(1) Compatibility

The BZ*i* sensor with the drawing number A860-2150-T***, which is described in this document, is smaller and thinner than the former BZ*i* sensor (A860-2120-T***), and as a result the method to install the sensor head and the relative axial dimension between the detection ring and the sensor head is different with each other. Please note that it is necessary to change the design of the sensor mounting surface and the axial position of the detection ring in order to replace the former BZi sensor with the new BZi sensor.

The outer and inner dimension of the detection ring is common between the BZi sensor which is described in this document and the former BZi sensor in case that the number of teeth is the same. It is not necessary to change the parameter in replacement of the sensor because the electrical specification of the output signal is common.

(2) Names and Drawing Numbers

Table (1) Names and Drawing Numbers

Name	Drawing No.	Remarks			
		Number of teeth	Maximum speed	Detection ring	
				Inner diameter	Outer diameter
BZ*i*sensor 128	A860-2150-T201	128	20,000min^{-1}	ϕ40	ϕ52
BZ*i*sensor 128H	A860-2150-T211		70,000min^{-1}		
BZ*i*sensor 192	A860-2150-T311	192	40,000min^{-1}	ϕ60	ϕ77.6
BZ*i*sensor 256	A860-2150-T401	256	15,000min^{-1}	ϕ82	ϕ103.2
BZ*i*sensor 256H	A860-2150-T411		30,000min^{-1}		
BZ*i*sensor 384	A860-2150-T511	384	15,000min^{-1}	ϕ125	ϕ154.4
BZ*i*sensor 512	A860-2150-T611	512	10,000min^{-1}	ϕ160	ϕ205.6

(3) Absolute Maximum Ratings

Table (2) Absolute Maximum Ratings

Item	Specifications
Power supply voltage	-0.5V～+7.0V
Operating temperature	0deg.～+80deg.
Humidity	95%RH or less

(4) Electrical Specifications

Table (3) Electrical Specifications

Item			Specifications
Power supply voltage			5V +/- 5%
Current consumption			0.05A
Output signals	VA,*VA VB,*VB	BZ*i* sensor 128/128H	128λ／rev
		BZ*i* sensor 192	192λ／rev
		BZ*i* sensor 256/256H	256λ／rev
		BZ*i* sensor 384	384λ／rev
		BZ*i* sensor 512	512λ／rev
	VZ,*VZ	Common to all models	1λ／rev

(5) Resolution and accuracy

Name	Resolution in Cs axis control	Accuracy (typ.)
BZ*i* sensor 128/128H	360,000/rev.	30/1000 deg.
BZ*i* sensor 192		25/1000 deg.
BZ*i* sensor 256/256H		20/1000 deg.
BZ*i* sensor 384		15/1000 deg.
BZ*i* sensor 512		10/1000 deg.

