OPERATION MANUAL

OF

GYROSTAR®

Piezoelectric vibrating Gyroscope

MODEL : ENC-03J TYPE

Support sensor for
video camera

May 6, 1999

PRODUCT ENGINEERING SECTION
SENSOR MODULE DEPERTMENT
CIRCUIT PRODUCTS DIVISION
MURATA MFG. CO., LTD.

Introduction

This angular velocity sensor employs the principle that a Coriolis force results if an angular velocity is applied to a vibrating object. Murata's unique ceramic bimorph vibrating unit is used as the sensor element unit, thereby enabling piezoelectric ceramics to be used for both excitation and detection. The use of this unit simplifies equipment structure and circuit configuration, thus making it possible to provide outstanding performance.

This sensor can be used for positional control and posture control of a moving object requiring high-precision measurements.

1. Features

- Ultra small and ultra lightweight
- Quick response
- Low driving voltage, low current consumption
- Reliable feature achieved by a built in AGC circuit

2. Applications

- Detecting hand movement involved in video and still camera
- Detecting vibrations in various vibration free table and isolators
- Detecting the own movement

3. Specifications

Type ENC-03JA and ENC-03JB

Characteristics	Symbol	Condition	MIN.	STD.	MAX.	Unit
Supply voltage	Vcc		+2.7	+3.0	+5.5	VDC
Current consumption	Isup	at Vcc = +3.0V	2.5	3.2	4.5	mA
Comparative voltage	Vref	at -5~+75°C	+1.25	+1.35	+1.45	VDC
Static output (Bias)	V0	angular velocity = 0 at -5~+75°C	Vref -0.55	Vref	Vref +0.55	VDC
Angular velocity range	ωmax			+300		deg/s
Scale factor	Sv		-20%	0.67	+20%	mV/deg/s
Temp. coefficient of scale factor		Reference : Ta at -5~+75°C	-20	-	+10	%FS
Resonance frequency - version ENC-03JA - version ENC-03JB	 fa fb		 - -	 22 24	 - -	 kHz kHz
Resonance frequency disparity	fa-fb	at -5~+75°C	1	-	-	kHz
Linearity		in the maximum angular velocity range	-5	-	+5	%FS
Response		Phase delay : 90deg	DC ~ 50			Hz
Operating temp. range	Topr		-5	-	+75	deg C
Storage temp. range	Tstg		-30	-	+85	deg C
Weight			-	-	1.0	g
Dimension		Refer to page 3	15.5 x 8.0x 4.3 mm			

All typical values

Unless otherwise specified, ambient temperature Ta= 25+/-5deg C, Vcc = +3.0 VDC

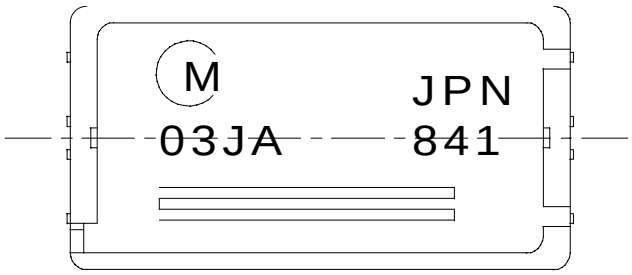
Use a sensor output load resistance of 50kΩ or more.

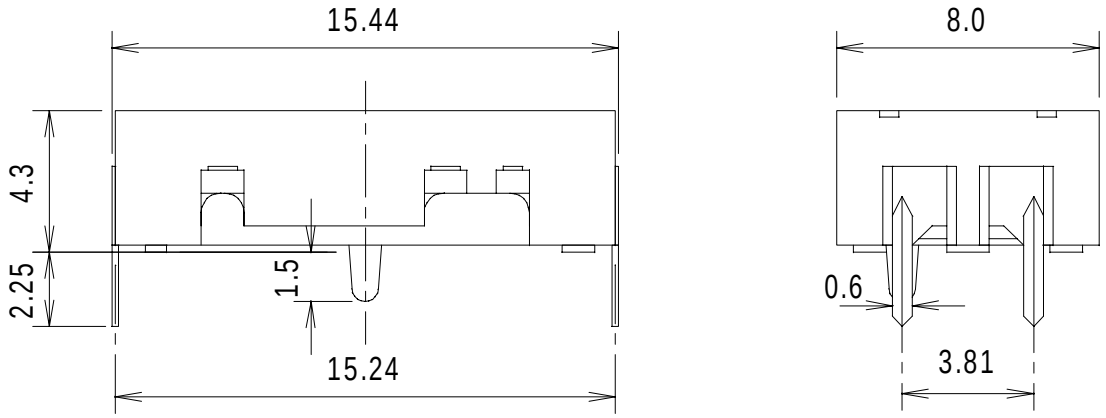
Comparative voltage (Vref) is grounded with condenser of 4.7μF.

