



# Artificial Life on Robot

## Expert Group on Force/Torque sensor

- Torque Sensor
- Force/Torque sensor
- Predictive Maintenance
- Intelligent Control
- Smart Factory



## 目次

- P3. ABOUT AL. Robot 会社紹介
- P4. INNOVATIVE Torque Sensor 製品紹介  
**3S2H**
- P5. TSR-J series 関節型トルクセンサー  
TSR-J series - 600Nm  
TSR-J series - 400Nm  
TSR-J series - 300Nm  
TSR-J series - 200NM  
TSR-J series - 150Nm  
TSR-J series - 100Nm  
TSR-J series - 50Nm  
TSR-J series - 10Nm . . . 容量順
- P13. TSR-J series overall Technical Data まとめ
- P14. FTR-M series 6軸力・トルクセンサー  
FTR-M series - 1000N\_50Nm  
FTR-M series - 300N\_30Nm  
FTR-M series - 150N\_10Nm
- P17. PC Interface & Software モニタリング
- P18. TSR-J & FTR-M series Application 適用分野



## ABOUT AL. Robot

AL. Robot (エーエルロボット) は、ロボットに必要な力・トルクセンサーを開発および製造する専門メーカーです。お客様のニーズに応じて迅速にカスタマイズおよび開発できる経歴30年以上のプロフェッショナルエンジニアが集まり、2017年に設立しました。

現在の主力商品は容量10～600Nmの関節型トルクセンサーと6軸力・トルクセンサーで、機械学習(Machine Learning)アルゴリズムを活用したキャリブレーション装置などの検査自動化装置を開発・運用し、高品質・高性能の製品をロボットメーカーに提供しています。当社の関節型トルクセンサーと6軸力・トルクセンサーは、大手ロボット製造会社から優れた性能と高信頼性、特に軽量・小型・薄型で認められ、産業用ロボットや協働ロボットに活用されております。

今後とも常に顧客満足を第一に考え、世界一のセンサー技術企業となることをお約束します。



# INNOVATIVE Torque Sensor

製品紹介

## 3S2H

- Slim, Strong & Smart
- HIGH PRECISION & HIGH RELIABILITY

### 1. Slim

- 小さく薄い
- 軽い

### 2. Strong

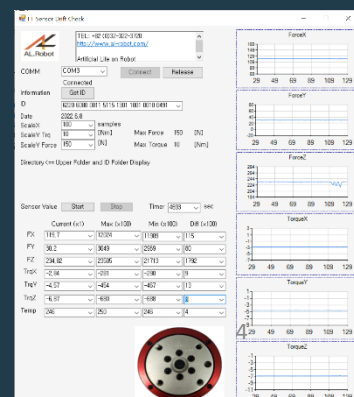
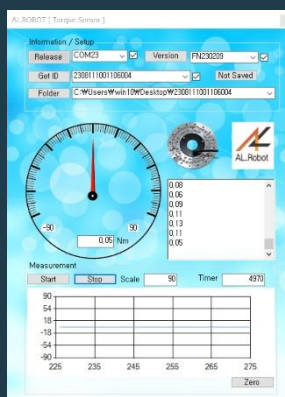
- ハーモニックドライブより3倍以上高い剛性
- オーバーロード安全性

### 3. Smart & Intelligent

- AI based algorithm
- Cross-talk cancelation algorithm
- Environment Compensation

### 4. Total Solution

- 多様な通信プロトコル
- Real-time monitoring S/W





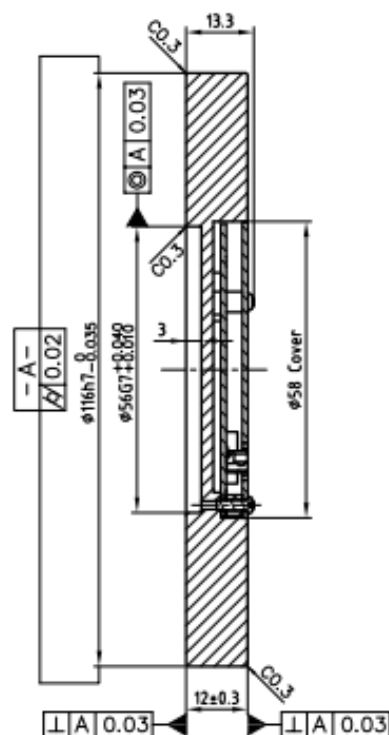
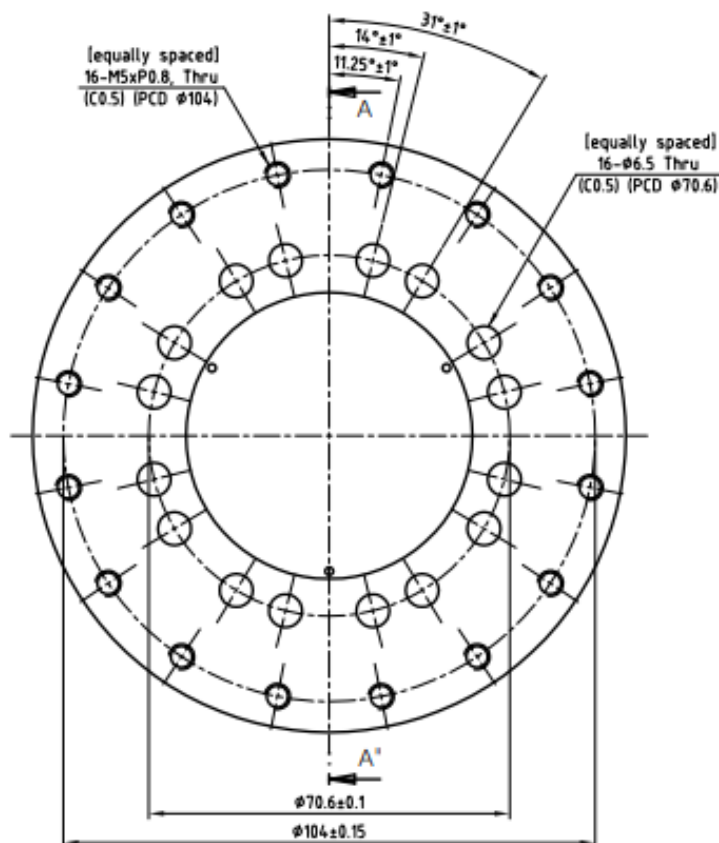
# TSR-J series – 600Nm

外径 :  $\varnothing 116\text{mm}$   
 厚さ : 12mm  
 重さ : 340g



## Specifications

Rated Load	600Nm
Safety Overload	300%
Torsional Stiffness	16,843 Nm/°
Diameter	$\varnothing 116\text{mm}$
Weight	340g
Height	12mm
Resolution	0.01Nm
Accuracy	<0.2%FS
NonLinearity	<0.2%FS
Hysteresis	<0.2%FS
Repeatability	<0.2%FS
Operating Temperature	-10°C~60°C
Thermal Zero Shift	<0.1%FS/10°C
Supply Power Voltage	DC 5V
Communication	RS485, CAN



