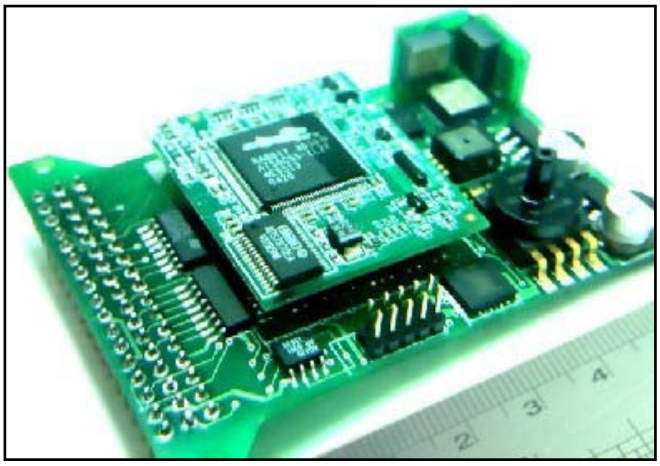
AUTOPILOT

AUTOPILOT FEATURES

- 24 grams weight
- 70 x 45 x 15 mm sizes
- On-board 3-axis angular rate MEMS gyros
- On-board 3-axis MEMS acceleration
- On-board 2-axis magnetometer
- Absolute pressure sensor for altimeter
- Differential pressure sensors for airspeed
- 16 channel / 4Hz GPS
- Ultrasonic range-meter
- 900 MHz / 1000 mW serial modem
- 1 RS232 serial port (camera control)
- Motor battery voltage and current monitor
- System & avionic battery voltage monitor
- 6 PPM servo signal inputs (for RPV control)
- 6 PPM servo outputs (for aircraft control)
- 2 PPM servo outputs (for pan-tilt control)
- 3 digital I/O outputs (TTL-Level)
- 3 analogue inputs @ 12bit resolution
- Temperature compensation
- 5.5 – 7.4 V / 150 mA power
- Isolated power input for servos
- 3.3 V & 5 V power regulation
- Lightweight connection board
- Power & function indicator LEDs
- Attitude estimation
- INS/GPS integrated navigation
- Auto takeoff & land features
- Vibration-free stabilized camera PT control
- 30Hz servo control update rate
- Auto-trim feature for fixed-wing aircrafts
- Optional failsafe & emergency scenarios

GROUNDSTATION FEATURES

- Different flight modes control (UAV, RPV, ARPV)
- Autopilot, Altitude & Heading Hold control
- Auto takeoff Hold control
- Failsafe & emergency setup control
- Attitude, Airspeed, Altitude gauges
- Main power & 2 avionic battery voltage indicators
- Failsafe & emergency indicators
- RPV and ARPV control joystic
- Camera control joystic
- 3D Digital map display
- Drag & Drop flight plan generation
- Camera display
- 1 Hz telemetry
- Telemetry & camera record / re-play features
- Target tracking
- Target coordinate localization
- 900MHz / 1000mW modem
- Antenna tracking feature
- 24V battery pack (1 hour operation)
- 220Vac or 24Vdc battery charging
- All in one composite lightweight bag



