



# Advisory Circular

## AC121-0

Revision 0

### FDR parameter requirements and FDR parameter specifications

26 March 2020

#### General

Civil Aviation Authority advisory circulars contain guidance and information about standards, practices, and procedures that the Director has found to be an **acceptable means of compliance** with the associated rules and legislation.

However the information in the advisory circular does not replace the requirement for participants to comply with their own obligations under the Civil Aviation rules, the Civil Aviation Act and other legislation.

An advisory circular reflects the Director's view on the rules and legislation. It expresses CAA policy on the relevant matter. It is not intended to be definitive. Consideration will be given to other methods of compliance that may be presented to the Director. When new standards, practices, or procedures are found to be acceptable they will be added to the appropriate advisory circular. Should there be any inconsistency between this information and the rules or legislation, the rules and legislation take precedence.

An advisory circular may also include **guidance material** generally, including guidance on best practice as well as guidance to facilitate compliance with the rule requirements. However, guidance material should not be regarded as an acceptable means of compliance.

An advisory circular may also include **technical information** that is relevant to the standards or requirements.

#### Purpose

This Advisory Circular provides an acceptable means of compliance with Civil Aviation Rule Part 121 FDR parameter requirements and FDR parameter specifications.

#### Related Rules

This Advisory Circular relates specifically to rule 121 Appendix B.6 Flight data recorder.

**Change Notice**

ICAO 29th Assembly Resolution A29-3 of year 1992 urges States to promote global harmonization of national rules.

In order to implement this Resolution, Mongolian Civil Aviation Safety Regulation has been developed based on “Memorandum for Technical Cooperation” between CAA of Mongolia and New Zealand, signed on 6th of May, 1999.

Amendment 164 of Annex 1 to the Chicago Convention on International Civil Aviation urges flight crew members, ATC personnel and aircraft maintenance engineers to comply with the language proficiency requirements; and

This AC has been released in English version only under Article 14 of the Civil Aviation Law of Mongolia 1999, “Use of foreign language in civil aviation” in order to prevent any mistranslation and misuse of the aviation safety related documents.

The AC121-0 was developed based on NZ Part 121 amendment 30, dated on 18 May 2018.

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**Table 1. Part 121 - FDR Parameter Requirements**

When reading the parameter specifications from Table 2 the corresponding shaded specification should be chosen for each parameter. This table refers to the FDR requirements of 121.373.

	(A)	(B)	(C)	(D)	(E)
Parameters * if sensor installed	6 Parameter	11 Parameter	17 Parameter	44 Parameter	88 Parameter
1	Time	Time	Time	Time	Time or Relative time counts
2	Altitude	Altitude	Altitude	Altitude	Pressure Altitude
3	Airspeed	Airspeed	Airspeed	Airspeed	Indicated airspeed or Calibrated airspeed
4	Vertical acceleration	Vertical acceleration	Vertical acceleration	Heading	Heading (primary flight crew reference)
5	Heading	Heading	Heading	Vertical acceleration	Normal acceleration (vertical)
6	Time of radio transmission to/from ATC	Time of radio transmission to/from ATC	Time of radio transmission to/from ATC	Pitch attitude	Pitch attitude
7		Pitch attitude	Pitch attitude	Roll attitude	Roll attitude
8		Roll attitude	Roll attitude	Radio transmitter keying	Manual radio transmitter keying or CVR/DFDR synchronisation reference
9		Longitudinal acceleration	Longitudinal acceleration	Thrust/power on each engine	Thrust/power on each engine (primary flight crew reference)
10		Control column OR pitch control surface position	Pitch trim position	Trailing edge flap OR cockpit control selection	Autopilot engagement

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	(A)	(B)	(C)	(D)	(E)
Parameters * if sensor installed	6 Parameter	11 Parameter	17 Parameter	44 Parameter	88 Parameter
11		Thrust of each engine	Control column OR pitch control surface position	Leading edge flap OR cockpit control selection	Longitudinal acceleration
12			Control wheel OR lateral control surface position	Thrust reverser position	Pitch control(s) position (non fly-by-wire systems)
					Pitch control(s) position (fly-by-wire systems)
13			Rudder pedal OR yaw control surface position	Ground spoiler position/speed brake selection	Lateral control(s) position (non fly-by-wire systems)
					Lateral control(s) position (fly-by-wire systems)
14			Thrust of each engine	Marker beacon passage	Yaw control(s) position (non fly-by-wire systems)
					Yaw control(s) position (fly-by-wire systems)
15			Position of each thrust reverser	Autopilot engagement	Pitch control surface(s) position
16			Trailing edge flap OR cockpit flap control position	Longitudinal acceleration	Lateral control surface(s) position
17			Leading edge flap OR cockpit flap control position	Pilot input and/or surface position - primary controls	Yaw control surface(s) position

