TransducerM *Compact Design*

Product Datasheet

Part Number / Order Number: TM421

TransducerM is a 9 Degree-of-Freedom attitude and heading reference system (AHRS)

Version	Date	Revision Info
V1.1.1 (R)	Mar 10, 2023	Version for preview or tests. Confidential.
V1.1.2	Mar 10, 2023	Diameter marking fixed.

* Actual product might be different from the photo illustrated.
* Specifications are subject to change without notice.

Confidentiality notice:
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Introduction

SYD Dynamics TransducerM is a complete solution for motion sensing applications, capable of providing computed data for determining orientation of an object in 3D space.

Out-of-box, it provides orientation data in terms of Euler angles, Quaternion, and, most commonly used Roll/Pitch/Yaw all of which can be computed with the reference to world frame (based on Earth's magnetic field and gravity direction). It can also output calibrated raw sensor data, including angular rate, acceleration and magnetometer measurement.

Magnetometer is equipped with 'Active Magnetic Field Compensator' to detect and remove any disturbances and ensure stable magnetometer data.

- Update rate: 300Hz – 430Hz depending on the computational load
- Accelerometer: ±8g range (16-bit ADC), 260Hz bandwidth, 0.5%fs non-linearity, 1kHz sampling rate
- Gyroscope: ±2000°/s range (16-bit ADC), 256Hz bandwidth, 0.2%fs non-linearity, 8kHz sampling rate
- Magnetometer: ±1.3 Gauss range (12-bit ADC), 0.1%fs non-linearity, 75Hz sampling rate

Product Specification Table 1/2

Operating conditions

PARAMETER	MIN	TYPICAL	MAX	UNIT
Operating voltage	4.5	5.0	5.5	V
Current	-	50	-	mA
Power consumption	200	250	300	mW
Power input	Recommended: regulated 5V through CAN Bus / UART interface			
Temperature	-20	25	80	°C
Shock	-8	-	+8	g

Physical data

PARAMETER		UNIT
Size (L x W x H)	30 x 26 x 11	mm
Weight	15 (Typical, include cable and connector)	g
Compliance	RoHS No IP (Ingress Protection) rating	
Casing material	Aluminum alloy ABS	
Connector	Molex 51021-0800 connector	

System parameters

PARAMETER		UNIT
Start-up time (cold)	13.5	seconds
Start-up time (cold. Use dynamic boot mode.)	6.8	seconds
Communication Interface	UART (Serial port) CAN 2.0 B (Standard ID)	
Data rate	CAN: 1M, 500K, 250K, 125K, 62.5K UART: 2400 ~ 921600 standard baudrate, 1M	bps

Product Specification Table 2/2

IMU sensor specification

PARAMETER	ACCELEROMETER	GYROSCOPE	MAGNETOMETER
DOF	3	3	3
ADC resolution, range	±8g 4096 LSB/g	±2000°/s 16.38 LSB/(°/s)	±1.3Gauss 1090 LSB/Gauss
Bandwidth	260 Hz max	256 Hz max	-
Non-linearity	0.5 %fs	0.2 %fs	0.1 %fs
Noise density	0.4 mg/√Hz	0.005 °/s /√Hz	-
Internal sampling rate	1 kHz	8 kHz	75 Hz max

Module output

PARAMETER	MIN	TYP	MAX	UNIT
Update rate	250	300	350	Hz
Output rate (depending on configurations)	Example	Configuration	UART: 921600 bps Output: Roll Pitch Yaw	Hz
		Output rate	250-300	
Output format	Roll/Pitch/Yaw (heading), Quaternion, Gravity direction, Calibrated raw sensor data			

Other features	FEATURE NAME		HIGHLIGHTS	
	Self-adapting filter		Improved heading accuracy	
	Sensor networking		Multiple sensors on the CAN Bus	

PERFORMANCE	ROLL	PITCH	YAW	
Resolution	0.01°	0.01°	0.01°	
Angle range	0° - 360°	±90°	±180°	
Static accuracy	<0.5°	<0.5°	<1.0°	Average[1]
Dynamic accuracy (inertial)	<2.0°	<2.0°	<4.6°	Average[1,2]
Repeatability (inertial)	<0.04°	< 0.04°	<0.28°	Absolute maximum[1]
Positional drift (inertial)	< 0.09 °/h	< 0.09 °/h	1.05 °/h	Static condition[1]
Positional drift (inertial)	<2.0° error RMS		8.5° error every 25 minutes	Dynamic condition, typical city car driving condition
Turn-on bias	< 0.4°	< 0.4°	< 0.4°	Typical

1. According to test results in laboratory environment.
2. Including error introduced by communication latency at 115200 bps.

