

Swiss Air Data System

Simtec AG



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ADS-9 Air Data System

The *ADS-9* is a miniature multi-function air data system for small flight vehicle. The *ADS-9* measures airspeed, altitude, angle of attack (AoA), angle of side-slip (AoS) and outside air temperature (OAT). All values are fully calibrated and aerodynamically corrected. Derived parameters like pressure altitude, true airspeed, Mach number and static temperature are supplied as well.

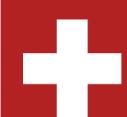
The individually calibrated silicon based pressure sensors enable the measurement of very accurate and fast air data over the full temperature range of -55°C to +80°C at a rate of up to 200 Hz.

Key Features

- Small, lightweight, low-power, robust, no moving parts
- Silicon pressure sensors with high accuracy and low drift
- Fully temperature compensated from -55°C .. +80°C (power up above -40°C)
- Outputs fully calibrated air data at up to 200Hz with very low transport delay
- RS-485 full-duplex data interface, suitable for use in high-noise environments on long cables
- EMI/EMC optimized aluminum box
- Compatible with Swiss Air Data line of Air Data Systems
- Easy configuration of data-labels, output rate, baud-rate over the maintenance software
- Compared to vane-type airflow angle measurement there is no friction and no overshoot

Typical Applications

- Air Data Measurement
- Flight Testing
- UAV, Drones
- VTOL, Rotary Wing UAV
- Wind-tunnel Measurement



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System Overview

The *ADS-9* is a complete solution for in flight measurement of air data. It is composed of the *ADC-9* Air Data Computer and the *ADP-9* miniature five-hole Air Data Probe. Additionally, the air data computer features a PT-100 input to connect an external outside air temperature sensor (OAT).

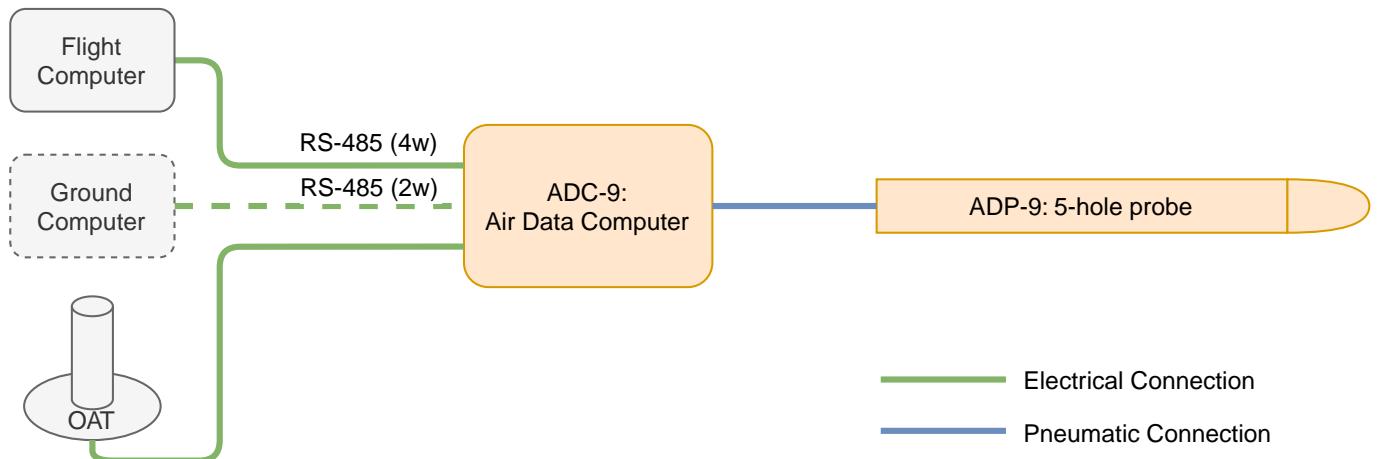


Figure 1. System Overview

Impact pressure, static pressure, angle of attack and angle of sideslip data are picked-up by the *ADP-9* five-hole probe. Six pneumatic tubes feed the pressure to the air data computer. The measurement is frictionless, fast and very accurate.

The air data computer utilizes integrated pressure sensors to measure these pressures and the outside temperature via the OAT sensor. It further enhances accuracy by digitally correcting impact and static pressure data based on the angle of side-slip and angle of attack. Derived parameters such as altitude, true airspeed, Mach number, and static temperature are subsequently transmitted to the flight computer over the RS-485 interface, ensuring reliable and precise flight data.

The *ADC-9* features a second RS-485 data interface for maintenance purposes, allowing users to access and modify configuration data. Data labels can be activated and the output frequency configured via the maintenance interface. The sensor zero point and offset can also be easily readjusted if necessary.