DESCRIPTION

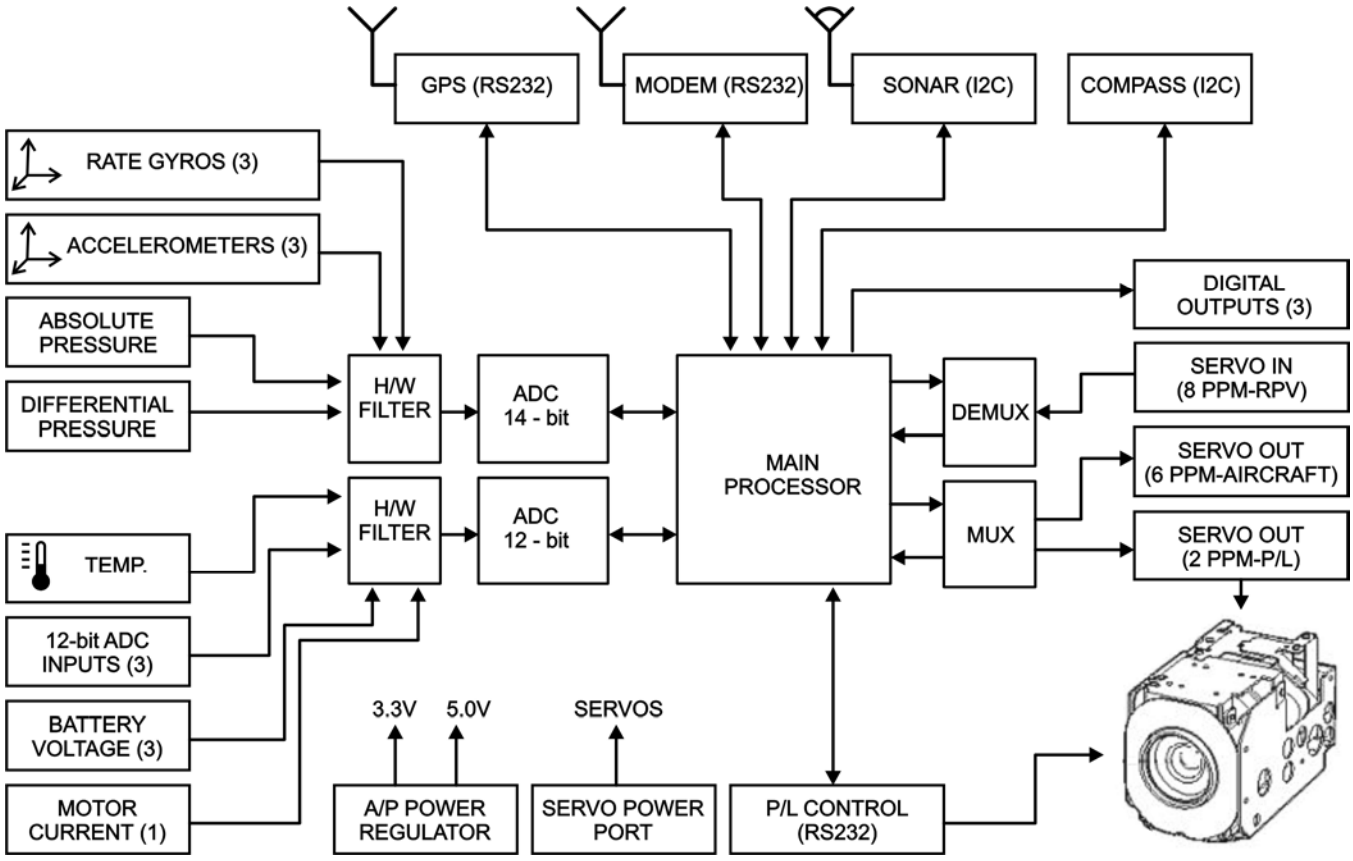
System was designed for low-cost, mid range mini or micro fixed-wing uav's. It has onboard sensor-level IMU, 2-axes magnetometer, absolute pressure transducer as barometric altimeter and a differential pressure transducer as pitot sensor. The full featured autopilot is the lightest (24gr) and the smallest (70x45x15mm) board in its range. System is integrated with a 16 channel GPS for INS integration and an ultrasonic sensor for auto takeoff and land capability. 900MHZ/1000mW radio modem was used for Telemetry and control.

