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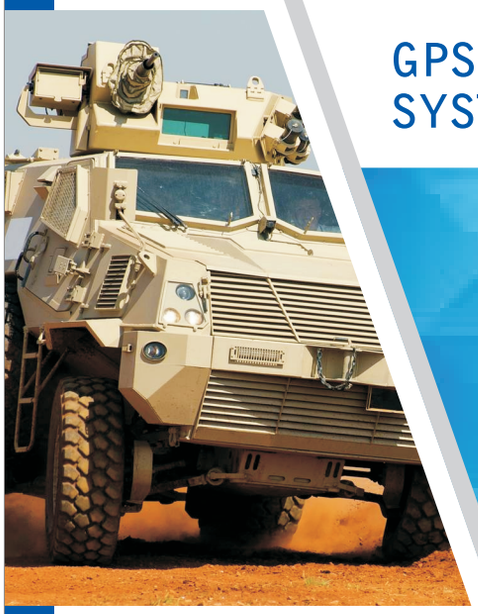


GPS-AIDED INERTIAL NAVIGATION SYSTEMS (INS-DM)

The DILABS GPS-Aided Inertial Navigation System (INS-DM) is the latest version of Inertial Navigation System. The INS-DM is the result of our experience in developing and supplying INS solutions to land, marine and aerial platforms.

This system, the INS-DM, is an IP68 rated version of an all-new generation of super ruggedized, shielded from the EMC/EMI, fully-integrated, combined Inertial Navigation System (INS) + Attitude & Heading Reference System (AHRS) + Air Data Computer (ADC) high-performance strapdown system, that determines position, velocity and absolute orientation (Heading, Pitch and Roll) for any device on which it is mounted. Horizontal and Vertical Position, Velocity and Orientation are determined with high accuracy for both motionless and dynamic applications.

The DILABS INS-DM can support multiple types of MEMS Inertial Measurement Units (IMU). Additionally, the INS-DM supports other IMU's, like the Honeywell HG4930. The INS-DM also utilizes different multi constellation (GPS, GLONASS, GALILEO, QZSS, IRNSS(NAVIC) and BEIDOU) GNSS receivers like Novatel OEM7 series or the uBlox F9 series. The design of the INS-DM also includes an optional Air Data Computer (ADC), supported by two barometers, and the ability to support an external Stand-Alone Magnetic Compass (SAMC). The INS-DM contains new on-board sensor fusion filter, state of the art navigation and guidance algorithms, and calibration software.

KEY FEATURES, BENEFITS AND FUNCTIONALITY

- Commercially exportable GPS-Aided Inertial Navigation System
- 3-in-1 strapdown system: INS + AHRS + ADC (Air Data Computer)
- Novatel OEM7 or UBlox ZED-F9P F9 High Precision GNSS receiver
- GPS, GLONASS, GALILEO, BEIDOU, QZSS, IRNSS (NAVIC) RTK supported signals
- Total and Static Pressure Sensors for calculating Indicated Airspeed
- SP, SBAS, DGPS, RTK and PPP for real time operation
- GNSS measurements and IMU raw data for post processing
- Advanced, extendable, embedded Kalman Filter based sensor fusion algorithms
- State-of-the-art algorithms for different dynamic motions of Helicopters, and UAV
- Full temperature calibration of all sensing elements
- EMC, EMI and ERD protection
- Environmentally sealed (IP68)
- Aiding data: Wind sensor, Air Speed Sensor, Doppler shift from locator (for long-term GPS denied), External position and External Heading

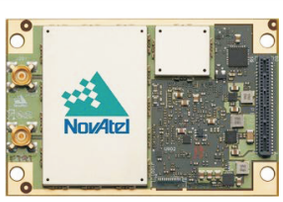
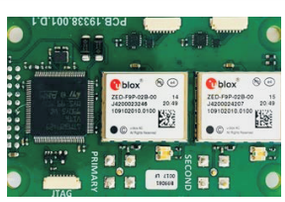
GENERAL	**OPTIONAL INPUT SIGNALS**	
	External Magnetometer, Wind sensor, Air Speed Sensor, Doppler shift from locator (for long- term GPS denied), External position and External Heading aiding data	
	OPTIONAL OUTPUT SIGNALS	
	• IMU data: Accelerations, Angular rates; • AHRS data: Heading, Pitch & Roll • INS data: Positions, Velocity, Delta Theta and Delta Velocity, GNSS data, Time • Air Data Computer data: Static Pressure (calibrated), Dynamic Pressure (calibrated), Baro- Corrected Pressure Altitude, Pressure Altitude, Calibrated Airspeed, True Airspeed, Mach- Number, Static Pressure Over Total Pressure, True Angle of Attack, Rate of Climb	
	ELECTRICAL & MECHANICAL	
	Update rate	1 … 200 Hz (user settable)
	Start-up time	<1 sec
	Interface	RS-232 / RS-422 / CAN / Ethernet
	Input power	9 to 36 V DC (27 ± 10 for MIL-1275 protection)
	Output data	Binary, NMEA 0183 ASCII characters
	1 PPS level	3.3 V DC TTL / 5 V DC TTL / differential via RS-422
	EMC/EMI	MIL-STD-461F