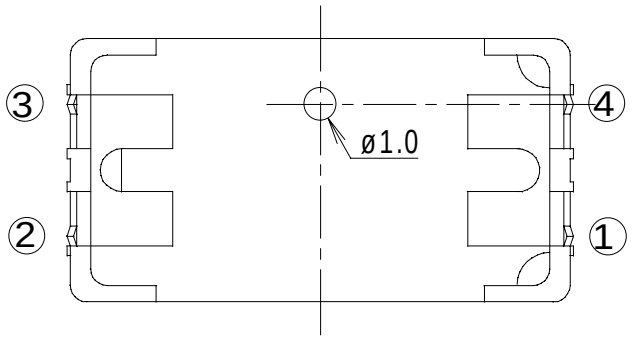
4. Dimensions

All dimensions are in "mm"

Measurement tolerance = +/- 0.2mm







① Vcc
② Vref
③ Gnd
④ Out

5. Installation

1) Install the sensor by using the bottom face as the reference point.

2) Install the sensor vertically with respect to the rotating surface. (90 +/- 5 deg)

3) Install the sensor in a location which minimizes excessive vibration (ex. Model helicopter application) and use elastic materials to absorb external shock and vibration.

Typically, the sensor can withstand vibration that frequency 10~55Hz, amplitude 1.5mmp-p, duration 2hours.

4) Install the sensor in a place which minimizes substantial temperature variations.

5) When installing the sensor, terminals should be hand soldered onto the PCB.

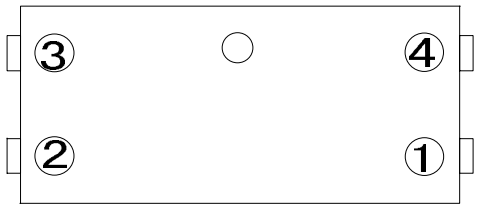
Observe the following guideline, otherwise, characteristics may vary due to excessive soldering heat:

320 +/- 10deg C, 2s or less.

6) Do not bend terminals.

6. Terminal connection

Terminal	Symbols	Descriptions	
1	+Vcc	Supply voltage	[input]
2	Vref	Comparative voltage(approx .+1.35V)	[output]
3	GND	Ground	[common]
4	OUT	Sensor output	[output]



BOTTOM VIWE

7. Connection

1) Operation voltage is +2.7V to +5.5V.

Use a stabilized power supply free from surge and ripple voltages. Also, Confirm proper power supply polarity before connecting sensor.

2) Output voltage is relative to the angular velocity.

Output voltage = V0 + Sv x ω [V]

V0 :Static output [V] (at angular velocity is 0 [deg/s])

Sv :Scale factor [mV/deg/s]

: Angular velocity [angular velocity range : -90 to +90 deg/s]

3) Use a sensor output load resistance of 50kΩ or more.

4) Comparative voltage (Vref) must be grounded with condenser of 4.7μF or more.

5) Comparative voltage is used as a reference voltage of amplification. (Refer to page 7)

8. Notice

1) ENC-03J can detect angular velocity along only one axis.

When using more than one of the same type ENC-03J at the same time, swelling may result on the output due to the mutual interference with sound waves of each sensing devices resonant frequency. Therefore, there are 2 types of the ENC-03J. One is the ENC-03JA and other is ENC-03JB. The ENC-03JA has the same specifications as the ENC-03JB with the exception of the resonant frequencies. By using different frequencies, mutual interference can be avoided.

When detecting just one axis, select model ENC-03JA.

