

CHAPTER

74

Ignition

(CFM56 ENGINES (CFM56-7))

CHAPTER 74
IGNITION

| Subject/Page | Date | COC | Subject/Page | Date | COC |
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| 74-EFFECTIVE PAGES | | | 74-00-00 (cont.) | | |
| 1 | Jun 15/2016 | | 17 | Oct 15/2015 | |
| 2 | BLANK | | 18 | Oct 15/2015 | |
| 74-CONTENTS | | | 19 | Oct 15/2015 | |
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| 2 | BLANK | | 21 | Oct 15/2015 | |
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| 2 | Feb 15/2015 | | 24 | Oct 15/2015 | |
| 3 | Feb 15/2015 | | 25 | Oct 15/2015 | |
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| 5 | Oct 15/2015 | | 27 | Oct 15/2015 | |
| R 6 | Jun 15/2016 | | 28 | BLANK | |
| 7 | Oct 15/2015 | | | | |
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| 9 | Oct 15/2015 | | | | |
| 10 | Oct 15/2015 | | | | |
| 11 | Oct 15/2015 | | | | |
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| 16 | Oct 15/2015 | | | | |

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CHAPTER 74
IGNITION

| <u>CH-SC-SU</u> | <u>SUBJECT</u> | <u>PAGE</u> | <u>EFFECT</u> |
|-----------------|---|-------------|---------------|
| 74-00-00 | IGNITION - INTRODUCTION | 2 | AKS ALL |
| 74-00-00 | IGNITION - GENERAL DESCRIPTION | 4 | AKS ALL |
| 74-00-00 | IGNITION - ENGINE COMPONENT LOCATION | 8 | AKS ALL |
| 74-00-00 | IGNITION - FLIGHT COMPARTMENT COMPONENT LOCATIONS | 12 | AKS ALL |
| 74-00-00 | IGNITION - IGNITION EXCITER | 16 | AKS ALL |
| 74-00-00 | IGNITION - DISTRIBUTION - IGNITION LEADS AND SPARK IGNITERS | 18 | AKS ALL |
| 74-00-00 | IGNITION - FUNCTIONAL DESCRIPTION | 21 | AKS ALL |
| 74-00-00 | IGNITION - OPERATION | 24 | AKS ALL |
| 74-00-00 | IGNITION - TRAINING INFORMATION POINT | 26 | AKS ALL |

74-CONTENTS



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IGNITION - INTRODUCTION

General

The ignition systems supply electrical sparks in the combustion chamber for combustion. Each engine has two ignition systems that operate independently. The ignition system usually operates manually. However, the ignition systems operate automatically when the electronic engine control (EEC) sees a possible engine flameout condition.

You use ignition during these times:

- Ground start
- Takeoff and landings
- In-flight (during heavy turbulence or bad weather)
- In-flight start.

Abbreviations and Acronyms

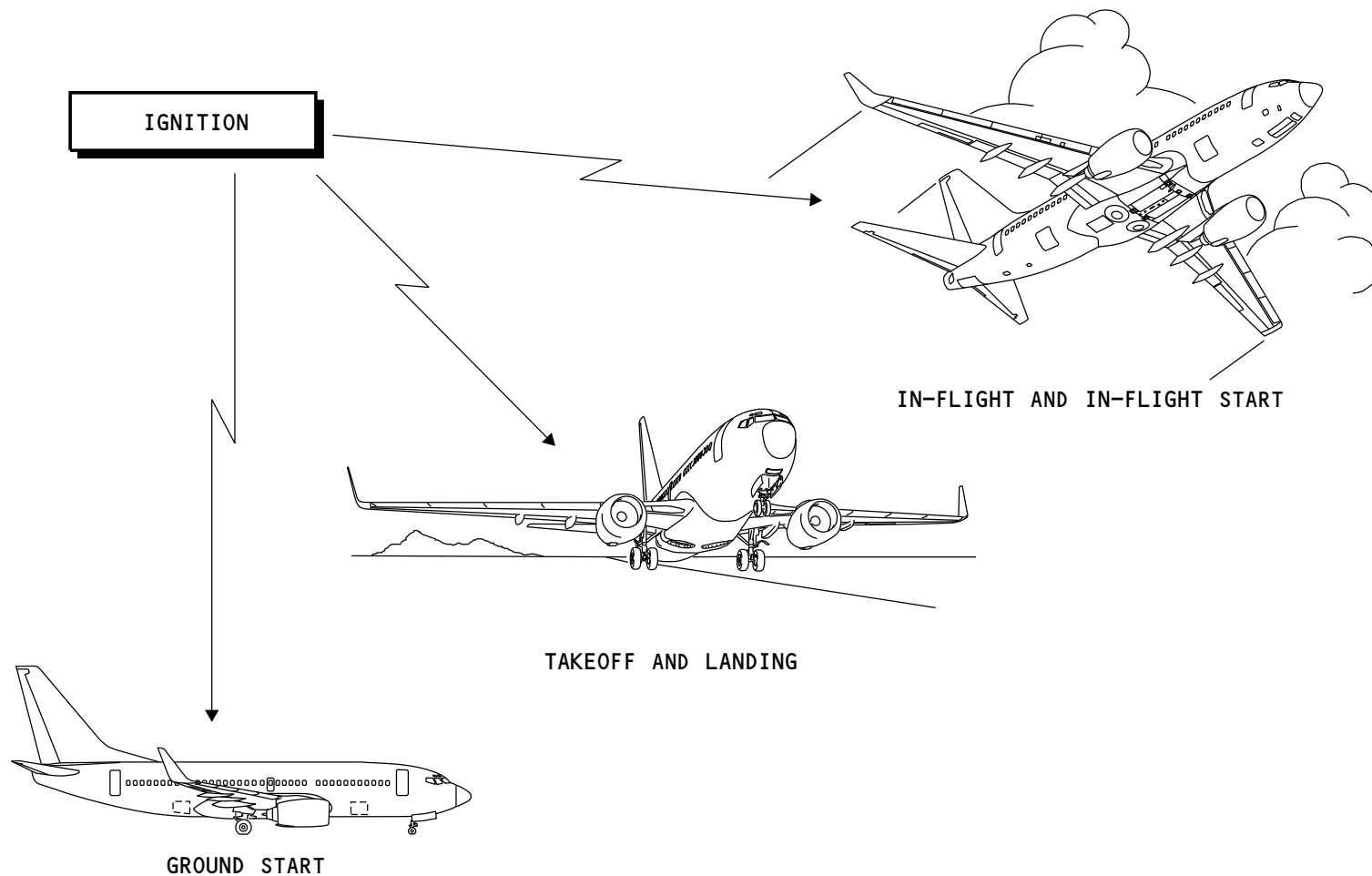
- CDS - common display system
- CDU - control display unit
- CONT - continuous
- DEU - display electronics unit
- EEC - electronic engine control
- FLT - flight
- FMC - flight management computer
- GRD - ground
- IGN - ignition
- L - left
- R - right

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IGNITION - INTRODUCTION

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IGNITION - GENERAL DESCRIPTION

General

These components control ignition:

- Engine start levers
- Start switches
- Ignition selector switch
- Electronic engine control (EEC).

