LAMPIRAN

```
#include <Wire.h>
#include "compass.h"
#include <LiquidCrystal.h>
#define Task_t 10          // Task Time in milli seconds
LiquidCrystal lcd(41,39,37,35,33,31);
int dt=0;
unsigned long t;
boolean pin_state[10]; //tipe data 1 &0 dengan pin state masukan 10 jalur
byte input_pin[]={5,6,7,8,9,10,11,12}; //tipe data bit dengan pinnya
int dec_position= 0; //type data bilangan bulat
float z= 1.41;
int elevasi;

// Main code ----------------------------------------------------------------

void setup(){

  Serial.begin(9600);
  Serial1.begin(57600);
  // Serial.print("Setting up I2C .....\n");
  Wire.begin();
  compass_x_offset = 38.86;
  compass_y_offset =141.66;
  compass_z_offset =116.84;
```

```
  compass_x_gainError = 1.03;
  compass_y_gainError = 1.05;
  compass_z_gainError = 0.98;

  compass_init(2);
  compass_debug = 1;
  compass_offset_calibration(0);

  lcd.begin(16,2); // lcd digunakan 16*2
  for(byte i=0;i<8;i=i+1)  //jenis data byte yang digunakan dengan nilai i=0 dan kurang dari 10(0-9)  pin 2=0 3=1 dll
  pinMode (input_pin[i],INPUT); // nilai pin i(10 pin) dijaidkan sebagai input


}

// Main loop
// Main loop ---------------------------------------------------------------
void loop(){

  t = millis();
  float load;
  compass_heading();
//  Serial.print ("Heading angle = ");
//  Serial.print (bearing);
```

```
//  Serial.println(" Degree");


  baca_enc(); // program dijelaskan di bawah void baca enc
  int pemetaan = map(bearing,0,359,359,0);
  lcd.setCursor (0,0); // lcd disetting dengan posisi 0,0
  lcd.print ("El:"); // menampilkan tulisan pos:
  lcd.print(elevasi); //nilai yang ditampilkan diambil dari hasil dec position
  lcd.print ((char)223);
  lcd.print (" ");
  lcd.setCursor (8,0); // lcd disetting dengan posisi 0,0
  lcd.print ("Az:"); // menampilkan tulisan pos:
  lcd.print((int)pemetaan);
  lcd.print ((char)223);
  lcd.print (" ");

  lcd.setCursor (0,1); // lcd disetting dengan posisi 0,0
  lcd.print ("B:");
  lcd.setCursor (11,1);
  lcd.print ("D:");
  lcd.print(dec_position); //nilai yang ditampilkan diambil dari hasil dec position
  lcd.print (" ");


  Serial.print((int)bearing);
```

```
  Serial.print(",");
  Serial.println(elevasi);
  Serial1.print((int)pemetaan);
  Serial1.print(",");
  Serial1.println(elevasi);
  delay(100);



}


void baca_enc()
{
  for(byte i=0;i<8; i++) pin_state [i] =digitalRead (input_pin[i]); //jenis data byte dimulai dari i=0 hingga kurang dari 10 (0-9) menunjukkan pin inputan. pembacaaan nilai binner akan diambil dari inputan pin i
  dec_position=0; //awalmula posisi dec adalah 0
  for (int i=0;i<8;i++)
  {
    dec_position = dec_position |(pin_state[i]<<i);
    //Serial.print("i=");
    //Serial.print(i);
    //Serial.print("dec pos value");
    //Serial.println(dec_position);
    lcd.setCursor(i+2,1);
    lcd.print(pin_state[i]);
```

```
    //delay(100);
    elevasi= z*(dec_position);
  }
}
```

EP50S Series

Diameter ø50mm Shaft type Absolute Rotary Encoder

■ Features

- Compact size of external diameter ø50mm
- Various output code: BCD, Binary, Gray code
- Various and high resolution(720, 1024 divisions)
- Protection structure IP64(Dust-proof, Oil-proof)

