

# Eurocopter EC135 with Glass Cockpit

---

## Operation Manual - English

Release 1, July 2003

Copyright ©2002-2003 Guenter Kraemer and Franz Haider.

Website: <http://www.gkflusi.de>



This manual is part of an EC135 package produced by Guenter Kraemer and Franz Haider. This package is freeware and may be freely distributed. It must not be sold single or as part of a collection without our permission.

For MS Flight Simulator 2002 only.  
Not for real world operation or training.

## Abbreviations and Terms:

A/C - Aircraft  
ADF – Automatic Direction Finder  
AEO – All Engines Operative  
AP – Autopilot  
BRG - Bearing  
CAD – Caution and Advisory Display  
CRS - Course  
DH – Decision Height  
DME – Distance Measurement Equipment  
DST – Distance to go  
DTK – Desired Track  
ENG – Engine  
FADEC – Full Authority Digital Engine Control  
FCDS – Flight Control Display System  
FCS – Flight Control System  
FLI – First Limit Indicator  
FMS – Flight Management System  
GPS – Global Positioning System  
GS – Glide Slope  
GSM – Global Standard for Mobile communication  
HDG – Heading  
HSI – Horizontal Situation Indicator  
IAS – Indicated Airspeed  
ICP – Instrument Control Panel  
IFR – Instrument Flight Rules  
ILS – Instrument Landing System  
MFD – Multi Function Display  
ND – Navigation Display  
NDB – Non Directional Beam  
NMS – Navigation Management System  
OAT – Outside Air Temperature  
OEI – One Engine Inoperative  
PFD – Primary Flight Display  
RA – Radio Altimeter  
SAS – Stability Augmentation System  
TAS – True Air Speed  
TCAS – Traffic Collision Avoidance System  
TRQ – Torque  
TTG – Time To Go  
UL – Upper Limit  
VEH – Vehicle  
VEMD – Vehicle and Engine Monitoring Display  
VFR – Visual Flight Rules  
VOR – Very high frequency Omnidirectional Radio ranging  
XMSN – Transmission  
XPDR - Transponder

## 1. INTRODUCTION

Hello and thanks for downloading the Eurocopter EC135.

After almost a year of work this helicopter add-on for Microsoft's Flight Simulator 2002 is ready for its final release. An update for the new FS2004 will be released as soon as possible. Since the panel is made using the XML-language, it will not work in FS2000.

## 2. NORMAL OPERATION

After loading the helicopter in FS2002 the view looks like the following screenshot. Please wait until the Rotor has stopped before you switch on the battery if you want the gauges working with maximum accuracy.



Fig.1, Panel after loading

After completing the outside check, turn on the battery master switch (BAT MSTR) located on the left bottom side of the panel. After that the CAD and VEMD displays and the Rotor & Engine RPM gauge are starting self tests. The warning lights "ROTOR RPM", "XMSN OIL P" and "BAT DISCH" are coming on on the warning panel. Switch the anti-collision light (A-COLL) on the overhead panel on.

When the self tests are completed, the panel looks like this:



Fig.2, Panel after self tests

Note that the generators are disconnected (warning “GEN DISCN” on the CAD). Therefore the battery will be discharged quickly. The DC bus voltage indication is located on the lower VEMD.

## 2.1 STARTING ENGINES

When you're ready to start the engines, open the overhead panel (Shift-4) and switch the PRIME PUMPS 1 and 2 on. The pump switches are located in the third row (see next screenshot). When they are switched on, all caution on the CAD are deleted, the caution “PRIME PMP” is coming on, accompanied by flashing yellow bars above and below the caution. At the same time the master warning light above the RPM gauge will illuminate. You can acknowledge the new caution either by pressing the brake button on your joystick or by pressing the “Select” button next to the CAD. This leads to all cautions being displayed in their order of appearance. Also the master caution will extinguish.



Fig.3, Prime pumps are switched on

Now turn on the FADEC switch located under the CAD. The FADEC is running a self test which can be seen at the upper VEMD. After completing the self test, the FLI needle shows the turbine outlet temperature.

Note: The markings and values on the FLI rose are showing neither percentages nor absolute values. They are for easy remembering only.

To start the engines switch the yellow engine control switch to the position “IDLE”. The engines are starting automatically. On the CAD the cautions “IDLE” and “STARTER” are coming on. These cautions can not be acknowledged. Monitor all engine parameters during startup. When the Rotor RPM is above 70%, you can switch on the XFER PUMPS FWD and AFT on the overhead panel. After that turn the prime pumps off.

Now you can turn on the avionics switches 1 and 2 on the overhead panel. The primary flight display (PFD) and the navigation display (ND) are starting up (see next screenshot).