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Performance

Property	Value	Details
Static Pressure Range	45 hPa ... 1'080 hPa -1'800 ft ... 69'000 ft	
Dynamic Pressure Range	±16 hPa dif ±30 hPa dif ±75 hPa dif ±105 hPa dif ±150 hPa dif Other ranges on request	~95 KCAS ~135 KCAS ~210 KCAS ~250 KCAS ~295 KCAS
AoA and AoS Range	±45° (preliminary)	Reduced PS/QC accuracy above ±30°
Accuracy	larger of 0.1%FS and ±1 Pa ^[1]	FS: Full Scale
Temperature Range	-40°C..+80°C -55°C..+80°C -55°C..+80°C	Power Up Operating Storage
Output Rate	200, 100, 50, 25, 20, 10, 5, 1Hz	
Transport Delay	<10ms	Valid at 200Hz, 500'000bps, 2 labels activated For other values see <i>ICD</i>
Resolution	24 bit	Pressure and Temperature Data
Basic Data Labels	Static Pressure (Ps) Dynamic Pressure (Qc) Angle of Attack (AoA) Angle of Sideslip (AoS) Total Air Temperature (TAT)	
Computed Air Data Labels	Pressure-Altitude (Hp) Barometric-Altitude (Hb) Calibrate airspeed (CAS) True airspeed (TAS) Mach-Number (M) Climb-Rate (CR) Static Air Temperature (SAT)	
Sensor Media Compatibility	Clean Air	Non-condensing and non-corrosive gases

Mechanical

ADC-9 (Air Data Computer)

Property	Value	Details
Mass	0.240kg	
Dimensions (LxWxH)	68 mm x 90 mm x 38 mm	Excluding connector and pressure fitting



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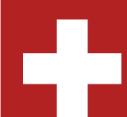


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Property	Value	Details
Pressure Fitting	For ID=Ø2.5 tube	

ADP-9 (Air Data Probe)

Property	Value	Details
Mass	0.060kg (preliminary)	Without carbon tube and tubing
Probe Diameter	Ø9 mm	See drawing for details
Pressure Fitting	For ID/OD Ø2.5/4.0 mm tube	1m pressure tubing included, Ø2.6/4.0mm (PUN-H-4X0.75)



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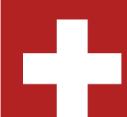
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Electrical

Property	Value	Details
Data Interface	RS-485 Full-Duplex (4-wire)	USB via FTDI converter cable
Maintenance Interface	RS-485 Half-Duplex (2-wire)	USB via FTDI converter cable
Power Supply	9..32 VDC	
Power Consumption	100 mA @ 9V (preliminary) 50 mA @28 V (preliminary)	
Baud-Rate	115'200 bps 230'400 bps 460'800 bps 500'000 bps	
Connector	DSUB-9 (Deltron DTS09SY/2M85UN) DSUB-9 (Deltron DTS09PY/2M85UN)	For pin-assignment see <i>ICD</i>



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Reliability

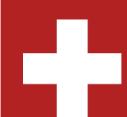
Environmental (DO-160G)

The *ADS-9* has been designed to withstand the tests in the table below as described by the DO-160G standard. Testing has been performed in-house (non-accredited laboratory). The design is based on the DO-160G tested ADC-10.

Name	Sec.	Cat.	Details
Ground Survival and Operating Low Temperature	4.5	E1	Ground Survival Low Temperature = -55°C, Operating Low Temperature= -55°C ⇒ Power-up above -40°C
Ground Survival and Operating High Temperature	4.5	E1	Ground Survival High Temperature = 85°C, Operating High Temperature= 70°C
Power Input	16	B	excl. section 16.6.1.3
Lightning Induced Transient Susceptibility Pin Injection Waveform 3/3 1MHz	22.5.1	A2	250V / 10A
Lightning Induced Transient Susceptibility Pin Injection Waveform 4/1 6.4/69µs	22.5.1	A2	125V / 25A

Mean Time Between Failures (MTBF)

Property	Value	Details
MTBF ADC-9	50'000 hrs	According to MIL-HDBK-217F, AIC, 40°C, manufacturer data used if available



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Ordering Information

Part-Number	Details
SIM-6F1-720-rrrHPA	ADC-9 Air Data Computer
SIM-431-D70-1111mm	ADP-9 Air Data Probe
SIM-DC7-A7B	PSS-8 OAT Outside Air Temperature Probe
SIM-6F7-CFC	Connector Kit. Includes DSUB-9 and Molex SL connectors.

Table 1. Ordering Code for Range of Dynamic Pressure ^[2]

rrr	Range	Details
16	±16 hPa	~95 KCAS
30	±30 hPa	~135 KCAS
75	±75 hPa	~210 KCAS
105	±105 hPa	~250 KCAS
150	±150 hPa	~295 KCAS

Other ranges on request

Table 2. Ordering Code for length of ADP-9 Carbon Tube

1111	Length	Length incl. Probe
0250	250mm	367.8mm
0500	500mm	617.8mm
0800	800mm	917.8mm

Contact Information

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[1] Accuracy is the sum of repeatability, hysteresis, thermal effects in the specified temperature range, the calibration is traceable to DAkkS.

[2] High pressure ranges are temporarily not available