TransducerM
Datasheet

Part Number: TM352, TM353

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

Version	Date	Revision Info
V1.2.2 (R)	Oct 9, 2017	Add comment in 'PERFORMANCE' section.
V1.2.4 (R)	Mar 1, 2018	For use with TM352 and TM353. Update 'Module output' section.
V1.2.5 (R)	Mar 14, 2018	'Update rate' section updated.
V1.2.6 (R)	Dec 10, 2018	TM353 wire definition added.
V1.2.7 (R)	Dec 11, 2018	Minor changes on wire connector notes.
V1.2.8 (R)	Jan 04, 2020	Minor changes on wire connector notes.
V1.3.1 (R)	Mar 18, 2020	TM352 connector definition updated. Add USB-UART adapter illustration. Apply to TransducerM TM35x shipped since February 2020.

** This document is non-public and is only for intended recipients.*
** Actual product might be different from the photo illustrated.*
** Specifications are subject to change without notice.*

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	4.0	5.0	6.0	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)	34 x 34 x 23 (Excluding Mounting Brackets) 34 x 48 x 23 (Including Mounting Brackets)	mm
Weight	< 60 (exclude cable and connector)	g
Compliance	RoHS IP67 (With SF12 connector)	
Casing material	Aluminum alloy, ABS, silicone rubber	
Connectors	Molex 43020-0801 connector (Standard) SF12 / RJ45 or other connectors (Customized)	

System parameters

Start-up time (cold)	13.5	seconds
Start-up time (cold. Use dynamic boot mode.)	6.8	seconds
Communication Interface	UART, 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	300	360	430	Hz

Output rate (depending on configurations)	Example	Configuration	UART: 921600 bps Output: Roll Pitch Yaw and Quaternion	Hz
		Output rate	300	
Output format	Roll/Pitch/Yaw (heading), Quaternion, Gravity direction, Calibrated raw sensor data			

	FEATURE NAME	HIGHLIGHTS
Other features	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°	

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
Functionality	Sensor configuration, calibration, data visualization, data recording

Cable Definition

TransducerM with part number (i.e. order number) TM352 and TM353 both deliver the same performance and functionality, they differ only in wire and connector configurations.

TransducerM TM352 with standard connector

TransducerM TM352 has cable pre-installed, which is further connected to an 8-pin Molex 43020-0801 connector. Shown as below.

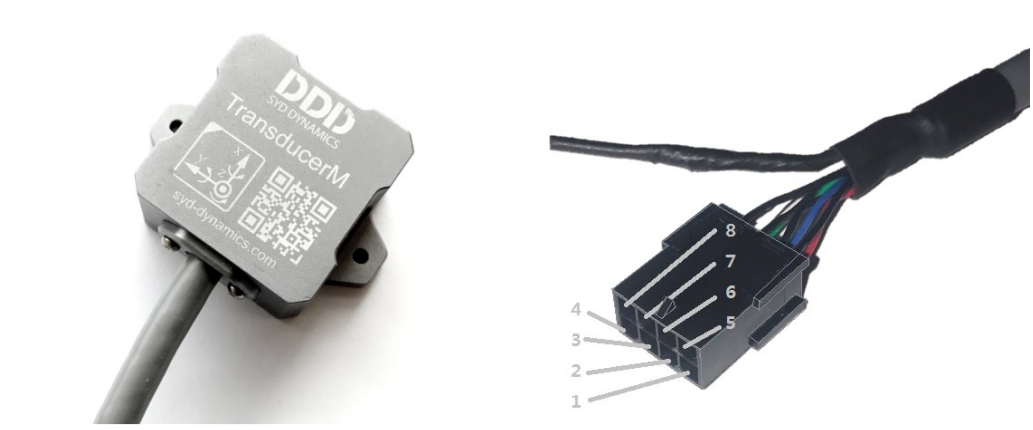

Figure 1: TransducerM TM352 cable and connector illustration

The cable definition is as follows.

***TransducerM Cable Definition** (8-pin-cable with Molex 43020-0801 connector)*			
Number	**Wire Color**	**Name / Function**	**Comments**
1	**Red**	**VCC 5V**	Recommended input voltage range: 4.5V ~ 5.5V
2	**Blue**	**TXD**	TXD is running at TTL 3.3V and is compatible with TTL 5.0V
3	**Green**	-	Reserved (Do not connect)
4	**White**	**CAN-L**	Dominant differential voltage is minimum 2.45V, and the recessive differential voltage is 0V (nominal). There is no termination resistor inside TransducerM.
5	**Black** (twisted-pair with red)	-	Reserved (Do not connect)
6	**Black** (twisted-pair with blue)	**RXD**	RXD is running at TTL 3.3V and is compatible with TTL 5.0V
7	**Black** (twisted-pair with green)	**GND**	
8	**Black** (twisted-pair with white)	**CAN-H**	Dominant differential voltage is minimum 2.45V, and the recessive differential voltage is 0V (nominal). No termination resistor inside.

TransducerM TM353 with adapter cable

You may use order number TM353 to indicate that adapter cable is required to be shipped together with TM352. Essentially TM353 is TM352 plus adapter cable. The adapter cable makes it easier to connect TransducerM to other devices for temporary use and tests.

The adapter cable is shown as below. Two kinds of 2.54mm housing are provided: Six 1-pin housings and one 5*2-pin housing. You may decide by yourself to choose a convenient way to connect the cable to your devices.