Section A-A"

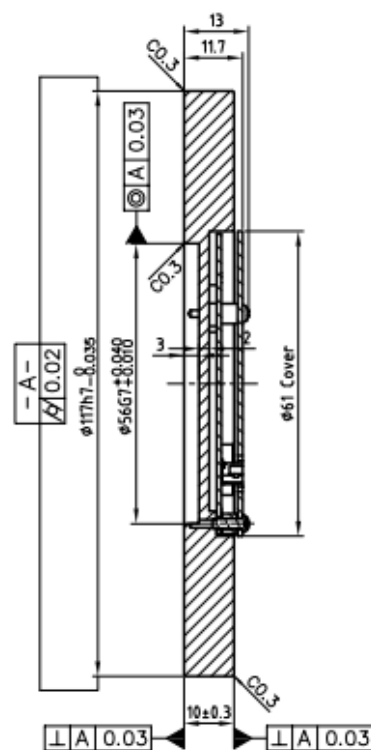
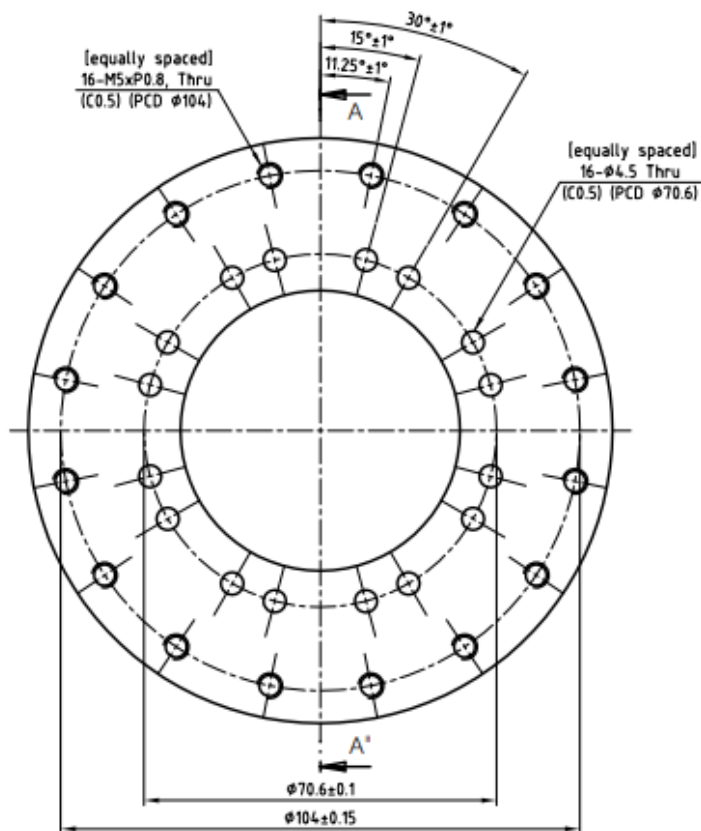
# TSR-J series – 400Nm

外径 :  $\varnothing 117\text{mm}$   
 厚さ : 10mm  
 重さ : 270g



## Specifications

Rated Load	400Nm
Safety Overload	300%
Torsional Stiffness	11,300 Nm/°
Diameter	$\varnothing 117\text{mm}$
Weight	270g
Height	10mm
Resolution	0.01Nm
Accuracy	<0.2%FS
NonLinearity	<0.2%FS
Hysteresis	<0.2%FS
Repeatability	<0.2%FS
Operating Temperature	-10°C~60°C
Thermal Zero Shift	<0.1%FS/10°C
Supply Power Voltage	DC 5V
Communication	RS485, CAN



Section A-A<sup>6</sup>

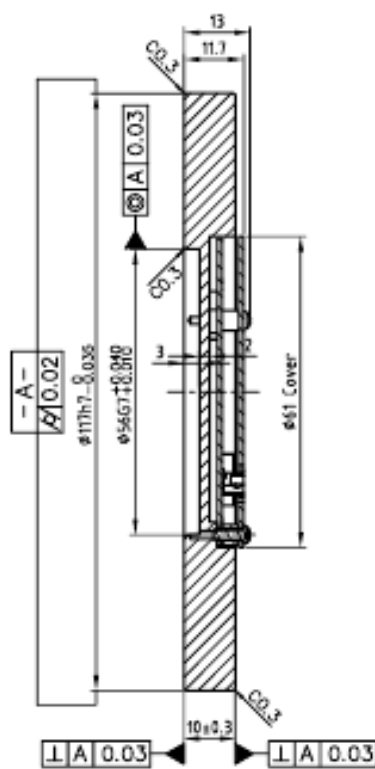
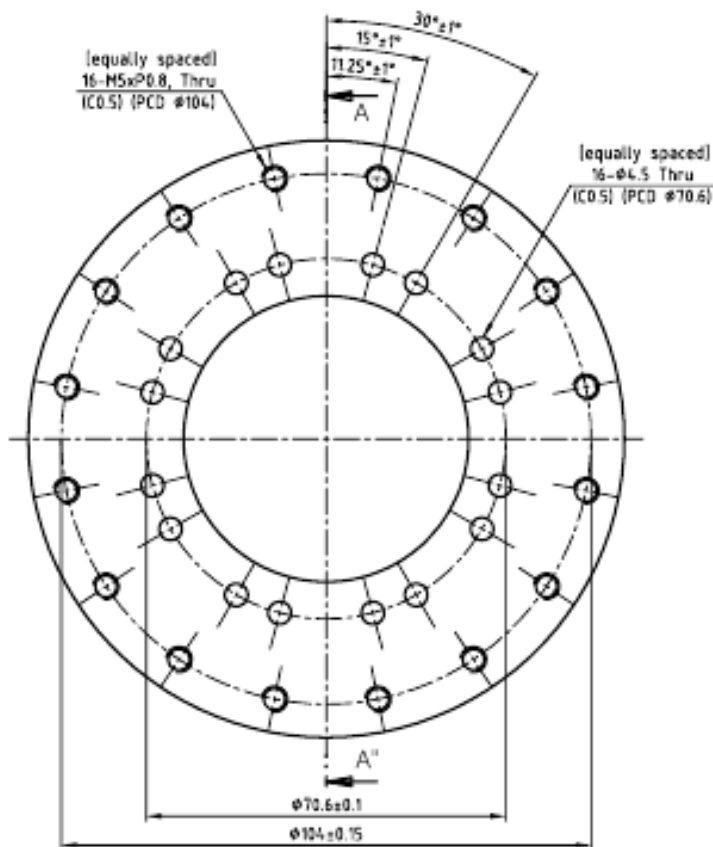
# TSR-J series – 300Nm