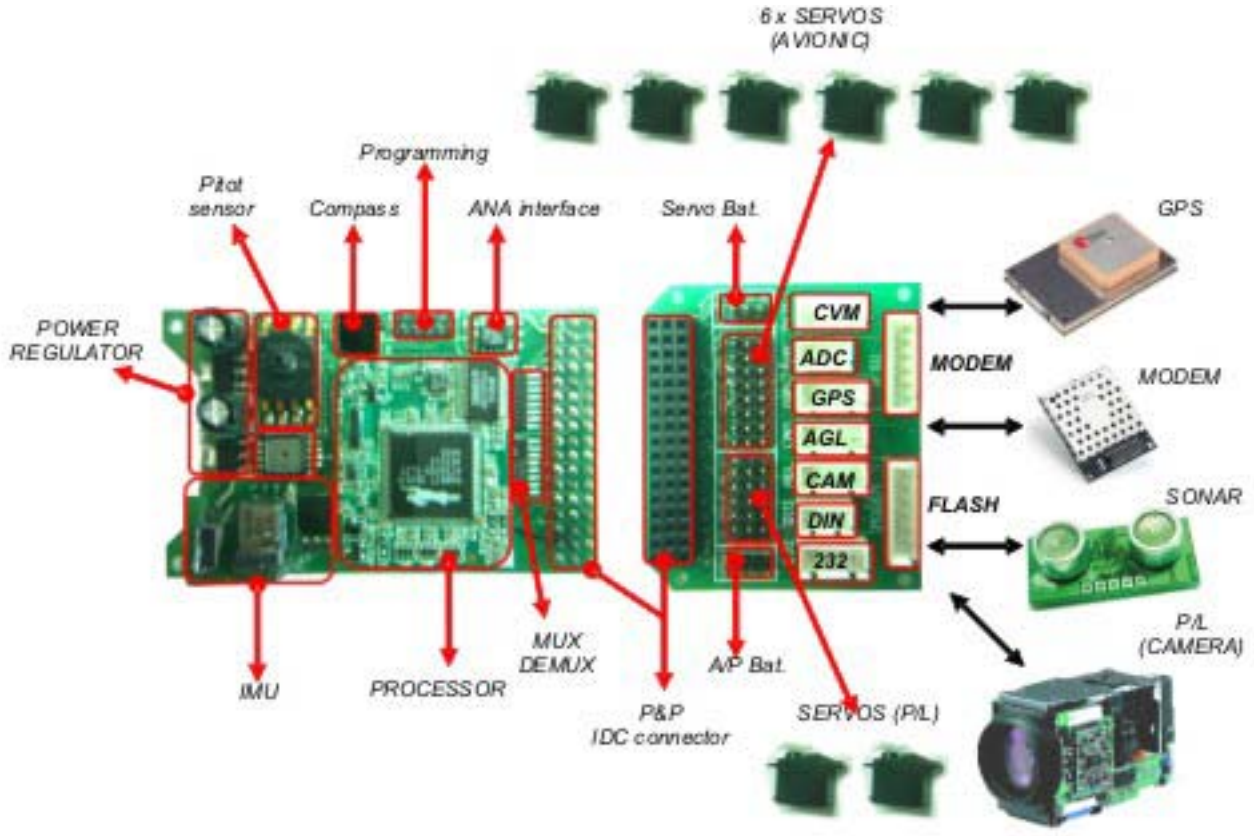
IMU sensors were measured with a real 14-bit fast ADC and a hardware filter was applied. EKF filter provides an accurate digital filter with 30Hz servo update rate. Sensor temperatures were also measured for temperature calibration. System is also capable to auto-trim in flight.

Onboard servo in/out, onboard programmable digital I/O's, 12-bit analogue outputs, PPM servo outputs and RS232 serial port provide efficient and reliable payload control.

Ground station control software was designed as a modern airliner cockpit with features like autopilot, altitude, heading, takeoff hold switches and setting gauges, combined attitude, airspeed and altitude gauges. Ground station digital display enables to make drag & drop flight plan development and 3D digital map is capable to map enhancement feature. System has also a payload (camera) view display and capable to process target, target tracking and target localisation. Vibration-free stabilized pan-tilt feature enables to control payload by a joystick only. Assisted RPV flight mode enables fast and safe operation and also reduces pilot training time.