The engine start lever controls ignition system power to the EEC.

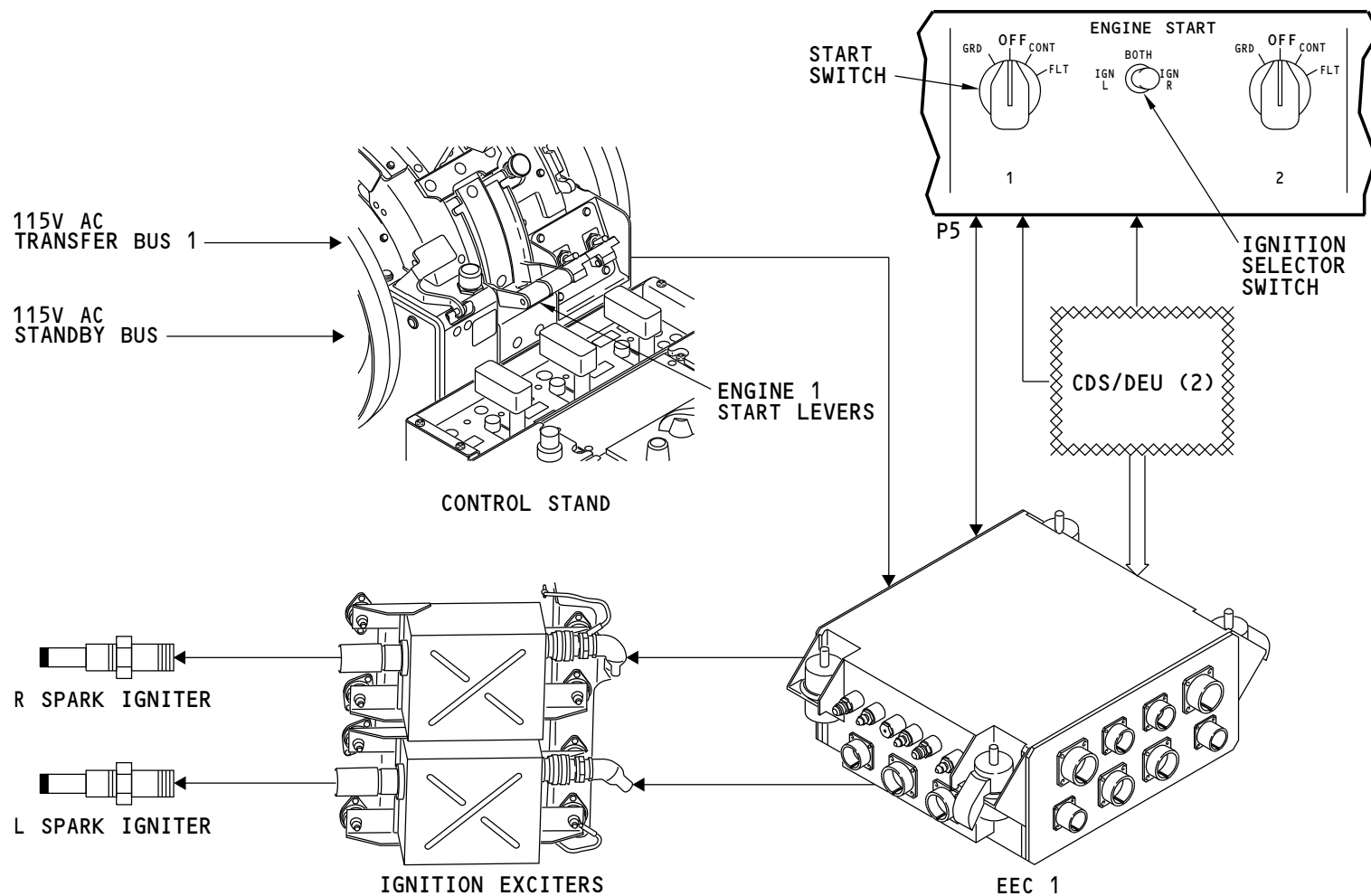
The start switch and the ignition selector switch supply inputs to the EEC. The EEC uses these inputs to supply power to the ignition exciters. The ignition exciters supply power to the spark igniters.

The engine starting system also uses the switch positions for control.

See the engine starting chapter for more information. (CHAPTER 80)

Electrical Power

The engine 1 ignition systems receive 115v AC from AC transfer bus 1 and the AC standby bus. The EEC has internal switches that control the 115v AC to the ignition exciters. The ignition exciters change the 115v AC input to a dc voltage of approximately 15,000 to 20,000v for the spark igniters. The spark igniters give a spark for combustion. The ignition systems of engine 2 receive AC power from AC transfer bus 2 and the AC standby bus.