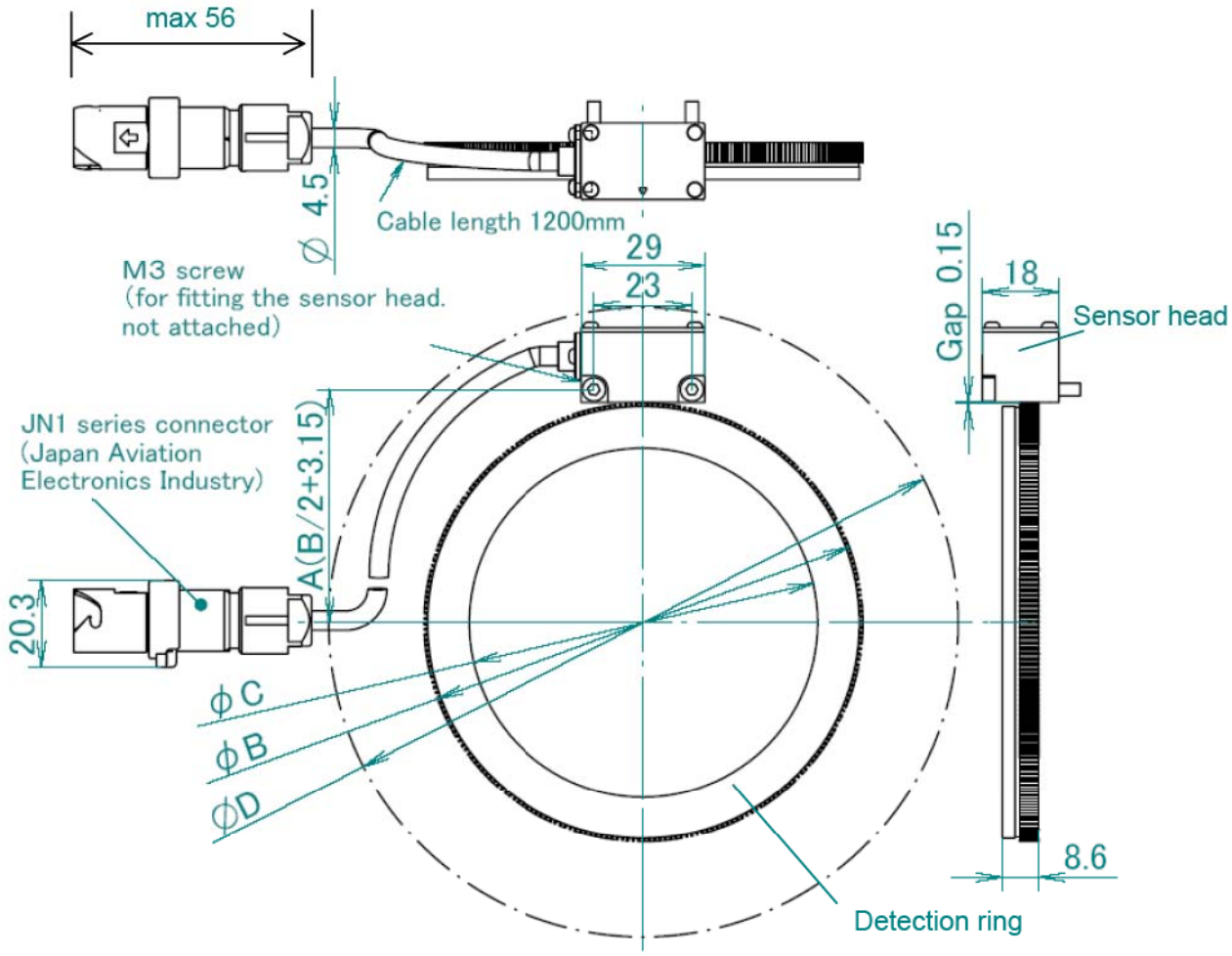
Note1: Please take care that the accuracy listed above is the typical amount and it is not guaranteed.

Note2: The amount of the accuracy mentioned above does not include the influence of the error caused by the radial eccentricity in the installation of the detection ring.
The error amount caused by the radial eccentricity in the installation of the detection ring is calculated as follows.

Error amount (deg.)=360A(mm)/B(mm)
A: Radial eccentricity of the machine spindle or sleeve in the area where the detection ring is installed.
B: Length of the outer diameter of the detection ring

e.g. In case that the radial eccentricity of the spindle is 0.005mm with the 256λ detection ring (outer diameter: ϕ103.2), the error amount is;
0.005X360/(103.2Xπ)=0.0055(deg.)

(6) Outline Drawing



Accessories: parallel pins (ϕ3m6 length 6), feeler gage (t=0.15mm)

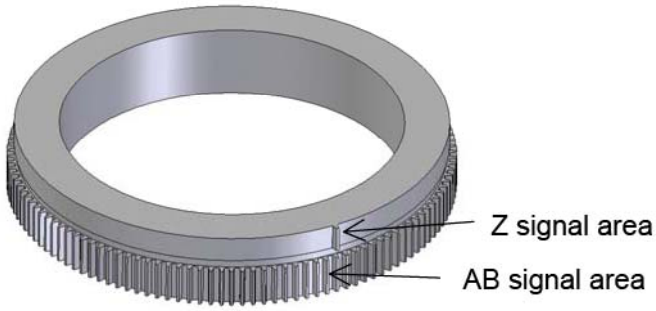
unit[mm]

Sensor drawing No.	Number of teeth	A	ϕB (the external diameter of the detection ring)	ϕC (the internal diameter of the detection ring)	ϕD (the external diameter of BZ*i* sensor)
A860-2150-T201 A860-2150-T211	128	29.15	$52^{+0}_{-0.020}$	$40^{+0.016}_{-0}$	98
A860-2150-T311	192	41.95	$77.6^{+0}_{-0.020}$	$60^{+0}_{-0.018}$	122
A860-2150-T401 A860-2150-T411	256	54.75	$103.2^{+0}_{-0.020}$	$82^{+0}_{-0.018}$	148
A860-2150-T511	384	80.35	$154.4^{+0}_{-0.020}$	$125^{+0.025}_{-0}$	198
A860-2150-T611	512	105.95	$205.6^{+0}_{-0.020}$	$160^{+0.020}_{-0.005}$	249