外径 :  $\varnothing 117\text{mm}$   
 厚さ : 10mm  
 重さ : 270g



## Specifications

Rated Load	300Nm
Safety Overload	300%
Torsional Stiffness	8,600 Nm/°
Diameter	$\varnothing 117\text{mm}$
Weight	270g
Height	10mm
Resolution	0.01Nm
Accuracy	<0.2%FS
NonLinearity	<0.2%FS
Hysteresis	<0.2%FS
Repeatability	<0.2%FS
Operating Temperature	-10°C~60°C
Thermal Zero Shift	<0.1%FS/10°C
Supply Power Voltage	DC 5V
Communication	RS485, CAN



Section A-A\* 7

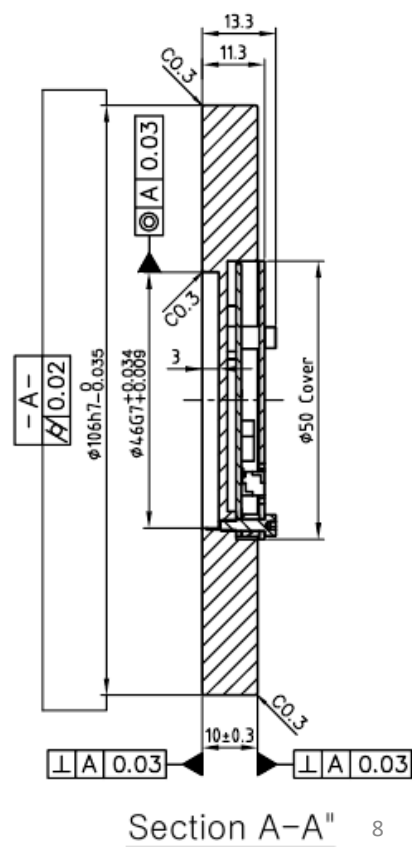
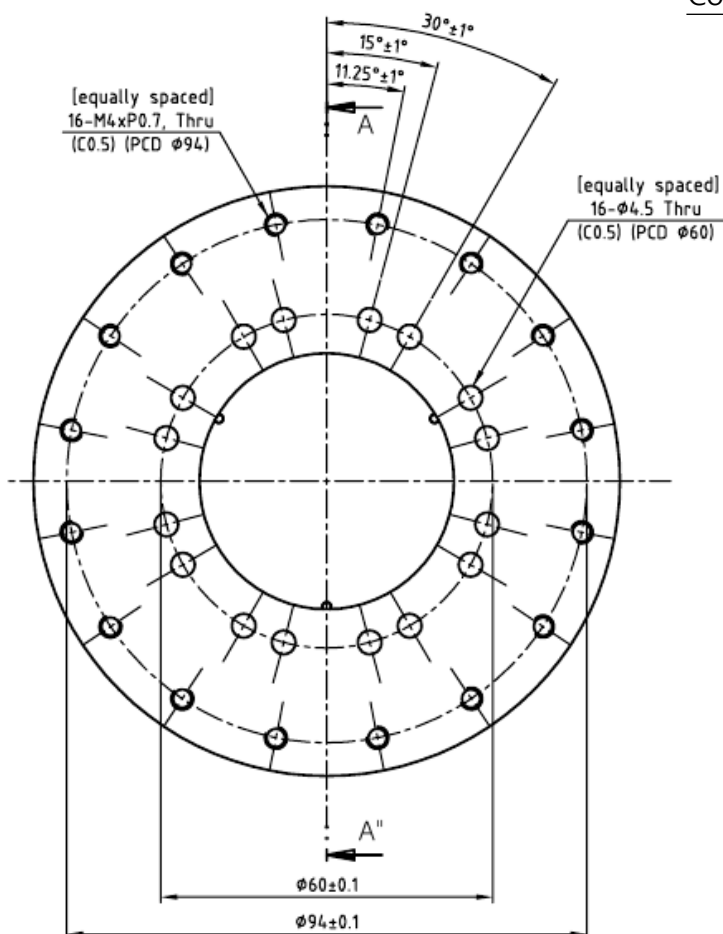
# TSR-J series – 200Nm

外径 :  $\varnothing 106\text{mm}$   
 厚さ : 10mm  
 重さ : 225g



## Specifications

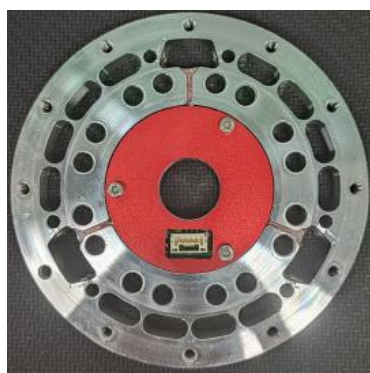
Rated Load	200Nm
Safety Overload	300%
Torsional Stiffness	5,800 Nm/°
Diameter	$\varnothing 106\text{mm}$
Weight	225g
Height	10mm
Resolution	0.01Nm
Accuracy	<0.2%FS
NonLinearity	<0.2%FS
Hysteresis	<0.2%FS
Repeatability	<0.2%FS
Operating Temperature	-10°C~60°C
Thermal Zero Shift	<0.1%FS/10°C
Supply Power Voltage	DC 5V
Communication	RS485, CAN