■ Applications

- Precision machine tool, Fabric machinery, Robot, Parking system

⚠ **Please read "Caution for your safety" in operation manual before using.**

CE

■ Ordering information

EP50S — **8** — **1024** — **1** — **R** — **P** — **24**

Series	Shaft diameter	Pulse/1Revolution	Output code	Revolution direction	Control output	Power supply
Diameter ø50mm shaft type	ø8mm	Refer to resolution	1 : BCD Code 2 : Binary Code 3 : Gray Code	F : Output value increase at CW direction R : Output value increase at CCW direction	P : PNP open collector output N : NPN open collector output	5 : 5VDC ±5% 24 : 12-24VDC ±5%

■ Specifications

Item			Diameter ø50mm shaft type of absolute rotary encoder						
Resolution			6, 8, 10, 12, 16, 20, 24, 32, 40, 45, 48, 64, 90, 128, 180, 256, 360, 512, 720, 1024						
Electrical specification	Output code			BCD Code	Binary Code	Gray Code		BCD Code	Binary Code	Gray Code
	Output phase / Output angle※1		1024-division	TS: 0.3515°±15'(13bit)	TS: 0.3515°±15'(10bit)	TS: 0.703°±15'(10bit)	20-division	TP1:12°±60'(1bit) TP2:2°±60'(1bit) TS: 18°±60'(5bit) EP: 18°±60'(1bit)	TP1: 12°±60'(1bit) TP2: 2°±60'(1bit) TS: 18°±60'(5bit) EP: 18°±60'(1bit)	TP1: 12°±60'(1bit) TP2: 2°±60'(1bit) TS: 36°±60'(5bit) EP:18°±60'(1bit)
			720-division	TS: 0.5°±25' (11bit)	TS: 0.5°±25' (10bit)	TS: 1°±25'(10bit)				
			512-division	TS: 0.703°±15'(11bit)	TS: 0.703°±15'(9bit)	TS: 1.406°±15'(9bit)				
			360-division	TS: 1°±25'(10bit)	TS: 1°±25'(9bit)	TS: 2°±25'(9bit)				
			256-division	TS: 1.406°±15'(10bit)	TS: 1.406°±15'(8bit)	TS: 2.8125°±15'(8bit)	16-division	TP1: 15°±60'(1bit) TP2:2°±60'(1bit) TS: 22.5°±60'(5bit) EP: 22.5°±60'(1bit)	TP1:15°±60'(1bit) TP2:2°±60'(1bit) TS: 22.5°±60'(4bit) EP: 22.5°±60'(1bit)	TP1:15°±60'(1bit) TP2: 2°±60'(1bit) TS:45°±60'(4bit) EP: 22.5°±60'(1bit)
			180-division	TS: 2°±25'(9bit)	TS: 2°±25'(8bit)	TS: 4°±25'(8bit)				
			128-division	TS: 2.8125°±15'(9bit)	TS: 2.8125°±15'(7bit)	TS:5S625°±15'(7bit)				
			90-division	TS: 4°±25'(8bit)	TS: 4°±25'(7bit)	TS: 8°±25'(7bit)				
			64-division	TS: 5.625°±15'(7bit)	TS: 5.625°±15'(6bit)	TS: 11.25°±15'(6bit)	12-division	TP1:15°±60'(1bit) TP2:3°±60'(1bit) TS:30°±60'(5bit) EP:30°±60'(1bit)	TP1: 15°±60'(1bit) TP2: 3°±60'(1bit) TS: 30°±60'(4bit) EP: 30°±60'(1bit)	TP1: 15°±60'(1bit) TP2: 3°±60'(1bit) TS: 60°±60'(4bit) EP: 30°±60'(1bit)
