AVIATION SPECIFICATIONS 2
FLIGHT RECORDERS

EFFECTIVE DATE : 5 NOVEMBER 2020
REVISION NO : 2

Contents

1 Introduction

1.1 These Aviation Specifications 2 ("AS-2") set out specifications on crashworthiness, fire protection, performance, parameters or information to be recorded and duration of recording, amongst others, pertaining to flight recorders to be used by an operator under the following Air Navigation Regulations:

(a) Air Navigation (91 – General Operating Rules) Regulations 2018 (as amended) ("ANR-91");
(b) Air Navigation (121 – Commercial Air Transport by Large Aeroplanes) Regulations 2018 (as amended) ("ANR-121");
(c) Air Navigation (125 – Complex General Aviation) Regulations 2018 (as amended) ("ANR-125");
(d) Air Navigation (135 – Commercial Air Transport by Helicopters and Small Aeroplanes) Regulations 2018 (as amended) ("ANR-135"); and
(e) Air Navigation (137 – Aerial Work) Regulations 2018 (as amended) ("ANR-137").

1.2 This AS-2 is issued by the Director-General of Civil Aviation (DGCA).

2 Types of flight recorders

2.1 Crash protected flight recorders comprise one or more of the following systems:

(a) a flight data recorder (FDR);

(b) a cockpit voice recorder (CVR);

(c) an airborne image recorder (AIR);

(d) a data link recorder (DLR).

Note: When image and data link information is required to be recorded on a crash-protected flight recorder, it is permissible to record it on either the CVR or the FDR.

2.2 Lightweight flight recorders, applicable for aeroplanes and helicopters, comprise one or more of the following systems:

(a) an aircraft data recording system (ADRS);

(b) a cockpit audio recording system (CARS);

(c) an airborne image recording system (AIRS);

(d) a data link recording system (DLRS).

Note: When image or data link information is required to be recorded on a lightweight flight recorder, it is permissible to record it on either the CARS or the ADRS.

2.3 Details and classification of various flight recorders are contained in Appendices 1 and 2 for aeroplanes and helicopters respectively.

3 General requirements for flight recorders

3.1 The non-deployable flight recorder containers shall be painted a distinctive orange colour.

3.2 The non-deployable crash-protected flight recorder containers shall:

(a) carry reflective material to facilitate their location; and

(b) have securely attached an automatically activated underwater locating device operating at a frequency of 37.5 kHz, which shall be capable of operating for a minimum of 90 days.

3.3 Automatic deployable flight recorder containers shall:

(a) be painted a distinctive orange colour, however the surface visible from outside the aircraft may be of another colour;

(b) carry reflective material to facilitate their location; and

(c) have an integrated automatically activated ELT.

3.4 The flight recorder systems shall be installed so that:

(a) the probability of damage to the recordings is minimized;

(b) there is an aural or visual means for pre-flight checking that the flight recorder systems are operating properly; and

(c) if the flight recorder systems have an erasure device, the installation shall be designed to prevent operation of the device during flight time or crash impact; and

(d) for an aeroplane or a helicopter for which the individual certificate of airworthiness is first issued on or after 1 January 2023, a flight crew-operated erase function shall be provided on the flight deck which, when activated, modifies the recording of a CVR and AIR so that it cannot be retrieved using normal replay or copying techniques. The installation shall be designed to prevent activation during flight. In addition, the probability of an inadvertent activation of an erase function during an accident shall also be minimized.

Note: The erase function is intended to prevent access to CVR and AIR recordings by normal replay or copying means, but would not prevent accident investigation authorities access to such recordings by specialized replay or copying techniques.

3.5 The crash-protected flight recorders shall be installed so that they receive electrical power from a bus that provides the maximum reliability for operation of the flight recorders without jeopardizing service to essential or emergency loads.

3.5A The lightweight flight recorders shall be connected to a power source having the characteristics which ensure proper and reliable recording in the operational environment.

3.6 The flight recorder systems, when tested by methods approved by the appropriate certificating authority, shall be demonstrated to be suitable for the environmental extremes over which they are designed to operate.

3.7 Means shall be provided for an accurate time correlation between the flight recorder systems recordings.

3.8 The manufacturer shall provide the appropriate certificating authority with the following information in respect of the flight recorder systems:

(a) manufacturer's operating instructions, equipment limitations and installation procedures;

(b) parameter origin or source and equations which relate counts to units of measurement; and

(c) manufacturer's test reports.

4 Continued serviceability of flight recorder systems

4.1 FDR systems or ADRS, CVR systems or CARS and AIR systems or AIRS shall have recording inspection intervals of one year; subject to the approval from the Authority. This period may be extended to two years provided these systems have demonstrated a high integrity of serviceability and self-monitoring. DLR systems or DLRS shall have recording inspection intervals of two years; subject to the approval from the Authority. This period may be extended to four years provided these systems have demonstrated a high integrity of serviceability and self-monitoring.

4.2 Recording inspections shall be carried out as follows:

(a) an analysis of the recorded data from the flight recorders shall ensure that the recorder operates correctly for the nominal duration of the recording;

(b) <deleted>;

(c) the FDR or the ADRS recording from a complete flight shall be examined in engineering units to evaluate the validity of all recorded parameters. Particular attention shall be given to parameters from sensors dedicated to the FDR or the ADRS. Parameters taken from the aircraft's electrical bus system need not be checked if their serviceability can be detected by other aircraft systems;

(d) the readout facility shall have the necessary software to accurately convert the recorded values to engineering units and to determine the status of discrete signals;

(e) an examination of the recorded signal on the CVR or the CARS shall be carried out by replay of the CVR or CARS recording. While installed in the aircraft, the CVR or CARS shall record test signals from each aircraft source and from relevant external sources to ensure that all required signals meet intelligibility standards;

(f) where practicable, during the examination, a sample of in-flight recordings of the CVR or CARS shall be examined for evidence that the intelligibility of the signal is acceptable; and

(g) an annual examination of the recorded images on the AIR or AIRS shall be carried out by replay of the AIR or AIRS recording. While installed in the aircraft, the AIR or AIRS shall record test images from each aircraft source and from relevant external sources to ensure that all required images meet recording quality standards.

(h) an examination of the recorded messages on the DLR or DLRS shall be carried out by replay of the DLR or DLRS recording.

4.3 A flight recorder system shall be considered unserviceable if there is a significant period of poor quality data, unintelligible signals, or if one or more of the mandatory parameters is not recorded correctly.

4.4 A report of the recording inspection shall be made available on request to the DGCA.

4.5 Calibration requirements of the FDR system shall be as follows:

(a) For those parameters which have sensors dedicated only to the FDR and are not checked by other means, recalibration shall be carried out at least every five years or in accordance with the recommendations of the sensor manufacturer to determine any discrepancies in the engineering conversion routines for the mandatory parameters, and to ensure that parameters are being recorded within the calibration tolerances;

(b) When the parameters of altitude and airspeed are provided by sensors that are dedicated to the FDR system, there shall be a recalibration performed as recommended by the sensor manufacturer, or at least every two years.