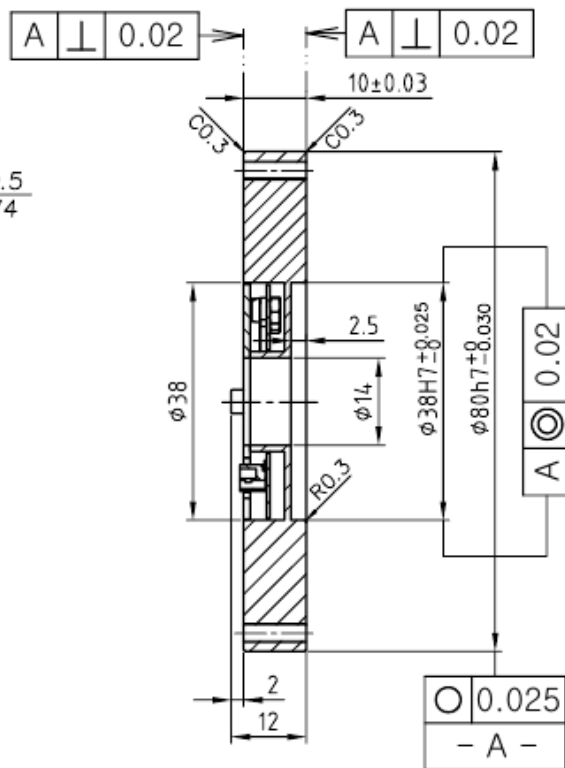
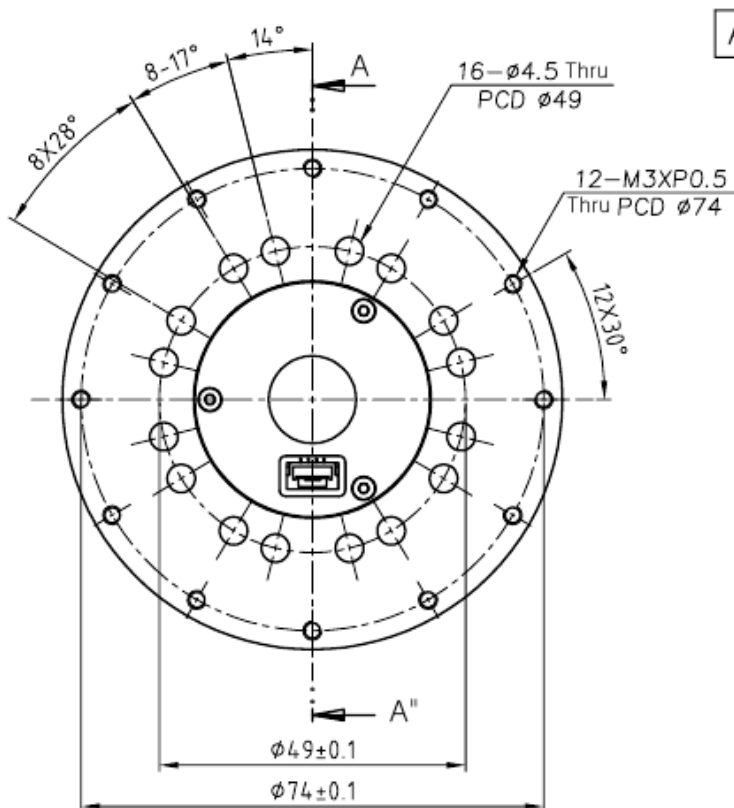
# TSR-J series – 150Nm

外径 :  $\varnothing 80\text{mm}$   
 厚さ : 10mm  
 重さ : 135g



## Specifications

Rated Load	150Nm
Safety Overload	300%
Torsional Stiffness	2,870 Nm/°
Diameter	$\varnothing 80\text{mm}$
Weight	135g
Height	10mm
Resolution	0.01Nm
Accuracy	<0.2%FS
NonLinearity	<0.2%FS
Hysteresis	<0.2%FS
Repeatability	<0.2%FS
Operating Temperature	-10°C~60°C
Thermal Zero Shift	<0.1%FS/10°C
Supply Power Voltage	DC 5V
Communication	RS485, CAN



Section A-A'

# TSR-J series – 100Nm

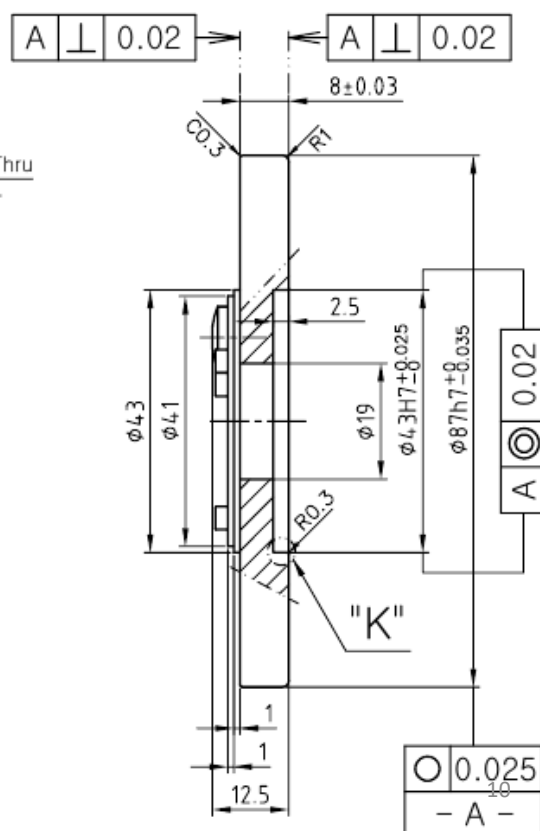
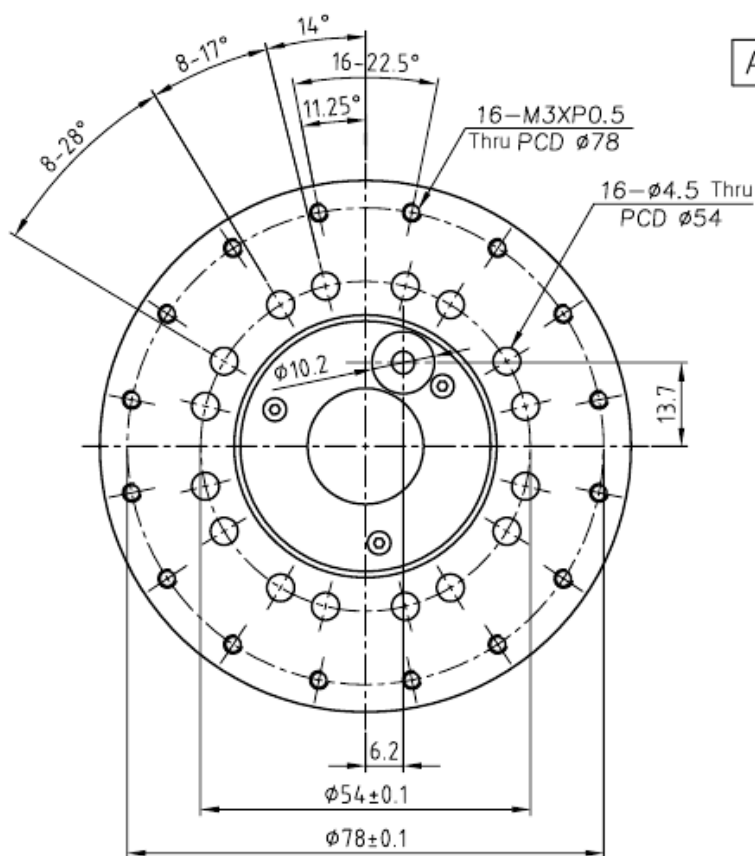
外径 :  $\varnothing 87\text{mm}$   
 厚さ : 8mm  
 重さ : 140g



## Specifications

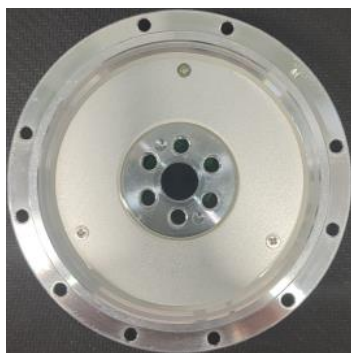
Rated Load	100Nm
Safety Overload	300%
Torsional Stiffness	1,520 Nm/°
Diameter	$\varnothing 87\text{mm}$
Weight	140g
Height	8mm