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	(A)	(B)	(C)	(D)	(E)
Parameters * if sensor installed	6 Parameter	11 Parameter	17 Parameter	44 Parameter	88 Parameter
18				Lateral acceleration	Lateral acceleration
19				Pitch trim position	Pitch trim surface position
20				Glideslope deviation	Trailing edge flap or cockpit control position
21				Localiser deviation	Leading edge flap or cockpit control position
22				AFCS mode and engagement status	Each thrust reverser position or equivalent for propeller aeroplane
23				Radio altitude	Ground spoiler position or speed brake position
24				Master warning	Outside air temperature or total air temperature
25				Main gear squat switch status	Autopilot/ autothrottle/AFC S mode and engagement status
26 *				Angle of attack	Radio altitude
27				Outside air temperature OR total air temperature	Localiser deviation or MLS azimuth
28				Hydraulics, each system, low pressure	Glideslope deviation or MLS elevation
29				Groundspeed	Marker beacon passage
30				Drift angle	Master warning
31				Wind speed and direction	Air/ground sensor (primary aeroplane sensor, nose or main gear)
32 *				Latitude and longitude	Angle of attack (if measure directly)

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	(A)	(B)	(C)	(D)	(E)
Parameters * if sensor installed	6 Parameter	11 Parameter	17 Parameter	44 Parameter	88 Parameter
33				Brake pressure/pedal position	Hydraulic pressure low, each system
34 *				Additional engine parameters: EPR, N <sub>1</sub> , N <sub>2</sub>	Groundspeed
35				Exhaust Gas Temperature	GPWS
36				Throttle lever position	Landing gear position or landing gear cockpit control selection
37 *				Fuel flow	Drift angle
38 *				TCAS-TA	Wind speed and direction
39 *				TCAS- RA	Latitude and longitude
40 *				TCAS - Sensitivity level	Stick shaker and pusher activation
41 *				Ground Proximity Warning System	Windshear detection
42				Landing gear or gear selector position	Throttle/power lever position
43				DME 1 and 2 distance	Additional engine parameters
44				Nav 1 and 2 frequency selection	TCAS
45					DME 1 and 2 distances
46					Nav 1 and 2 selected frequency
47 *					Selected barometric setting

**Table 1. Part 121 - FDR Parameter Requirements**

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	(A)	(B)	(C)	(D)	(E)
Parameters * if sensor installed	6 Parameter	11 Parameter	17 Parameter	44 Parameter	88 Parameter
48 *					Selected altitude
49 *					Selected speed
50 *					Selected Mach
51 *					Selected vertical speed
52 *					Selected heading
53 *					Selected flight path
54 *					Selected decision height
55					EFIS display format
56					Multi-function/engine alerts display format
57 *					Thrust command
58 *					Thrust target
59 *					Fuel quantity in CG trim tank
60					Primary navigation system reference
61 *					Ice detection
62 *					Engine warning each engine - vibration
63 *					Engine warning each engine - over temp
64 *					Engine warning each engine - oil pressure low
65 *					Engine warning each engine - over speed
66					Yaw trim surface position
67					Roll trim surface position
68					Brake pressure - left and right

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	(A)	(B)	(C)	(D)	(E)
Parameters * if sensor installed	6 Parameter	11 Parameter	17 Parameter	44 Parameter	88 Parameter
69					Brake pedal application - left and right
70 *					Yaw and side-slip angle
71 *					Engine bleed valve position
72 *					De-icing or anti-icing system selection
73 *					Computed centre of gravity
74					AC electrical bus status
75					DC electrical bus status
76 *					APU bleed valve position
77					Hydraulic pressure each system
78					Loss of cabin pressure
79					Computer failure - critical flight and engine control systems
80 *					HUD
81 *					Para-visual display
82					Cockpit trim control input position - pitch
83					Cockpit trim control input position - roll
84					Cockpit trim control input position - yaw
85					Trailing edge flap and cockpit flap control position
86					Leading edge flap and cockpit flap control position
87					Ground spoiler position and speed brake selection
88					All cockpit flight control input forces - control wheel, control column, rudder pedal

