TransducerM *Performance Series*

Part Number: TM500-x

TransducerM is an attitude and heading reference system (AHRS) with 9-axis IMU

Version	Date	Revision Info
V1.1.2 (R1)	Jul 31, 2018	Module output section updated.
V1.1.2 (R3)	Dec 11, 2018	Add part number. Minor fix.
V1.2.3 (R1)	May 22, 2019	Release version.
V1.2.3 (R3)	Jul 29, 2019	Update comment, connector specs and 2D drawing.
V1.2.3 (R4)	Oct 21, 2019	Release of TM500-x general version.

** 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 Series 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 [1]. Magnetometer is equipped with 'Active Magnetic Field Compensator' to detect and remove disturbances and ensure stable heading.

Products comparison as below[2]

FEATURES		PRODUCT SERIES			
		TransducerM TM100	**TransducerM TM200**	**TransducerM TM300**	**TransducerM TM500**
Sensors	3-Axis: Gyroscope and Accelerometer	●	●	●	●
	3-Axis: Magnetometer	●	●	●	●
Features	Sensor Fusion	●	●	●	●
	Sensor Fusion Profiles	-	●	●	●
	Vibration Resistant	-	● (Basic)	●(Mid)	● (Full)
	Configuration GUI	○	●	●	●
	Run-time calibration API	-	-	●	●
	Digital Compass Function	-	-	○	●
	Essential Factory Calibration	●	●	●	●
	Thermal Calibration	-	-	○	●
Interfaces	UART	●	●	●	●
	CAN Bus	-	-	●	●
	USB	-	-	-	○
Output	Calibrated Raw Data Output	●	●	●	●
	Roll, Pitch, Yaw Output	●	●	●	●
	Internal Update Rate	280-370Hz	280-370Hz	290-450Hz	800Hz
	Max Output Data Rate (ODR)	≤100Hz	<200Hz	200Hz	200Hz
	Precision ODR selectable by Hz	-	-	○	●
Performance	Static Accuracy (Roll-Pitch)	1°	0.7°	0.5°	0.3°
	Static Accuracy (Yaw)	2.5°	2.0°	1.0°	0.8°
	Dynamic Accuracy (Roll-Pitch)[3]	3°	2.5°	2.0°	0.5°
Operation Condition	Temperature	0-70°C	0-70°C	-20-85°C	-40-85°C
	Voltage	5V	5V	5V	5V, or 9-36V
	IP Rate	PCBA Unprotected	Module Up to IP50	Up to IP67	Up to IP67
Application		Consumer, Education, Laboratory, Hobby	Consumer, Education, Laboratory, Hobby	Commercial application, Laboratory	Commercial application, Heavy-duty-Industrial, Laboratory
Standard Warranty[4]		1 year	1 year	1-3 year	1-3 year
Extended Warranty		-	-	○	○

● Standard ○ Optional − Not Available

[1] For accelerometers and magnetometers, they are calibrated to 'units' and are accurate in terms of vector direction but not their absolute values. E.g. accelerometer may output 1.0 meaning equal to earth gravity magnitude.
[2] Specifications are subject to change without notice.
[3] According to tests in laboratory environment, typical performance. Actual performance may vary.
[4] For TM300 and TM500 series, please contact your supplier for exact warrant period.

Electronic and Physical Specification

Operating conditions

PARAMETER	MIN	TYPICAL	MAX	UNIT
Operating voltage	5	9~32	32	V
Current	125 (at 5V)	79 (at 9V) 62 (at 12V) 35 (at 24 V)	28 (at 32V)	mA
Power consumption	0.63	0.71~0.84	0.90	W
Power input	Recommended: Regulated 9V~32V through CAN / RS422 interface			
Operation temperate range	-40	-	85	°C
Shock (5ms)	-	-	90	g

Physical data

PARAMETER		UNIT
Size (L x W x H)	97 x 48 x 30 (Excluding Mounting Brackets) 107 x 50 x 34 (Including Mounting Brackets)	mm
Weight	256 (Including Mounting Brackets)	g
Compliance	RoHS IP67	
Casing material	Aluminum alloy	
Connectors	SF1213 S5/S9, 5-PIN or 9-PIN connector	

System parameters

Start-up time (cold)	12.0	seconds
Start-up time (cold. Use dynamic boot mode.)	3.0	seconds
Communication interface	Default Configuration: RS422 Options upon request: USB 2.0 Full Speed CAN 2.0B Standard ID	
Data rate	CAN 2.0B: 62.5K ~ 1M RS422: 1200 ~ 4M USB 2.0: Full Speed	bps

IMU Sensor and AHRS Specification

Gyroscope

PARAMETER	MIN	TYP	MAX	UNIT	DESCRIPTION
Measurement range	-300	-	+300	°/s	
Resolution	-	0.01	-	°/s	
Bandwidth	68	80	90	Hz	-3db
Noise	-	0.10	0.15	°/s	RMS
Bias instability	-	-	10	°/h	Allan Variance
Bias drift with temperature	-	±0.002	±0.004	°/s/°C	
Non-linearity	-	0.035	0.070	% FS	Full temperature range

