Contactless MEMS Tilt Angle Sensor

MIDORI **THD2000Z-D**

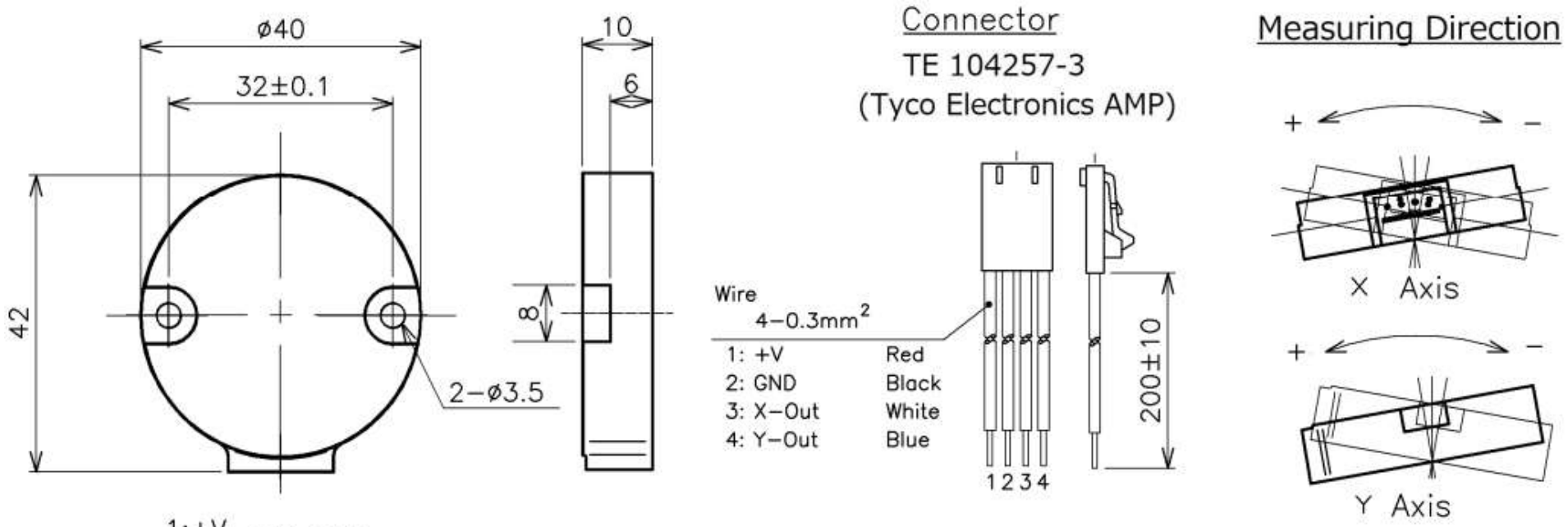
General

- Dual Axis Tilt Angle Sensor using MEMS Technology
- Effective Electrical Tilt Angle: ±30° (THD2030Z-D-)
  ±60° (THD2020Z-D-)
- Absolut Linearity: ±1%FS
- Digital Output (Serial Output RS-485)
- Stable Temperature Characteristic
- Built-in Connector
- Index Point Resetting Function (Option)
- Digital Damping Control Function (Option)

Material

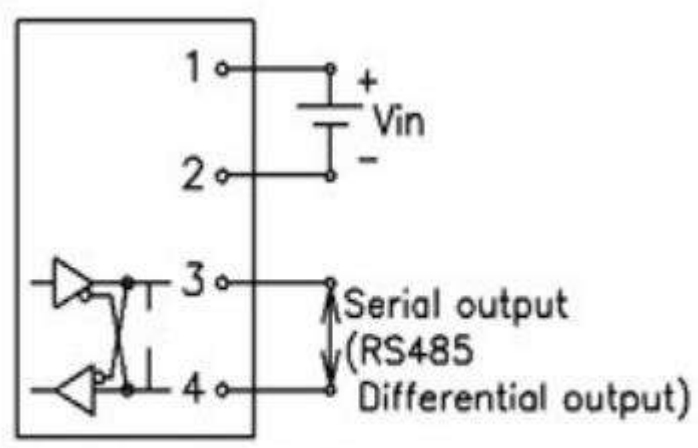
Housing: PBT

Dimension (mm)



Tarminal. 4pin,P=2.54

Schematic



• 1,2,3,4:Terminal No.

