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A318/A319/A320/A321

ATA 31
Indicating/Recording Systems

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Training Manual

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- The LTT production process ensures that the Training Manual contains a complete set of all necessary pages in the latest finalized revision.

ATA 31 INDICATING AND RECORDING SYSTEMS

31–33 DIGITAL FLIGHT DATA RECORDING SYSTEM

INTRODUCTION

GENERAL

This book covers the three main subjects:

- Digital Flight–Data Recording System (ATA 31–33)
- Aircraft Integrated Data System (31–36/37)
- Multifunction Printing (ATA 31–35)

Digital Flight Data Recording System

The main function of the DFDRS is to convert various critical flight parameters into a recordable form and to record them on a Digital Flight Data Recorder.

The stored data is also applicable to monitor the condition of the connected aircraft systems. The system design covers the basic DFDRS.

This includes the units and the parameters that are necessary for the mandatory requirements and an additional part to standardize the installation for different customers. The electrical characteristic is in compliance with ARINC 717.

Aircraft Integrated Data System (optional)

The main functions of the Aircraft Integrated Data System (AIDS) is:

- To monitor engine condition,
- APU condition
- and A/C performance, and to provide trouble shooting assistance.
- It fulfils the collection, processing and recording of various A/C parameters, which may be indicated on the MCDU in real time, printed via the on board printer.
- Furthermore the system can store these parameters and/or send this data via the aircraft data link to the ground.

Multifunction Printing (On Board Printer)

The printer (PRTR) is designed to achieve the print out on ”high contrast low abrasive” paper of reports coming from various systems such as AIDS, FMGC, CFDIU, EVMU either on ground or in flight.

Simple ”one hand” in flight or on ground paper roll loading allows 90 feet printing, 3 rolls being stowed on the left rear cockpit wall.

The thermal line PRINTER provides on board print outs for various aircraft systems, one at a time.