Software

IMU Assistant	Windows 7, 8, 8.1, 10, 11
Functionality	Sensor configuration, calibration, data visualization, data recording

Cable Definition

TransducerM TM421 has cable pre-installed, which is further connected to an 8-pin Molex 51021-0800 connector. Shown as below.

The Molex 51021-0800 connector mates with Molex 53261-0871 socket.
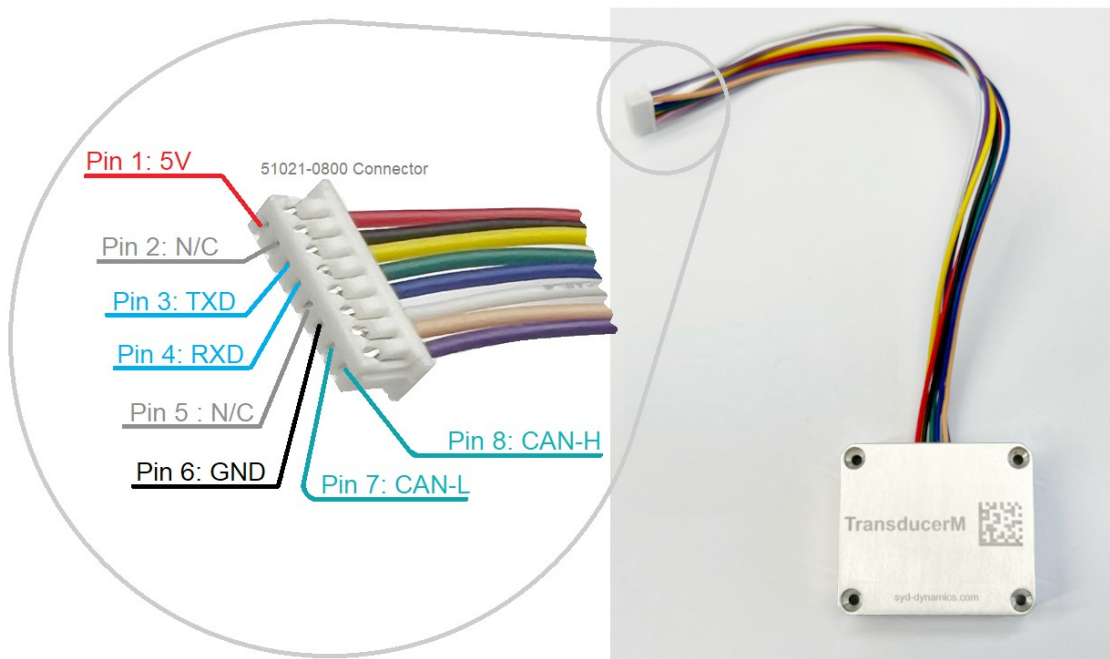

Figure 1: TransducerM TM421 cable and connector illustration

The Molex 51021-0800 connector pin definition is as follows. For pin numbers, please refer to the illustration above.

Number	**Name / Function**	**Comments**
TransducerM Cable Definition (8-pin-cable with Molex 51021-0800 connector)		
Pin 1	**VCC 5V**	Input voltage range: 4.5V ~ 5.5V, recommend regulated 5V
Pin 2	-	Reserved (Do not connect)
Pin 3	**TXD**	Serial port TXD running at TTL 3.3V and is compatible with TTL 5.0V
Pin 4	**RXD**	Serial port RXD running at TTL 3.3V and is compatible with TTL 5.0V
Pin 5	-	Reserved (Do not connect)
Pin 6	**GND**	
Pin 7	**CAN-L**	Dominant differential voltage is minimum 2.45V, and the recessive differential voltage is 0V (nominal). There is no termination resistor inside TransducerM.
Pin 8	**CAN-H**	Dominant differential voltage is minimum 2.45V, and the recessive differential voltage is 0V (nominal). No termination resistor inside.

⚠ The pin definition is only related to its pin number. The TransducerM TM421 may be shipped with pre-installed cable in different color code or the wires are in the same color.

Below is an example to connect TransducerM to PC through a USB-UART adapter, for reading sensor data and configuring TransducerM using the GUI software *ImuAssistant*.