Fig.4, PFD and ND startup

When the normal symbology appears, switch the engine control switch to the position “FLIGHT”. The rotor RPM is increasing until 100%. Uncage the backup horizon before takeoff.

Turn on lights as required.

## 2.2 ENGINE SHUTDOWN

Engine shutdown is performed in the opposite way like engine startup. Refer to the checklist in chapter 4.

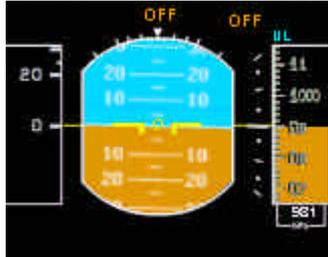
## 2.3 MINI PANEL

A smaller version of the panel can be accessed by clicking on the glare shield right of the PFD.

### 3. SYSTEM DESCRIPTION

#### Primary flight display SMD45H:

The primary flight display provides all essential flight parameters.



Displayed parameters:

- ⇒ Attitude
- ⇒ Airspeed
- ⇒ Altitude
- ⇒ Vertical speed, digital and analogous
- ⇒ Speed trend
- ⇒ Altimeter pressure
- ⇒ Radar Altitude (digital and bar graph)
- ⇒ Decision height flag
- ⇒ AFCS indications

In case of a failure of SMD Nr.2 or if you press “PFD” at the Instrument Control Panel the primary MFD displays all essential navigation data.

The aircraft symbol of the attitude indicator is vertically moveable with the POS knob on the ICP (Center Console Shift-2).

## Navigation Display SMD45H:

The navigation display provides all navigational data required by the pilot.



Displayed parameters:

- ⇒ Heading, analogous
- ⇒ VOR1/VOR2/ADF/GPS-Information
- ⇒ VOR Course
- ⇒ Time to Go to DME-Station or GPS waypoint
- ⇒ Speed
- ⇒ Autopilot Heading Setting
- ⇒ Bearing
- ⇒ Distance to DME-Station or GPS waypoint
- ⇒ Decision Height
- ⇒ Radar Altitude

## System Control Panel:

This Panel contains all switches for engine start and electrical systems.

The upper row is for engine control and consists of one engine start switch (yellow) and one FADEC switch for each engine. Since FS2002 simulates only one engine, they are switched in pairs. Before you can start the engine you must turn on the FADEC system.



The second row contains the battery master and generator 1 and 2 switches. The avionics switches are located on the overhead panel.

Because the Flight Simulator 2002 provides only one helicopter engine the systems one and two are coupled. I hope this problem can be solved with the coming FS2004 ACOF.

## 3 axis flight control system:

The EC135 is equipped with a 3 axis autopilot. The autopilot isn't released yet.

### Warning Unit:

The warning unit is located above the backup instruments and consists of several warning lights and two emergency fuel cutoff switches.



### Central Panel Display System CPDS:

The Central Panel Display System consists of the Caution and Advisory Display and the Vehicle and Engine Monitoring Display. The CPDS displays all essential engine parameters, FLI, cautions and fuel quantities.



**Caution and Advisory Display:**

The CAD displays cautions and fuel quantity parameters. The fuel parameters are only displayed on the CAD and are no longer available if the CAD fails.

The cautions inform the crew about defects in onboard systems. They appear in three columns:

- left column: messages relating to engine 1 and system 1
- center column: messages relating to non-redundant systems
- right column: messages relating to engine 2 and system 2

The cautions are listed in order of their appearance. If there isn't enough room to display all cautions, "1 of 2" will appear at the top of the center column to indicate the presence of a second page with cautions. This page can be accessed by the "Scroll" button.



**Vehicle and Engine Monitoring Display:**

The upper VEMD displays the FLI page. It contains following parameters: Torque, TOT, N1 and the Mast Moment. If a parameter fails, it is displayed with yellow characters without its associated numeric value.

The lower screen contains parameters of the engines and the electrical system. The following parameters are displayed: outside air temperature, voltage and current, oil pressure and temperature.



## 4. CHECKLIST FOR NORMAL OPERATION

### 4.1 ⇒ PRE-START CHECK

#### Instrument Panel:

BAT MSTR switch - ON; CPDS internal test starts

**NOTE:** Do not switch off CPDS during or after flight

**NOTE:** If INP FAIL appears in conjunction with the appropriate caution(s), this caution(s) will not be provided during flight. Abort pre-start check. Maintenance action is required.