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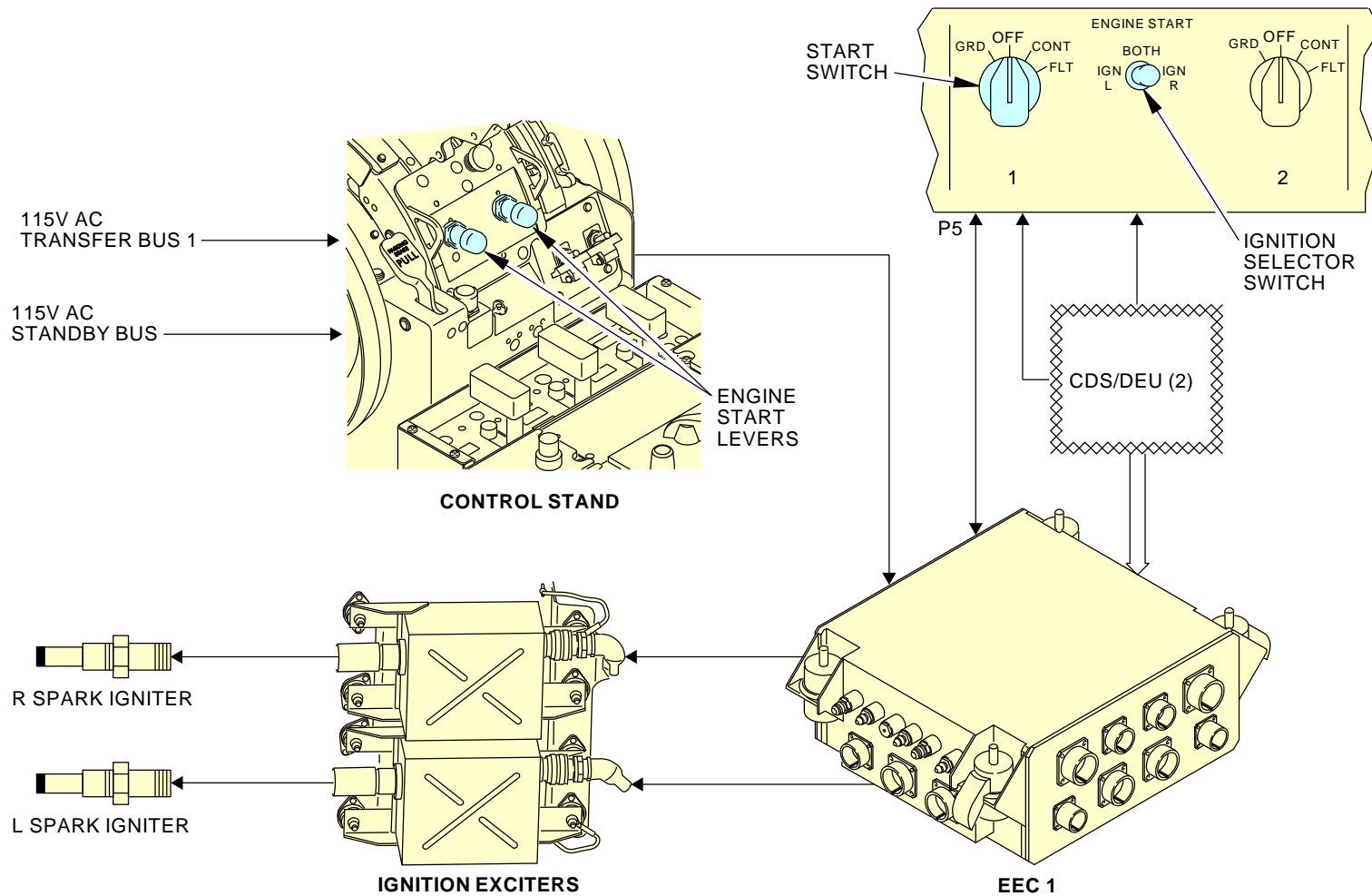
IGNITION - GENERAL DESCRIPTION

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IGNITION - GENERAL DESCRIPTION

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IGNITION - ENGINE COMPONENT LOCATION

General

Each engine has a right and a left ignition system. These are the components of each ignition system:

- Ignition exciter
- Ignition lead
- Air manifold
- Spark igniter.

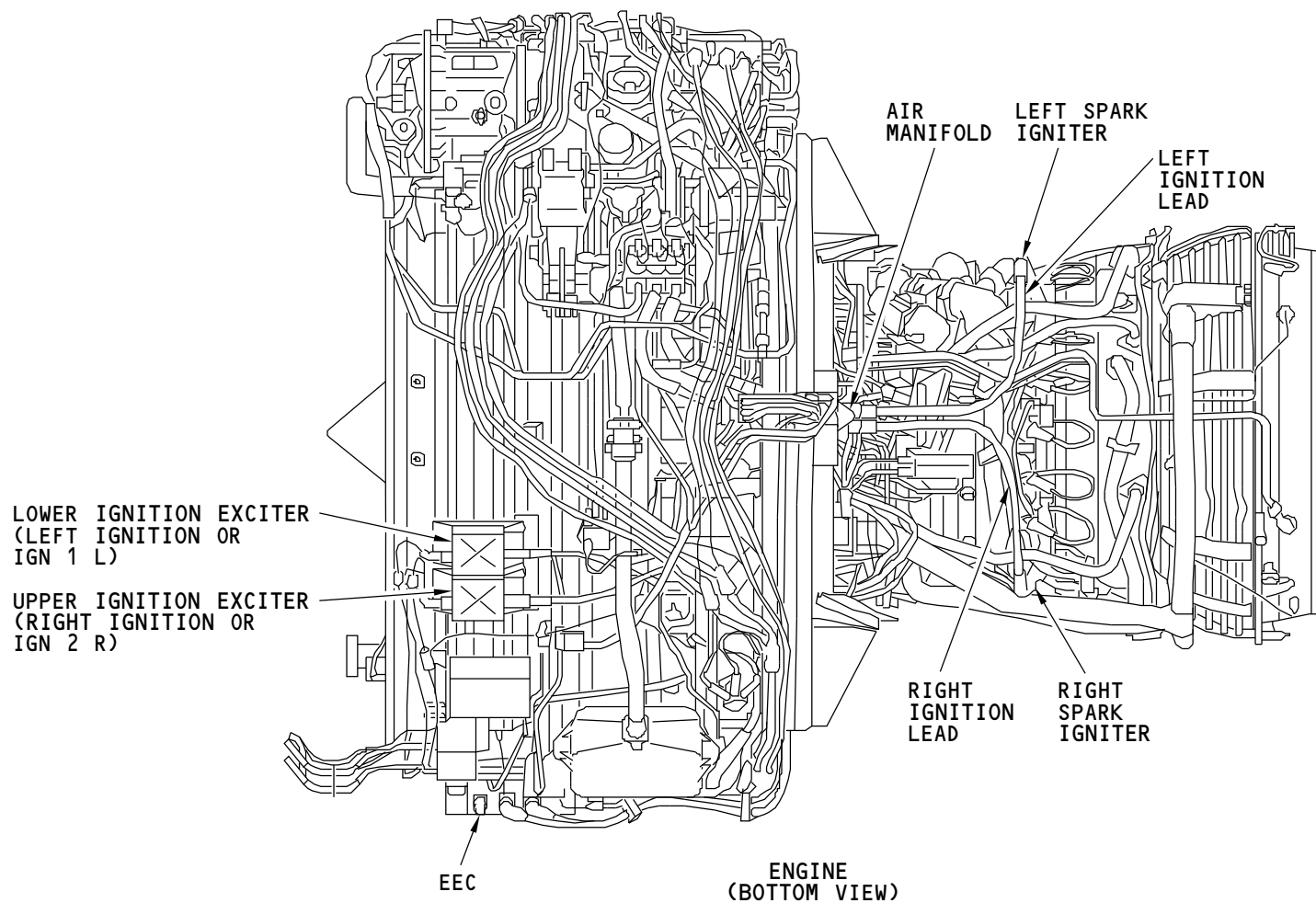
Component Locations

The ignition exciters are on the right side, lower portion, of the fan case.