Resolution	0.01Nm
Accuracy	<0.2%FS
NonLinearity	<0.2%FS
Hysteresis	<0.2%FS
Repeatability	<0.2%FS
Operating Temperature	-10°C~60°C
Thermal Zero Shift	<0.1%FS/10°C
Supply Power Voltage	DC 5V
Communication	RS485, CAN



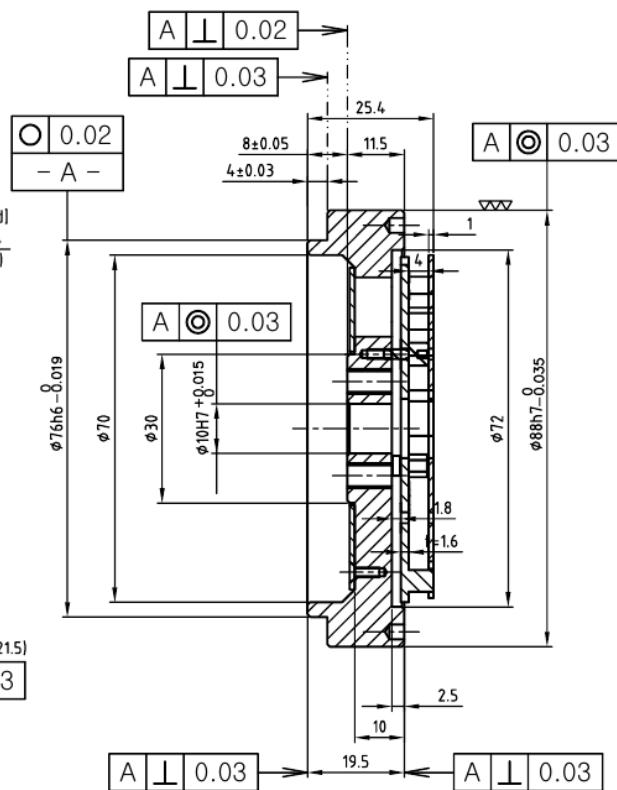
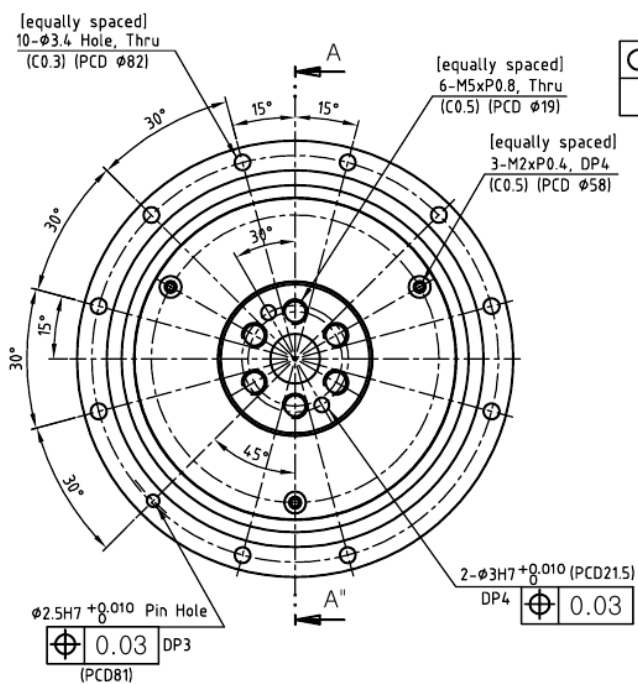
# TSR-J series – 50Nm

外径 :  $\varnothing 88\text{mm}$   
 厚さ :  $19.5\text{mm}$   
 重さ :  $200\text{g}$



## Specifications

Rated Load	50Nm
Safety Overload	300%
Torsional Stiffness	$873\text{Nm}/^\circ$
Diameter	$\varnothing 88\text{mm}$
Weight	200g
Height	19.5mm
Resolution	0.01Nm
Accuracy	$<0.2\%\text{FS}$
NonLinearity	$<0.2\%\text{FS}$
Hysteresis	$<0.2\%\text{FS}$
Repeatability	$<0.2\%\text{FS}$
Operating Temperature	$-10^\circ\text{C} \sim 60^\circ\text{C}$
Thermal Zero Shift	$<0.1\%\text{FS}/10^\circ\text{C}$
Supply Power Voltage	DC 5V
Communication	RS485, CAN



Section A-A''

# TSR-J series – 10Nm

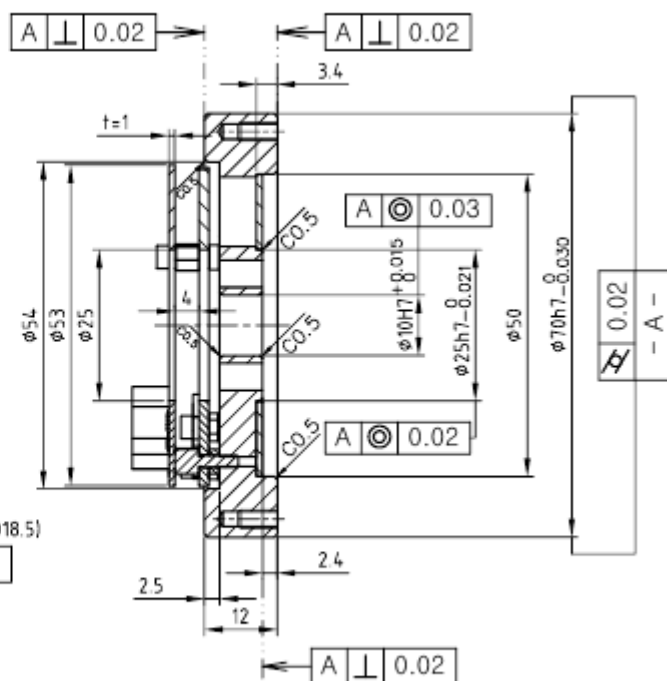
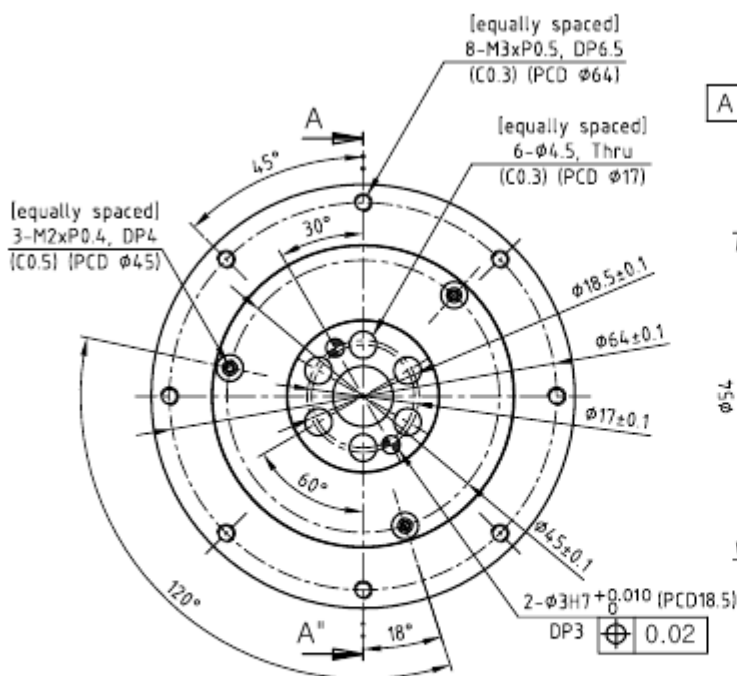
外径 :  $\varnothing 70\text{mm}$   
 厚さ : 12mm  
 重さ : 94g



