iTraceRT-MVT-300/TLE-LN1

Precise MEMS Based Inertial Measurement System with
integrated INS/GNSS/xxx Data Fusion
for all automotive Localization & Control Applications

iTraceRT-MVT-300/TLE-LN1 is a member of the advanced iTraceRT-MVT series, which is directly based on iMAR's iNAT (Navigation and Timing) system architecture, and which is one of the smallest powerful MEMS based INS/GNSS inertial navigation, measurement, surveying and control systems in the market for automotive applications. It provides all kinematic measurements like acceleration, angular rate, attitude, true heading, velocity and position of the target vehicle in real-time with an data update rate of up to 500 Hz.

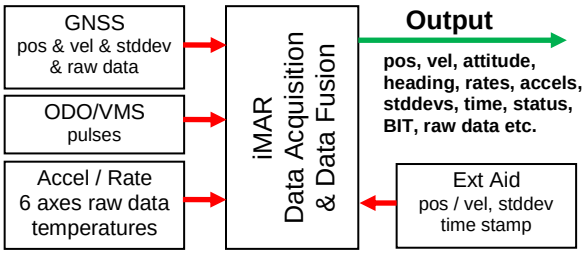
- robust, compact, light weight system, ~850 grams
- based on high grade MEMS gyro & accel technology and up to all frequency GNSS with optional dual-antenna heading (-DA) and RTK support; gyros highly resistant against vibration impacts
- integrated GNSS engine, up to RTK all frequ./const. (3 types of engines available: /TLE, /SLE, /RLE)
- ultra low noise version available as option (iTraceRT-MVT-300/TLE-ULN1)
- odometer / wheel sensor aiding capability
- output of angular rate, acceleration, attitude, true heading, CoG, velocity and position in realtime with up to 500 Hz (adjustable) with minimum latency
- several processing modes: Standard mode with 1 m position accuracy and RTK / PPP mode with 0.02 m position accuracy
- interfaces: UART RS232 & RS422 / CAN / Ethernet / USB for realtime data output and RS232 for DGPS/RTK correction input; odometer / VMS
- up to 128 GByte internal memory ("black-box")
- several versions with surveying grade GNSS, economic grade GNSS, standard noise as well as low-noise inertial sensors are available
- easy to use, easy to configure; powerful GUI with wizard; drivers for C++, Python and ROS 2

Depending on the application and ambient conditions, the integrated sensor data fusion includes INS, GNSS, VMS or any other external sensor providing position and/or velocity, standard deviation and time stamp.

In urban canyons often the number of observable satellites is quite limited and therefore the iTraceRT-MVT-300/TLE supports an all GNSS constellation data fusion. The 42+ state Kalman filter processsing provides a significant better and more robust position and velocity result compared to standard solutions.

An odometer aiding capability is available to further impove system accuracy where available, the scale factor of the wheel sensor is estimated automatically.

The **iTraceRT-MVT-M300/TLE** provides system



performance and system reliability which is required in standard tasks of navigation, guidance and control, mapping, vehicle motion dynamics testing, trajectory surveying and platform control tasks for cars, trucks, motorcycles etc.

The iTraceRT-MVT-M300 is delivered with the MS Windows (or LINUX or MacOS alternatively) based configuration software iXCOM-CMD. This software allows to configure the output interfaces, furthermore all output data can be displayed and stored online on the user's notebook, tablet or process computer. It also allows powerful playback capabilities and provides data export in many formats (csv, xml, GoogleEarth, InertialExplorer, GrafNav). With iREF-GNSS, iMAR also provides a GNSS reference station to provide RTK corrections for centimeter level accuracy on demand. Also PPP is supported.
A powerful postproc software is available to allow post-mission processing including a multi station GNSS correction data solution and a direct visualisation of the results in Google Earth™.

Technical Data iTraceRT-MVT-300/TLE-LN1 & /TLE-LN1-DA (typical, rms):

	Rate	Acceleration	Attit./Heading	Position	Velocity	Height
Range:	± 450 °/s	± 10 g (opt. 30 g)	unlimited	unlimited	515 m/s (without export control)	unlimited
Bias Stability (AV):	< 1 °/h	< 0.02 mg				
Bias (filtered[1]):	< 5 °/h	< 1.5 mg				
Bias day-to-day[2]:	< 0.1 °/s	< 2 mg				
Angles (Attitude, Hdg.):			0.03° / 0.12° RP/Y (INS/GNSS) [under best conditions 0.01° / 0.03° RP/Y] [5] 0.05° / 0.12° RP/Y (after 10 s GNSS outage) [best cond. 0.02° / 0.04° RP/Y] [5] 0.1 deg heading for 2 m baseline in dual-antenna setup (/TLN-DA) [2] 0.1 ° side slip angle (accuracy given for v > 10 m/s)[1]			
Position (horizontal plane) [3]:		*for **iTraceRT-MVT-300/TLE-LN1:***		+/- 0.02 m CEP (INS/GNSS RTK real-time) [4] +/- 0.01 m CEP (INS/GNSS RTK post-proc) [5] +/- 0.45 m CEP (INS/GNSS with SBAS) +/- 1.5 m CEP (INS/GNSS) 0.15 % of DT CEP (with VMS, during GNSS outages)[5] 0.02 m/s (INS / RTK GNSS)		
Noise:	0.06 °/sqrt(hr)	60 µg/√Hz	0.03 °	< 0.01 m	< 0.01 m/s	
Resolution:	< 0.000'1 °/s	< 10 µg	0.001 °	< 0.001 m	< 0.001 m/s	
Linearity error:	< 0.01 %	< 0.1 %	< 0.1 %			
Scale factor error:	< 0.1 %	< 0.1 %	< 0.1 %			
Non-Orthogonality:	< 0.2 mrad	< 0.2 mrad				