NOTE
- The maximum permissible temperature is 80deg.
- The BZ*i* sensor is precision device, so please be very careful in its handling. In particular, don't apply shock or stress to the sensor head.
- Attach and fix the sensor cable to the machine to prevent the direct tensile stress to the sensor head.
- The waterproof performance of the BZ*i* sensor is IP 67. But please notice that the waterproof performance prescribed by the IP rating is limited to the situation that the subject is water and the time of exposure is short, and it is not a guarantee. Please apply a cover or take some kind of countermeasure like that so that the coolant does not splash on the sensor head directly
- In installing the BZ*i* sensor, make sure that the regulations in (8) are satisfied.
- To ensure ease of maintenance, install a sensor in a location where it can be replaced easily.
- The detection ring of the BZ*i* sensor can be exchanged to another detection ring of the same drawing number.

Note about the detection ring

The detection ring of BZ*i* sensor has the Z signal area and the AB signal area, which is integrated in one ring. The Z signal area of the detection ring consists of the convex projection shape and the AB signal area consists of the gear shape. In the handling of the detection ring, please be careful to avoid the chipping or the deformation of its outer tip.



(7) Interference amount for Shrink Fitting

The table below indicates the interference amount of shrink fitting for each specification to the rotational speed.

Unit: μm

Maximum speed (min^{-1})	T201	T211	T311	T401	T411	T511	T611
3000	φ6～φ32	φ6～φ32	φ6～φ34	φ7～φ35	φ7～φ35	φ8～φ43	φ11～φ41
3500	↓	↓	↓	↓	↓	φ9～φ44	φ13～φ43
4500	↓	↓	↓	↓	↓	φ11～φ46	φ19～φ49
6000	↓	↓	φ7～φ35	φ9～φ37	φ9～φ37	φ15～φ50	φ29～φ59
8000	↓	↓	φ8～φ36	φ11～φ39	φ11～φ39	φ24～φ59	φ47～φ77
10000	↓	↓	φ9～φ37	φ14～φ42	φ14～φ42	φ35～φ70	φ71～φ101
12000	φ7～φ33	φ7～φ33	φ11～φ39	φ18～φ46	φ18～φ46	φ47～φ82	
15000	φ8～φ34	φ8～φ34	φ13～φ41	φ26～φ54	φ26～φ54	φ71～φ106	
20000	φ10～φ36	φ10～φ36	φ19～φ47		φ41～φ69		
25000		φ12～φ38	φ27～φ55		φ62～φ90		
30000		φ15～φ41	φ37～φ65		φ87～φ115		
40000		φ23～φ49	φ61～φ89				
50000		φ33～φ59					
60000		φ43～φ69					
70000		φ57～φ83					

NOTE

- Appropriate interference amount of the shrink fitting should be selected in accordance with the maximum rotational speed of the machine and the kind of the applied sensor. Inappropriate interference amount may cause the idle running of the detection ring or the malfunction.
- The detection rings cannot be used at a excessive speed than the maximum speed which appears in the table above.

(8) Installation

(8)-1 Abstruct

BZ*i* sensor should be installed in the following procedure.

1. Insert and attach the parallel pins to the sensor mounting surface of the spindle. ((8)-2)
2. Attach the detection ring to the spindle shaft (or the sleeve) by shrink fitting. ((8)-3)
3. Adjust the gap between the sensor head and the detection ring, and fix the sensor head to the spindle. ((8)-4)

Fig.1 shows the schematic drawing of the components of the BZ*i* sensor, and Fig.2 shows the schematic drawing of the BZ*i* sensor after installed.