## Specifications

Rated Load	10Nm
Safety Overload	300%
Torsional Stiffness	420Nm/°
Diameter	$\varnothing 70\text{mm}$
Weight	94g
Height	12mm

Resolution	0.01Nm
Accuracy	<0.2%FS
NonLinearity	<0.2%FS
Hysteresis	<0.2%FS
Repeatability	<0.2%FS
Operating Temperature	-10°C~60°C
Thermal Zero Shift	<0.1%FS/10°C
Supply Power Voltage	DC 5V
Communication	RS485, CAN



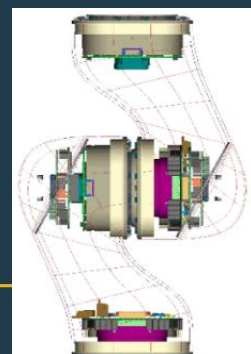
Section A-A"

## TSR-J series overall Technical Data

## まとめ

• Weight	95~375	g
• Safety Overload	300	%
• Insulation Resistance	2M	Ohm
• Supply Voltage	4.5~6.0	V
• Stiffness	23,435~877,664	Nm/rad
• Accuracy Class	0.1	%
• Linearity	0.1	%FS
• Repeatability	0.1	%FS
• Hysteresis	0.1	%FS
• Zero Balance	0.1	%FS
• Crosstalk	0.2	%
• Temperature effect Sensibility	0.01	%FS/K
• Operating temperature	-10 ~ 85	°C
• Storage temperature range	-40 ~ 130	°C

## Interface Type



- Mechanical Interface:
  - Suitable to harmonic drive
- Electrical interface:
  - Standard: CAN, RS485
  - Option: EtherCat, USB, SPI, I2C, etc.
- Maximum sampling frequency: 1.5kHz





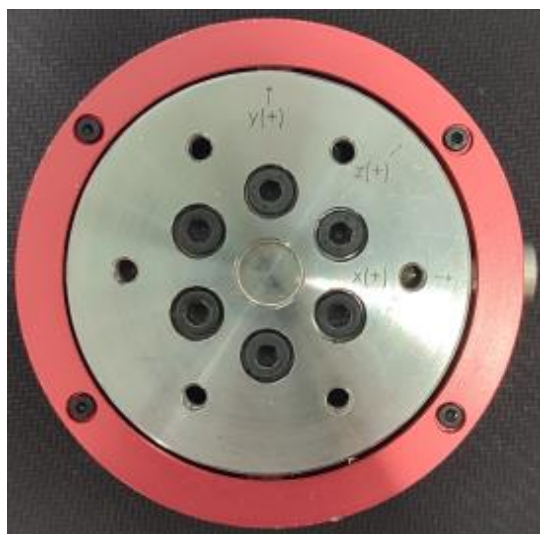
# FTR-M series – 1000N\_50Nm

## 6軸力・トルクセンサ

外径 : Ø90mm

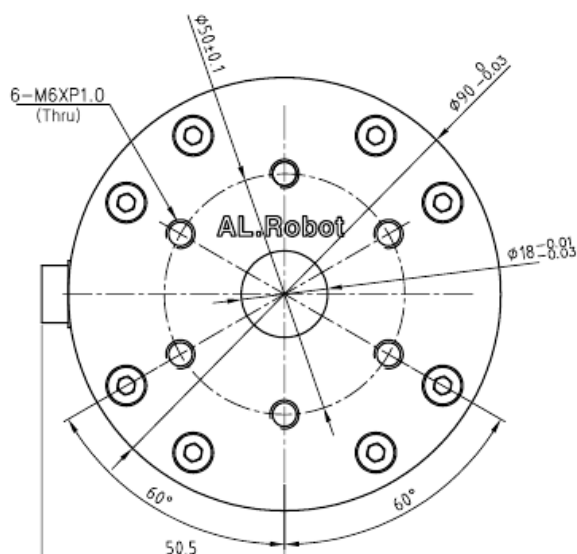
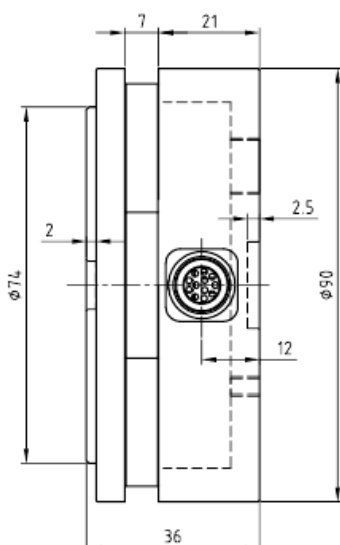
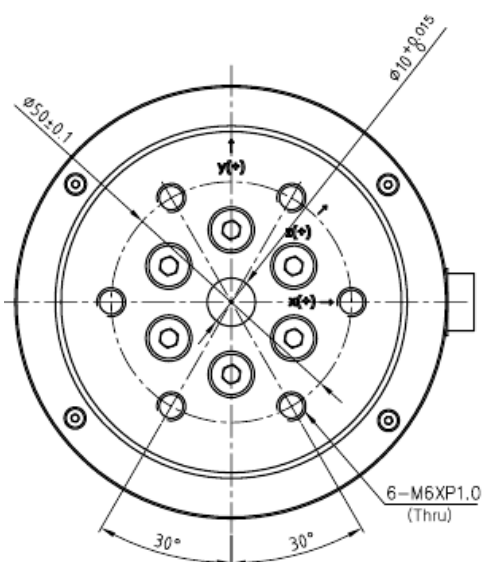
厚さ : 36mm

重さ : 840g



## Specifications

Rated Load	Fx,Fy	1000N
	Fz	2000N
	Tx,Ty,Tz	50Nm
Resolution	Fx,Fy	0.1N
	Fz	0.2N
	Tx,Ty,Tz	0.01Nm
Safety Overload	Fx, Fy	500%
	Fz	500%
	Tx, Ty, Tz	500%
Diameter		Φ90mm
Weight		840g±5g
Height		36mm
Operating Temperature		-10°C~60°C
Thermal Zero Shift		<0.1%FS/10°C
Supply Power Voltage		DC 5V
Communication		RS485, CAN