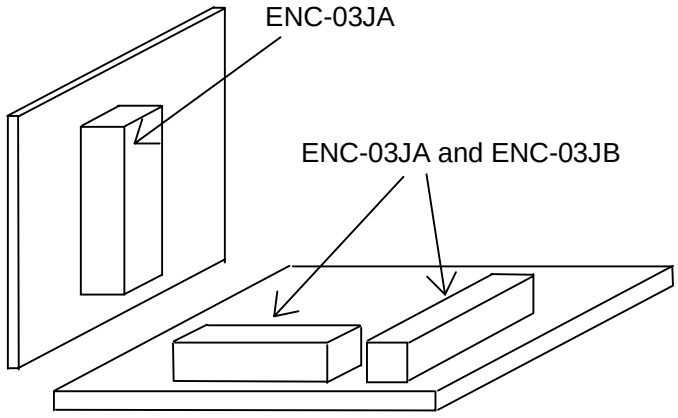
When detecting two axes, select models ENC-03JA and ENC-03JB.

When detecting three axes, select 2 pcs of ENC-03JA and 1pc of ENC-03JB and follow the bellow guideline to avoid mutual interference:

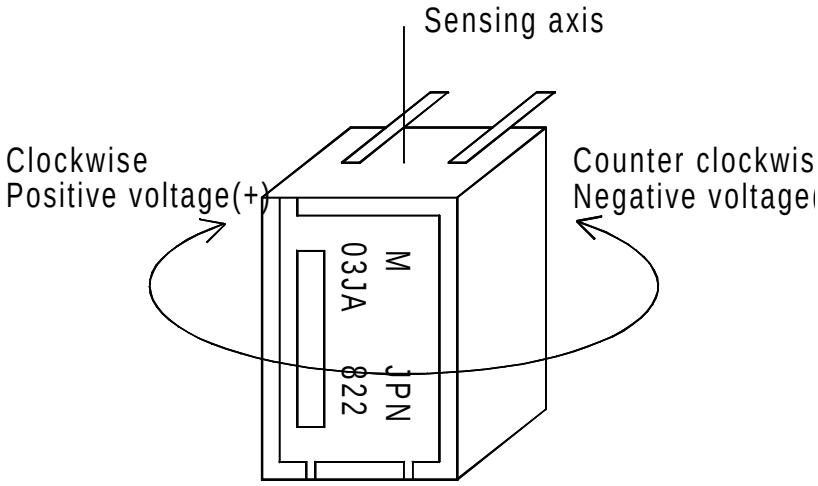
Install one ENC-03JA on a separate PCB from the other installed ENC-03JA.

Even while both devices are mounted on separate PCB's, it is critical that the two devices are still kept apart as far as possible.

Use acoustical material in order to isolate the sound wave.



2) Confirm the proper mounting direction before installing the sensor.



3) Bias and scale factor drift

Surrounding temperature variation may affect the sensor output (bias, scale factor). Sensor should be mounted where temperature does not vary significantly.

When canceling bias drift, please refer to the following examples.

- Cut DC level along output by using a HPF (Hi-Pass-Filter) with a low cut-off frequency on the sensor output. (Refer to page 7)

9. Handling

1) Incorrect handling may affect the sensor characteristics. Please note the following precautions;

A. Do not subject the sensor to shocks which exceed the rated limit.

Typically, the sensor can withstand shock peak to 500G, duration 1msec, half sine wave.

B. Do not install or store the sensor in a location where condensation is likely to form on it.

C. Do not install or store the sensor in a location where water may splash directly on it.

D. Do not install or store the sensor in a location in which it is likely to be exposed to salt water or corrosive vapor.

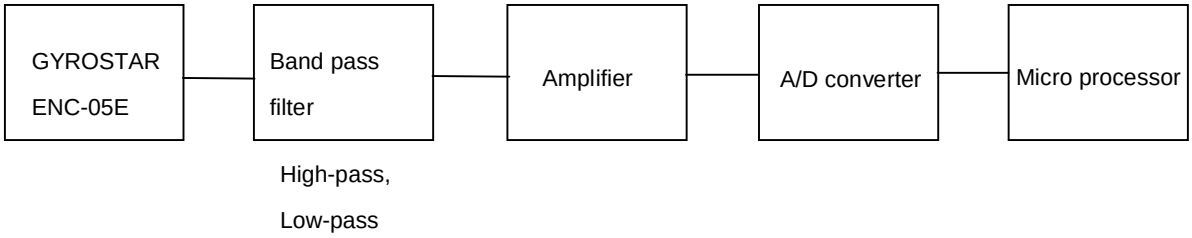
2) Precision electronic parts, such as ICs, are used for the sensor; therefore, it is necessary to take anti-static precautions when handling.