			48-division	TS: 7.5°±25'(7bit)	TS: 7.5°±25'(6bit)	TS: 15°±25'(6bit)				
			45-division	TS: 8°±25'(7bit)	TS: 8°±25'(6bit)	TS: 16°±25'(6bit)				
			40-division	TP1: 5°±60'(1bit) TP2: 2°±60'(1bit) TS: 9°±60'(6bit) EP: 9°±60'(1bit)	TP1: 5°±60'(1bit) TP2: 2°±60'(1bit) TS: 9°±60'(6bit) EP: 9°±60'(1bit)	TP1: 5°±60'(1bit) TP2: 2°±60'(1bit) TS: 18°±60'(6bit) EP: 9°±60'(1bit)	10-division	TP1:30°±60'(1bit) TP2: 12°±60'(1bit) TS: 36°±60'(4bit) EP: 36°±60'(1bit)	TP1: 30°±60'(1bit) TP2: 12°±60'(1bit) TS: 36°±60'(4bit) EP: 36°±60'(1bit)	TP1: 30°±60'(1bit) TP2: 12°±60'(1bit) TS: 72°±60'(4bit) EP: 36°±60'(1bit)
			32-division	TP1:7°±60'(1bit) TP2: 2°±60'(1bit) TS: 11.25°±60'(6bit) EP: 11.25°±60'(1bit)	TP1:7°±60'(1bit) TP2: 2°±60'(1bit) TS: 11.25°±60'(5bit) EP: 11.25°±60'(1bit)	TP1: 7°±60'(1bit) TP2: 2°±60'(1bit) TS: 22.5°±60'(5bit) EP: 11.25°±60'(1bit)	10-division	TP1:39°±60'(1bit) TP2: 15°±60'(1bit) TS: 45°±60'(3bit) EP: 45°±60'(1bit)	TP1: 39°±60'(1bit) TP2: 15°±60'(1bit) TS: 45°±60'(3bit) EP: 45°±60'(1bit)	TP1: 39°±60'(1bit) TP2: 15°±60'(1bit) TS: 90°±60'(3bit) EP: 45°±60'(1bit)
			24-division	TP1: 8°±60'(1bit) TP2: 3°±60'(1bit) TS: 15°±60'(6bit) EP: 15°±60'(1bit)	TP1: 8°±60'(1bit) TP2: 3°±60'(1bit) TS: 15°±60'(5bit) EP: 15°±60'(1bit)	TP1: 8°±60'(1bit) TP2: 3°±60'(1bit) TS: 30°±60'(5bit) EP: 15°±60'(1bit)	6-division	TP1: 53°±60'(1bit) TP2: 15°±60'(1bit) TS: 60°±60'(3bit) EP: 60°±60'(1bit)	TP1:53°±60'(1bit) TP2: 15°±60'(1bit) TS: 60°±60'(3bit) EP: 60°±60'(1bit)	TP1: 53°±60'(1bit) TP2: 15°±60'(1bit) TS: 120°±60'(3bit) EP: 60°±60'(1bit)
	Control output	PNP open collector output	Output voltage : Min. (Power supply-1.5)VDC, Load current : Max. 32mA							
		NPN open collector output	Load current : Max. 32mA, Residual voltage : Max. 1VDC							
	Response time(Rise/Fall)		Ton=800nsec, Toff=Max. 800nsec(Cable length : 2m, I sink = 32mA)							
	Max. Response frequency		35kHz							
	Power supply		• 5VDC ±5%(Ripple P-P : Max. 5%) • 12-24VDC ±5%(Ripple P-P : Max. 5%)							
	Current consumption		Max. 100mA(disconnection of the load)							
	Insulation resistance		Min. 100MΩ(at 500VDC megger between all terminals and case)							
	Dielectric strength		750VAC 50/60Hz for 1 minute(Between all terminals and case)							
	Connection		Cable type(Cable gland)							