5 Other specifications to be complied with

5.1 FDR, CVR, AIR and DLR must satisfy the industry crashworthiness and fire protection specifications contained in the EUROCAE ED-112, Minimum Operational Performance Specification (MOPS) for Crash Protected Airborne Recorder Systems, or equivalent documents.

5.2 ADRS, CARS, AIRS and DLRS must satisfy the industry crashworthiness and fire protection specifications contained in the EUROCAE ED-155, Minimum Operational Performance Specification (MOPS) for Lightweight Flight Recorder Systems, or equivalent documents.

5.3 Documentation concerning FDR and ADRS parameters is to take into account Industry specifications which may be found in the ARINC 647A, Flight Recorder Electronic Documentation, or equivalent document.

Appendix 1 Flight Recorders for Aeroplanes

The material in this Appendix concerns flight recorders intended for installation in aeroplanes operating under ANR-91, ANR-121, ANR-125, ANR-135 or ANR-137.

1 Flight data recorder (FDR) and aircraft data recording systems (ADRS)

1.1 Parameters to be recorded

(a) The parameters that satisfy the requirements for FDRs are listed in Table 1.1 below. The number of parameters to be recorded shall depend on aeroplane complexity. The parameters without an asterisk (*) are mandatory parameters which shall be recorded regardless of aeroplane complexity. In addition, the parameters designated by an asterisk (*) shall be recorded if an information data source for the parameter is used by aeroplane systems or the flight crew to operate the aeroplane. However, other parameters may be substituted with due regard to the aeroplane type and the characteristics of the recording equipment.

(b) If further recording capacity is available, recording of the following additional information should be considered:

(i) operational information from electronic display systems, such as electronic flight instrument systems (EFIS), electronic centralized aircraft monitor (ECAM) and engine indication and crew alerting system (EICAS). Use the following order of priority:

(1) parameters selected by the flight crew relating to the desired flight path, e.g. barometric pressure setting, selected altitude, selected airspeed, decision height, and auto flight system engagement and mode indications if not recorded from another source;

(2) display system selection/status, e.g. SECTOR, PLAN, ROSE, NAV, WXR, COMPOSITE, COPY, ETC.;

(3) warnings and alerts;

(4) the identity of displayed pages for emergency procedures and checklists;

(ii) retardation information including brake application for use in the investigation of landing overruns and rejected take-offs.

(c) The parameters that satisfy the requirements for flight path and speed as displayed to the pilot(s) are listed below. The parameters without an (*) are mandatory parameters which shall be recorded. In addition, the parameters designated by an (*) shall be recorded if an information source for the parameter is displayed to the pilot and is practicable to record:
– Pressure altitude
– Indicated airspeed or calibrated airspeed
– Heading (primary flight crew reference)

– Pitch attitude
– Roll attitude
– Engine thrust/power
– Landing-gear status*
– Total or outside air temperature*
– Time*
– Navigation data*: drift angle, wind speed, wind
– direction, latitude/longitude
– Radio altitude*

(d) The parameters that satisfy the requirements for ADRS are the first 7 parameters listed in Table 1-3. If further ADRS recording capacity is available, the recording of any parameters from 8 onwards defined in Table 1-3 may be included.

1.2 Duration of retention of recording

(a) A FDR shall retain the information recorded during at least the last 25 hours of its operation, except for a FDR that is described in paragraph (b).

(b) A FDR that is installed on a multi-engine turbine-powered aeroplane with MCTOM of 5,700 kg or less for which the individual certificate of airworthiness was first issued on or after 1 January 1990 but before 1 January 2016 shall retain the information recorded during at least the last 30 minutes of its operation, in addition to having sufficient information from the preceding take-off for calibration purposes.

1.3 Additional information

(a) The measurement range, recording interval and accuracy of parameters on installed equipment shall be verified by methods approved by the appropriate certificating authority.

(b) Documentation concerning parameter allocation, conversion equations, periodic calibration and other service-ability/maintenance information shall be maintained by the operator. The documentation needs to be sufficient to ensure that accident investigation authorities have the necessary information to read out the data in engineering units.

2 Cockpit voice recorder (CVR) and cockpit audio recording system (CARS)

2.1 Signals to be recorded

(a) The CVR shall record simultaneously on four separate channels, or more, at least the following:

(1) voice communication transmitted from or received in the aeroplane by radio;

(2) aural environment on the flight deck;

(3) voice communication of flight crew members on the flight deck using the aeroplane's interphone system, if installed;

(4) voice or audio signals identifying navigation or approach aids introduced in the headset or speaker; and

(5) voice communication of flight crew members using the passenger address system, if installed.

(b) The preferred CVR audio allocation should be as follows:

(1) pilot-in-command audio panel;

(2) co-pilot audio panel;

(3) additional flight crew positions and time reference; and

(4) cockpit area microphone.

(c) The CARS shall record simultaneously on two separate channels, or more, at least the following:

(1) voice communication transmitted from or received in the aeroplane by radio;

(2) aural environment on the flight deck; and

(3) voice communication of flight crew members on the flight deck using the aeroplane's interphone system, if installed.

(d) The preferred CARS audio allocation should be as follows:

(1) voice communication; and

(2) aural environment on the flight deck.

2.2 Duration

(a) Subject to subparagraph (b), a CVR intended for installation on any aeroplane shall be capable of retaining the information recorded during at least the last two hours of its operation.

(b) A CVR intended to be installed on an aeroplane with a MCTOM of over 27 000 kg for which the individual certificate of airworthiness is first issued on or after 1 January 2022 shall retain the information recorded during at least the last 25 hours of operation.

(c) A CAR intended to be installed on an aeroplane for which the certificate of airworthiness is first issued on or after 1 January 2025, shall retain the information recorded during at least the last 2 hours of its operation.

3 Automatic deployable flight recorder (ADFR)

3.1 The following requirements apply for an ADFR:

(a) deployment shall take place when the aeroplane structure has been significantly deformed;

(b) deployment shall take place when an aeroplane sinks in water;

(c) ADFR shall not be capable of manual deployment;

(d) the ADFR shall be able to float on water;

(e) the ADFR deployment shall not compromise the safe continuation of the flight;

(f) the ADFR deployment shall not significantly reduce the chance of survival of the recorder and of successful transmission by its ELT;

(g) the ADFR deployment shall not release more than one piece;

(h) an alert shall be made to the flight crew when the ADFR is no longer captive to the aircraft;

(i) the flight crew shall have no means to disable ADFR deployment when the aircraft is airborne;

(j) the ADFR shall contain an integrated ELT, which shall activate automatically during the deployment sequence. Such ELT may be of a type that is activated in-flight and provides information from which a position can be determined; and

(k) the integrated ELT of an ADFR shall satisfy the same requirements as an ELT required to be installed on an aeroplane. The integrated ELT shall at least have the same performance as the fixed ELT to maximize detection of the transmitted signal.