Specifications

	THD2000Z-D (Digital Output)
Effective Electrical Tilt Angle	±30°, ±60°
Absolute Linearity	±1%FS
Input Voltage	DC5±0.25V
Current Consumption	Steady-state: 30mA
Output Range	---
Output Resolution	0.001°(Not included noise)
Supply Current	10mA MAX.
Response Time	Step Response (Time Constant): 443ms (standard) Selectable time constant during 70ms~900ms in 16 steps (Option)
Temp. Characteristics **-20~80℃ (Ref. Temp.+25℃)**	**0° Position:** ±0.2° **Tilt Angle** @±30° : ±1.6° @±60° : ±4.4°
EMS	IEC61000-4-3: Level 3 (10V/m)
EMI	IEC61000-4-6: CISPR22_A_10m
ESD	IEC61000-4-2: ±16kV
Operating Temp. Range	-30~85℃
Vibration	70m/S2 5~500Hz (10min.) 2hours
Shock	1000m/S2, Half sine wave 6ms
IP Level	IP40
Index Point(±0°) Setting (OPTION)	Configurable within 0° ±5° range (Option)

Accessories

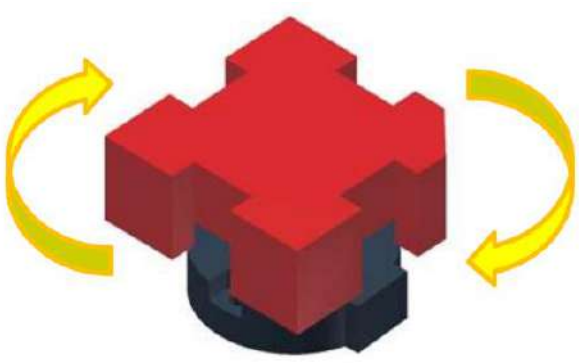
Connector: TE104257-3 (Tyco Electronics AMP) 1pc each

Special Functions

1. Index Point Resetting Function (Reconfiguring the Zero deg. Position)

① User-Configurable Adjustment Card* *Sold separetly

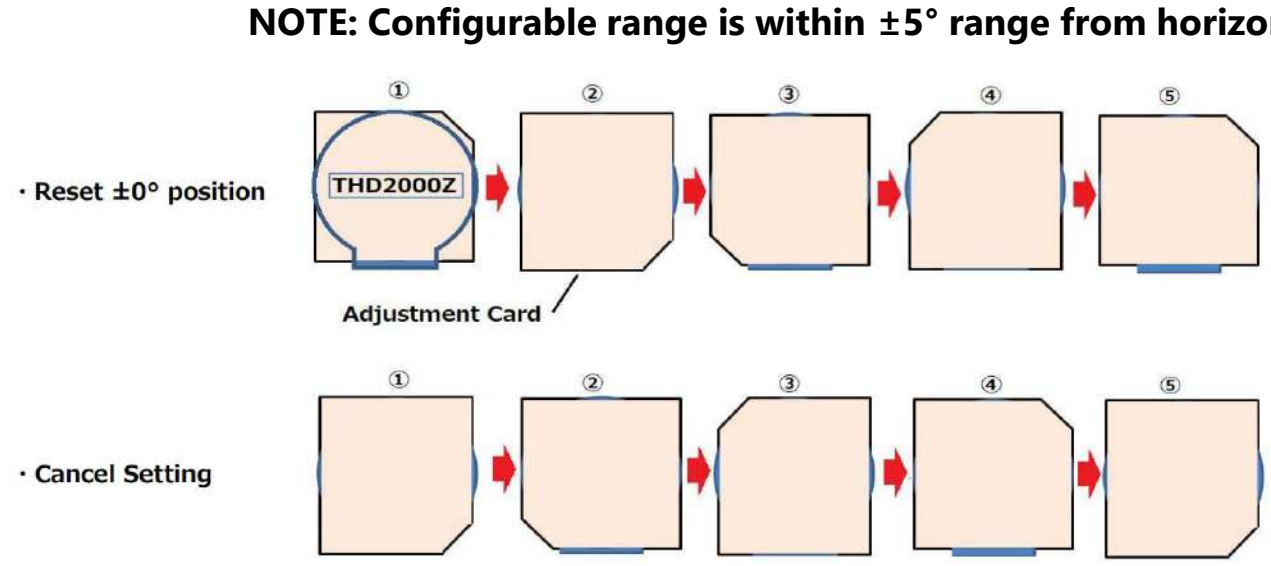
Reset to 0° position easily by using the User-Configurable Adjustment Card.