※1: TS=Signal Pulse, Tp=Timing Pulse, EP=Even Parity

■ Specifications

Item		Diameter ø50mm shaft type of absolute rotary encoder
Mechanical specification	Starting torque	Max. 40gf·cm(0.004N·m)
	Moment of inertia	Max. 40g·cm²(4×10⁻⁶kg·m²)
	Shaft loading	Radial : 10kgf, Thrust : 2.5kgf
	Max. allowable revolution※2	3000rpm
Vibration		1.5mm amplitude or 300m/s² at frequency of 10 to 55Hz(for 1 min.) in each of X, Y, Z directions for 2 hours
Shock		Approx. Max. 50G
Environment	Ambient temperature	-10 to 70℃, storage : -25 to 85℃
	Ambient humidity	35 to 85%RH, storage : 35 to 90%RH
Protection		IP64(IEC standard)
Cable		ø7, 15-wire, Length : 2m, Shield cable(AWG 28, Core diameter: 0.08mm, Number of cores: 40, Insulator out diameter: ø0.8)
Accessory		Fixing bracket, Coupling
Approval		CE
Unit weight		Approx. 380g

※2: Make sure that. Max response revolution should be lower than or equal to max. allowable revolution when selecting the resolution.

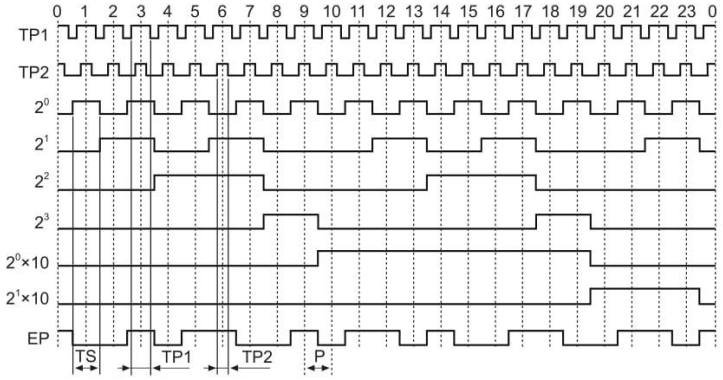
$$[\text{Max. response revolution(rpm)}= \frac{\text{Max. response frequency}}{\text{Resolution}} \times 60 \text{ sec}]$$

※Environment resistance is rated at no freezing or condensation.

■ Output waveform

• 24 division (BCD code output)

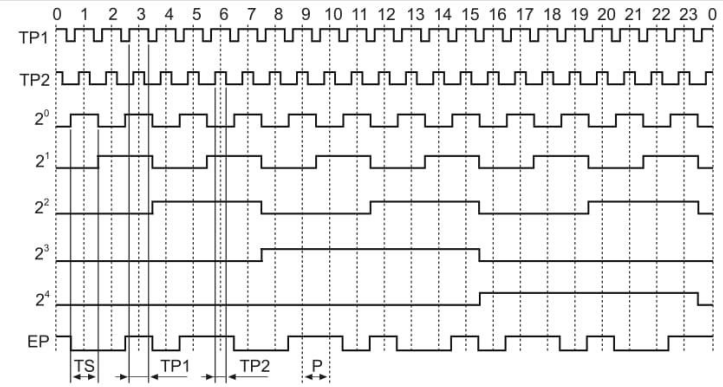
Model	EP50S8-24-1 □ - □ - □



※TP1=8°±60', TP2=3°±60', TS=15°±60', P=15°±60'
※Above waveform is based on the positive logic. (The output waveform of negative logic is opposed to above waveform.)

• 24 division (Binary code output)

Model	EP50S8-24-2 □ - □ - □

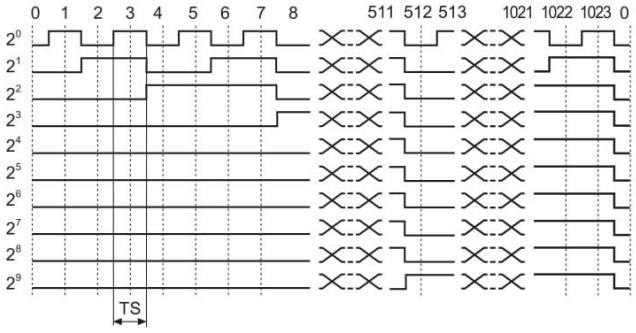


※TP1=8°±60', TP2=3°±60', TS=15°±60', P=15°±60'
※Above waveform is based on the positive logic. (The output waveform of negative logic is opposed to above waveform.)

■ Output waveform

• 1024 division (Binary code output)

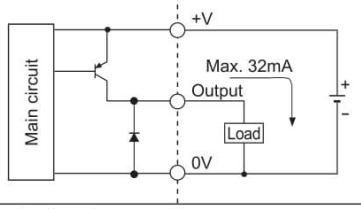
Model	EP50S8-1024-2□-P-□

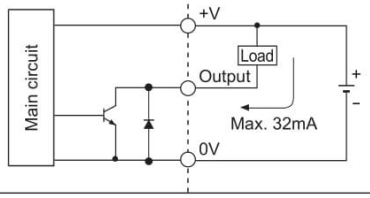


※TS=0.3515°±15'
※Above waveform is based on the positive logic. (The output waveform of negative logic is opposite to the above waveform.)

