℃ ±5℃ (TSW : detect on heatsink of power switch)	
		Protection type : Shut down o/p voltage, recovers automatically after temperature goes down	
FUNCTION	DC OK REALY CONTACT RATINGS (max.)	60Vdc/0.3A, 30Vdc/1A, 30Vac/0.5A resistive load	
ENVIRONMENT	WORKING TEMP. Note.5	-25 ~ +70℃ (Refer to "Derating Curve")	
	WORKING HUMIDITY	20 ~ 95% RH non-condensing	
	STORAGE TEMP., HUMIDITY	-40 ~ +85℃, 10 ~ 95% RH	
	TEMP. COEFFICIENT	±0.03%/℃ (0 ~ 50℃)	
	VIBRATION	Component:10 ~ 500Hz, 2G 10min./1cycle, 60min. each along X, Y, Z axes; Mounting: Compliance to IEC60068-2-6	
SAFETY & EMC (Note 4)	SAFETY STANDARDS	UL508, TUV BS EN/EN62368-1, AS/NZS 62368.1, EAC TP TC 004 approved;(meet BS EN/EN60204-1)	
	WITHSTAND VOLTAGE	I/P-O/P:3KVAC I/P-FG:2KVAC O/P-FG:0.5KVAC O/P-DC OK:0.5KVAC	
	ISOLATION RESISTANCE	I/P-O/P, I/P-FG, O/P-FG:>100M Ohms / 500VDC / 25℃/ 70% RH	
	EMC EMISSION	Compliance to BS EN/EN55032 (CISPR32), BS EN/EN61204-3 Class B, BS EN/EN61000-3-2,-3, EAC TP TC 020	
	EMC IMMUNITY	Compliance to BS EN/EN61000-4-2,3,4,5,6,8,11, BS EN/EN55024, BS EN/EN61000-6-2 (BS EN/EN50082-2), BS EN/EN61204-3, heavy industry level, EAC TP TC 020, SEMI F47 approved	
OTHERS	MTBF	1160.3K hrs min. Telcordia SR-332 (Bellcore) ; 169.3K hrs min. MIL-HDBK-217F (25℃)	
	DIMENSION	63*125.2*113.5mm (W*H*D)	
	PACKING	1.03Kg; 12pcs/13.4Kg/1.22CUFT	

NOTE

1. All parameters NOT specially mentioned are measured at 230VAC input, rated load and 25℃ of ambient temperature.
2. Ripple & noise are measured at 20MHz of bandwidth by using a 12" twisted pair-wire terminated with a 0.1uf & 47uf parallel capacitor.
3. Tolerance : includes set up tolerance, line regulation and load regulation.
4. The power supply is considered a component which will be installed into a final equipment. The final equipment must be re-confirmed that it still meets EMC directives.
5. Installation clearances : 40mm on top, 20mm on the bottom, 5mm on the left and right side are recommended when loaded permanently with full power. In case the adjacent device is a heat source, 15mm clearance is recommended.
6. 3 seconds max., please refer to peak loading curves.
7. Derating may be needed under low input voltage. Please check the derating curve for more details.
8. After 30 minutes of burn-in.
9. The ambient temperature derating of 3.5℃/1000m with fanless models and of 5℃/1000m with fan models for operating altitude higher than 2000m(6500ft).

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