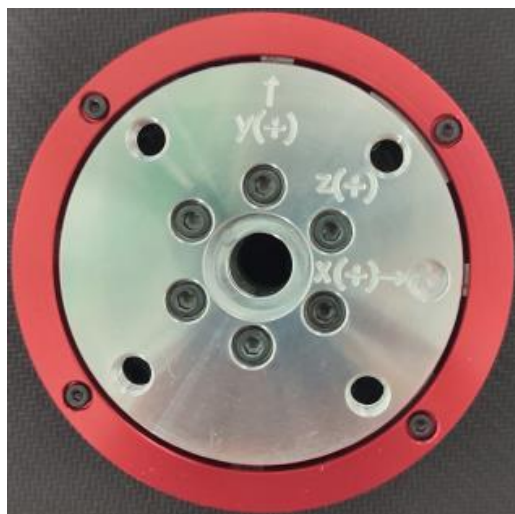
# FTR-M series – 300N\_30Nm

## 6軸力・トルクセンサ

外径：Ø75mm

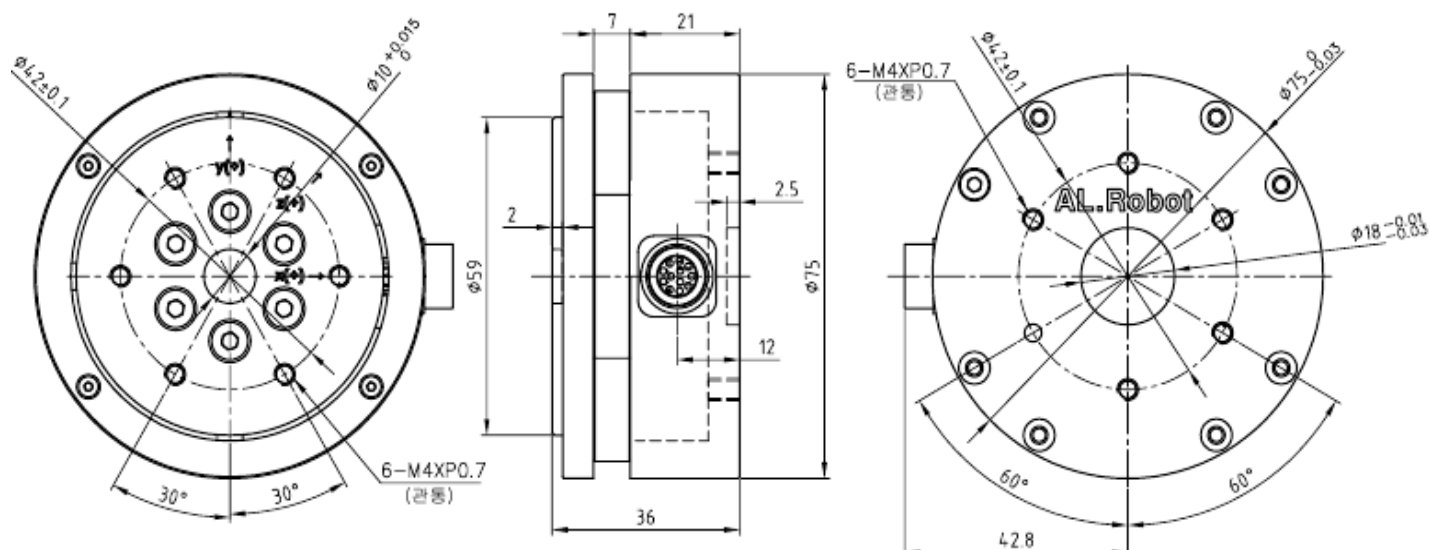
厚さ：36mm

重さ：390g



## Specifications

Rated Load	Fx, Fy	300N
	Fz	600N
	Tx, Ty, Tz	30Nm
Resolution	Fx, Fy	1/30N
	Fz	1/60N
	Tx, Ty, Tz	1/300Nm
Safety Overload	Fx, Fy	500%
	Fz	500%
	Tx, Ty, Tz	500%
Diameter		Ø75mm
Weight		390±5g
Height		36mm
Operating Temperature		-10°C~60°C
Thermal Zero Shift		<0.1%FS/10°C
Supply Power Voltage		DC 5V
Communication		RS485, CAN