**Table 2. Part 121 - FDR Parameter Specifications.**

*This table refers to the FDR requirements of 121.373.*

Parameters	Range	Sensor input accuracy	Seconds per sampling interval	Resolution	Remarks
Time or Relative time counts	24 hours 0 to 4095	$\pm 0.125\%$ per hour	4	1s	UTC time preferred when available. Counter increments each four seconds of system operation
Pressure Altitude	-1000' to maximum certificated altitude -1000' to maximum certificated altitude +5000'	$\pm 100'$ to $\pm 700'$ (refer TSO C124a, C51a)	1	5' to 35'	Data should be obtained from the air data computer when practicable
Indicated airspeed or Calibrated airspeed	50 KIAS or minimum value to Max V <sub>so</sub> , and V <sub>so</sub> to 1.2V <sub>d</sub>	$\pm 5\%$ and $\pm 3\%$	1	1 kt	Data should be obtained from the air data computer when practicable
Heading (primary flight crew reference)	0 - 360° 0 - 360° and discrete 'true' or 'mag'	$\pm 2^\circ$	1	0.5°	When true or magnetic heading can be selected as the primary heading reference, a discrete indicating selection must be recorded
Normal acceleration (vertical)	-3g to +6g	$\pm 1\%$ maximum range excluding datum error of $\pm 5\%$	0.125	0.004g	
Pitch attitude	$\pm 75^\circ$	$\pm 2^\circ$	1 or 0.25 for aeroplanes manufactured after 2002	0.5°	A sampling rate of 0.25 is recommended

**Table 2. Part 121 - FDR Parameter Specifications.**

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Parameters	Range	Sensor input accuracy	Seconds per sampling interval	Resolution	Remarks
Roll attitude	±180°	±2°	1 or 0.5 for aeroplanes manufactured after 2002	0.5°	A sampling rate of 0.5 is recommended
Manual radio transmitter keying or CVR/DFDR synchronisation reference	Discrete - 'on' or 'off'		1		Preferably each crew member but one discrete acceptable for all transmission provided the CVR/DFDR system complies with TSO C124a CVR synchronisation requirements
Thrust/power on each engine (primary flight crew reference)	Full range forward	±2%	1 per engine	0.3% of full range	Sufficient parameters (e.g. EPR, N <sub>1</sub> or Torque, N <sub>P</sub> ) as appropriate to the particular engine be recorded to determine power in forward and reverse thrust, including potential overspeed conditions
Autopilot engagement	Discrete - 'on' or 'off'		1		
Longitudinal acceleration	±1g	±1.5% maximum range excluding datum error of ±5%	0.25	0.004 g	
Pitch control(s) position (non fly-by-wire systems) <sup>1</sup>	Full range	±2°	1  0.5 or 0.25 for aeroplanes manufactured after 2002	0.5% of full range	For aeroplanes that have a flight control break away capability that allows either pilot to operate the controls independently, record both control inputs. The control inputs may be sampled alternately once per second to produce the sampling interval of 0.5 or 0.25, as applicable

**Table 2. Part 121 - FDR Parameter Specifications.**

*This table refers to the FDR requirements of 121.373.*

Parameters	Range	Sensor input accuracy	Seconds per sampling interval	Resolution	Remarks
Pitch control(s) position (fly-by-wire systems)	Full range	$\pm 2^\circ$	1 0.5 or 0.25 for aeroplanes manufactured after 2002	0.275% of full range	
Lateral control(s) position (non fly-by-wire systems) <sup>1</sup>	Full range	$\pm 2^\circ$	1 0.5 or 0.25 for aeroplanes manufactured after 2002	0.2% of full range	For aeroplanes that have a flight control break away capability that allows either pilot to operate the controls independently, record both control inputs. The control inputs may be sampled alternately once per second to produce the sampling interval of 0.5 or 0.25, as applicable
Lateral control(s) position (fly-by-wire systems)	Full range	$\pm 2^\circ$	1 0.5 or 0.25 for aeroplanes manufactured after 2002	0.22% of full range	
Yaw control(s) position (non fly-by-wire systems) <sup>1</sup>	Full range	$\pm 2^\circ$	1 0.5	0.3% of full range	For aeroplanes that have a flight control break away capability that allows either pilot to operate the controls independently, record both control inputs. The control inputs may be sampled alternately once per second to produce the sampling interval of 0.5