Note 1.— Refer to the Manual on Location of Aircraft in Distress and Flight Recorder Data Recovery (Doc 10054) for more information on ADFR.

Note 2.— If an integrated ELT of a type that is activated in flight is used within an ADFR it could be a means to comply with requirements of Regulation 105 of ANR-121.

4 Data link recorder (DLR)

Note: Refer to requirements in ANR-91, ANR-125, ANR-137, ANR-135 and ANR-121 for applicability of recording of data link communications.

4.1 Applications to be recorded

(a) Where the aircraft flight path is authorized or controlled through the use of data link messages, all data link messages, both uplinks (to the aircraft) and downlinks (from the aircraft), shall be recorded on the aircraft. As far as practicable, the time the messages were displayed to the flight crew and the time of the responses shall be recorded.

Note: Sufficient information to derive the content of the data link communications message and the time the messages were displayed

to the flight crew is needed to determine an accurate sequence of events on board the aircraft.

(b) Messages applying to the applications listed in Table 1-2 shall be recorded. Applications without the asterisk (*) are mandatory applications which shall be recorded regardless of the system complexity. Applications with an (*) shall be recorded only as far as is practicable given the architecture of the system.

4.2 Duration

The minimum recording duration shall be equal to the duration of the CVR.

5 Airborne image recorder (AIR), airborne image recording system (AIRS) and flight crew-machine interface recordings

5.1 Classes

(a) A Class A AIR or AIRS captures the general cockpit area in order to provide data supplemental to conventional flight recorders.

Note 1: To respect crew privacy, the cockpit area view may be designed as far as practical to exclude the head and shoulders of crew members whilst seated in their normal operating position.

Note 2: There are no provision for Class A AIRs or AIRS in this document.

(b) A Class B AIR or AIRS captures data link message displays.

Note: A Class B AIR may be considered as a means for recording data link communications applications messages to and from the aeroplanes where it is not practical or is prohibitively expensive to record those data link communications applications messages on FDR or CVR.

(c) A Class C AIR or AIRS captures instruments and control panels.

Note: A Class C AIR or AIRS may be considered as a means for recording flight data where it is not practical or is prohibitively expensive to record on an FDR or an ADRS, or where an FDR is not required.

5.2 Applications to be recorded for flight crew-machine interface recordings

(a) The operation of switches and selectors and the information displayed to the flight crew from electronic displays shall be captured by sensors or other electronic means.

(b) The recording of operation of switches and selectors by the flight crew shall include the following:

(1) any switch or selector that will affect the operation and the navigation of the aircraft; and

(2) selection of normal and alternate systems.

(c) The recording of the information displayed to the flight crew from electronic displays shall include the following:

(1) primary flight and navigation displays;

(2) aircraft system monitoring displays;

(3) engine indication displays;

(4) traffic, terrain, and weather displays;

(5) crew alerting systems displays;

(6) stand-by instruments; and

(7) installed EFB to the extent it is practical.

(d) If image sensors are used, the recording of such images shall not capture the head and shoulders of the flight crew members whilst seated in their normal operating position.

Table 1-1
Parameters to be recorded by
Crash Protected Flight Data Recorders

Serial number	*Parameter*	*Applicability*	*Measurement range*	*Maximum sampling and recording interval (seconds)*	*Accuracy limits (sensor input compared to FDR read-out)*	*Recording resolution*
1	Time (UTC when available, otherwise relative time count or GNSS time sync)		24 hours	4	±0.125% /h	1 s
2	Pressure-altitude		–300 m (–1 000 ft) to maximum certificated altitude of aircraft +1 500 m (+5 000 ft)	1	±30 m to ±200 m (±100 ft to ±700 ft)	1.5 m (5 ft)
3	Indicated airspeed or calibrated airspeed		95 km/h (50 kt) to max V_{So} *(Note 1)* V_{So} to 1.2 V_D *(Note 2)*	1	±5%□ ±3%	1 kt (0.5 kt recommended)
4	Heading (primary flight crew reference)		360°	1	±2°	0.5°
5	Normal acceleration (*Note 8*)	Application for type certification is submitted to a Contracting State before 1 January 2016	–3 g to +6 g	0.125	±1% of maximum range excluding datum error of ±5%	0.004 g
		Aeroplane operating under Parts 121 and 135: Application for type certification is submitted to a Contracting State before 1 January 2016	–3 g to +6 g	0.0625	±1% of maximum range excluding datum error of ±5%	0.004 g
6	Pitch attitude		±75° or usable range whichever is greater	0.25	±2°	0.5°
7	Roll attitude		±180°	0.25	±2°	0.5°
8	Radio transmission keying		On-off (one discrete)	1		
9	Power on each engine *(Note 4)*		Full range	1 (per engine)	±2%	0.2% of full range or the resolution required to operate the aircraft

Serial number	*Parameter*	*Applicability*	*Measurement range*	*Maximum sampling and recording interval (seconds)*	*Accuracy limits (sensor input compared to FDR read-out)*	*Recording resolution*
10*	Trailing edge flap and cockpit control selection		Full range or each discrete position	2	±5% or as pilot's indicator	0.5% of full range or the resolution required to operate the aircraft
11*	Leading edge flap and cockpit control selection		Full range or each discrete position	2	±5% or as pilot's indicator	0.5% of full range or the resolution required to operate the aircraft
12*	Thrust reverser position		Stowed, in transit, and reverse	1 (per engine)		
13*	Ground spoiler/speed brake selection (selection and position)		Full range or each discrete position	1	±2% unless higher accuracy uniquely required	0.2% of full range
14	Outside air temperature		Sensor range	2	±2°C	0.3°C
15*	Autopilot/auto throttle/AFCS mode and engagement status		A suitable combination of discretes	1		
16	Longitudinal acceleration (*Note 8*)	Application for type certification is submitted to a Contracting State before 1 January 2016	±1 g	0.25	±0.015 g excluding a datum error of ±0.05 g	0.004 g
		Aeroplane operating under Parts 121 and 135: Application for type certification is submitted to a Contracting State before 1 January 2016	±1 g	0.0625	±0.015 g excluding a datum error of ±0.05 g	0.004 g