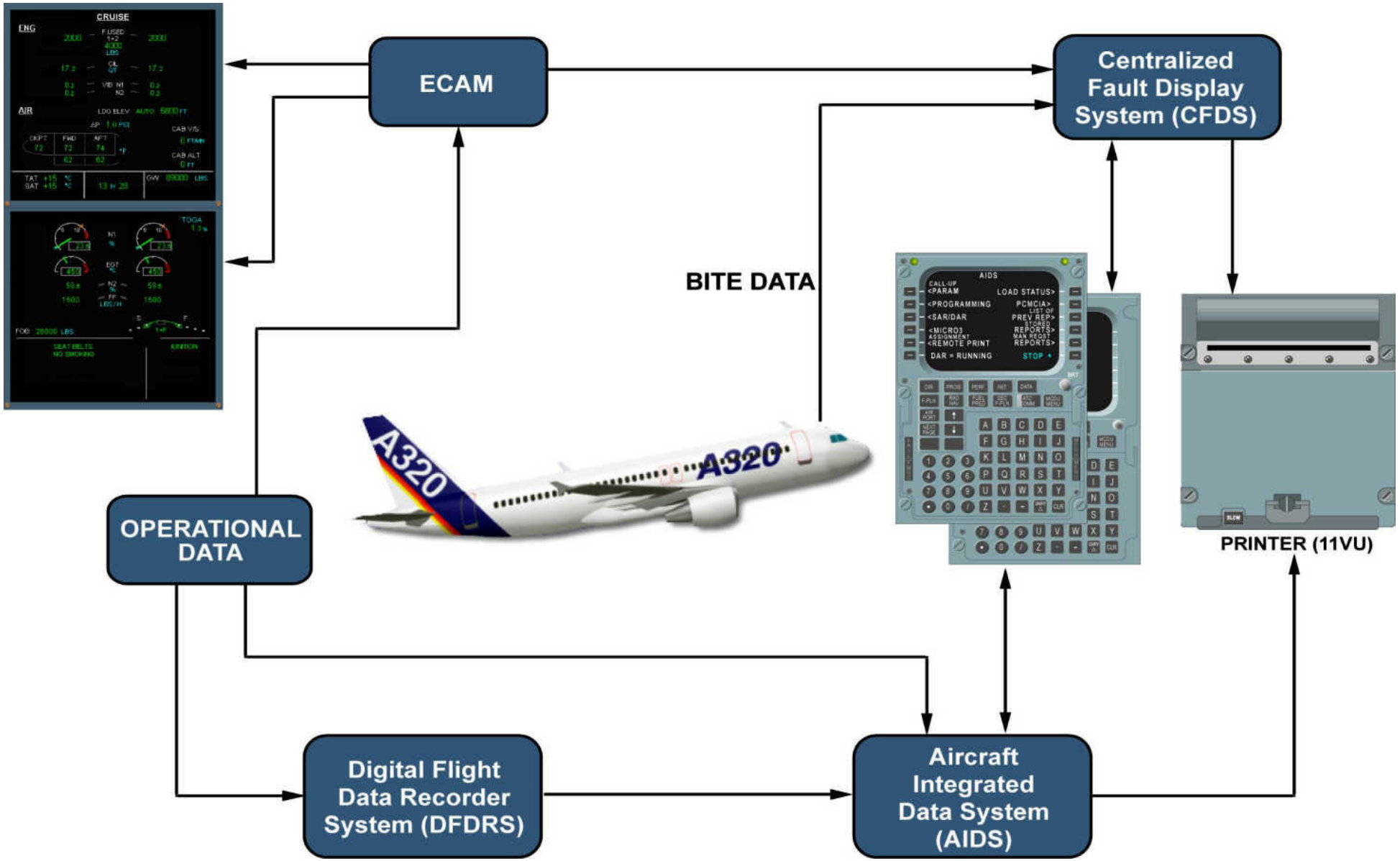


Figure 1 Recording Systems Overview

DFDR GENERAL DESCRIPTION

GENERAL

The main function of the DFDRS is to convert various critical flight parameters into a recordable form and to record them on a Digital Flight Data Recorder.

The stored data is also applicable to monitor the condition of the connected aircraft systems. The system design covers the basic DFDRS. This includes the units and parameters which are necessary for the mandatory requirements and an additional part to standardize the installation for different customers.

The electrical characteristic is in compliance with ARINC 717.

System Architecture

The basic DFDRS Components are:

- A FDIU (**F**light **D**ata **I**nterface **U**nit) or
- An enhanced FDIMU (**F**light **D**ata **I**nterface **M**anagement **U**nit)
- A DFDR (**D**igital **F**light **D**ata **R**ecorder)
- A LA (**L**inear **A**ccelerometer)
- A CTL PNL (Control Panel)
- A EVENT (Event Marker Button)

The minimum equipment of a basic DFDRS (FDIU, DFDR, LA, CTL PNL and EVENT) must be installed on each aircraft. This is to meet the requirement of the authorities for recording of mandatory parameters.

The optional DFDRS Component are:

- a QAR (**Q**uick **A**ccess **R**ecorder), or
- a WQAR (**W**ireless **QAR**)

System Description

The FDIU is connected to different aircraft systems.

DATA (parameters) are received in discrete and digital form.

The FDIU collects these parameters and converts them for internal processing.

A standardized set of flight critical parameters are transmitted in serialized digital form to the SSDFDR (Solid State Digital Flight Data Recorder).

These parameters are stored on the recorder in data frame cycles.

The FDIU generates aircraft data and sends them to the ARINC 429 output bus.

A separate linear accelerometer is installed to provide the FDIU with acceleration data appearing in the center of gravity.

The SDAC digitizes the analog signal of the LA and sends it to the FDIU via ARINC 429 bus.

The EVENT Button and the Override Button of power interlock are located on the CTL PNL‘s.

For maintenance and performance purposes, the optional QAR records the same parameters as the SSFDR.

The operation of the SSFDR is automatic.

On the overhead panel, there is a GrouND ConTroL P/B located on the ReCorDeR panel. This P/B lets the SSFDR be supplied when the A/C is on ground for preflight checks before engine start or for test and maintenance purposes.

On the center pedestal, there is a DFDR EVENT P/B which can be used to set an event mark on the SSFDR memory.

