

	POWER PLANT		1.70.80	P 1
	IGNITION AND STARTING		SEQ 150	REV 15

GENERAL

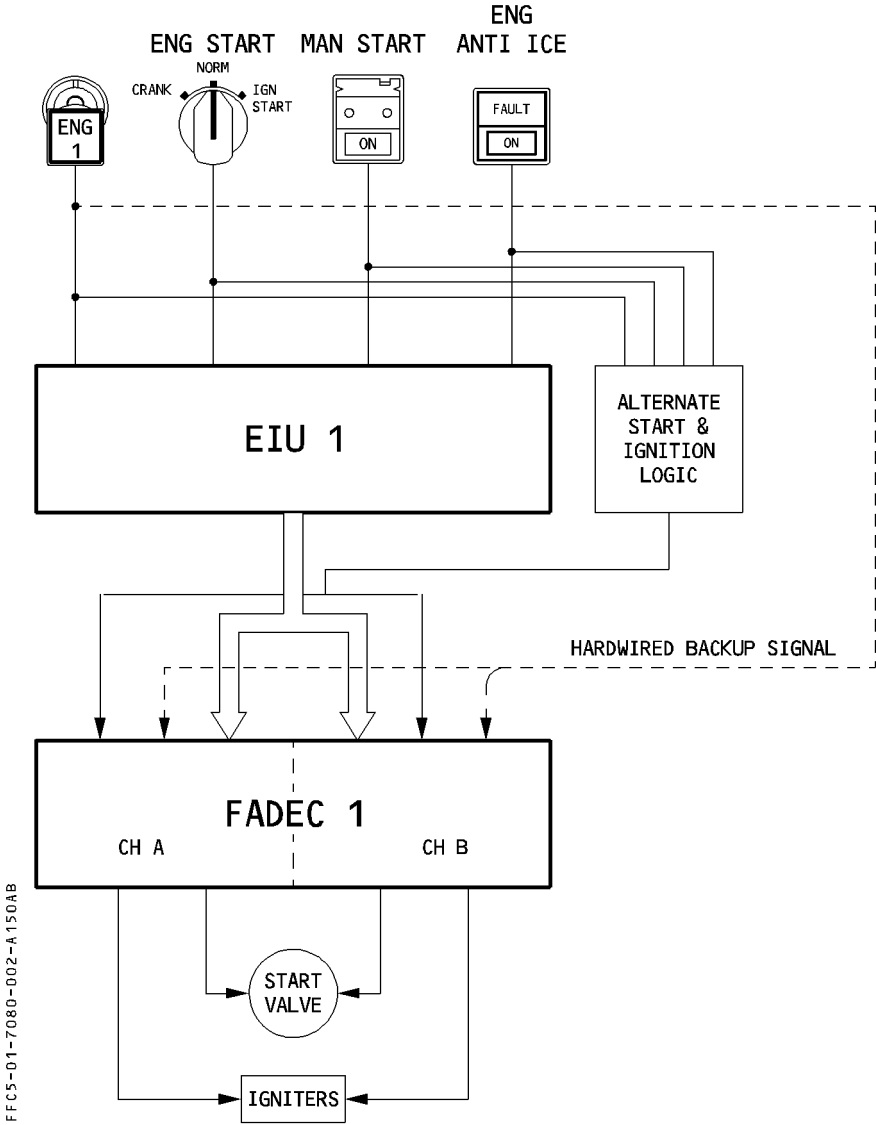
The ignition and starting system is controlled by the FADEC according to the :

- Engine start selector position
- Engine master switch position
- ENG MAN START pushbutton position
- ENG ANTI ICE pushbutton position
- Flight/ground aircraft condition.

In normal operation, the FADEC receives its inputs from the EIU.

In the event of EIU signal loss, all the functions, except manual start and wet crank, will remain available by using both a backup signal from the engine master switch, and the alternate start/ignition signal.