Serial number	*Parameter*	*Applicability*	*Measurement range*	*Maximum sampling and recording interval (seconds)*	*Accuracy limits (sensor input compared to FDR read-out)*	*Recording resolution*
17	Lateral acceleration (*Note 8*)	Application for type certification is submitted to a Contracting State before 1 January 2016	±1 g	0.25	±0.015 g excluding a datum error of ±0.05 g	0.004 g
		Aeroplane operating under Parts 121 and 135: Application for type certification is submitted to a Contracting State before 1 January 2016	±1 g	0.0625	±0.015 g excluding a datum error of ±0.05 g	0.004 g
18	Pilot input and/or control surface position-primary controls (pitch, roll, yaw) *(Notes 4 and 8)*	Application for type certification is submitted to a Contracting State before 1 January 2016	Full range	0.25	±2° unless higher accuracy uniquely required	0.2% of full range or as installed
		Application for type certification is submitted to a Contracting State before 1 January 2016	Full range	0.125	±2° unless higher accuracy uniquely required	0.2% of full range or as installed
19	Pitch trim position		Full range	1	±3% unless higher accuracy uniquely required	0.3% of full range or as installed
20*	Radio altitude		–6 m to 750 m (–20 ft to 2 500 ft)	1	±0.6 m (±2 ft) or ±3% whichever is greater below 150 m (500 ft) and ±5% above 150 m (500 ft)	0.3 m (1 ft) below 150 m (500 ft.) 0.3 m (1 ft) +0.5% of full range above 150 m (500 ft)
21*	Vertical beam deviation (ILS/ GNSS/GLS glide path, MLS elevation, IRNAV/IAN vertical deviation)		Signal range	1	±3%	0.3% of full range
22*	Horizontal beam deviation (ILS/ GNSS/GLS localizer, MLS azimuth, IRNAV/IAN lateral deviation)		Signal range	1	±3%	0.3% of full range
23	Marker beacon passage		Discrete	1		

Serial number	*Parameter*	*Applicability*	*Measurement range*	*Maximum sampling and recording interval (seconds)*	*Accuracy limits (sensor input compared to FDR read-out)*	*Recording resolution*
24	Master warning		Discrete	1		
25	Each NAV receiver frequency selection *(Note 5)*		Full range	*4*	As installed	
26*	DME 1 and 2 distance (includes Distance to runway threshold (GLS) and Distance to missed approach point (IRNAV/IAN)) *(Notes 5 and 6)*		0 – 370 km (0 – 200 NM)	4	As installed	1852 m (1 NM)
27	Air/ground status		Discrete	1		
28*	TAWS/GCAS status (selection of terrain display mode including pop-up display status) and (terrain alerts, both cautions and warnings, and advisories) and (on/off switch position)		Discrete	1		
29*	Angle of attack		Full range	0.5	As installed	0.3 % of full range
30*	Hydraulics, each system (low pressure)		Discrete	2		0.5% of full range
31*	Navigation data (latitude/longitude, ground speed and drift angle) *(Note 9)*		As installed	1	As installed	
32*	Landing gear and gear selector position		Discrete	4	As installed	
33*	Groundspeed		As installed	1	Data should be obtained from the most accurate system	1 kt
34	Brakes (left and right brake pressure, left and right brake pedal position)		(Maximum metered brake range, discretes or full range)	1	± 5%	2% of full range
35*	Additional engine parameters (EPR, N_1, indicated vibration level, N_2, EGT, fuel flow, fuel cut-off lever position, N_3, engine fuel metering valve position)	Engine fuel metering valve position: Application for type certification is submitted to a Contracting State on or after 1 January 2023	As installed	Each engine each second	As installed	2% of full range

Serial number	*Parameter*	*Applicability*	*Measurement range*	*Maximum sampling and recording interval (seconds)*	*Accuracy limits (sensor input compared to FDR read-out)*	*Recording resolution*
36*	TCAS/ACAS (traffic alert and collision avoidance system)		Discretes	1	As installed	
37*	Windshear warning		Discrete	1	As installed	
38*	Selected barometric setting (pilot, co-pilot)		As installed	64	As installed	0.1 hPa (0.003 in-Hg)
39*	Selected altitude (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
40*	Selected speed (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
41*	Selected Mach (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine
42*	Selected vertical speed (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
43*	Selected heading (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
44*	Selected flight path (all pilot selectable modes of operation) (course/DSTRK, path angle, final approach path (IRNAV/IAN))			1	As installed	
45*	Selected Decision Height		As installed	64	As installed	Sufficient to determine crew selection
46*	EFIS display format (pilot, co-pilot)		Discrete(s)	4	As installed	
47*	Multi-function/engine/alerts display format		Discrete(s)	4	As installed	
v48*	AC electrical bus status		Discrete(s)	4	As installed	
49*	DC electrical bus status		Discrete(s)	4	As installed	
50*	Engine bleed valve position		Discrete(s)	4	As installed	
51*	APU bleed valve position		Discrete(s)	4	As installed	
52*	Computer failure		Discrete(s)	4	As installed	

Serial number	*Parameter*	*Applicability*	*Measurement range*	*Maximum sampling and recording interval (seconds)*	*Accuracy limits (sensor input compared to FDR read-out)*	*Recording resolution*
53*	Engine thrust command		As installed	2	As installed	
54*	Engine thrust target		As installed	4	As installed	2% of full range
55*	Computed centre of gravity		As installed	64	As installed	1% of full range
56*	Fuel quantity in CG trim tank		As installed	64	As installed	1% of full range
57*	Head up display in use		As installed	4	As installed	
58*	Para visual display on/off		As installed	1	As installed	
59*	Operational stall protection, stick shaker and pusher activation		As installed	1	As installed	
60*	Primary navigation system reference (GNSS, INS, VOR/DME, MLS, Loran C, localizer glideslope)		As installed	4	As installed	
61*	Ice detection		As installed	4	As installed	
62*	Engine warning each engine vibration		As installed	1	As installed	
63*	Engine warning each engine over temperature		As installed	1	As installed	
64*	Engine warning each engine oil pressure low		As installed	1	As installed	
65*	Engine warning each engine over speed		As installed	1	As installed	
66*	Yaw Trim Surface Position		Full range	2	± 3% unless higher accuracy uniquely required	0.3% of full range
67*	Roll Trim Surface Position		Full range	2	± 3% unless higher accuracy uniquely required	0.3% of full range
68*	Yaw or sideslip angle		Full range	1	± 5%	0.5°
69*	De-icing and/or anti-icing systems selection		Discrete(s)	4		

Serial number	*Parameter*	*Applicability*	*Measurement range*	*Maximum sampling and recording interval (seconds)*	*Accuracy limits (sensor input compared to FDR read-out)*	*Recording resolution*
70*	Hydraulic pressure (each system)		Full range	2	± 5%	100 psi
71*	Loss of cabin pressure		Discrete	1		
72*	Cockpit trim control input position Pitch		Full range	1	± 5%	0.2% of full range or as intalled
73*	Cockpit trim control input position Roll		Full range	1	± 5%	0.2% of full range or as installed
74*	Cockpit trim control input position Yaw		Full range	1	± 5%	0.2% of full range or as installed
75*	All cockpit flight control input forces (control wheel, control column, rudder pedal)		Full range (±311 N (±70 lbf), ± 378 N (±85 lbf), ± 734 N (±165 lbf))	1	± 5%	0.2% of full range or as installed
76*	Event marker		Discrete	1		
77*	Date		365 days	64		
78*	ANP or EPE or EPU		As installed	4	As installed	
79*	Cabin pressure altitude	Application for type certification submitted to a Contracting State on or after 1 January 2023	As installed (0 ft to 40 000 ft recommended)	1	As installed	100 ft
80*	Aeroplane computed weight	Application for type certification submitted to a Contracting State on or after 1 January 2023	As installed	64	As installed	1% of full range
81*	Flight director command	Application for type certification submitted to a Contracting State on or after 1 January 2023	Full range	1	± 2%	0.5°
82*	Vertical speed	Application for type certification submitted to a Contracting State on or after 1 January 2023	As installed	0.25	As installed (32 ft/min recommended)	16 ft/min