The ignition leads go from the ignition exciters to the spark igniters on the right and left sides of the engine.

The air manifold goes around the ignition leads. The air manifold starts in the 6:00 strut and goes to the igniters.

The spark igniters are just forward of the fuel manifold, at the 4:00 position and the 8:00 position.



IGNITION - ENGINE COMPONENT LOCATION

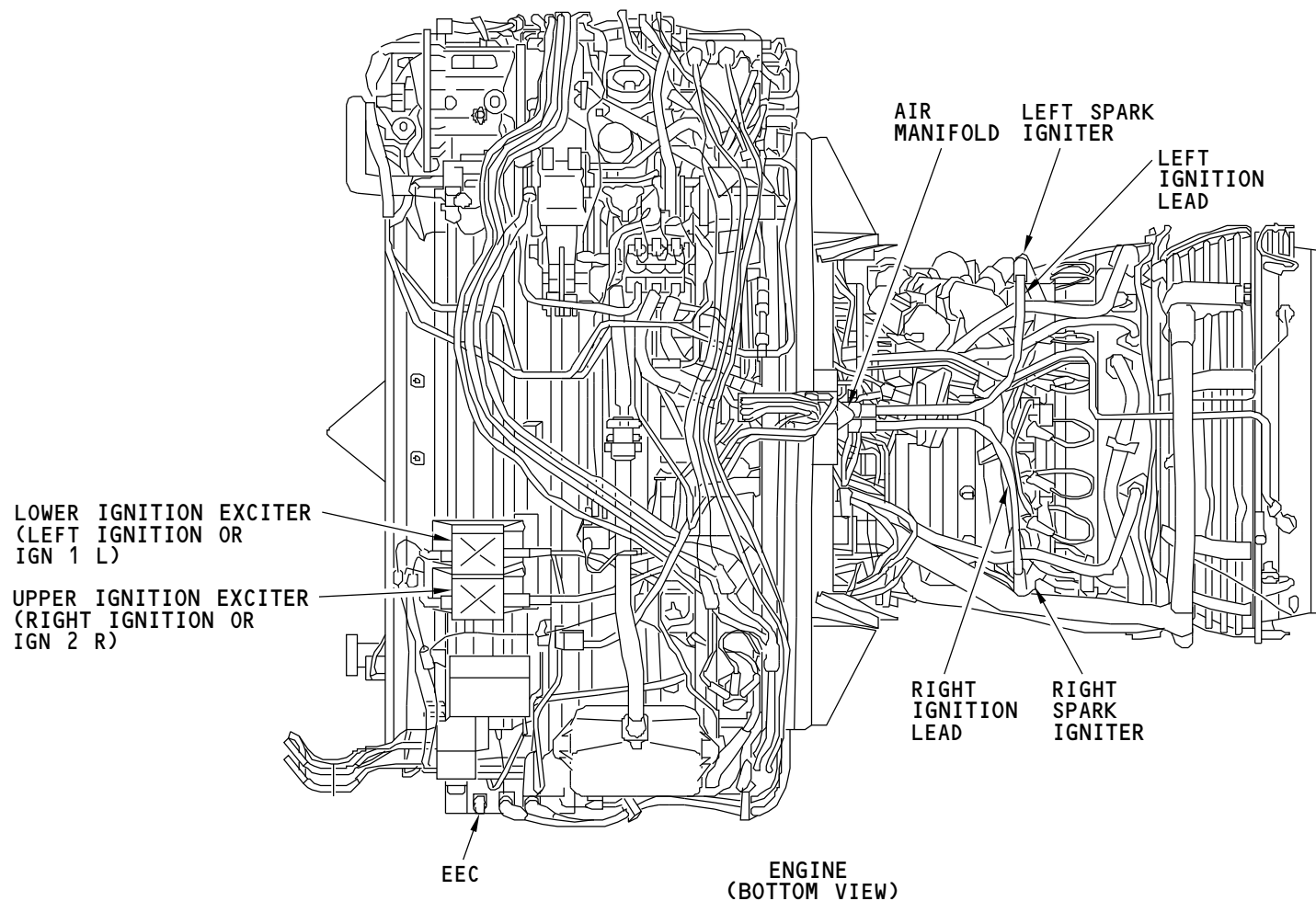
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IGNITION - ENGINE COMPONENT LOCATION

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**IGNITION - FLIGHT COMPARTMENT COMPONENT LOCATIONS****General**

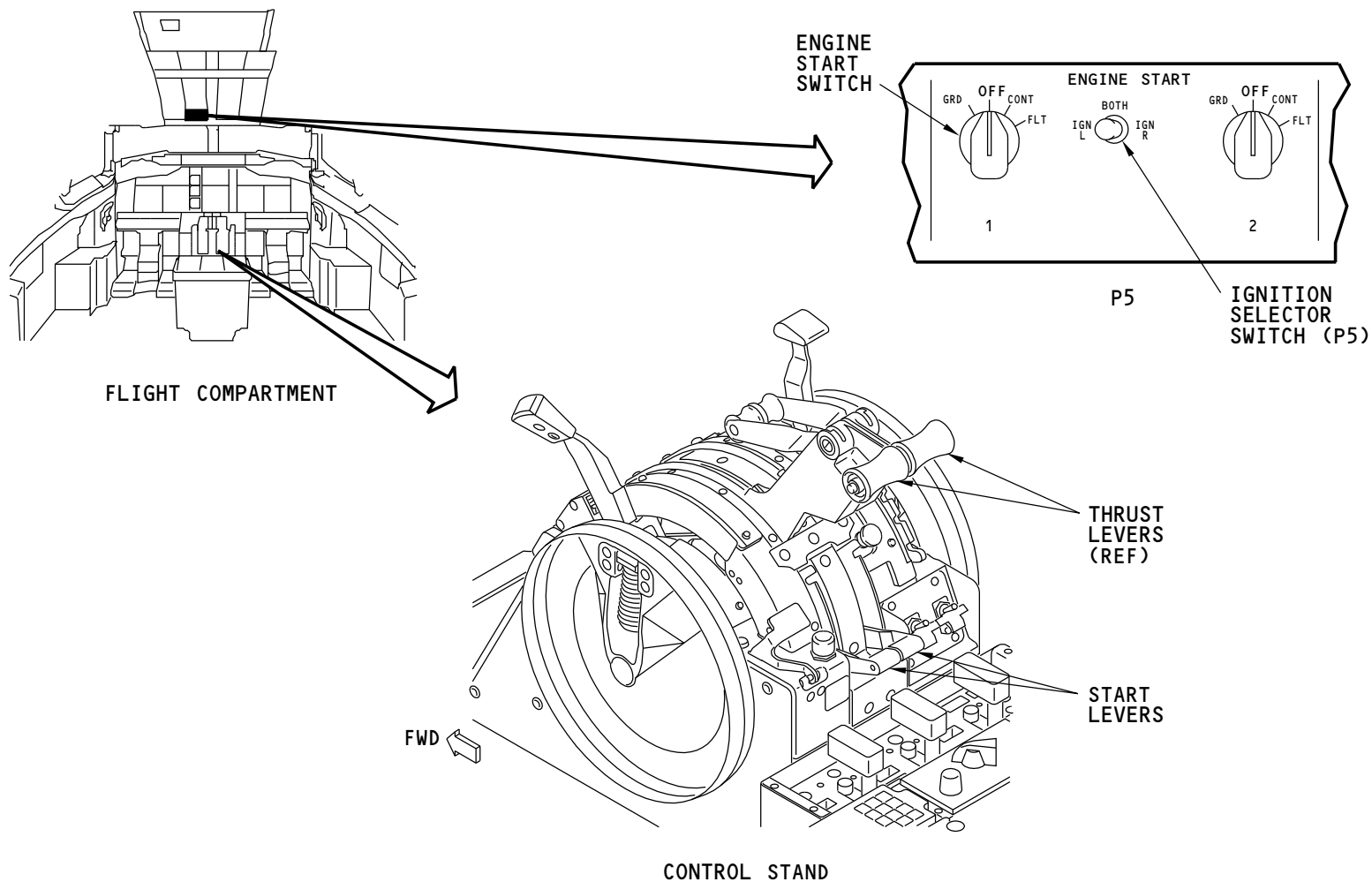
These components which control the ignition system are in the flight compartment:

- Engine start switches
- Ignition selector switch
- Engine start levers.

Component Locations

The ignition selector switch and engine start switches are on the forward overhead panel (P5).

The engine start levers are on the control stand.



IGNITION - FLIGHT COMPARTMENT COMPONENT LOCATIONS

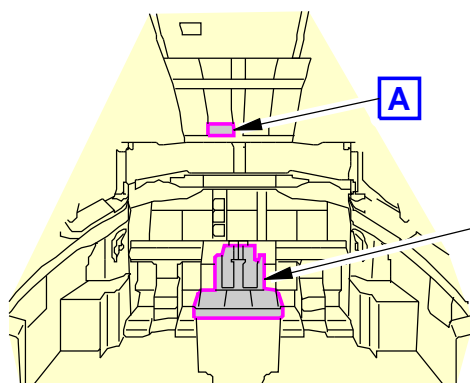
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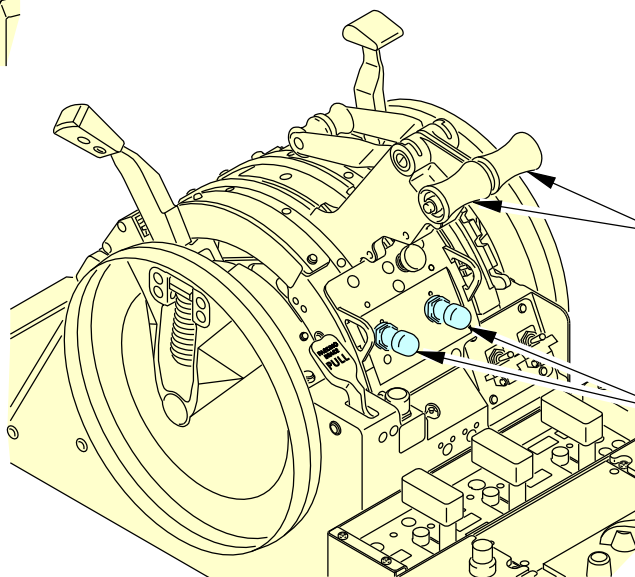
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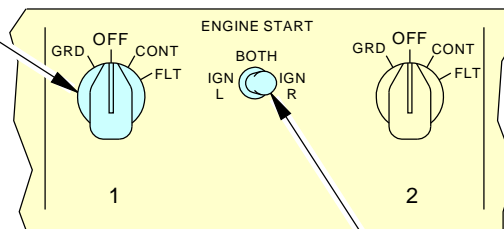


FLIGHT COMPARTMENT



CONTROL STAND

ENGINE
START
SWITCH



P5
A

IGNITION
SELECTOR
SWITCH (P5)

THRUST
LEVERS
(REF)

ENGINE START
LEVERS

IGNITION - FLIGHT COMPARTMENT COMPONENT LOCATIONS

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**IGNITION - IGNITION EXCITER****Purpose**

The ignition exciters supply power to spark igniters.

General

The ignition exciters change 115v ac to 20,000v dc. The output of the ignition exciter is 14.5 to 16 joules. The spark igniter uses this power to ignite the fuel/air mixture in the combustion chamber. Usually, only one ignition exciter per engine operates at a time.