Placing the adjustment card on the THD2000Z for approx. one second and rotate it clockwise by 90degrees.

By repeating above manner 5 times, THD2000Z resets the current level as the ±0° position.

NOTE: Configurable range is within ±5° range from horizontal.



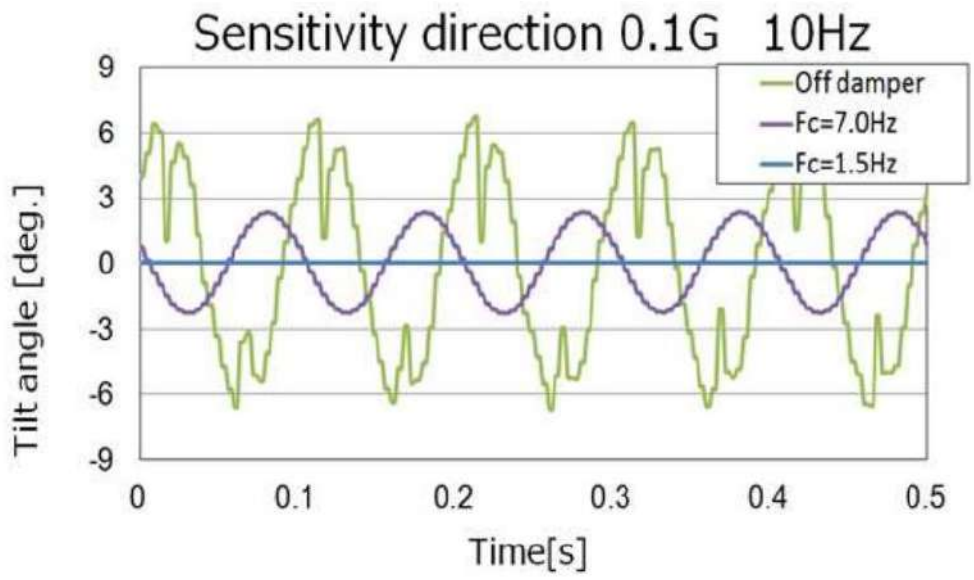
② Using the RS-485 communication protocol

The Index point can also be configured manually by using the RS-485 protocol.

NOTE: Configurable range is within ±5° range from horizontal.

2. Digital Damping Control Function

THD2000Z can apply a digital filter that removes external noise. You can select from 16 available setting.



