

General

1.1 Application

This specification applies to 12mm rotary encoder for micro current circuit electronic equipment.

1.2 Standard atmospheric conditions

Unless otherwise specified, the standard range of atmospheric conditions for making measurements and tests are as follows:

Ambient temperature: 15°C to 35°C

Relative humidity: 25% to 85%

Air pressure: 86kpa to 106kpa

If there is any doubt about the results, measurements shall be made within the following:

Ambient temperature: 20±2°C

Relative humidity: 60% to 70%

Air pressure: 86kpa to 106kpa

1.3 Operating temperature range: -10°C to +70°C

1.4 Storage temperature range: -40°C to +85°C

1.5 Construction and dimensions. Refer to drawings.

1.6 Rating: DC 5V 0.5m

Operating current (resistive load) Each bit : 0.5mA

2. Electrical Characteristics

No.	Item	Conditions	Specification	
2.1	Output signal format		2. Phase different signals (Signal A & Signal B) Details shown in fig 1. (The broken line shows detent position of detent type)	
		Shaft rotational direction	Signal	Output - constant speed : 360°
		C.W.	A (Terminal A-C)	
			B (Terminal B-C)	
C.C.W.	A (Terminal A-C)			
	B (Terminal B-C)			
2.2	Resolution	Number of pulses in 360° rotation	24 pulses / 360° for each phase (1 click, 1 pulse)	
2.3	Switching characteristics	Measurement shall be made under the condition as follows: 1) Shaft rotational speed: 360° / S 2) Test circuit: Fig. 2		

Fig. 2

No.	Item	Conditions	Specification
2.4	Sliding noise	1) Chattering Details shown in fig. 3 specified by the signal's passage time from 3.5V to 1.5V or from 1.5V to 3.5V of each switching position (code OFF→ON or ON→OFF) Note: To avoid chattering (t_1 , t_3), please consider masking time and adding C/R filters on your circuit for pulse count design, as shown in fig. 4	$t_1, t_3 \leq 3\text{ms}$
		2) Bounce Details shown in fig. 3. Specified by the time of voltage change exceeding 1.5V in code -ON area. When bounce has code -ON time less than 1ms between chattering and when the code -ON time between 2 bounces is less than 1ms, they are regarded as 1 linked bounce.	$t_2 \leq 2\text{ms}$
		3) Sliding noise The voltage change in code -OFF area	3.5V Min.
		<div style="display: flex; justify-content: space-around;"> <div> <p>Fig. 3</p> </div> <div> <p>Fig. 4</p> </div> </div> <p>(t_1, t_3) : Masking time to avoid chattering Code - OFF area: The area which the voltage is 3.5V or more. Code - ON area: The area which the voltage is 1.5V or less.</p>	
2.5	Phase difference	Measurement shall be made under the condition which the shaft is rotated at $360^\circ / \text{S}$ (constant speed) 	$\Delta T \geq 3.5\text{msec}$ in fig. 5
		Note: The test is conducted with equipment at constant speed: $360^\circ/\text{S}$ according to spec. item 2.4 & 2.5, and the test result could be different from the result by manual rotating. In order to prove the interoperability between the firmware and the encoder, please test the part in real condition.	

No.	Item	Conditions	Specification
2.6	Insulation resistance	Measurement shall be made under the condition where a voltage of 250V DC is applied between individual terminals and attaching plate.	Between individual terminals and bushing. 100MΩ MIN.
2.7	Dielectric strength	A voltage of 300V AC shall be applied for 1 min. or a voltage of 360V AC shall be applied for 2 sec between individual terminals and attaching plate (Leakage current : 1mA)	No arcing or breakdown

3. Mechanical characteristics

No.	Item	Conditions	Specification
3.1	Total rotational angle		360° (Endless)
3.2	Rotational torque		50gf.cm (MAX)
3.3	Detent torque		30~200gf.cm
3.4	Number and position of detents		24 detents Step angle: 15°±3°
3.5	Terminal strength	A static load of 300gf shall be applied to the tip of terminals for 1 minute in any direction.	No damage or excessive looseness of terminals. Terminal bend is permitted.
3.6	Push - pull strength of shaft	Push and pull static load of 5Kgf shall be applied to the shaft in the axial direction for 10sec. (After soldering to the PC board)	No damage or excessive play in shaft. No excessive abnormality in rotational feel.
3.7	Shaft wobble	A momentary load of 500gf.cm shall be applied at the point from the tip of the shaft in a direction perpendicular to the axis of shaft.	1.0xL/30mm.p-p (MAX) L: Shaft length
3.8	Side thrust strength of shaft	A load of 2Kgf shall be applied at the point 5mm from the tip of the shaft in a direction perpendicular to the axis of shaft. (After soldering to PC board).	No damage or excessive play in shaft. No excessive abnormality in rotational feeling.
3.9	Rotation play at the click position	Measure with jig for rotational angle	4° MAX.