Notes.—

1. V_{So} stalling speed or minimum steady flight speed in the landing configuration.

2. V_D design diving speed.

3. Record sufficient inputs to determine power.

4. For aeroplanes with control systems in which movement of a control surface will back drive the pilot's control, ''or'' applies. For aeroplanes with control systems in which movement of a control surface will not back drive the pilot's control, ''and'' applies. In aeroplanes with split surfaces, a suitable combination of inputs is acceptable in lieu of recording each surface separately. In aeroplanes with independent pilot input on primary controls, each pilot input on primary controls needs to be recorded separately.

5. If signal available in digital form.

6. Recording of latitude and longitude from INS or other navigation system is a preferred alternative.

7. If signals readily available.

8. It is not intended that aeroplanes issued with an individual certificate of airworthiness before 1 January 2016 be modified to meet the measurement range, maximum sampling and recording interval, accuracy limits or recording resolution description detailed in this Appendix.

Table 1-2
Description of Applications for Data Link Recorders

Item No.	Application Type	Application Description	Recording Content
1	Data link Initiation	This includes any applications used to logon to or initiate data link service. In FANS-1/A and ATN, these are ATS Facilities Notification (AFN) and Context Management (CM) respectively.	C
2	Controller/Pilot Communication	This includes any application used to exchange requests, clearances, instructions and reports between the flight crew and controllers on the ground. In FANS-1/A and ATN, this includes the CPDLC application. It also includes applications used for the exchange of oceanic (OCL) and departure clearances (DCL) as well as data link delivery of taxi clearances.	C
3	Addressed Surveillance	This includes any surveillance application in which the ground sets up contracts for delivery of surveillance data. In FANS-1/A and ATN, this includes the Automatic Dependent Surveillance (ADS-C) application. Where parametric data are reported within the message they shall be recorded unless data from the same source are recorded on the FDR.	C
4	Flight Information	This includes any service used for delivery of flight information to specific aircraft. This includes, for example, D-METAR, D-ATIS, D-NOTAM and other textual data link services.	C
5	Aircraft Broadcast Surveillance	This includes Elementary and Enhanced Surveillance Systems, as well as ADS-B output data. Where parametric data sent by the aeroplane are reported within the message they shall be recorded unless data from the same source are recorded on the FDR.	M *
6	Aeronautical Operational Control Data	This includes any application transmitting or receiving data used for AOC purposes (per the ICAO definition of AOC).	M *

Key:

C: Complete contents recorded.
M: Information that enables correlation to any associated records stored separately from the aircraft.
*: Applications to be recorded only as far as is practicable given the architecture of the system.

Table 1-3
Parameters to be recorded by Aircraft Data Recording Systems for aeroplanes

N°	Parameter name	Minimum Recording Range	Maximum recording interval in seconds	Minimum Recording Accuracy	Minimum Recording Resolution	Remarks
1	Heading					
	a) Heading (Magnetic or True)	±180º	1	±2°	0.5°	Heading is preferred, if not available, yaw rate shall be recorded
	b) Yaw rate	±300º/s	0.25	±1% + drift of 360°/h	2°/s	
2	Pitch					
	a) Pitch attitude	±90º	0.25	±2º	0.5°	Pitch attitude is preferred, if not available, pitch rate shall be recorded
	b) Pitch rate	±300º/s	0.25	±1% + drift of 360°/h	2°/s	
3	Roll					
	a) Roll attitude	±180º	0.25	±2º	0.5°	Roll attitude is preferred, if not available, roll rate shall be recorded
	b) Roll rate	±300º/s	0.25	±1% + drift of 360°/h	2°/s	
4	Positioning system					
	a) Time	24 hours	1	±0.5 s	0.1 s	UTC time preferred where available.
	b) Latitude/longitude	Latitude:±90° Longitude:±180°	2 (1 if available)	As installed (0.00015° recommended)	0.00005°	
	c) Altitude	–300 m (–1 000 ft) to maximum certificated altitude of aeroplane +1 500 m (5 000 ft)	2 (1 if available)	As installed (±15 m (±50 ft) recommended)	1.5 m (5 ft)	
	d) Ground speed	0–1 000 kt	2 (1 if available)	As installed (±5 kt recommended)	1 kt	
	e) Track	0–360º	2 (1 if available)	As installed (± 2º recommended)	0.5	

N°	Parameter name	Minimum Recording Range	Maximum recording interval in seconds	Minimum Recording Accuracy	Minimum Recording Resolution	Remarks
	f) Estimated error	Available range	2 (1 if available)	As installed	As installed	Shall be recorded if readily available
5	Normal acceleration	- 3 g to + 6 g (*)	0.25 (0.125 if available)	As installed (± 0.09 g excluding a datum error of ±0.45 g recommended)	0.004 g	
6	Longitudinal acceleration	±1 g (*)	0.25 (0.125 if available)	As installed (±0.015 g excluding a datum error of ±0.05 g recommended)	0.004 g	
7	Lateral acceleration	±1 g (*)	0.25 (0.125 if available)	As installed (±0.015 g excluding a datum error of ±0.05 g recommended)	0.004 g	
8	External static pressure (or pressure altitude)	34.4 hPa (1.02 in-Hg) to 310.2 hPa (9.16 in-Hg) or available sensor range	1	As installed (±1 hPa (0.03 in-Hg) or ±30 m (±100 ft) to ±210 m (±700 ft) recommended - refer to table IIA. 2)	0.1 hPa (0.003 in-Hg) or 1.5 m (5 ft)	
9	Outside air temperature (or total air temperature)	-50° to +90°C or available sensor range	2	As installed (±2°C recommended)	1°C	
10	Indicated air speed	As the installed Pilot display measuring system or available sensor range	1	As installed (±3 % recommended)	1 kt (0.5 kt recommended)	
11	Engine RPM	Full range including overspeed condition	Each engine each second	As installed	0.2% of full range	
12	Engine oil pressure	Full range	Each engine each second	As installed (5% of full range recommended)	2% of full range	
13	Engine oil temperature	Full range	Each engine each second	As installed (5% of full range recommended)	2% of full range	
14	Fuel flow or pressure	Full range	Each engine each second	As installed	2% of full range	