	ELECTRICAL & MECHANICAL	
GENERAL	Input Power Protection	MIL-1275 (optional)
	Type of Sealing	IP-68
	MTBF	100000 hours
	Dimensions	160.4 x 141.2 x 61.1 mm
	Weight	1345 grams (depends on configuration)
	ENVIRONMENT	
	Operational Temperature	-40 to +80C
	Storage Temperature	-50 to +85C
	Humidity	Up to 95%
	Sand, Dust, Water, Shock, Vibration	MIL-STD-810G
	Altitude	up to 15,000 m (50,000 ft)
	Acoustic noise	185 dB max

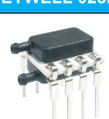
IMU OPTIONS

GYROSCOPES				
	 **KERNEL-110**	 **KERNEL-210**	 **IMU-NAV-100**	 **HG4930 CA51**
Measurement range	±2000 deg/sec	±2000 deg/sec	±2000 deg/sec	±400 deg/sec
Bias in-run stability, RMS	2 deg/hr	1 deg/hr	0.5 deg/hr	0.25 deg/hr
Bias residual error, RMS	72 deg/hr	25 deg/hr	15 deg/hr	7 deg/hr
SF error	1000 ppm	1000 ppm	1000 ppm	100 ppm
Noise (ARW)	0.38 deg/√hr	0.2 deg/√ hr	0.1 deg/√ hr	0.04 deg/√hr
ACCELEROMETERS				
Measurement range	±8g (±15g & ±40g)	±8g (±15g & ±40g)	±8g (±15g & ±40g)	±20g
Bias in-run stability, RMS	0.01 mg	0.005 mg	0.003 mg	0.025 mg
Bias residual error, RMS	0.7 mg	0.5 mg	0.4 mg	1.7 mg
SF error	500 ppm	150 ppm	150 ppm	600 ppm
Noise (VRW)	0.02 m/s/√hr	0.015 m/s/√hr	0.008 m/s/√ hr	0.03 m/s/√hr

GNS RECEIVER OPTIONS

SPECIFICATIONS		
	 **Novatel OEM7720**	 **uBlox ZED-F9P**
Number of GNSS Antennas	Dual	Dual
GNSS constellations	GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BeiDou B1I, B1C, B2I, B2a, B3I; Galileo E1, E5 AltBOC, E5a, E5b, E6; NavIC (IRNSS) L5; QZSS L1 C/A, L1C, L2C, L5, L6; L-Band	GPS L1C/A L2C, GLONASS L1OF L2OF, Galileo E1B/C E5b, BeiDou B1I B2I, QZSS L1C/A L2C
GNSS corrections	WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar	WAAS; EGNOS; MSAS; GAGAN; SBAS L1C/A, L5; DGPS; RTK
Channel configuration	555 Channels	184 Channels
GNSS data rate	5 Hz / 20 Hz / 100 Hz	10, 20 Hz (1)
RTK corrections	RTCM 2, RTCM 3	RTCM 3
Velocity accuracy, RMS	0.03 m/sec	0.05 m/sec
Initialization time	<39 (cold start), <20 (hot start)	<39 (cold start), <10 (hot start)
Time accuracy (clock drift)	20 nano sec	30 nano sec

AIR DATA COMPUTER

SPECIFICATIONS	USING HONEYWELL 025MD SENSOR	USING HONEYWELL 600MD SENSOR
		
Static Pressure (calibrated)	300 to 1100 hPa, from -2000 ft to 30000 ft, Accuracy: ±0.1% FSS	300 to 1100 hPa, from -2000 ft to 30000 ft, Accuracy: ±0.1% FSS
Dynamic Pressure (calibrated)	0.15 to 25 hPa / 10 to 124 KCAS, Accuracy: ±0.25% FSS	0.15 to 600 hPa / 10 to 600 KCAS, Accuracy: ±0.25% FSS