Physical Description

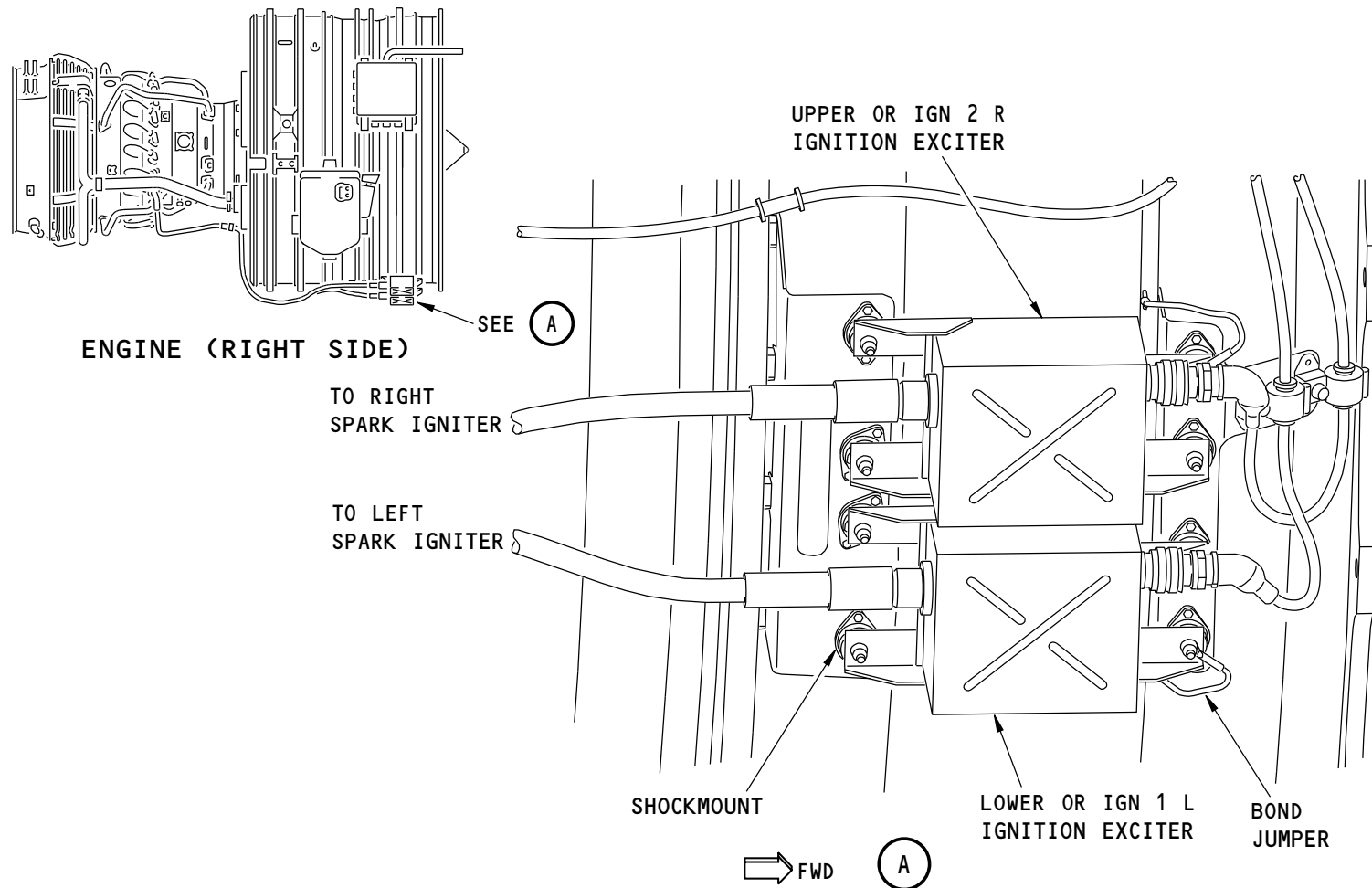
A 115v ac electrical connector attaches to the forward face of the ignition exciter. The ignition lead attaches to the aft face of the ignition exciter.

The ignition exciters attach to the fan case with four shockmounts.

Each ignition exciter has a bond jumper that attaches to the engine.

Training Information Point

WARNING: MAKE SURE THAT THE IGNITION EXCITERS ARE DE-ENERGIZED FOR A MINIMUM OF FIVE MINUTES BEFORE YOU START WORK ON THE IGNITION SYSTEM. THE IGNITION SYSTEM VOLTAGE IS DANGEROUSLY HIGH. DO NOT TOUCH THE ELECTRICAL CONTACTS. THE IGNITION EXCITERS CAN HAVE AN ELECTRICAL CHARGE EVEN WHEN NOT ENERGIZED. IF YOU DO NOT OBEY THIS STEP, INJURY TO PERSONS CAN OCCUR.



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IGNITION - IGNITION EXCITER

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**IGNITION - DISTRIBUTION - IGNITION LEADS AND SPARK IGNITERS****Purpose**

The spark igniters supply an electrical spark to ignite the fuel/air mixture in the combustion chamber.

The ignition leads transmit power from the ignition exciters to the spark igniters.

General Description

Each spark igniter has its own ignition lead. Air goes around each ignition lead to decrease the temperature of the lead.

Ignition Lead Cooling

Each ignition lead goes into an air manifold at the 6:00 position at the aft end of the fan case. Booster air (low pressure compressor exhaust air), makes each ignition lead cool. The booster air goes into the air manifold and moves around the inner part of the ignition lead shroud. Booster air comes out of the spark igniter end of the ignition lead to cool the spark igniter.

Spark Igniters

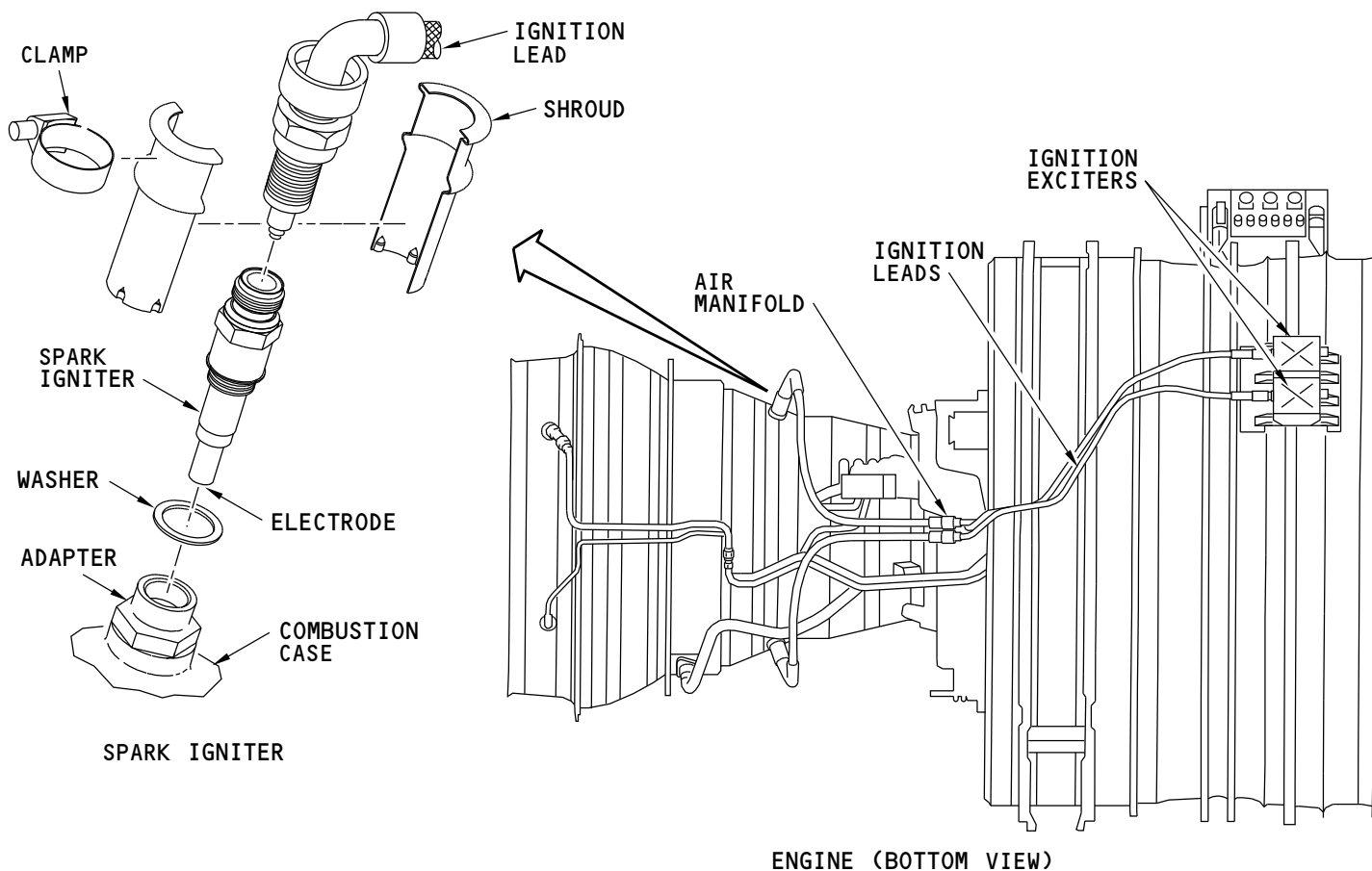
Each spark igniter installs into an adapter at the 4:00 and 8:00 positions on the engine. The spark igniter electrode is inside the combustion chamber.