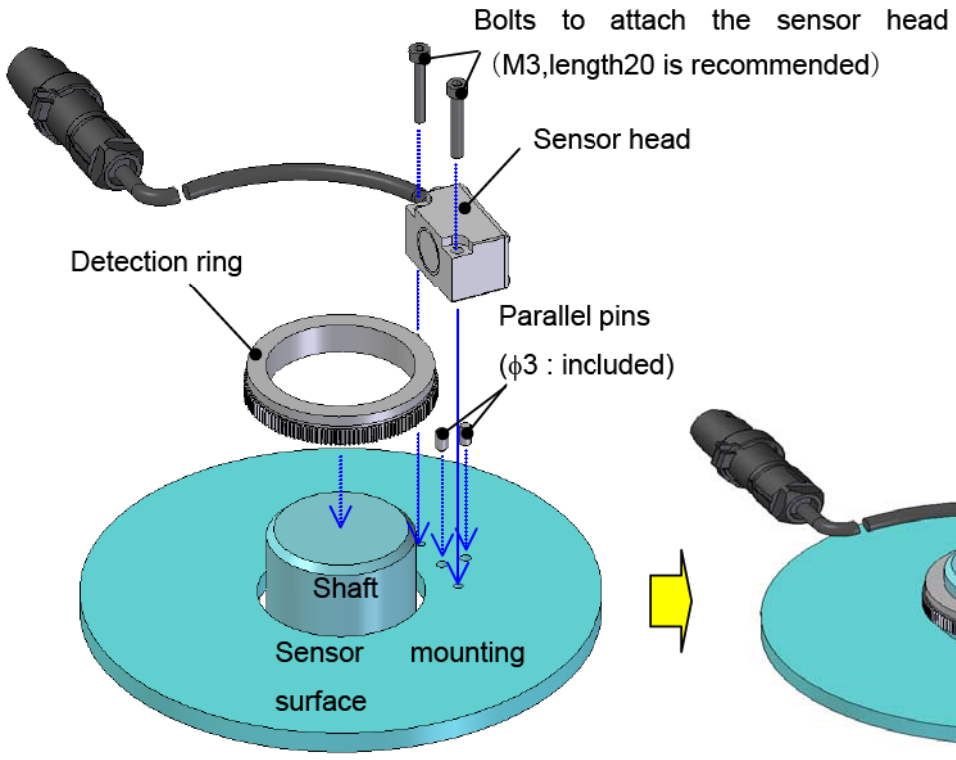


Fig.1

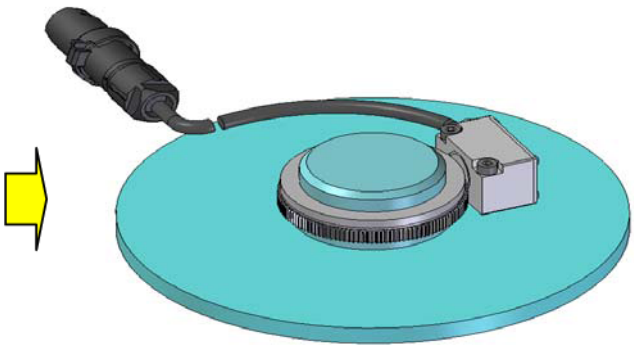


Fig.2

				TITLE	BZ*i* Sensor
01	04.07.05	NAGATOMO	NEW	DRAW. No.	B-65282EN/05-06
EDIT	DATE	DESIGN	DESCRIPTION	FANUC LTD	Page 7/11

(8)-2 Dimensions on the sensor mounting surface

Machine the hole and the tap on the sensor mounting surface as shown in fig. 3. Insert the parallel pins in the 2-ϕ3H6 holes. Parallel pins are used as a guide in adjusting the gap between the sensor head and the detection ring explained as mentioned in this document later.

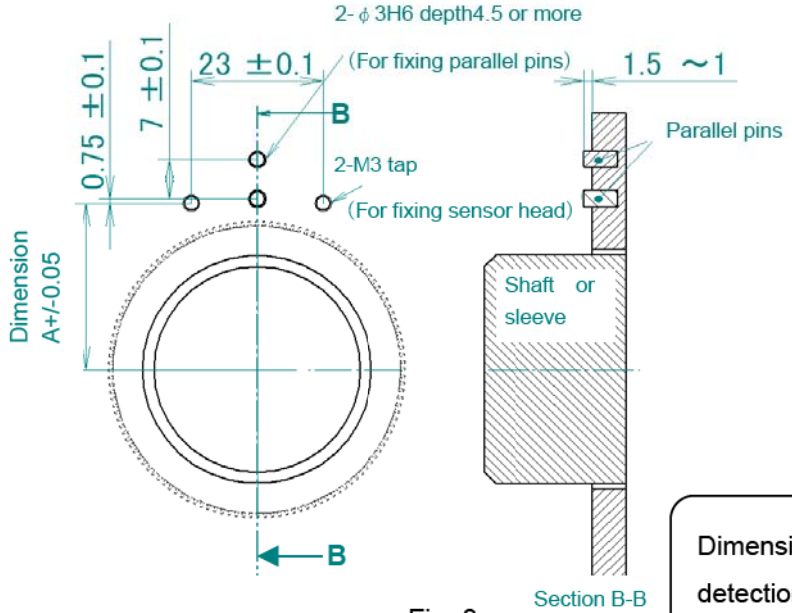


Fig. 3

Dimension A: Outer diameter of detection ring /2+3.15

(8)-3 Dimensions about installation of the detection ring

The detection ring should be attached to the spindle shaft or sleeve by heat shrink fitting in the position that the distance between the AB signal end surface of the detection ring and the sensor mounting surface is 4.7mm plus/minus 0.2mm as shown in Fig.4. Radial eccentricity of the spindle shaft or sleeve in the area where the detection ring is attached should be less than 0.005mm