SPECIFICATIONS	USING HONEYWELL 025MD SENSOR	USING HONEYWELL 600MD SENSOR
Baro-Corrected Pressure Altitude	-500 to 9000 meters; Accuracy: 1	-500 to 9000 meters; Accuracy: 1
Pressure Altitude	-500 to 9000 meters; Accuracy: 1	-500 to 9000 meters; Accuracy: 1
Calibrated Airspeed	5 to 64 meters/sec; Accuracy: 0.5	5 to 310 meters/sec; Accuracy: 0.5
True Airspeed	5 to 64 meters/sec; Accuracy: 0.5	5 to 310 meters/sec; Accuracy: 0.5
Mach-Number	0.01 to 0.2 M, Accuracy: 0.001 M	0.01 to 0.99 M, Accuracy: 0.002 M
Static Pressure Over Total Pressure	0.97 to 1, Resolution 0.000001	0.63 to 1, Resolution 0.000001
True Angle of Attack	-50 to 50 deg; Accuracy ±0.25	-50 to 50 deg, Accuracy ±0.25
Rate of Climb	±515 meters/sec; Accuracy 0.05	±515 meters/sec; Accuracy 0.05
Air Density	0.3 to 1.6 kg/m3; Accuracy 0.002	0.3 to 1.6 kg/m3; Accuracy 0.002
Outside Air Temperature (OAT)	-40 to +85 deg C; Resolution 0.01	-40 to +85 degC; Resolution 0.01
Wind Speed	±200 meters/sec; Accuracy: 0.1	±200 meters/sec; Accuracy: 0.1

INS OPTIONS

					
Model	**INS-DM-M1**	**INS-DM-E1**	**INS-DM-A1**	**INS-DM-N11**	**INS-DM-B1**
Weight (grams)	1,060	1,047	1,110	1,255	1,300
Type of IMU	**IMU: miniAHRS** 	**IMU: KERNEL-110** 	**IMU: KERNEL-210** 	**IMU: IMU-NAV-100** 	**IMU: HG4930 Ca51** 
NAVIGATION					
Horizontal position accuracy (SP)	1.2 m	1.2 m	1.2 m	1.2 m	1.2 m
Horizontal position accuracy (SBAS)(1)	0.6 m	0.6 m	0.6 m	0.6 m	0.6 m
Horizontal position accuracy (DGPS)	0.4 m	0.4 m	0.4 m	0.4 m	0.4 m
Horizontal position accuracy (TerraStar-C PRO)(2)	0.025 m	0.025 m	0.025 m	0.025 m	0.025 m
Horizontal position accuracy (PPK)(3)	0.005 m	0.005 m	0.005 m	0.005 m	0.005 m
Horizontal position accuracy (RTK)	0.01 m	0.01 m	0.01 m	0.01 m	0.01 m
Vertical position accuracy (RTK)	0.02 m	0.02 m	0.02 m	0.02 m	0.02 m
Velocity accuracy (OEM7720), RMS	0.03 m/sec	0.03 m/sec	0.03 m/sec	0.03 m/sec	0.03 m/sec
Velocity accuracy (uBlox F9P), RMS	0.05 m/sec	0.05 m/sec	0.05 m/sec	0.05 m/sec	0.05 m/sec
Horizontal Position accuracy (free inertial, land vehicles)	1% DT	1% DT	2% DT	1% DT	1% DT
Horizontal Position accuracy (free inertial, aerial)	<10 NMPH	<10 NMPH	<7 NMPH	<5 NMPH	<3 NMPH
HEADING					
Range	0 to 360 deg	0 to 360 deg	0 to 360 deg	0 to 360 deg	0 to 360 deg
Angular Resolution	0.01 deg	0.01 deg	0.01 deg	0.01 deg	0.01 deg
Static & Dynamic Accuracy(4) (Dual antenna, 1 meter baseline)	0.15 deg	0.15 deg	0.15 deg	0.15 deg	0.15 deg
Static & Dynamic Accuracy(4) (Dual antenna, 2 meters baseline)	0.08 deg	0.08 deg	0.08 deg	0.08 deg	0.08 deg
Dynamic Accuracy(4) (Single antenna)	0.15 deg	0.15 deg	0.15 deg	0.15 deg	0.15 deg
Post processing accuracy(3)	0.05 deg	0.05 deg	0.03 deg	0.015 deg	0.01 deg
Free inertial	10 deg/hr	10 deg/hr	2 deg/hr	1 deg/hr	0.5 deg/hr
PITCH & ROLL					
Range	±90, ±180	±90, ±180	±90, ±180	±90, ±180	±90, ±180
Angular Resolution	0.01	0.01	0.01	0.01	0.01
Static Accuracy	0.08	0.08	0.05	0.03	0.02
Dynamic Accuracy (with GNSS correction)	0.05	0.05	0.03	0.02	0.01
Post processing accuracy(3)	0.05 deg	0.05 deg	0.006 deg	0.003 deg	0.002 deg

Notes:

(1) GPS only

(2) For Novatel OEM7720 GNSS receiver only. Requires a subscription to a TerraStar data service

(3) RMS, incremental error growth from steady state accuracy. Post-processing results using third party software;

(4) dynamic accuracy may depend on type of motion