N°	Parameter name	Minimum Recording Range	Maximum recording interval in seconds	Minimum Recording Accuracy	Minimum Recording Resolution	Remarks
15	Manifold pressure	Full range	Each engine each second	As installed	0.2% of full range	
16	Engine thrust/power/torque parameters required to determine propulsive thrust/power*	Full range	Each engine each second	As installed	0.1% of full range	* Sufficient parameters e.g. EPR/N1 or torque/Np as appropriate to the particular engine shall be recorded to determine power in both normal and reverse thrust. A margin for possible overspeed should be provided.
17	Engine gas generator speed (Ng)	0-150%	Each engine each second	As installed	0.2% of full range	
18	Free power turbine speed (Nf)	0-150%	Each engine each second	As installed	0.2% of full range	
19	Coolant temperature	Full range	1	As installed (±5°C recommended)	1°	
20	Main voltage	Full range	Each engine each second	As installed	1 Volt	
21	Cylinder head temperature	Full range	Each engine each second	As installed	2% of full range	
22	Flaps position	Full range or each discrete position	2	As installed	0.5°	
23	Primary flight control surface position	Full range	0.25	As installed	0.2 % of full range	
24	Fuel quantity	Full range	4	As installed	1% of full range	
25	Exhaust gas temperature	Full range	Each engine each second	As installed	2% of full range	
26	Emergency voltage	Full range	Each engine each second	As installed	1 Volt	

N°	Parameter name	Minimum Recording Range	Maximum recording interval in seconds	Minimum Recording Accuracy	Minimum Recording Resolution	Remarks
27	Trim surface position	Full range or each discrete position	1	As installed	0.3 % of full range	
28	Landing gear position	Each discrete position*	Each gear every two seconds	As installed		* Where available, record up-and-locked and down-and-locked position
29	Novel/unique aircraft features	As required	As required	As installed	As required	

Appendix 2 Flight Recorders for Helicopters

The material in this Appendix concerns flight recorders intended for installation in helicopters operating under ANR-91, ANR-125, ANR-135 or ANR-137.

1 Flight data recorder (FDR) and aircraft data recording systems (ADRS)

1.1 Parameters to be recorded

Note: In previous editions of Annex 6, Part III, types of recorders were defined to capture the first evolutions of FDRs.

(a) The parameters that satisfy the requirements for FDRs, are listed in Table 2-1 below. The number of parameters to be recorded shall depend on helicopter complexity. The parameters without an asterisk (*) are mandatory parameters which shall be recorded regardless of helicopter complexity. In addition, the parameters designated by an asterisk (*) shall be recorded if an information data source for the parameter is used by helicopter systems or the flight crew to operate the helicopter. However, other parameters may be substituted with due regard to the helicopter type and the characteristics of the recording equipment.

(b) The following parameters shall satisfy the requirements for flight path and speed:

- Pressure altitude
- Indicated airspeed
- Outside air temperature
- Heading
- Normal acceleration
- Lateral acceleration
- Longitudinal acceleration (body axis)
- Time or relative time count
- Navigation data*: drift angle, wind speed, wind direction, latitude/longitude
- Radio altitude*

(c) If further FDR recording capacity is available, recording of the following additional information shall be considered:

(1) additional operational information from electronic displays, such as electronic flight instrument systems (EFIS), electronic centralized aircraft monitor (ECAM) and engine indication and crew alerting system (EICAS); and

(2) additional engine parameters (EPR, N_1, fuel flow, etc.).

(d) The parameters that satisfy the requirements for ADRS are the first 7 parameters listed in Table 2-3. If further ADRS recording capacity is available, the recording of any other parameters defined in Table 2-3 may be included.

1.2 Duration of retention of recording

All FDRs shall retain the information recorded during at least the last 10 hours of their operation.

1.3 Additional information

(a) The measurement range, recording interval and accuracy of parameters on installed equipment is usually verified by methods approved by the appropriate certificating authority.

(b) Documentation concerning parameter allocation, conversion equations, periodic calibration and other serviceability/maintenance information shall be maintained by the operator/owner. The documentation shall be sufficient to ensure that accident investigation authorities have the necessary information to read out the data in engineering units.

2 Cockpit voice recorder (CVR) and cockpit audio recording system (CARS)

2.1 Signals to be recorded

(a) The CVR shall record simultaneously on four separate channels, or more, at least the following:

(1) voice communication transmitted from or received in the aircraft by radio;

(2) aural environment on the flight deck;

(3) voice communication of flight crew members on the flight deck using the interphone system, if installed;

(4) voice or audio signals identifying navigation or approach aids introduced in the headset or speaker; and

(5) voice communication of flight crew members using the passenger address system, if installed.

(b) The preferred CVR audio allocation should be as follows:

(1) pilot-in-command audio panel;

(2) co-pilot audio panel;

(3) additional flight crew positions and time reference; and

(4) cockpit area microphone.

(c) The CARS shall record simultaneously on two separate channels, or more, at least the following:

(1) voice communication transmitted from or received in the helicopter by radio;

(2) aural environment on the flight deck; and

(3) voice communication of flight crew members on the flight deck using the helicopter's interphone system, if installed.

(d) The preferred CARS audio allocation should be as follows:

(1) voice communication; and

(2) aural environment on the flight deck.

2.2 Duration

A CVR intended for installation on any helicopter shall retain the information recorded during at least the last 2 hours of its operation.

3 Airborne image recorder (AIR) and airborne image recording systems (AIRS)

3.1 Classes

(a) A Class A AIR or AIRS captures the general cockpit area in order to provide data supplemental to conventional flight recorders.

Note 1; To respect crew privacy, the cockpit area view may be designed as far as practical to exclude the head and shoulders of crew members whilst seated in their normal operating position.

Note 2: There are no provisions for Class A AIR or AIRS in this document.

(b) A Class B AIR or AIRS captures data link message displays.

Note: A Class B AIR could be a means for recording data link communications applications messages to and from the helicopters where it is not practical or is prohibitively expensive to record those data link communications applications messages on FDR or CVR.

(c) A Class C AIR or AIRS captures instruments and control panels.

Note: A Class C AIR or AIRS may be considered as a means for recording flight data where it is not practical or prohibitively expensive to record on an FDR, or where an FDR is not required.

4 Data link recorder (DLR)

Note: Refer to requirements in Parts 91, 125, 137 and 135 for applicability of recording of data link communications.

4.1 Applications to be recorded

(a) Where the helicopter flight path is authorized or controlled through the use of data link messages, all data link messages, both uplinks (to the helicopter) and downlinks (from the helicopter), shall be recorded on the helicopter. As far as practicable, the time the messages were displayed to the flight crew and the time of the responses shall to be recorded.

Note: Sufficient information to derive the content of the data link communications message and the time the messages were displayed to the flight crew is needed to determine an accurate sequence of events on board the aircraft.

(b) Messages applying to the applications listed in Table 2-2 shall be recorded. Applications without the asterisk (*) are mandatory applications which shall be recorded regardless of the system complexity. Applications with an (*) are to be recorded only as far as is practicable given the architecture of the system.