G sensitivity	-	±0.005	±0.010	°/s/g	
Angle Random Walk	-	-	0.4	°/√h	Allan Variance

Accelerometer

PARAMETER	MIN	TYP	MAX	UNIT	DESCRIPTION
Measurement range	-10	-	+10	g	
Resolution	-	0.40	-	mg	
Bandwidth	60	70	80	Hz	-3db
Noise	-	1.0	1.5	mg	RMS
Bias instability	-	-	0.05	mg	Allan Variance
Bias drift with temperature	-	±2.5	±6.5	mg	Full temperature range
Non-linearity	-	0.500	1.000	% FS	Full temperature range

Magnetometer

PARAMETER	MIN	TYP	MAX	UNIT	DESCRIPTION
Measurement Range	-1.3	-	+1.3	Gauss	
Resolution	-	0.001	-	Gauss	
Internal sampling rate	-	-	75	Hz	
Non-linearity	-	0.1	-	% FS	Full temperature range

Module output

PARAMETER	MIN	TYP	MAX	UNIT
Update rate	780	800	820	Hz
Output rate (depending on configurations)	200, 100, 50, 25, 10, 5, 1			Hz
Output format	Roll/Pitch/Yaw (heading), Quaternion, Gravity direction, Calibrated raw sensor data			

Other features	FEATURE NAME	HIGHLIGHTS
	Self-adapting filter	Improved heading accuracy
	Digital Compass Calibration	Work as a digital compass
	Thermal Calibration	Calibrated for entire operation temperate range
	Sensor networking	Multiple sensors on the CAN Bus, RS422 Bus

PERFORMANCE	ROLL	PITCH	YAW	
Resolution	0.01°	0.01°	0.01°	
Angle range	-180° ~ 180°	-90° ~ 90°	0° ~ 360°	
Static accuracy	<0.3°	<0.3°	<0.8°	RMS Error[1]
Dynamic accuracy (inertial)	<0.5°	<0.5°	<2.0°	RMS Error[1, 2]

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 / Ubuntu 16.04 64-bit (Only upon request)
Functionality	Sensor configuration, calibration, data visualization, data recording

Mechanical Drawing

The following figure shows the 2D mechanical drawing of TransducerM TM500-x. Unit: millimeter.

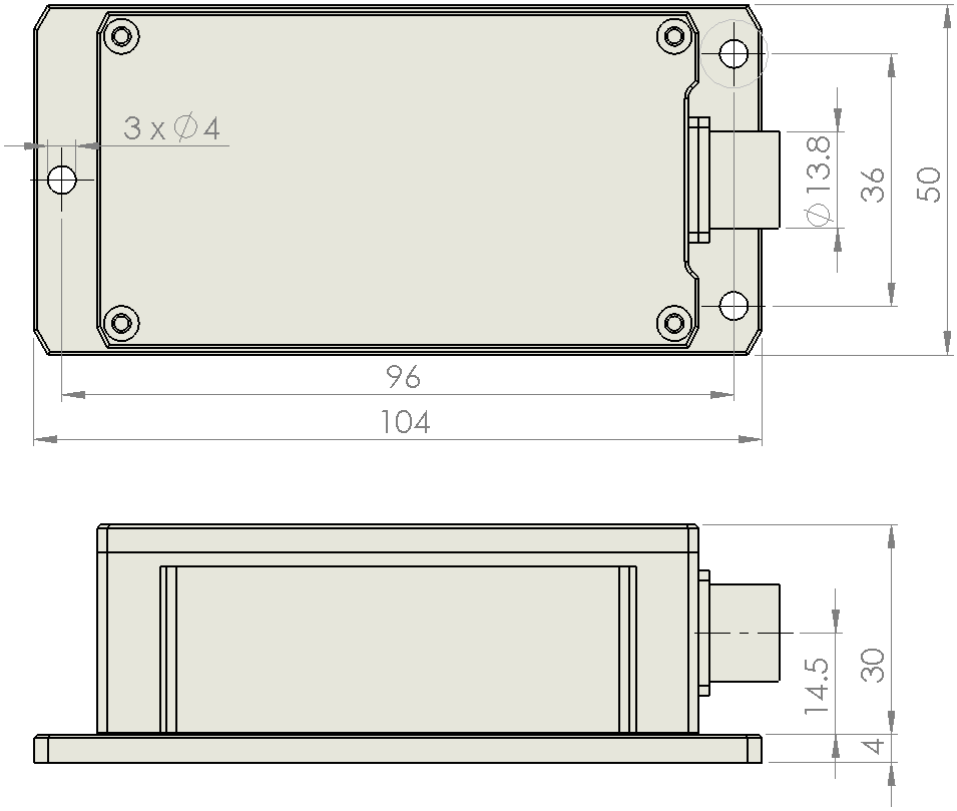

Figure 1: TransducerM TM500-x Mechanical Drawing
Unit: mm