4. Endurance characteristics			
No.	Item	Conditions	Specification
4.1	Rotational life	The shaft of encoder shall be rotated to 30,000 cycles at a speed of 600-1000 cycles per hour without electrical load, after which measurements shall be made. (1 cycle: rotate 360° CCW, rotate 360° CW)	Chattering: $t_1, t_3 \leq 5\text{ms}$ Bounce: $t_2 \leq 3\text{ms}$ Phase difference: $\Delta T \geq 2.5\text{msec}$ Detent feeling has to remain (Detent type only) Except for above items, specifications in items 2.1-7 and 3.1-9 shall be satisfied
5. Soldering conditions			
No.	Item	Conditions	Specification
5.1	Manual soldering	Bit temperature of soldering : 350°C or less Application time of soldering : 3sec. Max.	
5.2	Dip soldering	Printed wiring board: Single-sided copper clad laminate board with thickness of 1.6mm. Flux: <ul style="list-style-type: none"> • Specific gravity: 0.82 or more. • Flux shall be applied to the board using a bubble foaming type flux. • The board shall be soaked in the flux bubble only to be 2/3 of its thickness. Preheating: <ul style="list-style-type: none"> • Surface temperature of board: 100°C or less • Preheating time: within 2 mins Soldering: <ul style="list-style-type: none"> • Solder temperature: 260°±5°C • Immersion time: 5±1 sec. Apply the above soldering process for 1 or 2 times.	There shall be no deformation or cracks in moulded part. No excessive abnormality in rotational feeling.
6. Switch electrical characteristics			
No.	Item	Conditions	Specification
6.1	Contact resistance	Measured by the electric current DC voltage drop method.	100mΩ MAX
6.2	Chattering	Switch is operated at the rate of 1 cycle 1 sec. The 1 cycle shall be OFF - ON - OFF	Less than 10msec.
6.3	Insulation resistance	Measurement shall be made under the condition which a voltage of 250V DC is applied between individual terminals and attaching plate.	Between individual terminals and attaching plate 100MΩ MIN.
6.4	Dielectric strength	A voltage of 300V AC shall be applied for 1 min or a voltage of 360V AC shall be applied for 2 secs between individual terminals and bushing. (Leakage current: 1mA)	No damage to parts arcing or breakdown
6.5	Switch rating (Resistor load)	Applies to switch version only.	DC5V 10mA (1mA MIN)
Note: Shaft is insulated from switch terminal			

7. Switch mechanical characteristics

No.	Item	Conditions	Specification
7.1	Contact arrangement	Applies to switch version only.	S.P.S.T. (PUSH ON)
7.2	Switching stroke	Applies to switch version only.	$^{+0}_{0.5-0.3}$ mm
7.3	Switch strength	Applies to switch version only.	450 ± 200 gf

8. Switch endurance characteristics

No.	Item	Conditions	Specification
8.1	Operating life	The shaft of switch shall be operated 20,000 times without electronic load, after which measurements shall be made.	Switch contact resistance: 200mΩ MAX. Switch strength: Relative to the previously specified value +10% / -30%. Except for above items, specification in items 6.1-4 and 7.1-3 shall be satisfied.

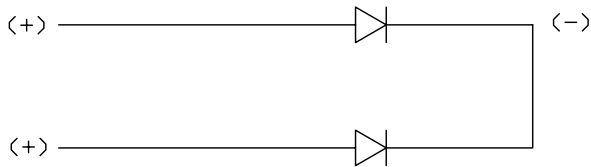
9. LED Characteristics

9.1 Dual colour type with switch

Reverse Voltage : 5V

Operating temp: -40°C to +85°C

Circuit

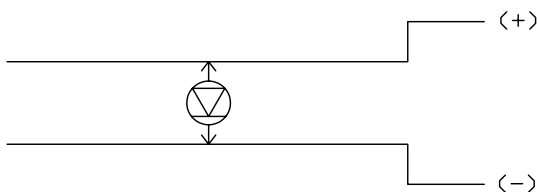


Emitting Colour		Power Dissipation	DC Forward Current	Test conditions TF=20mA	
				Forward voltage (V)	
				Typ	MAX
Blue/Orange	Blue	105mW	30mA	3.3	4
	Orange	75mW	30mA	2.1	2.5
Green/Red	Green	120mW	30mA	3.2	4
	Red	75mW	30mA	1.95	2.5
Blue/Green	Blue	120mW	30mA	3.3	4
	Green	120mW	30mA	3.2	4
Red/Green	Red	75mW	30mA	1.95	2.5
	Green	120mW	30mA	3.2	4

9.2 One colour type

Reverse Voltage : 5V

Circuit



Emitting Colour	Power Dissipation	DC Forward Current	Test conditions TF=20mA		
			Forward voltage (V)		
				Typ	MAX
Red	60mW	30mA	1.8	2.6	
Lawn green	100mW	30mA	2	2.6	
Blue	72mW	20mA	3.2	3.6	
Orange	100mW	30mA	2.1	2.6	
White	72mW	20mA	3.2	3.6	
Green	72mW	20mA	3.2	3.6	
Dark orange	100mW	30mA	2.1	2.6	