4.2 Duration

The minimum recording duration shall be equal to the duration of the CVR.

Table 2-1
Parameters to be recorded by Flight Data Recorders

Serial number	*Parameter*	*Applicability*	*Measurement range*	*Maximum sampling and recording interval (seconds)*	*Accuracy limits (sensor input compared to FDR readout)*	*Recording resolution*
1	Time (UTC when available, otherwise relative time count or GNSS time sync)		24 hours	4	±0.125% /h	1 s
2	Pressure altitude		maximum certificated altitude of aircraft +1 500 m (+5 000 ft)	1	±30 m to ±200 m (±100 ft to ±700 ft)	1.5 m (5 ft)
3	Indicated airspeed		As the installed pilot display measuring system	1	±3%	1 kt
4	Heading		360°	1	±2°	0.5°
5	Normal acceleration		–3 g to +6 g	0.125	±0.09 g excluding a datum error of ±0.045 g	0.004 g
6	Pitch attitude		±75° or 100% of useable range whichever is greater	0.5	±2°	0.5°
7	Roll attitude		±180°	0.5	±2°	0.5°
8	Radio transmission keying		On-off (one discrete)	1	—	—
9	Power on each engine		Full range	1 (per engine)	±2%	0.1% of full range
10	Main rotor:					
	Main rotor speed		50–130%	0.51	±2%	0.3% of full range
	Rotor brake		Discrete		—	—
11	Pilot input and/or control surface position — primary controls (collective pitch, longitudinal cyclic pitch, lateral cyclic pitch, tail rotor pedal)		Full range	0.5 (0.25 recommended)	±2% unless higher accuracy uniquely required	0.5% of operating range
12	Hydraulics, each system (low pressure and selection)		Discrete	1	—	—

Serial number	*Parameter*	*Applicability*	*Measurement range*	*Maximum sampling and recording interval (seconds)*	*Accuracy limits (sensor input compared to FDR readout)*	*Recording resolution*
13	Outside air temperature		Sensor range	2	±2°C	0.3°C
14*	Autopilot/ autothrottle/ AFCS mode and engagement status		A suitable combination of discretes	1	—	—
15*	Stability augmentation system engagement		Discrete	1	—	—
16*	Main gearbox oil pressure		As installed	1	As installed	6.895 kN/m^2 (1 psi)
17*	Main gearbox oil temperature		As installed	2	As installed	1°C
18	Yaw rate		±400°/second	0.25	±1.5% maximum range excluding datum error of ±5%	±2°/s
19*	Sling load force		0 to 200% of certified load	0.5	±3% of maximum range	0.5% for maximum certified load
20	Longitudinal acceleration		±1 g	0.25	±0.015 g excluding a datum error of ±0.05 g	0.004 g
21	Lateral acceleration		±1 g	0.25	±0.015 g excluding a datum error of ±0.05 g	0.004 g
22*	Radio altitude		–6 m to 750 m (–20 ft to 2 500 ft)	1	±0.6 m (±2 ft) or ±3% whichever is greater below 150 m (500 ft) and ±5% above 150 m (500 ft)	0.3 m (1 ft) below 150 m (500 ft), 0.3 m (1 ft) + 0.5% of full range above 150 m (500 ft)
23*	Vertical beam deviation		Signal range	1	±3%	0.3% of full range
24*	Horizontal beam deviation		Signal range	1	±3%	0.3% of full range
25	Marker beacon passage		Discrete	1	—	—
26	Warnings		Discrete(s)	1	—	—
27	Each navigation receiver frequency selection		Sufficient to determine selected frequency	4	As installed	—
28*	DME 1 and 2 distances		0–370 km (0–200 NM)	4	As installed	1 852 m (1 NM)

Serial number	*Parameter*	*Applicability*	*Measurement range*	*Maximum sampling and recording interval (seconds)*	*Accuracy limits (sensor input compared to FDR readout)*	*Recording resolution*
29*	Navigation data (latitude/longitude, ground speed, drift angle, wind speed, wind direction)		As installed	2	As installed	As installed
30*	Landing gear or and gear selector position		Discrete	4	—	—
31*	Engine exhaust gas temperature (T_4)		As installed	1	As installed	
32*	Turbine inlet Temperature (TIT/ITT)		As installed	1	As installed	
33*	Fuel contents		As installed	4	As installed	
34*	Altitude rate		As installed	1	As installed	
35*	Ice detection		As installed	4	As installed	
36*	Helicopter health and usage monitor system		As installed	—	As installed	—
37	Engine control modes		Discrete	1	—	—
38*	Selected barometric setting (pilot and co-pilot)		As installed	64 (4 recommended)	As installed	0.1 mb (0.01 in Hg)
39*	Selected altitude (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
40*	Selected speed (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
41*	Selected Mach (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
42*	Selected vertical speed (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
43*	Selected heading (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
44*	Selected flight path (all pilot selectable modes of operation)		As installed	1	As installed	Sufficient to determine crew selection
45*	Selected decision height		As installed	4	As installed	Sufficient to determine crew selection

Serial number	*Parameter*	*Applicability*	*Measurement range*	*Maximum sampling and recording interval (seconds)*	*Accuracy limits (sensor input compared to FDR readout)*	*Recording resolution*
46*	EFIS display format (pilot and co-pilot)		Discrete(s)	4	—	—
47*	Multifunction/ engine/ alerts display format		Discrete(s)	4	—	—
48*	Event marker		Discrete	1	—	—
49*	GPWS/TAWS/GCAS status (selection of terrain display mode including pop-up display status) and (terrain alerts, both cautions and warnings, and advisories) and (on/off switch position) and (operational status)	Application for type certification is submitted to a Contracting State on or after 1 January 2023	Discrete(s)	1	As installed	—
50*	TCAS/ACAS (traffic alert and collision avoidance system) and (operational status)	Application for type certification is submitted to a Contracting State on or after 1 January 2023	Discrete(s)	1	As installed	—
51*	Primary flight controls – pilot input forces	Application for type certification is submitted to a Contracting State on or after 1 January 2023	Full range	0.125 (0.0625 recommended)	± 3% unless higher accuracy is uniquely required	0.5% of operating range
52*	Computed centre of gravity	Application for type certification is submitted to a Contracting State on or after 1 January 2023	As installed	64	As installed	1% of full range
53*	Helicopter computed weight	Application for type certification is submitted to a Contracting State on or after 1 January 2023	As installed	64	As installed	1% of full range