Digital Damping Control Setting Value and Cut-off Frequency

Figures (Model#)	Digital Damping Level	Cut-off frequency (Hz)	Time constant (ms)
0	0	11.2Hz	60ms
1	1	9.27Hz	114ms
2	2	7.65Hz	126ms
3	3	6.32Hz	140ms
4	4	5.21Hz	156ms
5	5	4.30Hz	181ms
6	6	3.55Hz	205ms
7	7	2.93Hz	246ms
8	8	2.42Hz	277ms
9	9	2.00Hz	321ms
A	10	1.65Hz	378ms
B	11	1.36Hz	443ms(Standard)
C	12	1.21Hz	532ms
D	13	0.92Hz	627ms
E	14	0.76Hz	749ms
F	15	0.62Hz	900ms

NOTE: ***Configuring of the digital filter is enabled only at our factory.***
Please contact us for selection method of the digital filter level.

3. Serial Communication Function

The THD2000Z-D has a RS-485 as a serial interface.

Interface	RS-485 2 wires Master (Controller) ID: 0 Slave (Sensor) ID: 0001~9998 (9999: Broadcast) Up to 32 slaves can be multi-dropped to the same network cable.
Communication Speed	9600bps (default) or 115200bps
Format	Start bit: 1 bit Data: 8 bits Stop bit: 1 bit No Parity bit

Command Frame

DUMMY	'<'	ID	Space	Command	Space	Data	'>'	CRC	CR
0x2a	0x3c		0x20		0x20		0x3e		0x0d
(1)	(1)	(4)	(1)	(1~)	(1)	(1~)	(1)	(4)	(1)

Response Frame

DUMMY	'['	ID	Space	Command	Space	Data	Error Code	']'	CRC	CR
0x2a	0x5b		0x20		0x20			0x5d		0x0d
(1)	(1)	(4)	(1)	(1~)	(1)	(1~)	(3)	(1)	(4)	(1)

CRC

Using CRC instead of Parity.

The calculation object of the CRC is from ID to the data end.

CCIT CRC16

Bit length	16bit
Polynomial	1+X^5+X^12+x^16
Initial Value	0xFFFF
Feed	LSB First (right-feed)
Output operation	No output inverting

Error code

R00	No error
R01	Wrong command
R07	Violating value

Serial Command Functions

The following functions are available by serial commands:

1. Acquiring and Changing ID

Command Frame	<0001 ID 0032>
Response Frame	[0001 ID 0032 R00]
Data Value	0001 ~ 9999 Default: '0001'
Function	Change ID

2. Acquiring Serial Number

Command Frame	<0001 SERIAL>
Response Frame	[0001 SERIAL 123456789 R00]
Data Value	000000001 ~ 999999999
Function	Acquiring serial number

3. Acquiring Tilt Angle Data (Single Incidence)

Command Frame	<0001 A>
Response Frame	[0001 A "X" "Y" R00]
Data Value	"X" : X axis tilt angle data "Y" : Y axis tilt angle data -999.99 ~ 999.99 (deg.)
Function	Acquiring tilt angle data only once from ESC

4. Serially Acquiring Tilt Angle Data (Begin)

Command Frame	<0001 A_START>
Response Frame	[0001 A "X" "Y" R00]
Data Value	"X" : X axis tilt angle data "Y" : Y axis tilt angle data -999.99 ~ 999.99 (deg.)
Function	Start acquiring tilt angle data serially

5. Serially Acquiring Tilt Angle Data (End)

Command Frame	<0001 STOP>
Response Frame	[0001 STOP R00]
Function	Stop acquiring tilt angle data

6. Setting Output Cycle of Serial Data

If data is not attached to the command frame, the response frame will be the current setting value.