ARCHITECTURE



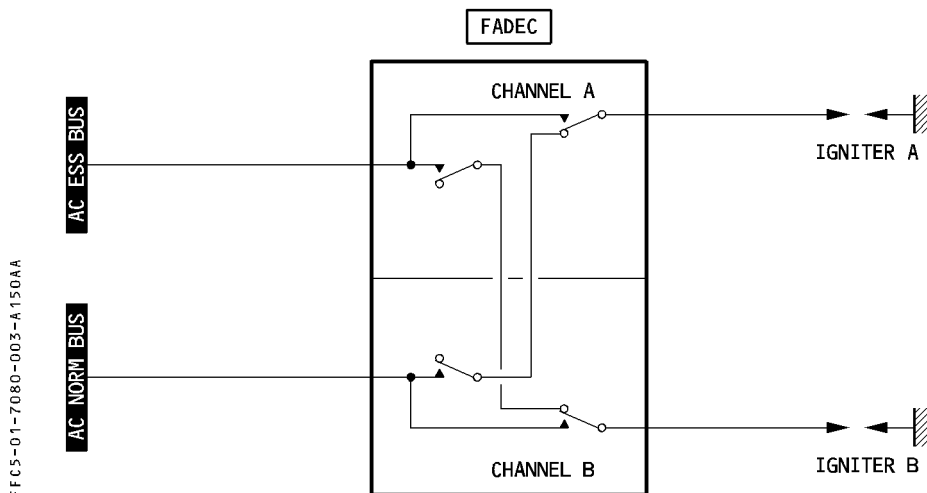
	POWER PLANT IGNITION AND STARTING	1.70.80	P 3
		SEQ 150	REV 15

IGNITION SYSTEM

The ignition system is for engine starting on the ground and restart in flight.

It consists of two identical independent circuits for each engine, normally controlled by the FADEC Channel A, with the Channel B on standby. Each FADEC channel can control both igniters.

FOR INFO



IGNITION FOR STARTING

ON THE GROUND

During an automatic start only one igniter is supplied. The FADEC automatically alternates the use of igniters at each start and also the power supply source.

When residual EGT is above 100° C, both igniters are supplied.

Note : *In case of automatic restart attempts following an automatic start abort, both igniters are supplied.*

The ignition is automatically selected, when N3 is between 25% and 30 %.

It is automatically cut off when N3 reaches 50 %.

During a manual start, both igniters are supplied, when the engine MASTER switch is at ON. Both stop firing, when N3 reaches 50 %.

IN FLIGHT

Both igniters are supplied by the AC ESS BUS, when the engine MASTER switch is at ON.

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CONTINUOUS IGNITION

Continuous ignition is either selected manually or automatically to maintain engine combustion.

MANUAL SELECTION

In flight, continuous ignition is selected when the ENG START selector is on IGN/START, provided the related engine is running.

Only one igniter is selected. If failed, both igniters are automatically selected.

On ground, after starting, since ignition is automatically cut off, it is necessary to cycle the ENG START selector to NORM, then back to IGN/START, to select continuous ignition.

AUTOMATIC SELECTION

Continuous ignition (igniters A + B) is automatically selected :

- If engine anti-ice is selected on, and relevant EIU is inoperative ;
- For 10 seconds, in the event of engine flame-out condition detected by the FADEC ;
- For 10 seconds, in the event of inadvertent cycling of the Master lever with the engine running, provided N3 is above 50 %.

AUTO RELIGHT FUNCTION

If the FADEC detects a flame-out condition on ground, or in flight, both igniters A + B will be automatically energized for 10 seconds.

QUICK RELIGHT FUNCTION

In case of a flame-out in flight, provided the MASTER sw is selected OFF, then ON, within 30 seconds and N3 is above 10 %, the quick relight function will immediately open the HP fuel valve and energize both igniters A + B, regardless of the ENG START selector position.

HYDRAULIC PUMP OFF LOAD

In flight, in order to improve the engine restart capability, the engine-driven hydraulic pump is depressurized when :

- N3 < 50% for more than 8 seconds and N3 < 30%, and,
- The aircraft speed is above 200 knots.

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ENGINE STARTING SYSTEM

GENERAL

The engine starting system consists of an air turbine starter and a start valve.

The start valve admits air supplied by the pneumatic system to operate the starter.

The FADEC electrically controls the start valve. On the ground, in the event of electrical control failure, the start valve can be manually operated by a handle.

AUTOMATIC STARTING

This sequence is under the full authority of the FADEC, which controls the :

- Start valve
- Igniter(s)
- Fuel HP valves.

It provides:

- Detection of hot start, hung start, surge, no light up or N1 rotor locked.
- FAULT announcement with specific ECAM message.
- Start abort on ground (high pressure valve closure, start valve closure, ignition stopped) and automatic engine dry crank after start abort.