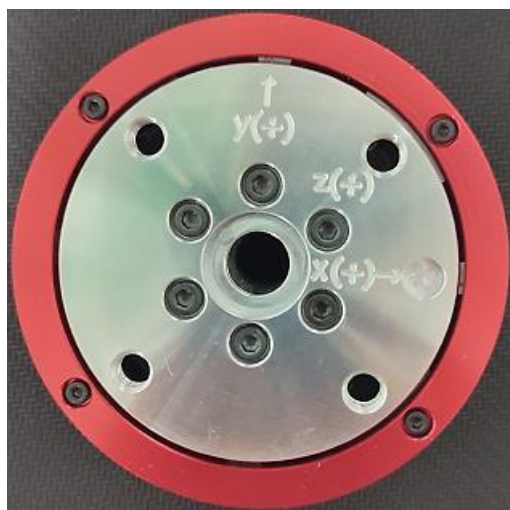
# FTR-M series – 150N\_10Nm

## 6軸力・トルクセンサ

外径：Ø75mm

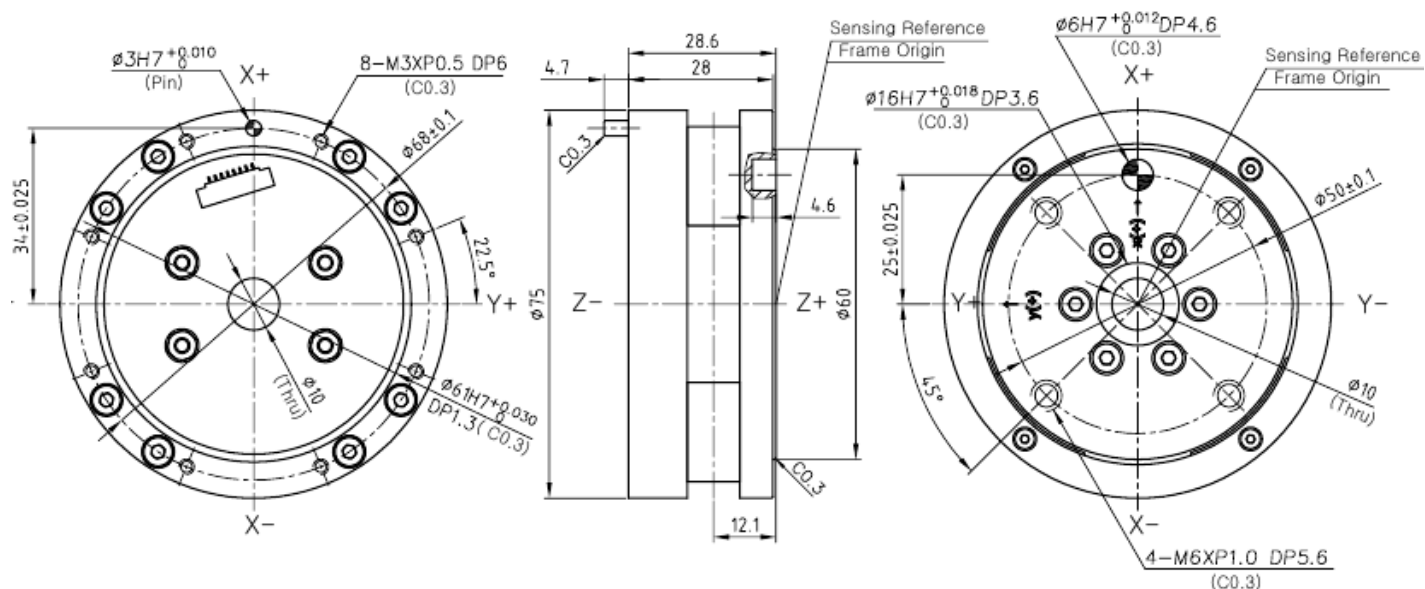
厚さ：28.6mm

重さ：265g



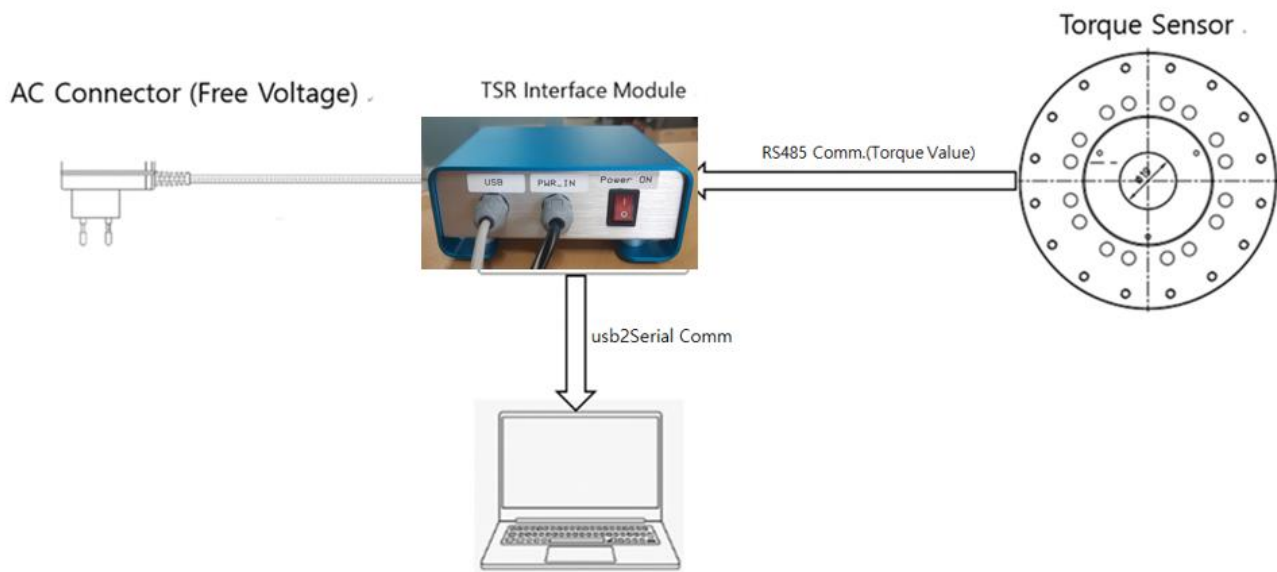
## Specifications

Rated Load	Fx, Fy	150N
	Fz	300N
	Tx, Ty, Tz	10Nm
Resolution	Fx, Fy	1/60N
	Fz	1/30N
	Tx, Ty, Tz	1/900Nm
Safety Overload	Fx, Fy	500%
	Fz	500%
	Tx, Ty, Tz	500%
Diameter		Ø75mm
Weight		265±5g
Height		28.6mm
Operating Temperature		-10°C~60°C
Thermal Zero Shift		<0.1%FS/10°C
Supply Power Voltage		DC 5V
Communication		RS485, CAN



# PC Interface & Software

# モニタリング



## PC UI for Torque sensor

## PC UI for Force/Torque sensor

AL.ROBOT [ Torque Sensor ]

Information / Setup

Release: COM23  Version: FN230209

Get ID: 2308111001106004  Not Saved

Folder: C:\Users\win10\Desktop\2308111001106004

0.08  
0.06  
0.09  
0.11  
0.13  
0.11  
0.05

Measurement

Start Stop Scale 90 Timer 4970

225 235 245 255 265 275

Zero

FT Sensor Drift Check

AL.Robot TEL: +82 (0)32-322-3720 <http://www.al-robot.com/>

Artificial Life on Robot

COMM: COM3

Information

Get ID

ID: 6220 6080 0011 5115 1301 1001 0010 0491

Date: 2022.6.8

ScaleX: 100 samples

ScaleY Trq: 10 [Nm] Max Force 150 [N]

ScaleY Force: 150 [N] Max Torque 10 [Nm]

Directory <= Upper Folder and ID Folder Display

Sensor Value   Timer 4693 sec

	Current (x1)	Max (x100)	Min (x100)	Diff (x100)
FX	119.7	12024	11909	115
FY	30.2	3049	2969	80
FZ	234.82	23505	21713	1792
TrqX	-2.84	-281	-290	9
TrqY	-4.57	-454	-467	13
TrqZ	-6.87	-680	-688	8
Temp	246	250	246	4



# TSR-J & FTR-M series

適用分野

## Robot



Mobile robot



Industrial robot



Wearable robot

## Medical



Rehabilitation



Haptic device



Medical robot

## Life



VR machine



PAS Bicycle



Auto mobile



Artificial Life on Robot



AL.Robot

AL. Robot Co. Ltd.  
655 Pyongcheon-ro, Bucheon  
Gyeonggi-do 14502 Korea  
[sales@al-robot.com](mailto:sales@al-robot.com)  
Phone: +82-32-322-3720  
FAX: +82-32-322-3721  
<http://www.al-robot.com>

販売  
株式会社パシフィック テクノロジー  
Tel: 047-426-1650 Fax: 047-426-1652  
E-mail : [sales@pac-tech.com](mailto:sales@pac-tech.com)  
〒273-0005 千葉県船橋市本町 6-18-5  
アサヒ船橋ビル 602