**Table 2. Part 121 - FDR Parameter Specifications.**

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Parameters	Range	Sensor input accuracy	Seconds per sampling interval	Resolution	Remarks
Yaw control(s) position (fly-by-wire systems)	Full range	$\pm 2^\circ$	1 0.5	0.2% of full range	
Pitch control surface(s) position <sup>1</sup>	Full range	$\pm 2^\circ$	1 0.5 or 0.25 for aeroplanes manufactured after 2002	0.2% of full range	For aeroplanes fitted with multiple or split surfaces, a suitable combination of inputs is acceptable in lieu of recording each surface separately. The control surfaces may be sampled alternately to produce the sampling interval of 0.5 or 0.25
Lateral control surface(s) position <sup>1</sup>	Full range	$\pm 2^\circ$	1 0.5 or 0.25 for aeroplanes manufactured after 2002	0.3% of full range	For aeroplanes fitted with multiple or split surfaces, a suitable combination of surface position sensors is acceptable in lieu of recording each surface separately. The control surfaces may be sampled alternately to produce the sampling interval of 0.5 or 0.25
Yaw control surface(s) position <sup>1</sup>	Full range	$\pm 2^\circ$	1 0.5	0.2% of full range	For aeroplanes fitted with multiple or split surfaces, a suitable combination of surface position sensors is acceptable in lieu of recording each surface separately. The control surfaces may be sampled alternately to produce the sampling interval of 0.5
Lateral acceleration	$\pm 1g$	$\pm 1.5\%$ maximum range excluding datum error of $\pm 5\%$	0.25	0.004g	Twin engine aircraft only

**Table 2. Part 121 - FDR Parameter Specifications.**

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Parameters	Range	Sensor input accuracy	Seconds per sampling interval	Resolution	Remarks
Pitch trim surface position	Full range	±3%	1	0.6% of full range	
Trailing edge flap or cockpit control position	Full range or discrete each position	±3° or pilot's indicator	2	0.5% of full range	Flap position and cockpit control may each be sampled alternately at four second intervals, to give a data point every two seconds
Leading edge flap or cockpit control position	Full range or discrete each position	±3° or pilot's indicator	2	0.5% of full range	Left and right sides, or flap position and cockpit control may each be sampled at four second intervals, so as to give a data point each two seconds
Each thrust reverser position or equivalent for propeller aeroplane	Discrete - 'stowed', 'in transit', 'reverse'		1 per engine		Turbo-jet - two discrettes enable the three states to be determined Turbo-prop - one discrete
Ground spoiler position or speed brake position	Full range or discrete each position	±2°	1 or 0.5 for aeroplanes manufactured after 2002	0.5% of full range	
Outside air temperature or total air temperature	-50°C to +90°C	±2° C	2	0.3° C	
Autopilot / autothrottle / AFCS mode and engagement status	Discrettes - suitable combination		1		Discrettes should show which systems are engaged and which primary modes are controlling the flight path and speed of the aircraft

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Parameters	Range	Sensor input accuracy	Seconds per sampling interval	Resolution	Remarks
Radio altitude	-20' to +2 500'	±2' or ±3% whichever is the greater below 500' and ±5% above 500'	1	1' + 5% above 500'	For autoland / category III operations, each radio altimeter should be recorded, but arranged so that at least one is recorded each second.
Localiser deviation, MLS azimuth, or GPS latitude deviation.	±400 microamps or available sensor range as installed  ±62°	As installed - ±3% recommended	1	0.3% of full range	For autoland / category III operations, each radio altimeter should be recorded, but arranged so that at least one is recorded each second. It is not necessary to record ILS and MLS at the same time, only the approach aid in use need be recorded
Glideslope deviation, MLS elevation, or GPS vertical deviation.	±400 microamps or available sensor range as installed  +0.9° to +30°	As installed - ±3% recommended	1	0.3% of full range	For autoland / category III operations, each radio altimeter should be recorded, but arranged so that at least one is recorded each second. It is not necessary to record ILS and MLS at the same time, only the approach aid in use need be recorded
Marker beacon passage	Discrete - 'on' or 'off'		1		A single discrete is acceptable for all markers
Master warning	Discrete		1		Record the master warning and record each 'red' warning that cannot be determined from other parameters or from the cockpit voice recorder
Air/ground sensor (primary aeroplane sensor, nose or main gear)	Discrete - 'air' or 'ground'		1 (0.25 recommended)		