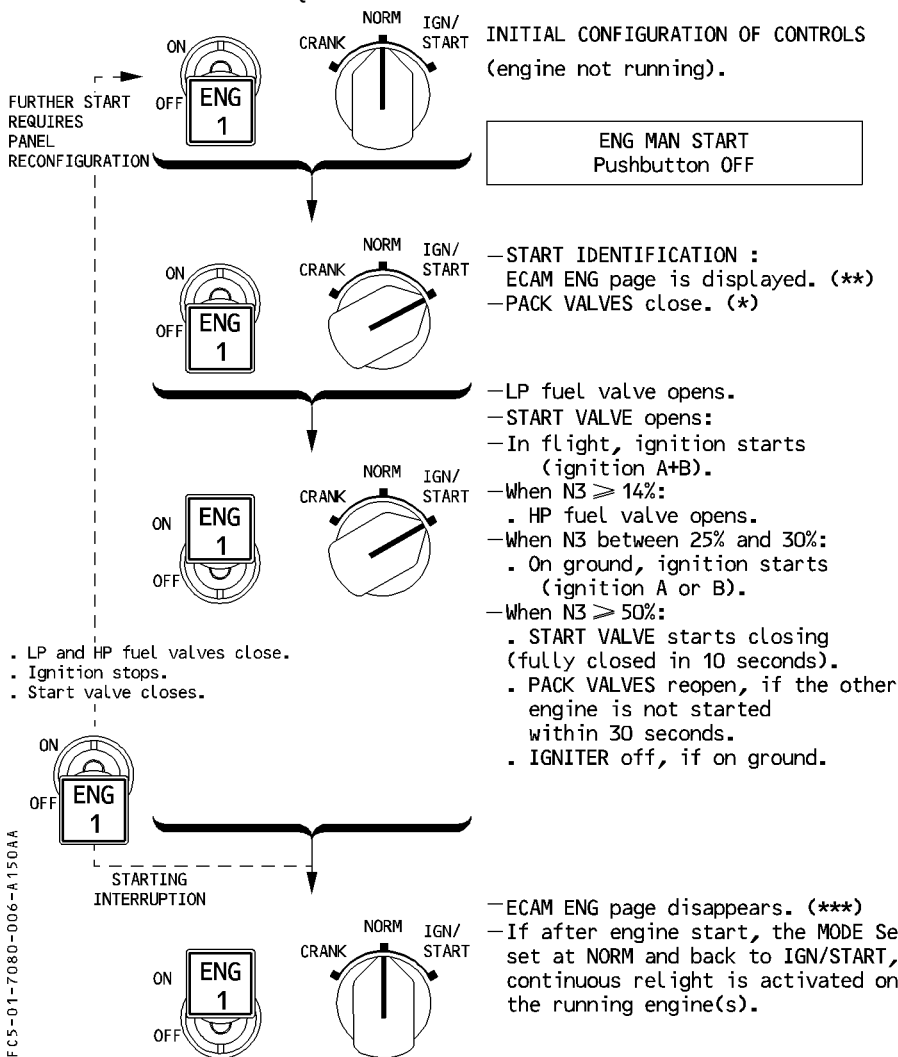
One further automatic start attempt will be initiated by the FADEC after cranking, except in case of N1 rotor locked. If this start attempt fails, the start will be aborted.

In flight, the FADEC identifies the windmilling or starter-assisted airstart conditions, according to engine parameters and the flight environmental parameters.

This sequence may be interrupted by selecting the engine master switch to OFF.

Automatic start abort is inhibited on ground, when N3 is above 50% or in flight.

AUTOMATIC STARTING SEQUENCE



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Note : (*) If after 30 seconds the engine master switch is not ON, the pack valves will reopen.

(**) At first engine start, if after IGN/START selection no further action is applied, the ECAM ENG page will automatically disappear after 30 seconds.

(***) If ENG START selector is not switched to NORM the ENG page is automatically replaced by the WHEEL page, 15 seconds after the 4th engine start.

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MANUAL STARTING

Manual starting is under limited authority by the FADEC which controls :

- start valve opening when the ENG START selector is set to IGN/START and the MAN START pushbutton is depressed
- high pressure fuel valve and operation of both igniters when the engine master switch is set to ON.
- start valve closure and, on ground, ignition cut off at 50 % N3.

The FADEC provides a passive survey of the engine during the starting sequence.

On the ground, it will automatically abort the starting sequence in case starter reengagement speed exceedance.

The sequence may be interrupted :

- before engine master switch set to on by selecting MAN START pushbutton to OFF.
- after engine master switch set to on by selecting it back to OFF. In this case a dry crank shall be selected by the crew.

Note : *When the engine master switch is set to on, selecting the MAN START pushbutton to off has no effect.*

In flight, the FADEC always commands a starter assisted airstart unless the N3 is above the start valve closure value (50 % N3).