■ Control output diagram

PNP open collector output		NPN open collector output	
Rotary encoder circuit	Load connection	Rotary encoder circuit	Load connection





※Output circuits of all phases are the same.

■ Connections

• BCD Code

Color		Resolution: 6-division	8-division	10-division	12-division	16-division	20-division	24-division	32-division	40-division	45-division	48-division	64-division	90-division	128-division	80-division	256-division	360-division	512-division	720-division	1024-division
Power	White	+V																			
	Boack	0V																			
Outpur wire	Brown	2^0																			
	Red	2^1																			
	Orange	2^2																			
	Yellow	N·C		2^3																	
	Blue	N·C			2^0×10																
	Purple	N·C						2^{21}×10													
	Gray	N·C									2^2×10										
	White/Brown	TP1									N·C			2^3×10							
	White/Red	TP2									N·C				2^0×10						
	White/Orange	EP									N·C					2^1×100					
	White/Yellow	N·C															2^2×100				
	White/Blue	N·C																			2^3×100
	White/Purple	N·C																			2^0×1000
	Shield wire	F.G.																			

※Unused wires must be insulated.
※Encoder case and shield wire must be grounded(F.G.).
※N·C: Not Connected.
※Output cable must not be short-circuited, because Driver IC is used in output circuit.

▣ Connections

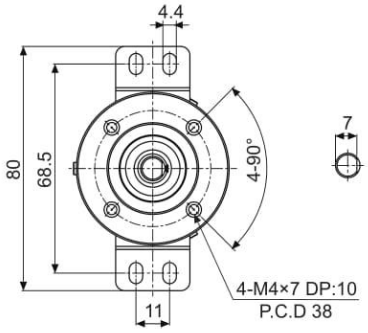
• Binary Code/Gray Code

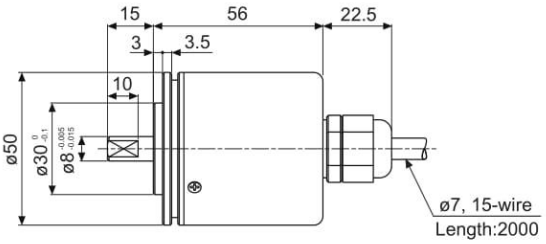
Color \ Resolution		6-division	8-division	10-division	12-division	16-division	20-division	24-division	32-division	40-division	45-division	48-division	64-division	90-division	128-division	80-division	256-division	360-division	512-division	720-division	1024-division
Power	White	+V																			
	Boack	0V																			
Outpur wire	Brown	2^0																			
	Red	2^1																			
	Orange	2^2																			
	Yellow	N·C		2^3																	
	Blue	N·C				2^4															
	Purple	N·C							2^5												
	Gray	N·C												2^6							
	White/Brown	TP1									N·C				2^7						
	White/Red	TP2									N·C					2^8					
	White/Orange	EP									N·C									2^9	
	Shield wire	F.G.																			

※Unused wires must be insulated.
※Encoder case and shield wire must be grounded(F.G.).
※N·C: Not Connected.
※Output cable must not be short-circuited, because Driver IC is used in output circuit.

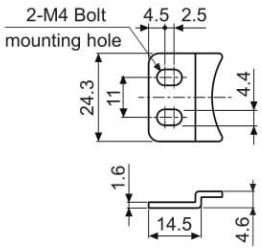
▣ Dimensions

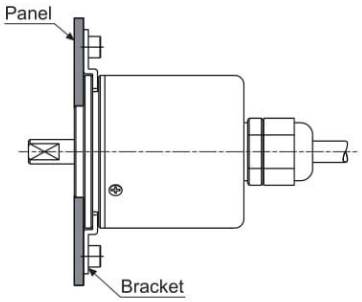
(unit: mm)



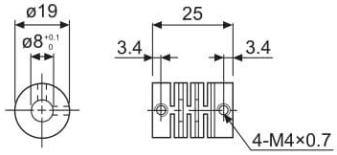


• Bracket





• Coupling(EP50S)



- Parallel misalignment : Max. 0.25mm
- Angular misalignment : Max. 5°
- End-play : Max. 0.2mm

※For parallel misalignment, angular misalignment, end-play terms, refer to the F-78 page.
※For flexible coupling(ERB Series) information, refer to the F-71 page.