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IGNITION - DISTRIBUTION - IGNITION LEADS AND SPARK IGNITERS

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IGNITION - FUNCTIONAL DESCRIPTION**General**

These are the components that operate the ignition system:

- Start levers
- Engine start switches
- Ignition selector switch
- EEC.

The ac transfer bus 1 supplies 115v ac electrical power to the EEC for the left ignition exciter. The ac standby bus supplies 115v ac electrical power to the EEC for right ignition exciter. The left ignition exciter for engine 2 uses power from ac transfer bus 2. The right ignition exciter uses the ac standby bus.

The EEC controls power to the ignition exciters. Input from the flight compartment components give manual control. The EEC has internal logic for automatic ignition system control.

Manual Control

The EEC and the CDS/DEUs monitor the position of these flight compartment components:

- Ignition selector switch
- Engine start switches
- Start levers.

Each CDS/DEU sends a digital data signals to the EEC with switch position information.

The EEC looks at the CDS/DEU digital data signal and the analog signal. The EEC compares the two signals. If the CDS/DEU 1 or CDS/DEU 2 digital data signal to the EEC logic stops, the EEC uses the analog signal as the flight compartment input.

The EEC uses switch position data to control four internal EEC ignition on/off switches. These switches control the 115v ac power to the ignition exciters. Each EEC channel (A and B) controls one ignition on/off switch to each ignition exciter. Only one EEC channel is active at a time. Therefore, only one ignition on/off switch, for an ignition exciter, works at a time. The other EEC channel is in the standby mode.

115v ac power goes to the EEC when you move the start lever to the idle position. The 115v ac power goes through the start lever switches that are in the closed position.

The ignition exciters receive power and supply 15,000 to 20,000v dc of electrical power to the spark igniters. The voltage goes across the electrodes of the spark igniter to make sparks.

Flameout Protection

The EEC turns on both ignition systems of an engine automatically if one of these conditions are true:

- The engine start lever is in the IDLE position, the start switch is in the FLT position
- The engine start lever is in the IDLE position, start switches in GRD or CONT position, N2 less than idle and the airplane is in flight
- The engine start lever is in the IDLE position, engine speed decreases uncommanded or N2 is less than 57% and N2 is more than 50%. For this condition only, both ignition systems are energized for 30 seconds
- The engine start lever is in the IDLE position, the airplane is in flight, start switch is in the OFF position, N2 speed is less than idle, and N2 speed is more than 5%.

The EEC turns ignition off when these conditions are true:

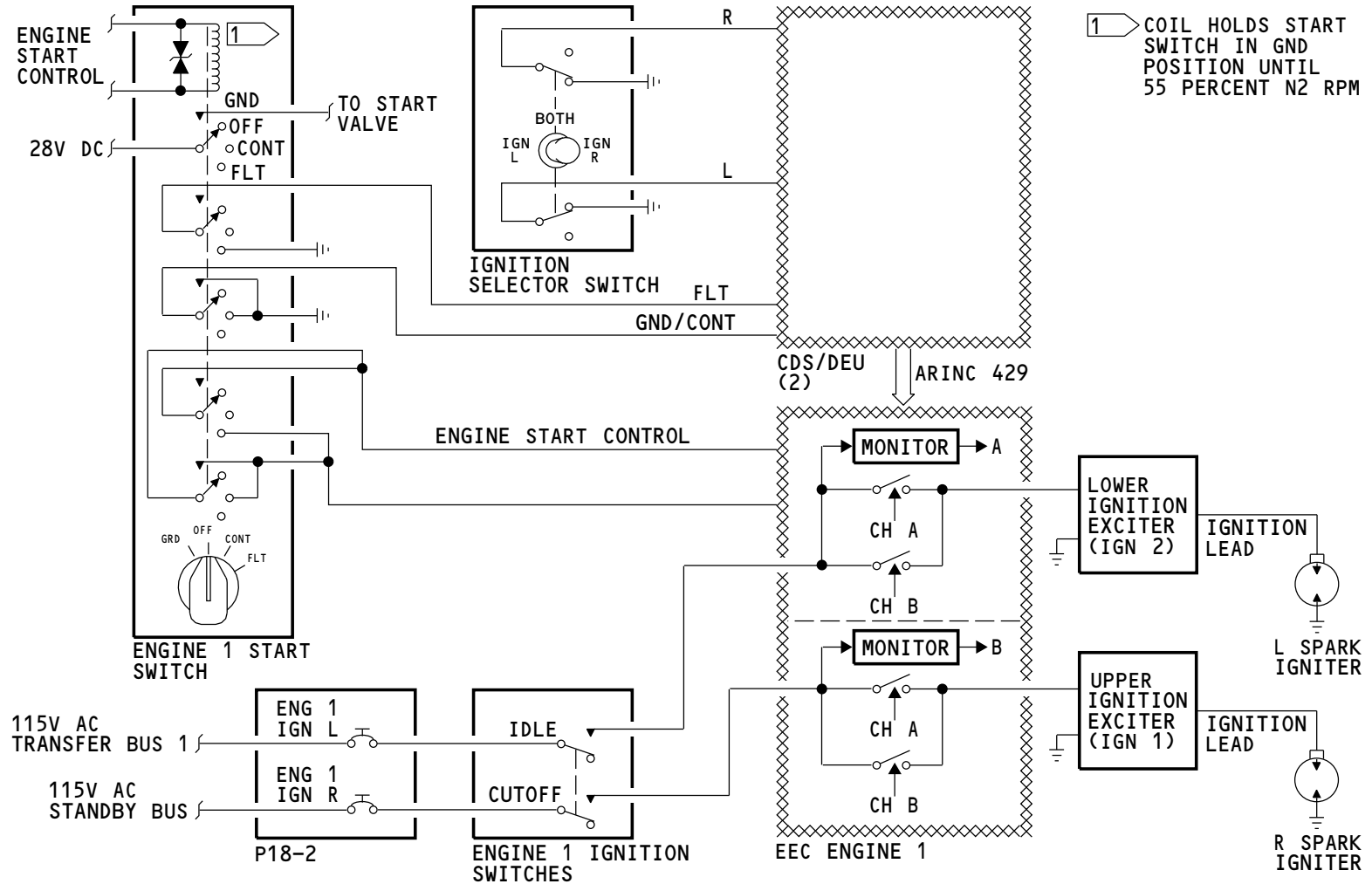
- Engine start switches are not in a position that command ignition operation
- Hot start on the ground
- Wet start on the ground