#### Overhead Panel:

CDS/WARN UNIT TEST sw - WARN UNIT (all warning lights and double gong must come on)  
 CDS/WARN UNIT TEST sw - CPDS; Check display self test  
 Fuel XFER pumps (AFT and FWD) - ON; Check caution (F PMP AFT/FWD) off  
 Fuel XFER pumps (AFT and FWD) - OFF  
 Fuel PRIME pumps (1 and 2) - ON and check caution coming on  
 A-COLL light sw - ON

#### Instrument Panel:

Instrument panel cooling - Check operative  
 CAD & VEMD brightness - Adjust as required  
 CPDS - Check units  
 VEMD - DC voltage: minimum 24V DC  
 CAD fuel quantity indication - Check quantity

**CAUTION** DO NOT SWITCH ON FADEC UNTIL CPDS SELF TEST HAS BEEN COMPLETED.

FADEC sw I then II - ON;

### 4.2 STARTING ENGINES

#### Before starting engines

Rotor area - Clear

#### Abort start procedure

**CAUTION** IMMEDIATELY ABORT START AND, IF INDICATED, PERFORM MAINTENANCE ACTION BEFORE RESTART FOR ANY OF THE FOLLOWING:

*If 25 Ah or 26 Ah battery is installed:*

IF IGNITION DOES NOT TAKE PLACE AFTER REACHING OF  $N_1=20\%$  BUT LATEST AFTER 15 SECONDS. PERFORM A 15 SEC. ENGINE VENTILATION AND WAIT FOR 60 SEC. BEFORE TRYING STARTING AGAIN.

*If 40 Ah battery is installed:*

IF IGNITION DOES NOT TAKE PLACE AFTER REACHING OF  $N_1=20\%$  BUT LATEST AFTER 15 SECONDS. WAIT ANOTHER 30 SEC. AND PERFORM A 15 SEC. ENGINE VENTILATION. WAIT FOR 30 SEC. BEFORE TRYING STARTING AGAIN.

- TOT RISES ABNORMALLY RAPIDLY ABOVE  $810^{\circ}\text{C}$  AND IS QUICKLY APPROACHING  $895^{\circ}\text{C}$ .  
(If start is aborted but TOT limits are not exceeded, wait 15 seconds after  $N_1$  RPM has returned to zero before attempting restart. This permits excessive fuel to drain from combustion chamber.)
- NO POSITIVE ENGINE OR TRANSMISSION OIL PRESSURE INDICATIONS UPON REACHING GROUND IDLE CONDITION.  
(MAINTENANCE ACTION!)
- $N_2$  RPM AND ROTOR RPM NEEDLES ARE NOT MATCHED AFTER REACHING STABILIZED GROUND IDLE CONDITION.  
(MAINTENANCE ACTION!)
- ABNORMAL VIBRATIONS DURING  $N_{RO}$  INCREASE

ENG MAIN sw(s)

- OFF

**NOTE** If, for any reason, a starting attempt is discontinued, the entire starting sequence must be repeated from the beginning.

## Starting Engine

First Limit Indicator  
ENG MAIN sw

- Check needle shows TOT
- IDLE, simultaneously start clock
- Monitor:
  - $N_1$  increase
  - TOT rise ( $\sim 720^\circ\text{C}$ )
    - note that FLI needle moves not until  $\sim 350^\circ\text{C}$ .
  - Engine oil pressure increase
  - $N_2$  and  $N_{RO}$  increase

Ground IDLE

- Check approx.  $N_2=70\%$

When IDLE speed of  $N_2=70\%$  is reached:

Both Fuel XFER pumps  
Both Fuel PRIME pumps  
Inverter sw (if inverter(s) installed)  
Avionic Master switches  
Avionics  
Instruments  
Both ENG MAIN switches

- ON
- OFF
- ON
- ON
- Check on and set
- Set and check
- FLIGHT

After rotor RPM has stabilized:

Both ENG Main switch guards

- Close

## Engine quick start procedure

**NOTE** Only recommended if special circumstances require.

INVERTER 1 sw (if inverter(s) installed)	- ON
Cyclic stick	- Unlock and hold in neutral pos.
First Limit Indicator	- Check needle shows TOT
ENG MAIN sw	- FLIGHT, simultaneously start clock
	- Monitor:
	- $N_1$ increase
	- TOT rise ( $\sim 720^\circ\text{C}$ ) note that FLI needle moves not until $\sim 350^\circ\text{C}$ .
	- Engine oil pressure increase
	- $N_2$ and $N_{RO}$ increase

When  $N_2 > 70\%$  at both engines:

Both Fuel XFER pumps	- ON
Both Fuel PRIME pumps	- OFF
Inverter 2 sw (if installed)	- ON
Avionic Master switches	- ON