Table 2-2
Description of Applications for Data Link Recorders

Item No.	Application Type	Application Description	Recording Content
1	Data link Initiation	This includes any applications used to logon to or initiate data link service. In FANS-1/A and ATN, these are ATS Facilities Notification (AFN) and Context Management (CM) respectively.	C
2	Controller/Pilot Communication	This includes any application used to exchange requests, clearances, instructions and reports between the flight crew and controllers on the ground. In FANS-1/A and ATN, this includes the CPDLC application. It also includes applications used for the exchange of oceanic (OCL) and departure clearances (DCL) as well as data link delivery of taxi clearances.	C
3	Addressed Surveillance	This includes any surveillance application in which the ground sets up contracts for delivery of surveillance data. In FANS-1/A and ATN, this includes the Automatic Dependent Surveillance (ADS-C) application. Where parametric data are reported within the message they shall be recorded unless data from the same source are recorded on the FDR.	C
4	Flight Information	This includes any service used for delivery of flight information to specific aircraft. This includes, for example, D-METAR, D-ATIS, D-NOTAM and other textual data link services.	C
5	Aircraft Broadcast Surveillance	This includes Elementary and Enhanced Surveillance Systems, as well as ADS-B output data. Where parametric data sent by the aeroplane are reported within the message they shall be recorded unless data from the same source are recorded on the FDR.	M *
6	Aeronautical Operational Control Data	This includes any application transmitting or receiving data used for AOC purposes (per the ICAO definition of AOC).	M *

Key:

C: Complete contents recorded.
M: Information that enables correlation to any associated records stored separately from the aircraft.
*: Applications to be recorded only as far as is practicable given the architecture of the system.

Table 2-3
Parameters to be recorded by Aircraft Data Recording Systems for helicopters

N°	Parameter name	Minimum Recording Range	Maximum recording interval in seconds	Minimum Recording Accuracy	Minimum Recording Resolution	Remarks
1	Heading					
	a) Heading (Magnetic or True)	±180 degrees	1	±2 degrees	0.5 degree	*Heading is preferred, if not available, yaw rate shall be recorded
	b) Yaw rate	±300°/s	0.25	±1% + drift of 360°/h	2°/s	
2	Pitch					
	a) Pitch attitude	±90 degrees	0.25	±2 degrees	0.5 degree	*Pitch attitude is preferred, if not available, pitch rate shall be recorded
	b) Pitch rate	±300°/s	0.25	±1% + drift of 360°/h	2°/s	
3	Roll					
	a) Roll attitude	±180 degrees	0.25	±2 degrees	0.5 degree	*Roll attitude is preferred, if not available, roll rate shall be recorded
	b) Roll rate	±300°/s	0.25	±1% + drift of 360°/h	2°/s	
4	Positioning system:					
	a) Time	24 hours	1	±0.5°	0.1°	UTC time preferred where available
	b) Latitude/longitude	Latitude:±90° Longitude:±180°	2 (1 if available)	As installed (0.00015° recommended)	0.00005°	
	c) Altitude	–300 m (–1 000 ft) to maximum certificated altitude of aircraft +1 500 m (5 000 ft)	2 (1 if available)	As installed (±15 m (±50 ft) recommended)	1.5 m (5 ft)	
	d) Ground speed	0–1 000 kt	2 (1 if available)	As installed (±5 kt recommended)	1 kt	
	e) Track	0–360°	2 (1 if available)	As installed (± 2° recommended)	0.5°	
	f) Estimated error	Available range	2 (1 if available)	As installed	As installed	Shall be recorded if readily available
5	Normal acceleration	- 3 g to + 6 g (*)	0.25	As installed	0.004 g	

N°	Parameter name	Minimum Recording Range	Maximum recording interval in seconds	Minimum Recording Accuracy	Minimum Recording Resolution	Remarks
			(0.125 if available)	(± 0.09 g excluding a datum error of ±0.45 g recommended)		
6	Longitudinal acceleration	±1 g (*)	0.25 (0.125 if available)	As installed (±0.015 g excluding a datum error of ±0.05 g recommended)	0.004 g	
7	Lateral acceleration	±1 g (*)	0.25 (0.125 if available)	As installed (±0.015 g excluding a datum error of ±0.05 g recommended)	0.004 g	
8	External static pressure (or pressure altitude)	34.4 hPa (1.02 in-Hg) to 310.2 hPa (9.16 in-Hg) or available sensor range	1	As installed (±1 hPa (0.03 in-Hg) or ±30 m (±100 ft) to ±210 m (±700 ft) recommended)	0.1 hPa (0.003 in-Hg) or 1.5 m (5 ft)	
9	Outside air temperature (or total air temperature)	-50° to +90°C or available sensor range	2	As installed (±2°C recommended)	1°C	
10	Indicated air speed	As the installed Pilot display measuring system or available sensor range	1	As installed (±3 % recommended)	1 kt (0.5 kt recommended)	
11	Main rotor speed (Nr)	50% to 130% or available sensor range	0.5	As installed	0.3% of full range	
12	Engine RPM (*)	Full range including overspeed condition	Each engine each second	As installed	0.2% of full range	* for piston engine helicopters
13	Engine oil pressure	Full range	Each engine each second	As installed (5% of full range recommended)	2% of full range	
14	Engine oil temperature	Full range	Each engine each second	As installed (5% of full range recommended)	2% of full range	
15	Fuel flow or pressure	Full range	Each engine each second	As installed	2% of full range	
16	Manifold pressure (*)	Full range	Each engine	As installed	0.2% of full range	* for piston engine helicopters

N°	Parameter name	Minimum Recording Range	Maximum recording interval in seconds	Minimum Recording Accuracy	Minimum Recording Resolution	Remarks
			each second			
17	Engine thrust/power/torque parameters required to determine propulsive thrust/power*	Full range	Each engine each second	As installed	0.1% of full range	* Sufficient parameters e.g. EPR/N1 or torque/Np as appropriate to the particular engine shall be recorded to determine power in both normal and reverse thrust. A margin for possible overspeed should be provided. Only for turbine engine helicopters.
18	Engine gas generator speed (Ng) (*)	0-150%	Each engine each second	As installed	0.2% of full range	* Only for turbine engine helicopters.
19	Free power turbine speed (Nf) (*)	0-150%	Each engine each second	As installed	0.2% of full range	* Only for turbine engine helicopters.
20	Collective pitch	Full range	0.5	As installed	0.1% of full range	
21	Coolant temperature (*)	Full range	1	As installed (±5°C recommended)	1 degree celsius	* Only for piston engine helicopters.
22	Main voltage	Full range	Each engine each second	As installed	1 Volt	
23	Cylinder head temperature (*)	Full range	Each engine each second	As installed	2% of full range	* Only for piston engine helicopters.
24	Fuel quantity	Full range	4	As installed	1% of full range	
25	Exhaust gas temperature	Full range	Each engine each second	As installed	2% of full range	
26	Emergency voltage	Full range	Each engine each second	As installed	1 Volt	
27	Trim surface position	Full range or each discrete position	1	As installed	0.3 % of full range	
28	Landing gear position	Each discrete position*	Each gear every two seconds	As installed		* Where available, record up-and-locked and down-and-locked position

N°	Parameter name	Minimum Recording Range	Maximum recording interval in seconds	Minimum Recording Accuracy	Minimum Recording Resolution	Remarks
29	Novel/unique aircraft features	As required	As required	As installed	As required	