iTraceRT-MVT-60X/T

**Ultra Precise Inertial INS/GNSS Navigation System for most
Advanced Automotive Applications anf Ground Truth Reference**

iTraceRT-MVT-60x is part of the IMS product family of systems for inertial navigation and guidance, gyro compassing, stabilization, true heading determination and for dynamically motion analysis as well as the ultimate inertial ground truth reference with ring laser gyros, that covers applications, which require accuracy, reliability, a flexible interface and easy usage.

- High performance ring laser gyro based inertial navigation and surveying system for automotive testing; self-gyro compassing. Additional dual-antenna GNSS heading setup as option (iTraceRT-MVT-60x-DA)
- Integrated time synchronization module and GPS / RTK-GNSS engine with single or dual antenna, all frequency, all constellation.
- High data rate, open interface: UART RS422 / RS232, Ethernet TCP/IP - UDP, CAN, ARINC825, NMEA 183.
- Integrated VMS / odometer interface.
- Internal 32 GByte non-volatile memory ("black-box"), up to 128 GByte on demand
- Small size, low weight, low power; integrated surveying markers and aiding support points on the enclosure (to support also advanced surveying applications).

The iTraceRT-MVT-6xx consists of three high precision ring laser gyroscopes, three servo accelerometers, a powerful strapdown processor and an open and modular architecture, which allows also adaptations to customer's demands.

The system contains an all-frequency RTK capable GNSS receiver (GPS, GLONASS, GALILEO, Beidou), several Dig-I/Os (e.g. for odometer). Optional communication I/Os are Ethernet (TCP/IP, UDP), RS422/232 UART, CAN as well as internal data storage on non-volatile memory.

Data processing (strapdown navigation, gyro compassing or motion monitoring) is performed inside of the iTraceRT-MVT-60X, and also data trans mission and storage of pure or corrected raw data is available.
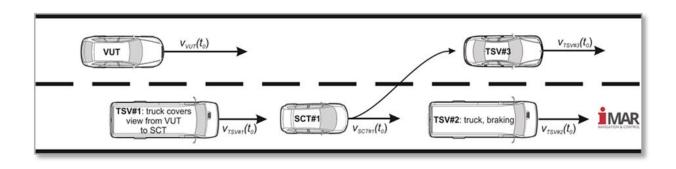
A key feature is its high data rate of up to 400 Hz and its unique resolution (0.001 degree in roll/pitch/yaw) as well as its superior accuracy (e.g., for stabilization tasks). As an option, special designed algorithms and features are available, e.g. the Multi-Vehicle-Tracking Mode (MVT), which allows an exchange of information between several iTraceRT-MVT systems with-

out the need of any additional computation power. iTraceRT-MVT can also operate as PTP time server as an option.

The iTraceRT-MVT contains a INS/GNSS/ODO based data fusion, using iMAR's highly sophisticated 42+ state Kalman filtering incl. gyro compassing, free inertial or dead-reckoning navigation etc. iTraceRT-MVT-60X is usually operated in online mode, however, it also provides the possibility of post-processing, e.g. to perform additional reverse Kalman filtering and smoothing.

The systems iTraceRT-MVT-600 / -601 are only covered by standard dual-use export control and not by any ITAR regulations. The EU001 procedure even allows a simplified export and hence fast delivery from iMAR to end-user inside the EU and 10 further countries.

Technical Data of iTraceRT-MVT-60X (rms values)

Data Output:	Heading, Roll, Pitch, Angular Velocity, Velocity (Body and World), Position, Raw Data of INS / GNSS / VMS incl. time-stamp, Internal Status Information
True Heading	iTraceRT-MVT-602: 0.020° [0.3 mils] sec(lat) free inertial; < 0.01° with GNSS[1], < 0.008° post-proc[1] RTK
	iTraceRT-MVT-601A: 0.035° [0.6 mils] sec(lat) free inertial; < 0.01° with GNSS[1], < 0.008° post-proc[1] RTK
	iTraceRT-MVT-601: 0.057° [1.0 mils] sec(lat) free inertial; < 0.01° with GNSS[1], < 0.008° post-proc[1] RTK
	iTraceRT-MVT-600: 0.086° [1.5 mils] sec(lat) free inertial; < 0.01° with GNSS[1], < 0.008° post-proc[1] RTK
	option: Dual-Antenna Setup with 0.2 °/L[m] with L = antenna baseline; e.g. 0.02 ° @ 10 m baseline (MVT-60x-DA)
Attitude Accuracy:	< 0.025° [0.5 mils] (< 0.01° with GNSS, < 0.0025° postproc with RTK aiding)
Position Accuracy	iTraceRT-MVT-602: < 10 cm RTK[1] online; < 0.8 nm/hr free inertial [CEP][2]; typically < 1.6 m GPS (S/A off)
	iTraceRT-MVT-601: < 10 cm RTK[1] online; < 1.2 nm/hr free inertial [CEP][2]; typically < 1.6 m GPS (S/A off)
	iTraceRT-MVT-600: < 10 cm RTK[1] online; < 1.5 nm/hr free inertial [CEP][2]; typically < 1.6 m GPS (S/A off)
	< 0.6 m [rms] SBAS (WAAS/EGNOS); < 0.2 m DGPS; 2 cm RTK/INS (good GNSS conditions or post-proc.)
	< 0.1 % distance travelled [CEP] (with odometer and GPS, application dependant)
Velocity Accuracy:	5 mm/s (aided with multi-frequency / multi-constellation RTK GNSS, < 3 mm/s postproc RTK)