1. Connect Pin 1 (**VCC**) to USB-UART adapter **5V**;

2. Connect Pin 6 (**GND**) to USB-UART adapte **GND**;

3. Connect Pin 3 (**TXD**) to USB-UART adapte **RXD**;
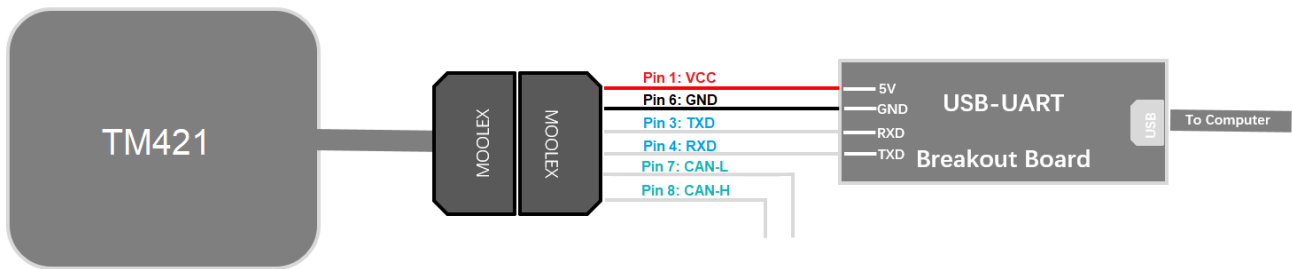
4. Connect Pin 4 (**RXD**) to USB-UART adapte **TXD**.

Figure 2: Connect to USB-UART adapter

* Note: USB-UART Breakout Board can be ordered separately.

Mechanical Drawing and Axis Definition

The following figure shows the 2D mechanical drawing of TransducerM (Unit: millimeter [inch]).
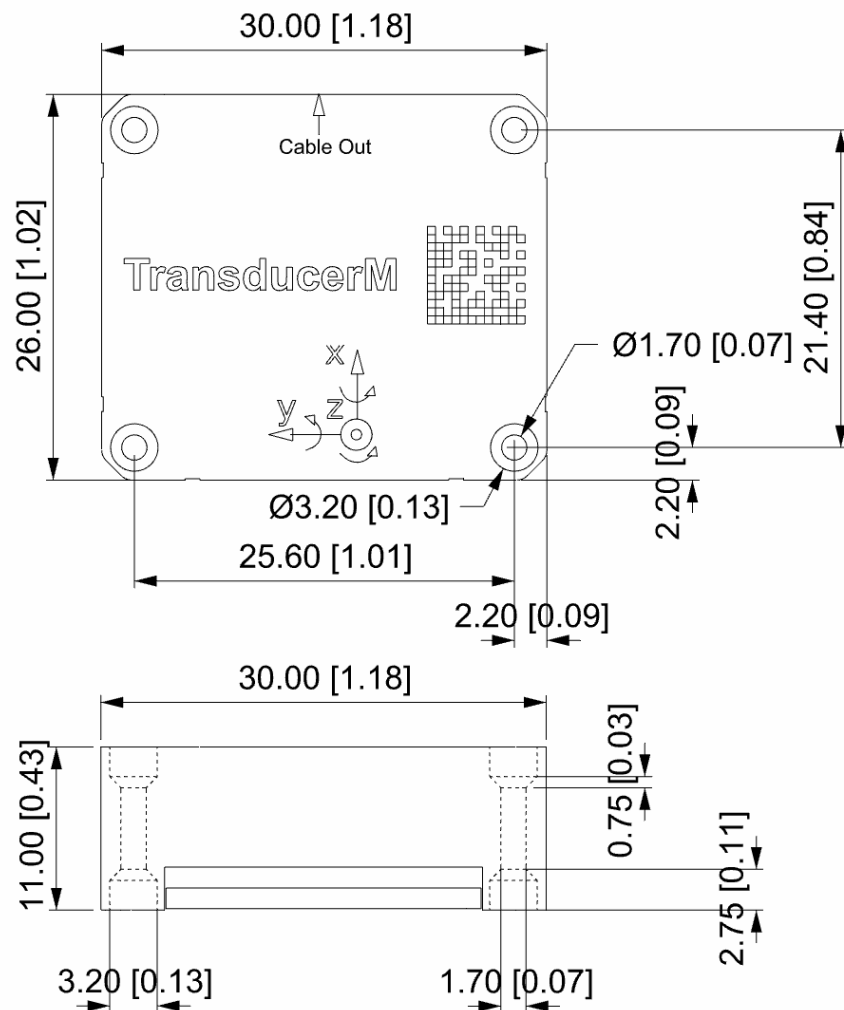

Figure 3: TransducerM TM421 Mechanical Drawing and Axis Definition