HARDWARE LAYOUT





6-DOF IMU SENSORS

GYROS (3 sensors was used for all 3 axes)

Parameter	Conditions	Min	Typ	Max	Unit
Sensitivity	CW rotation is positive	11.25	12.5	13.75	mV/°/s
Range	Full-scale range over spesifications	±150			°/s
Nonlinearity	Best fit straight line		0.1		% of FS

ACCELEROMETERS (1 sensor was used for all 3 axes)

Parameter	Conditions	Min	Typ	Max	Unit
Sensitivity	CW rotation is positive		600		mV/g
Range	Full-scale range over spesifications		±2		G
Zero g	T_A=25°C, V_{DD}=3.3V	1.48	1.65	1.81	V
Temperature drift	All axes		±0.03		%/°C

2-AXES MAGNETOMETER – COMPASS

Parameter	Conditions	Min	Typ	Max	Unit
Heading accuracy	Full-scale @ T_{amb}		6		degRMS
Heading resolution	Full-scale @ T_{amb}		0.5		deg
Heading repeatability			1		deg
Field range	Total applied field	0.10		0.75	gauss

NAVIGATION SENSOR

GPS

Parameter	Max	Unit	
Receiver type	L1 frequency, C/A Code 16 channles 8192 search bins		
Max. Update rate	4	Hz	
Accuracy	Position	2.5 m CEP	5.0 m SEP
	DGPS/SBAS	2.0 m CEP	3.0 m SEP

SONAR

Parameter	Conditions	Min	Typ	Max	Unit
Range		2	6	10	m
Resolution	@ 10 m range		42		mm
Update rate			20		Hz

PORTS

Port	Feature	# of channel
PPM Servo inputs	Standart PPM servo inputs /w standart servo connectors	6
PPM Servo outputs	Standart PPM servo outputs /w standart servo connectors	8
ADC inputs	12-bit / 0...5V analogue inputs	3
P/L control port	RS232 (Rx, Tx, V_{DD}, GND)	1
Programming port	2x5 2mm IDC	1
Serial port	RS232 (Rx, Tx, V_{DD}, GND)	1
Motor voltage monitor	0...30 V range	1
Motor current monitor	0...60 A range	1
A/P battery voltage monitor	0...10 V range	1
Avionics battery voltage monitor	0...10 V range	1
Serial modem port	RS232 (Rx, Tx, V_{DD}, GND)	1
Sonar port	I2C	1
Digital outputs	TTL-Level buffered output	3

ELECTRICAL

Parameter	Conditions	Min	Typ	Max	Unit
A/P Power	T_A = 25°C				
Voltage		5.5	7.4	9.9	V
Current		-	150	-	mA
Servo Power	T_A = 25°C				
Voltage		4.5	5.0	6.5	V
Current		-	-	2.0	A
P/L Serial I/O					
High		2.3	-	-	V
Low		-	-	0.4	V
Supply		4.95	5.0	5.15	V
Servo Inputs					
High		2.3	-	-	V
Low		-	-	0.4	V
Servo Outputs					
High		2.3	-	-	V
Low		-	-	0.4	V
ADC Inputs					
Range		-	5.0	12.0	V
Resolution		-	12.0	-	V
TTL-Outputs					
High		-	5.0	0	V
Low		-	0.0	0	V

FLIGHT CHARACTERISTICS

Parameter	Conditions	Min	Typ	Max	Unit
Gyros					
Dynamic range		-	-	±150	deg
Frequency responce		-	10	20	Hz
Accelerometers					
Dynamic range		-	-	±2	g
Frequency responce		-	10	20	Hz
Attitude estimation error (Roll & Pitch)					
Level flight		-	-	5	deg
Barometer					
Range		15	-	110	kPa
Resolution		-	54	-	mV/Pa
Altitude					
Range		-50	-	15000	m
Resolution		-	1.0	-	m
Pitot Tube					
Range		0	-	3.92	kPa
Resolution		-	1	-	V/kPa
Airspeed					
Range		2	-	60	m/s
Resolution		-	0.03	-	m/s

PHYSICAL

Parameter	Typ	Error	Unit
Dimentions			
Witdh	45	±0.5	mm
Lenght	70	±0.5	mm
Height	15	±0.5	mm
Weight	24	±2	gr