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**IGNITION - FUNCTIONAL DESCRIPTION**

- The engine start lever is in the IDLE position, airplane is on the ground, the engine completed a start, N2 speed goes less than 50% and EGT is more than the start limit
- Ignition system energized because of N2 less than idle or uncommanded decrease in N2 and engine speed goes back to normal.



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IGNITION - FUNCTIONAL DESCRIPTION

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IGNITION - OPERATION

General

These are the flight compartment controls you use to operate the engine ignition:

- Start lever
- Ignition selector switch
- Engine start switch.

Start Lever

The start lever controls ignition electrical power to the EEC. The EEC receives 115v ac power for ignition when the start lever is in the idle position.

Ignition Selector Switch

There are three ignition selector switch positions:

- IGN L (Left spark igniter)
- IGN R (right spark igniter)
- BOTH (both spark igniters).

Engine Start Switch

There are four engine start switch selection positions:

- GRD (ground start)
- OFF
- CONT (continuous ignition)
- FLT (flight).

Engine Start Switch Position (GRD)

The engine starter engages and turns the engine when you put the engine start switch to the GRD position. You supply ignition and fuel to the engine combustor when you move the start lever to the idle position.

You use the GRD position to start the engine on the ground.

See the engine starting chapter for more information. (CHAPTER 80)

Engine Start Switch Position (OFF)

Usually the igniters do not operate when the start switch is in the OFF position. However, the EEC turns on the ignition system automatically if the EEC sees a possible engine flameout condition. See the functional description page in this section for more information about this function.

Engine Start Switch Position (CONT)

The flight crew may turn the engine start switch to the CONT position at these times:

- Takeoff
- Approach
- Landing
- Bad Weather.

The spark igniters, as selected by the ignition selector switch, turn on and operate continuously when the switch is in this position.

Engine Start Switch Position (FLT)

Both spark igniters operate continuously when you turn the engine start switch to FLT position. The EEC does not use the ignition selector switch position information.

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| IGNITION SELECTION | AIRPLANE CONDITION | IGNITER OPERATION |
|---------------------------------------|---|--|
| <p>ENGINE START</p> <p>1 2</p> | <p>START LEVERS</p> <p>CONTROL STAND ENGINE 1 RIGHT IGNITER SELECTION 1 START LEVER UP</p> | <p>LEFT IGNITER</p> <p>RIGHT IGNITER</p> |
| <p>ENGINE START</p> <p>1 2</p> | <p>ENGINE 1 & 2, LEFT IGNITER SELECTION</p> | <p>LEFT IGNITER</p> <p>RIGHT IGNITER</p> |
| <p>ENGINE START</p> <p>1 2</p> | <p>ENGINE 1 & 2 CRUISE, NO IGNITION (UNLESS FLAMEOUT)</p> | <p>LEFT IGNITER</p> <p>RIGHT IGNITER</p> |
| <p>ENGINE START</p> <p>1 2</p> | <p>ENGINE 1 & 2 FLIGHT, BOTH IGNITERS OPERATE</p> | <p>LEFT IGNITER</p> <p>RIGHT IGNITER</p> |

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IGNITION - OPERATION

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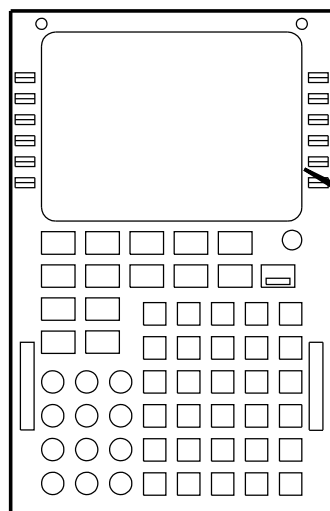
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**IGNITION - TRAINING INFORMATION POINT****General**

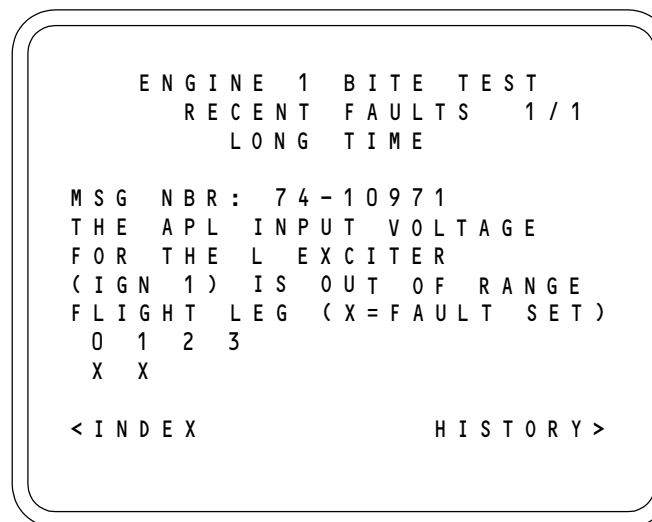
The control display unit (CDU) helps you do troubleshooting of the ignition system.

You can also use the CDU to do a ground test of the ignition system.

See the engine indicating chapter for more information. (CHAPTER 77)



CDU



CDU - ENGINE IGNITION SYSTEM

IGNITION - TRAINING INFORMATION POINT

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