Command Frame	<0001 INTERVAL 200>
Response Frame	[0001 INTERVAL 200 R00]
Data Value	100 ~ 10000, Step Default: '200' (ms)
Function	Setting output cycle of serial data

100ms MAX. ⇒ Set baud rate at 115200

7. Resetting the Index Point

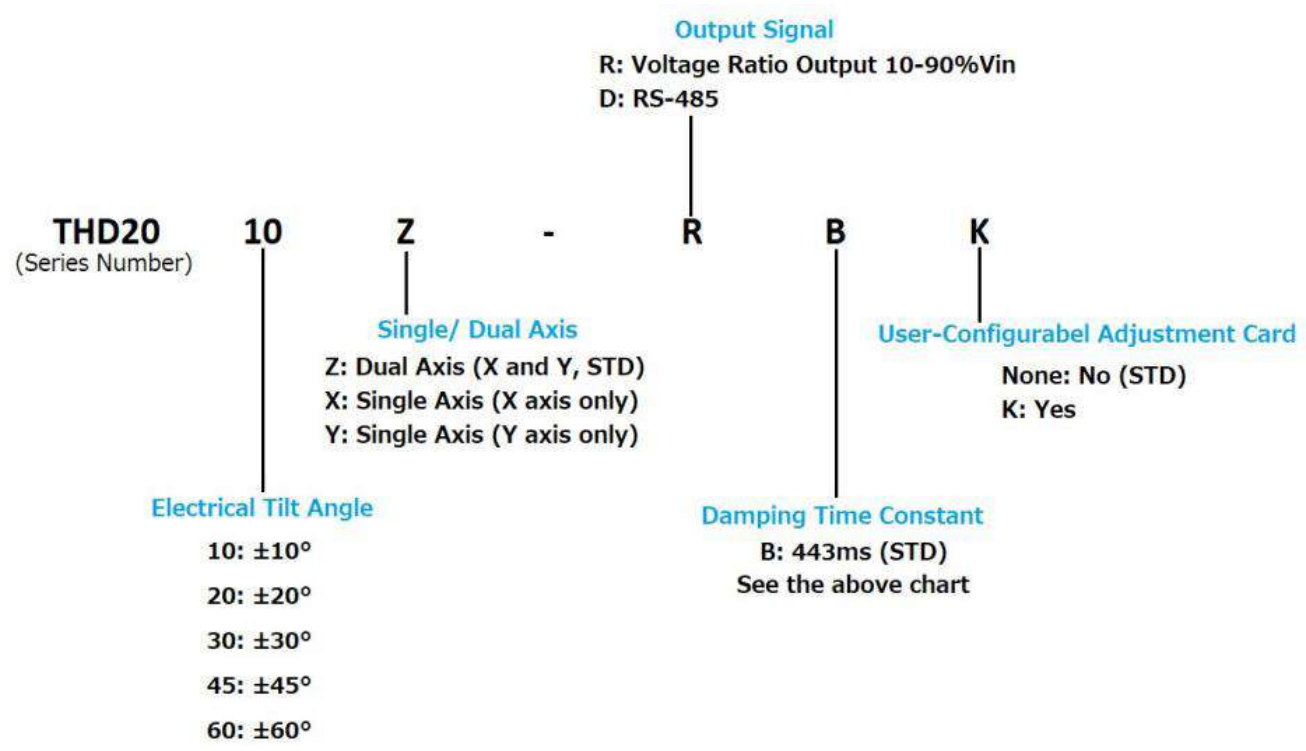
Command Frame	<0001 INDEX_SET>
Response Frame	[0001 INDEX_SET "X" "Y" R00]
Data Value	"X" : X axis Index Point "Y" : Y axis Index Point -5.000 ~ +5.000 Default : '0.0' (deg.)
Function	Reset index position (horizontal level) ±0° Available reset range within -5.000 ~ +5.000

8. Setting RS-485 Baud Rate

Command Frame	<0001 BAUD 1>
Response Frame	[0001 BAUD 1 R00]
Data Value	1. Baud rate 9600bps (Default) 2. Baud rate 115200bps
Function	RS-485 baud rate setting

If data does not attach to the command, the current setting value is replied.

Model Number Designation



Handling Instruction

- This product can not be used for measurement of resistance value.
- Use this product in an environment protected from ESD.
- Depending on the state of the vibration environment, the product may not be able to measure the tilt angle accurately even if the digital filter is selected.