When both engines in Flight idle:

Both ENG Main switch guards	- Close
Avionics	- Check on and set
Instruments	- Set and check

## 4.3 SYSTEM CHECKS

### Miscellaneous Checks

Optional equipment check	- As required
--------------------------	---------------

### Power Check

Perform power check as required

### Cyclic stick:

Cyclic trim system	- Check function in all four Directions
--------------------	---

**NOTE** Monitor Mast Moment Indication while performing small cyclic inputs

#### 4.4 PRE-TAKEOFF CHECK

$N_{RO}/N_2$	- Check ~97%
All WARNINGS, CAD & VEMD indications	- Check
All doors	- Closed
Collective pitch	- Unlock

**NOTE** Due to start sequence the FLI needle of the second started engine can show TOT start mode instead of torque. Switch the engine in TOT mode to FLIGHT position first.

#### 4.8 TAKEOFF

Collective	- Check if starting triangles disappeared, if not perform small input (~ 30% torque)
Hover flight	- Perform
$N_{RO}/N_2$ instrument	- Check ~ 100%
FLI needles	- Check matched at same Parameter
All WARNING, CAD & VEMD indications	- Check

#### Recommended takeoff procedure:

Acceleration and climb	- Start nose down pitch rotation and simultaneously increase power smoothly so that the helicopter gains speed and height. Observe Height-Velocity-diagram as described in Section 5
When reaching 50 KIAS	- Maintain airspeed until reaching 50ft AGL, then accelerate to $V_Y$ (65kt) and climb through 100ft AGL

**CAUTION** AN OSCILLATION, WHICH COULD BE UNINTENTIONALLY INDUCED/ASSISTED BY THE PILOT (**PIO/PAO**) MAY BE EXPERIENCED INFLIGHT IN TURBULENT WEATHER CONDITIONS.  
IN CASE OF PIO/PAO, RELEASE COLLECTIVE LEVER MEMENTARILY AND INCREASE COLLECTIVE LEVER BRAKE FRICTION.

## 4.9 PRE-LANDING CHECK

- |                                      |         |
|--------------------------------------|---------|
| All instruments                      | - Check |
| All WARNINGS, CAD & VEMD indications | - Check |

## 4.10 LANDING

**CAUTION** AN OSCILLATION, WHICH COULD BE UNINTENTIONALLY INDUCED/ASSISTED BY THE PILOT (**PIO/PAO**) MAY BE EXPERIENCED DURING RUNNING LANDING OR HARDER VERTICAL LANDINGS.  
IN CASE OF PIO/PAO, RAPIDLY INCREASE OR DECREASE COLLECTIVE LEVER, WHATEVER SITUATION ALLOWS, UNTIL OSCILLATION HAS STOPPED.

### Recommended landing procedure:

- |                          |   |
|--------------------------|---|
| After reaching 50 ft AGL | - Descent with 300 ft/min = R/D<br>< 500 ft/min at 40 KIAS                                      |
| Before touchdown         | - Establish flare attitude to reduce ground speed and raise collective lever to cushion landing |
| Touchdown                | - Establish with zero groundspeed   |
| Cyclic stick             | - Neutral   |
| Collective pitch         | - Lock  |

## 4.11 ENGINE SHUTDOWN

- |                               |   |
|-------------------------------|---|
| ENG I/II main switches        | - IDLE  |
| Clock                         | - Start   |
| Inverter sw(s)                | - OFF   |
| Avionic Master switches       | - OFF   |
| STBY/HOR sw (if installed)    | - OFF   |
| Fuel XFER pumps (FWD and AFT) | - OFF   |
| All electrical consumers      | - OFF; except anti-collision light and FADEC sw |
| Cyclic stick                  | - Lock  |
| After 60 seconds:             |   |
| ENG I/II main switched        | - OFF   |
| Engine parameters             | - Monitor                                       |
| When rotor has stopped        |   |
| Anti collision light          | - OFF   |
| FADEC switches (2)            | - OFF   |
| BAT MSTR switch               | - OFF   |

***SPECIAL THANKS:***

Gerhard Schaible  
for his great support and the many information's  
about the real EC135 and the panel

Johann-Paul Brunner & Günter Grassinger  
for their explanation and demonstration of the panels of OE-XER  
and OE-XEQ of the ÖAMTC Flugrettung

and thanks to everybody else  
who helped us...



Franz Haider, Gerd Schaible Günter Krämer

If you have any suggestions, comments or problems please write to:

Guenter Kraemer: [guenter@kraemerg.de](mailto:guenter@kraemerg.de)

Franz Haider: [ith@gmx.at](mailto:ith@gmx.at)