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Parameters	Range	Sensor input accuracy	Seconds per sampling interval	Resolution	Remarks
Angle of attack (if measure directly)	As installed	As installed	2 or 0.5 for aeroplanes manufactured after 2002	0.3% of full range	If left and right sensors are available, each may be recorded at four second intervals so as to give a data point each 0.5 second
Hydraulic pressure low, each system	Discrete - 'low' or 'normal' or available sensor range	±5%	2	0.5% of full range	
Groundspeed	As installed	Most accurate system installed	1	0.2% of full range	
GPWS	Discrete - 'warning' or 'off'		1		A suitable combination of discrettes unless recorder capacity is limited in which case a single discrete for all modes is acceptable
Landing gear position or landing gear cockpit control selection	Discrete		4		A suitable combination of discrettes should be recorded
Drift angle	As installed	As installed	4	0.1°	
Wind speed and direction	As installed	As installed	4	1kt and 1°	
Latitude and longitude	As installed	As installed	4	0.002°	Provided by the Primary Navigation System Reference. Where capacity permits latitude/longitude resolution should be 0.0002°

**Table 2. Part 121 - FDR Parameter Specifications.**

*This table refers to the FDR requirements of 121.373.*

Parameters	Range	Sensor input accuracy	Seconds per sampling interval	Resolution	Remarks
Stick shaker and pusher activation	Discrete - 'on' or 'off'		1		A suitable combination of discretely to determine activation
Windshear detection	Discrete - 'warning' or 'off'		1		
Throttle/power lever position	As installed	As installed	1 per lever		For aeroplanes with nonmechanically linked cockpit engine controls
	Full range	±2%		2% of full range	
Additional engine parameters	As installed	As installed	Each engine each second	2% of full range	EPR, N <sub>1</sub> , N <sub>2</sub> , EGT  Where capacity permits, the preferred priority is - indicated vibration level, N <sub>2</sub> , EGT, Fuel Flow, Fuel Cut-off lever position, and N <sub>3</sub> , unless the engine manufacturer recommends otherwise
TCAS	Discretely	As installed	1		A suitable combination of discretely should be recorded to determine the status of - Combined Control, Vertical Control, Up Advisory, and Down Advisory. (refer ARINC Characteristic 735 - Attachment 6E, TCAS VERTICAL RA DATA OUTPUT WORD)
DME 1 and 2 distances	0 -200nm	As installed	4	1nm	1 mile
Nav 1 and 2 selected frequency	Full range	As installed	4		Sufficient to determine selected frequency
Selected barometric setting	Full range	±5%	1 per 64 seconds	0.2% of full range	

**Table 2. Part 121 - FDR Parameter Specifications.**

*This table refers to the FDR requirements of 121.373.*

Parameters	Range	Sensor input accuracy	Seconds per sampling interval	Resolution	Remarks
Selected altitude	Full range	±5%	1	100'	
Selected speed	Full range	±5%	1	1kt	
Selected Mach	Full range	±5%	1	0.01	
Selected vertical speed	Full range	±5%	1	100ft/min	
Selected heading	Full range	±5%	1	1°	
Selected flight path	Full range	±5%	1	1°	
Selected decision height	Full range	±5%	64	1'	
EFIS display format	Discrettes		4		Discrettes should show the display system status (off, normal, fail, composite, sector, plan, navigation aids, weather radar, range, copy)
Multi-function/engine alerts display format	Discrettes		4		Discrettes should show the display system status (off, normal, fail) and the identity of display pages for emergency procedures need not be recorded
Thrust command	Full range	±2%	2	2% of full range	
Thrust target	Full range	±2%	4	2% of full range	
Fuel quantity in CG trim tank	Full range	±5%	1 per 64 seconds	1% of full range	