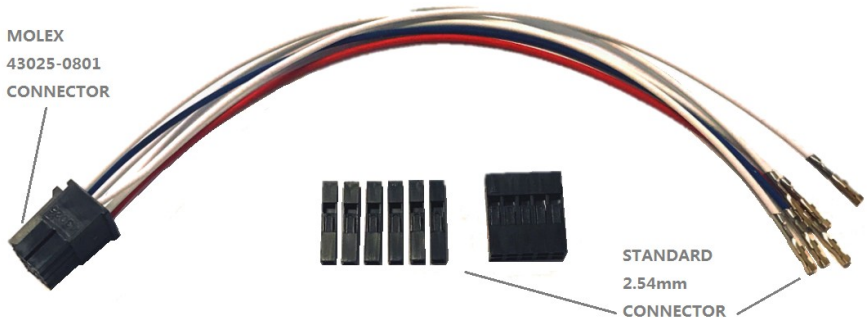

Figure 2: TransducerM TM353 adapter cable and connector illustration

Here 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 adapter cable's pin1(red wire, ***VCC***) to USB-UART adapter ***5V***;
2. Connect adapter cable's pin7(blue wire, ***GND***) to USB-UART adapte ***GND***;
3. Connect adapter cable's pin2(white wire, ***TXD***) to USB-UART adapte ***RXD***;
4. Connect adapter cable's pin6(white wire, ***RXD***) to USB-UART adapte ***TXD***.

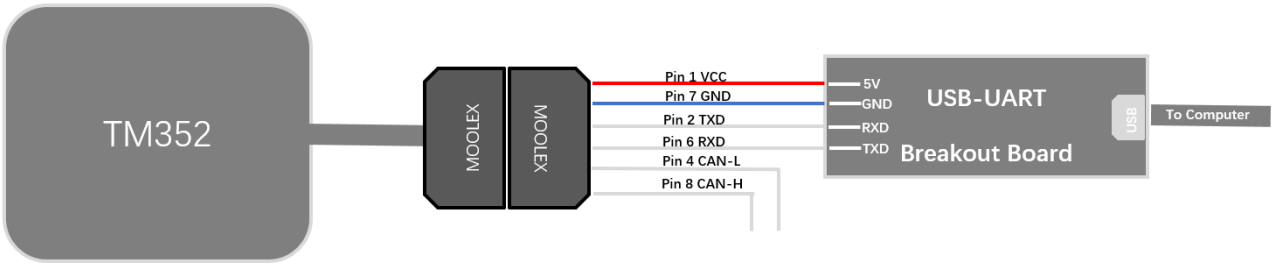

Figure 3: Connect to USB-UART adapter

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

Mechanical Drawing

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

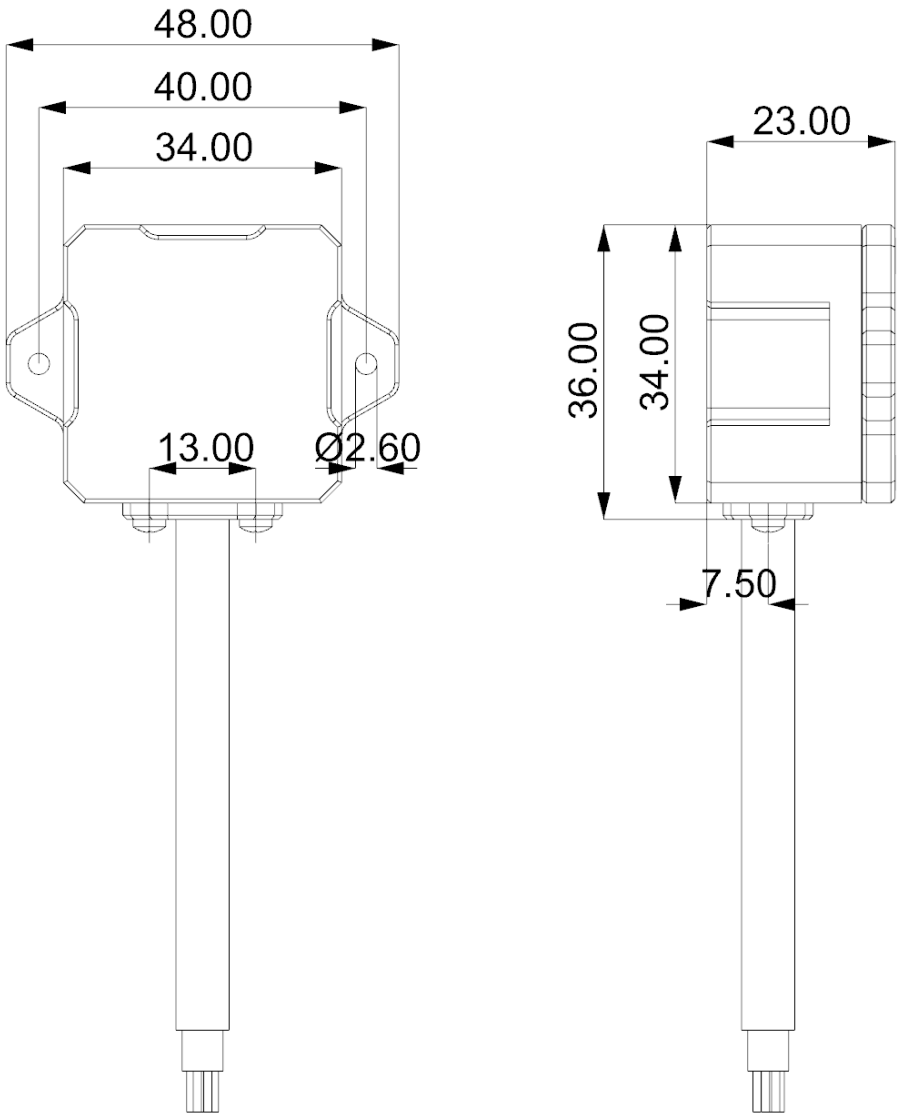

Figure 4: TransducerM TM352/TM353 Mechanical Drawing