ARW / bias / alignment Time:

	Gyroscopes		Accelerometer		0.25°	0.15°	0.10°	0.086°	0.06°	0.028°	(sec lat)
iTraceRT-MVT-602:	<0.0020 °/√h	0.004 °/hr	< 12 µg/√Hz	50 µg		2 min	2 min	3 min	4 min	6 min	15 min	
iTraceRT-MVT-601:	<0.0025 °/√h	0.007 °/hr	< 12 µg/√Hz	75 µg		2 min	3 min	4 min	5 min	6 min		
iTraceRT-MVT-600:	<0.0050 °/√h	0.010 °/hr	< 12 µg/√Hz	100 µg		2 min	4 min	6 min	8 min			
	Off-shore Alignment Duration = On-shore Alignment Duration + 15…60 minutes (depends on v-aiding)										

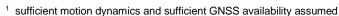|		
Range:	± 395 °/s	± 20 g
Bias Stability:	< 0.001 °/hr	< 12 µg (AllanVar)
Resolution:	0.00033 ° (1,2"), < 0.001 °/s	< 5 µg (depends on data rate)
Scale/Linearity Error:	< 15 ppm / < 10 ppm	< 100 ppm / < 30 µg/g²
Axis Misalignment:	< 30 µrad	< 50 µrad
GNSS Receiver (integrated):	up to all frequencies / all constellations (GPS+GLONASS+GALILEO+BEIDOU), SBAS, RTK/PPP	
Input Interfaces (options):	external GNSS receiver (standard: integrated GNSS receiver); event trigger (PPS / SYNC, RS422 level), odometer (opto-coupler input up to 32 V, A/B quadrature or counts & direction, RS422 level compliant); interface to ABD steering robot The usage of an odometer / wheel sensor for aiding is always recommended, but the iMAR systems provide also an unmatched integrated Motion Detector, which allows to achieve advanced accuracy also without.	
Output Interfaces (options):	UART RS232/422, Ethernet TCP/IP / UDP, CAN, PPT (Pulse per Time), PPS, SYNC; NTP Server (since HW rev. 5); NTRIP caster; PPD (Pulse-per Distance)	
Data Output Rate:	1…400 Hz, internal data rate 3'200 Hz	
Real-Time-Clck (RTC):	as option available	
Data Latency:	< 5.3 ms (sampling accuracy better 1 µs, time-stamped according to PPS; jitter < 1 ms)	
Data storage:	32 GByte on internal non-volatile memory (128 GByte as option)	
Dual-Antenna GNSS (opt.):	Additionally providing independent heading from dual-antenna GNSS setup: Accuracy = 0.2 deg/L[m] where L is the baseline between both antennas (example: 0.02 deg @ 10 m baseline)	
Connectors:	MIL-C-38999 Series III for signals and power, TNC for antenna	
Temperature (case):	-40...+65°C operating, -55...+85°C storage	
Rel. Humidity:	8...100%, IP67	
Magnetic. insensitivity:	< 500 µTesla (5 Gauss)	
MTBF / MTTR:	> 50,000 hrs (field tested for surveying applications) / < 30 minutes	
Shock, Vibration, Altitude:	6 g, 20 ms (operating); 5…2'000 Hz, 6.3 g rms (operating); 60'000 ft	
Qualification:	MIL-STD-810G, MIL-STD-461G, MIL-STD-704F, partially DO160G	
Power:	10...35 V DC, < 20 W (incl. GNSS); 50 ms hold up time according to DO160E; continuous overvoltage protection up to 60 V	
Weight / Size:	approx. 6.9 kg / approx. 187 x 128 x 296 mm³ (w/o connectors);	
Installation:	Installation in all arbitrary orientations allowed Drivers / scripts / SDK available for ROS 2, Python, C++	
Software:	real-time data output; iXCOM communication protocol; iXCOM-CMD GUI / HMI software under MS Windows and Linux available; INS/GNSS post-proc iWP+ available	

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iMAR Navigation GmbH manufactures and designs inertial navigation, surveying, guidance, control and stabilization systems for airborne, industrial, automotive, agriculture, mining, drilling, surveying, defence and many other applications. All systems are manufactured and maintained by iMAR Navigation in Europe / Germany.

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[1] sufficient motion dynamics and sufficient GNSS availability assumed
[2] after suffient motion with reasonable GNSS availability