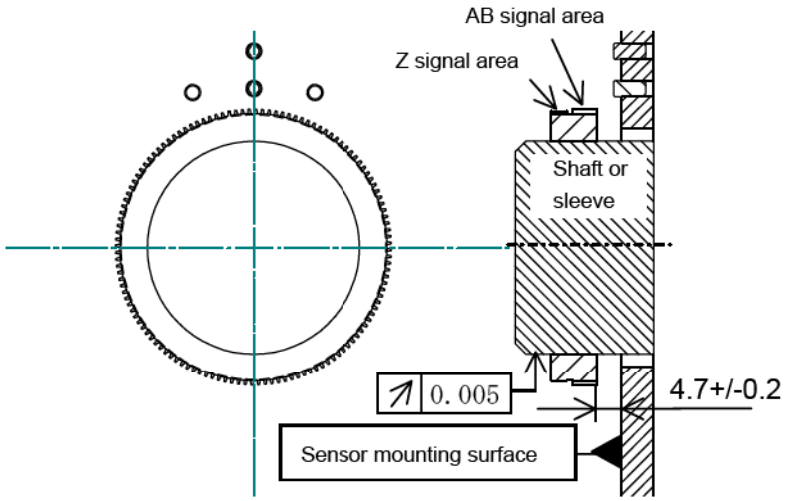


Fig. 4

(8)-4 The installation of the sensor head

The installation method of BZ*i* sensor is described below.

① Attach the sensor head to the sensor mounting surface so that the groove on the sensor head is engaged with the parallel pins, and fix the sensor head temporally. Be careful that the detection ring does not strike the sensor head in installing.

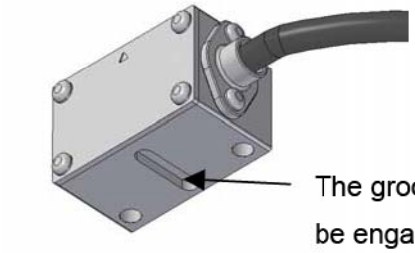


Fig.5

② Put the feeler gage (included: t=0.15mm) between the detection ring and the sensor head. Push the sensor head to the detection ring lightly and fix the sensor head firmly (recommended fastening torque: 1.3Nm +/- 10%). Use of some kind of thread locker is recommended to prevent loosening of the screw to fix the sensor head.