3) Do not wash the sensor, as it is not water resistant.

4) Do not disassemble.

10. Application

A simplified block diagram is shown in the illustration.



1) Positive voltage(+) and negative voltage(-) are obtained in the clockwise and counterclockwise directions, respectively, with the static output as a reference.

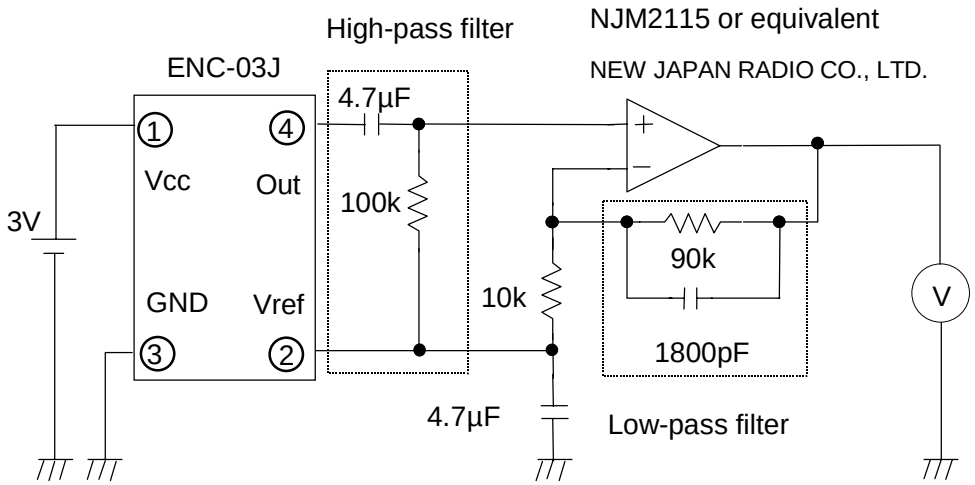
2) Cut DC level of output using HPF (Hi-Pass-Filter) with low cut-off frequency on sensor output In order to cancel bias drift. Cut-off frequency of HPF will affect measurement accuracy. Please choose a proper cut-off frequency according to the application.

3) Always use an A/D converter of 8 bits or more. Resolution of A/D converter will affect measurement accuracy . Please choose a proper resolution according to the application.

4) The sampling frequency used for measurement should be 50 times/sec minimum. Sampling frequency will affect measurement accuracy . Please choose a proper sampling frequency according to the application.

5) Please choose a proper amplification factor according to the application.

6) Typical circuit



The high-pass filter's cut-off frequency in this circuit is approx. 0.3Hz. The low-pass filter's cut-off frequency in this circuit is approx. 1kHz.

⚠ Note

1) Please contact our sales representatives or product engineers before using our products listed in this catalog for the applications listed below which require especially high reliability for the prevention of defects which might directly cause damage to the third party's life, body or property, or when intending to use one of our products for other applications than specified in this catalog.

(1) Aircraft equipment
(2) Aerospace equipment
(3) Undersea equipment
(4) Medical equipment
(5) Transportation equipment (vehicles, trains, ships, etc.)
(6) Traffic signal equipment
(7) Disaster prevention / crime prevention equipment
(8) Data-processing equipment
(9) Applications of similar complexity or with reliability requirements comparable to the applications listed in the above.

2) Product specifications in this catalog are as of May, 99. They are subject to change or our products in it may be discontinued without advance notice. Please check with our sales representatives or product engineers before your ordering. If there are any questions, please contact our sales representatives or product engineers.

3) The parts numbers and specifications listed in this catalog are for information only. You are requested to approve our product specification or to transact the approval sheet for product specification, before your ordering.