INS / GNSS / ODO proc.:	integrated advanced 42+ state INS/GNSS/+ extended Kalman filter based data fusion
Internal GNSS Engine:	iTraceRT-MVT-300/TLE-LN1: **single-antenna**, all frequency, GPS+GLONASS, Beidou, GALILEO, SBAS, QZSS, RTK iTraceRT-MVT-300/TLN-LN1-DA: **dual antenna**, multi frequency GPS+GLONASS, Beidou, GALILEO, SBAS, QZSS, RTK
Data Processing Rate:	up to 500 Hz; PPS timing accuracy better 10 ns
Data Output Rate:	1...500 Hz; all data available in real time, latency < 3 ms, jitter < 1 ms
Synchronisation:	PPS_OUT (RS422 level, latency < 1 µs); 2x EVENT_IN (RS422 or TTL level, latency < 2 ms)
Output (options):	USB, 2 x CAN, 4 x UART RS232/422, Ethernet 100 Mbit/s, NMEA183, ARINC825, TCP/IP, UDP, NTRIP caster with RTCM104 rev 3 (can serve as a GNSS reference station); NTP Time Server capability
Inputs:	DGPS/RTK correction data from base station, if available (RS232); odometer / VMS (A or A/B at RS422 level) as an option
Data Latency and Jitter:	< 11.3 ms (sampling accuracy better 1 µs, time-stamped according to PPS; jitter < 1 ms)
Connectors:	MIL-C-38999 III (data), SMA (antenna), M12 (Ethernet)
Integrated Data Storage:	32 GByte non-vlatime memory, option 128 GByte (lasts for several days continuous data sampling as “black-box”)
Real Time Clock:	as option available to cover few days of power-off
Graphical User Interface:	MS Windows or LINUX or MacOS based software iXCOM-CMD for configuration, visualization, data recording, data converting and playback operation
Power Supply:	10...34 V DC, two independent and isolated inputs available; reverse an overvoltage protection; approx. 8.5 …11 W (dep. on options); < 14 W for < 1 sec after power-on
Temperature; MTBF:	-40...+71 °C (outer case temperature) operating, -40…85 °C storage; 49’000 hrs (AUC, Airborne Uninhabited Cargo, 25 °C)
Shock, Vibration, Altitude:	100 g, 11 ms; 1’000 g, 0.5 ms; 10…2’000 Hz 5 g rms (endurance); 10...2’000 Hz 2 g rms (operational); 60’000 ft
g / g² depenent gyro drift:	< 0.005 °/s/g (internally compensated)
Mass, size; IP:	approx. 900 grams , approx. 102 x 112 x 65 mm; IP67 environmental protection
Operational Support:	Automotive, Ground (with and without odometer); ZUPT (auto or on demand); advanced motion detector; open interface
Deliverables:	- MEMS based INS with integrated GNSS receiver, GNSS antenna, cable set - iXCOM-CMD MS Windows or LINUX or MacOS based GUI / HMI software (if ordered)
PartNumber:	single antenna version: P/N 00193-060C2-0516 iTraceRT-MVT-300/TLE-LN1 dual-antenna version: P/N 00193-060C2-0517 iTraceRT-MVT-300/TLE-LN1-DA
Options:	- SW-Development Kit with DLL (with SDK under Qt / C); Python scripts available - ulra-low noise version available with ARW 0.03 deg/sqrt(hr): iTraceRT-MVT-300/TLE-ULN1 - dual-antenna GNSS based true heading **(iTraceRT-MVT-300/TLE-LN1-DA)** allows heading determination even at standstill conditions -> typ. 0.2° at 1 m baseline - odometer (VMS) interface for velocity aiding during longer GNSS outages (position error is then correlated to wheel sensor performance, typically 0.1 % longitudinal error of distance travelled) **- interface to iMAR Dynamic Mesh Communication System** iDMN of up to 128 vehicles on a proving ground (car-2-base and car-2-car simultaneously with up to video data rate and latency < 50 ms (rms)) - interface to ABD driving robot (via Ethernet) - fully compatible to the **Proving Ground Automation iSWACO-ARGUS**

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[1] heading accuracy at initial standstill even without any required motion due to dual-antenna GNSS feature (requires sufficient GNSS satellite observability)
[2] values without sufficient INS/GNSS data fusion conditions; the bias are estimated / compensated during GNSS aiding under motion automatically (Kalman filter); iTraceRT-MVT-300/TLE-LN1 provides 10 deg/hr bias stability for several hours duration at const. temperature
[3] GNSS based altitude deviation is abut 1.5 times of GNSS based horizontal error
[4] after algorithm converging under sufficient motion / trajectory and multiple heading changes with GNSS aiding
[5] Position error in relation to distance travelled during short GNSS outages (requires a vehicle motion sensor / wheel sensor), after suffic. GNSS

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