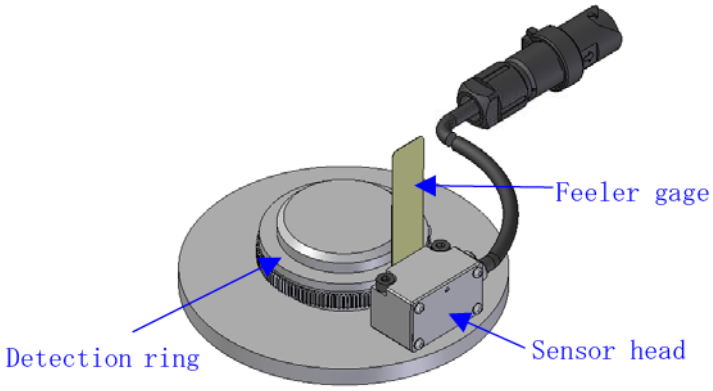


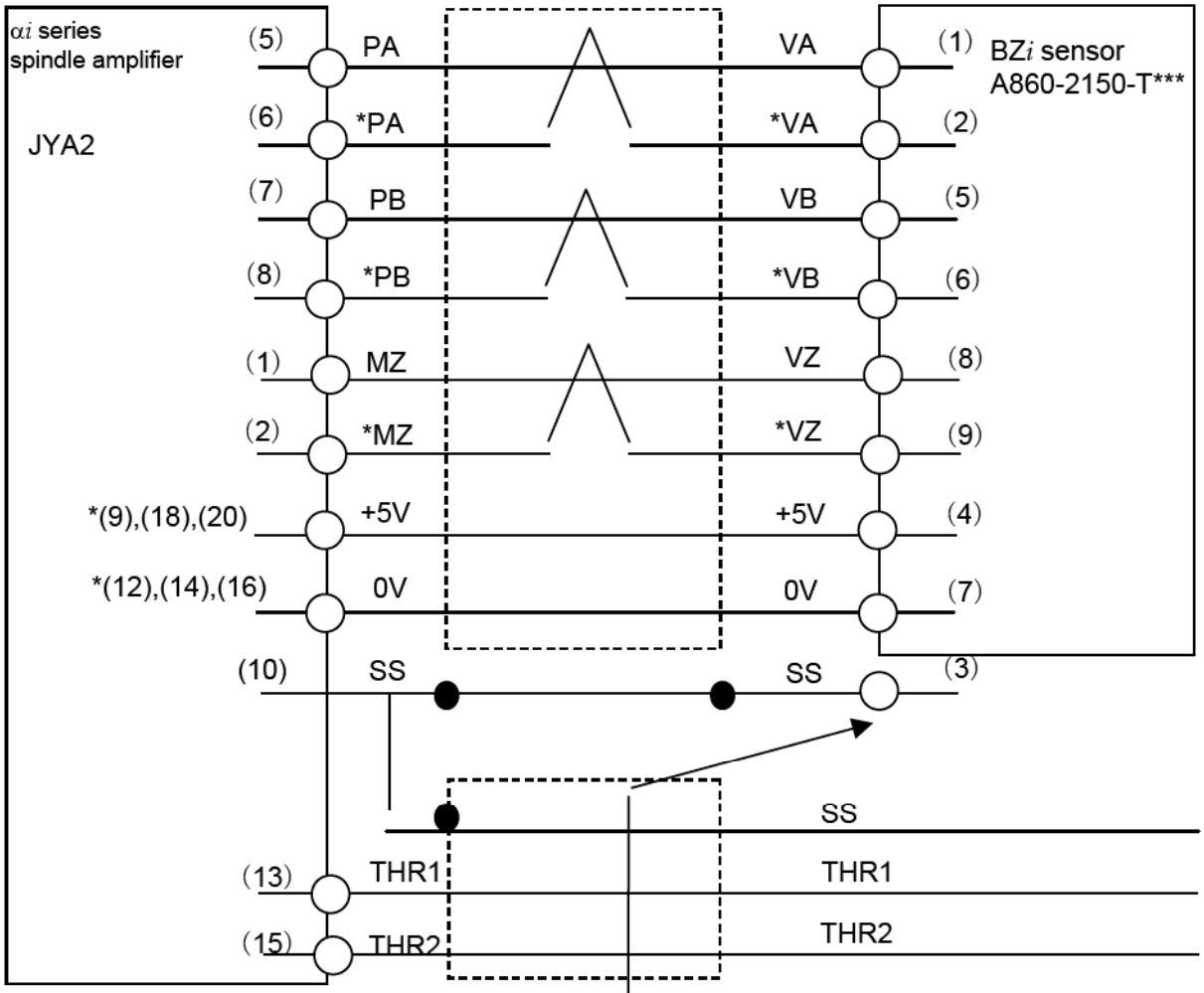
Fig.6

③ Pull off the feeler gage. Rotate the spindle slowly and check that the detection ring does not contact with the sensor head.

④ Confirm the gap between the sensor head and the detection ring is more than 0.1mm.

⑤ The BZ*i* sensor is so designed that the output voltage of the sensor is within the permissible amount. But there is a possibility of that the voltage does not satisfies the specification with the inappropriate installation.
Check that the output voltage satisfies the signal specification described in FANUC BUILT-IN AC SPINDLE MOTOR αi series (B-65292EN), chapter II

(9) Connection



Connector example

Connector : FI40A-20S (Hirose Electronics)
Housing : FI-20-CV5 (Hirose Electronics)

Connector (Japan Aviation Electronics)
JN2DS10SL1 : applicable sheath diameter ϕ 5.7- ϕ 7.3
JN2DS10SL2 : applicable sheath diameter ϕ 6.5- ϕ 8.0
Contact (Japan Aviation Electronics)
JN1-22-22S (signal line)
JN1-22-20S (power line)

Recommended cable : A66L-0001-0482

Cable length	28m or shorter
5V,0V	0.3mm^2 (connected to one of the line with *)
VA,*VA,VB,*VB,VZ,*VZ	0.2mm^2 each twisted paired