**Table 2. Part 121 - FDR Parameter Specifications.**

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Parameters	Range	Sensor input accuracy	Seconds per sampling interval	Resolution	Remarks
Primary navigation system reference	Discrettes - 'GPS', 'INS', 'VOR/DME', 'MLS', 'Loran C', 'Omega', 'Localiser Glideslope'		4		A suitable combination of discrettes to determine the Primary Navigation System reference
Ice detection	Discrete - 'ice' or 'no ice'		4		
Engine warning each engine - vibration	Discrete		1		
Engine warning each engine - over temp	Discrete		1		
Engine warning each engine - oil pressure low	Discrete		1		
Engine warning each engine - over speed	Discrete		1		
Yaw trim surface position	Full range	±3%	2	0.3% of full range	
Roll trim surface position	Full range	±3%	2	0.3% of full range	
Brake pressure - left and right	As installed	As installed ±5%	1		To determine braking effort applied by pilots or by autobrakes

**Table 2. Part 121 - FDR Parameter Specifications.**

*This table refers to the FDR requirements of 121.373.*

Parameters	Range	Sensor input accuracy	Seconds per sampling interval	Resolution	Remarks
Brake pedal application - left and right	Discrete or analogue - 'applied' or 'off'	As installed $\pm 5\%$	1		To determine braking applied by pilots
Yaw and sideslip angle	Full range	$\pm 5\%$	1	0.5°	
Engine bleed valve position	Discrete - 'open' or 'closed'		4		
De-icing or anti-icing system selection	Discrete - 'on' or 'off'		4		
Computed centre of gravity	Full range	$\pm 5\%$	1 per 64 seconds	1% of full range	
AC electrical bus status	Discrete - 'power' or 'off'		4		Each bus
DC electrical bus status	Discrete - 'power' or 'off'		4		Each bus
APU bleed valve position	Discrete - 'open' or 'closed'		4		
Hydraulic pressure each system	Full range	$\pm 5\%$	2	100psi	
Loss of cabin pressure	Discrete - 'loss' or 'normal'		1		
Computer failure - critical flight and engine control systems	Discrete - 'fail' or 'normal'		4		

**Table 2. Part 121 - FDR Parameter Specifications.**

*This table refers to the FDR requirements of 121.373.*

Parameters	Range	Sensor input accuracy	Seconds per sampling interval	Resolution	Remarks
HUD	Discrete - 'on' or 'off'		4		
Para-visual display	Discrete - 'on' or 'off'		1		
Cockpit trim control input position - pitch	Full range	±5%	1	0.2% of full range	Where mechanical means for control inputs are not available, cockpit display trim positions should be recorded.
Cockpit trim control input position - roll	Full range	±5%	1	0.7% of full range	Where mechanical means for control inputs are not available, cockpit display trim positions should be recorded.
Cockpit trim control input position - yaw	Full range	±5%	1	0.3% of full range	Where mechanical means for control inputs are not available, cockpit display trim positions should be recorded.
Trailing edge flap and cockpit flap control position	Full range or discrete each position	±5%	2	0.5% of full range	T railing edge flaps and cockpit flap control position may each be sampled alternately at four second intervals to provide a sample each 0.5 second
Leading edge flap and cockpit flap control position	Full range or discrete each position	±5%	1	0.5% of full range	
Ground spoiler position and speed brake selection	Full range or discrete each position	±5%	0.5	0.3% of full range	
All cockpit flight control input forces - control wheel, control column, rudder pedal	Full range - control wheel- ±70lbs, control column ±85lbs, rudder pedals, ±165lbs.	±5%	1	0.3% of full range	For fly-by-wire flight control systems, where flight control surface position is a function of the displacement of the control input device only, it is not necessary to record this parameter

**Notes:**

1. For aeroplanes that can demonstrate the capability of deriving either the control input or control movement (one from the other) for all modes of operation and flight regimes only the surface position OR the control position need be sensed. For aeroplanes with non-mechanical control systems (fly-by-wire) both surface and control position must be recorded.

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