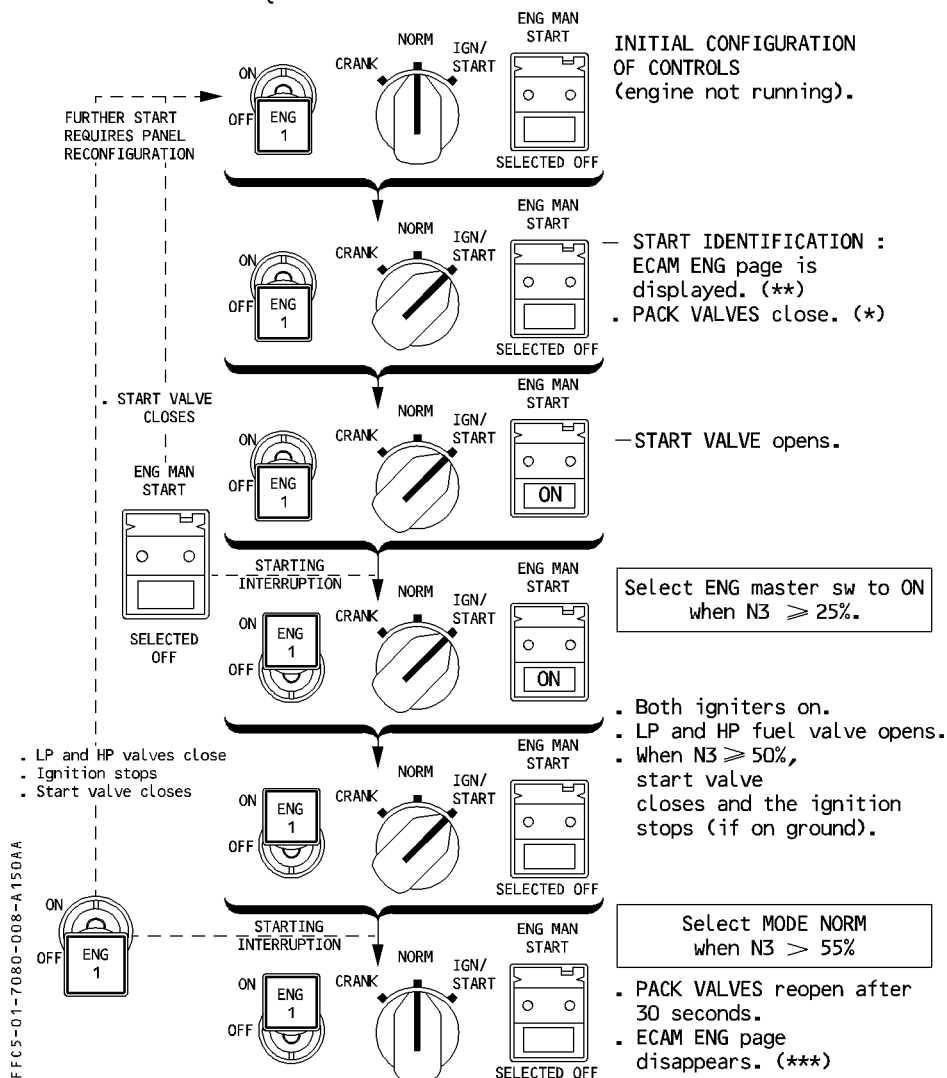
ENGINE VENTILATION (Dry cranking)

A dry cranking cycle enables the engine to be ventilated to remove fuel vapors after an unsuccessful start attempt on the ground.

Cranking can be manually selected by setting the ENG START selector to CRANK and the MAN START pushbutton to ON (engine master switch off). It is stopped by setting the MAN START pushbutton to off or selecting the ENG START selector to NORM.

A manual start sequence can be initiated immediately following a dry crank sequence by selecting the ENG START selector to IGN/START and engine master switch to ON.

MANUAL STARTING SEQUENCE



Note : (*) If after 30 seconds the ENG MAN START pushbutton is not switched ON, the pack valves will reopen.

(**) At first engine start, if after IGN/START selection no further action is applied, the ECAM ENG page will automatically disappear after 30 seconds.

(***) If ENG START selector is not switched to NORM the ENG page is automatically replaced by the WHEEL page, 15 seconds after the 4th engine start.

ALTERNATE START / IGNITION INFORMATION

In case of EIU failure, the FADEC uses a backup signal from the engine master switch and the alternate start/ignition signal to control :

- An automatic start,
- A dry crank, or
- Continuous ignition

Manual starting is no longer available.

FOR INFO