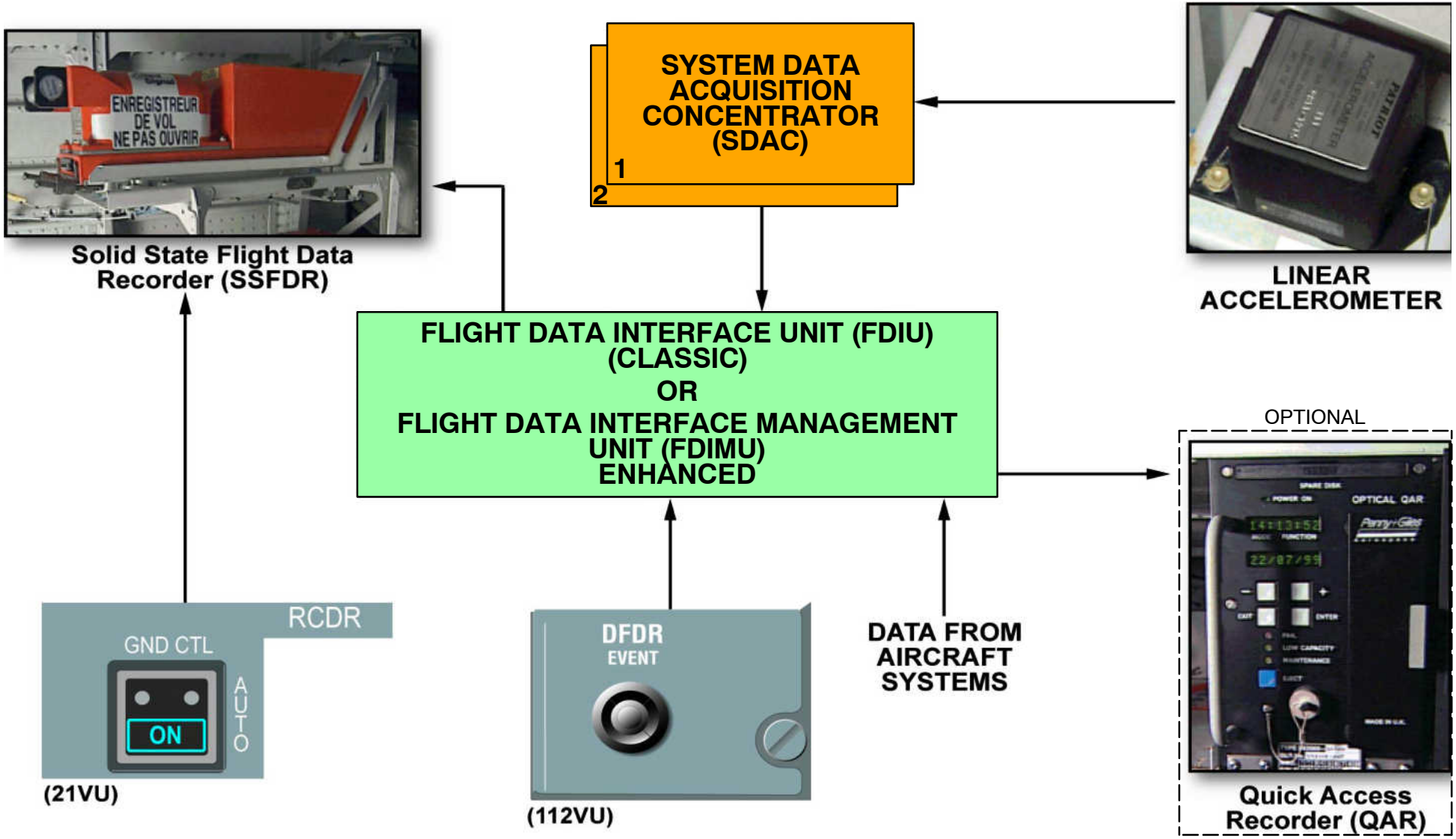


Figure 2 DFDRS Overview

DFDRS SYSTEM DESCRIPTION

FDIU (CLASSIC)

The FDIU (**F**light **D**ata **I**nterface **U**nit) receives discrete and digital parameters and processes them. The functions of the FDIU are:

- conversion,
- comparison,
- check and BITE (**B**uilt–**I**n **T**est **E**quipment).

The FDIU converts the input parameters into a recordable format for recorders:

- harvard biphase for the DFDR (**D**igital **F**light **D**ata **R**ecorder),
- bipolar return to zero for the optional QAR (**Q**uick **A**ccess **R**ecorder).

The FDIU compares the data that it sends with the data recorded by the DFDR. The recorded data is transmitted back to the FDIU through the playback data bus. The FDIU checks the integrity of the mandatory parameters during the flight. After the flight, engines shutdown, only the LA (**L**inear **A**ccelerometer) signal check is done. The FDIU includes BITE and monitoring functions.

DFDR

The DFDR stores data, which the FDIU has collected during the last 25 hours. The data is recorded in data frames. Each frame contains data received during one second. The DFDR includes BITE functions. The DFDR status signal is sent to the CFDIU (**C**entralized **F**ault **D**isplay **I**nterface **U**nit) through the FDIU and to the ECAM (**E**lectronic **C**entralized **A**ircraft **M**onitoring) through the SDACs (**S**ystem **D**ata **A**cquisition **C**oncentrator**s**). The DFDR energization is controlled through the power interlock circuit. The underwater locator beacon installed on the front face of the DFDR gives the location of the recorder if the aircraft is immersed in water following an accident. The underwater locator beacon has a battery, which is activated by both fresh and salt water.

QAR

The QAR stores the same data as the DFDR for on ground performance, maintenance or condition monitoring tasks. The data frames stored in the QAR are identical to the DFDR data frames. The QAR includes BITE functions. The QAR status signals (QAR MEDIA LOW, QAR FAIL) are sent to the lamps on its front face and to the CFDIU through the FDIU. The QAR energization is controlled through the power interlock circuit.

LINEAR ACCELEROMETER

The task of the LA is to measure the acceleration of the aircraft in all three axes. The range of measurement is:

- vertical axis (Z): –3 to +6 g,
- longitudinal axis (X): –1 to +1 g,
- lateral axis (Y): –1 to +1 g.

The LA generates an analog signal, which is sent to the SDACs. This signal is digitalized and sent to the FDIU through an ARINC 429 bus.

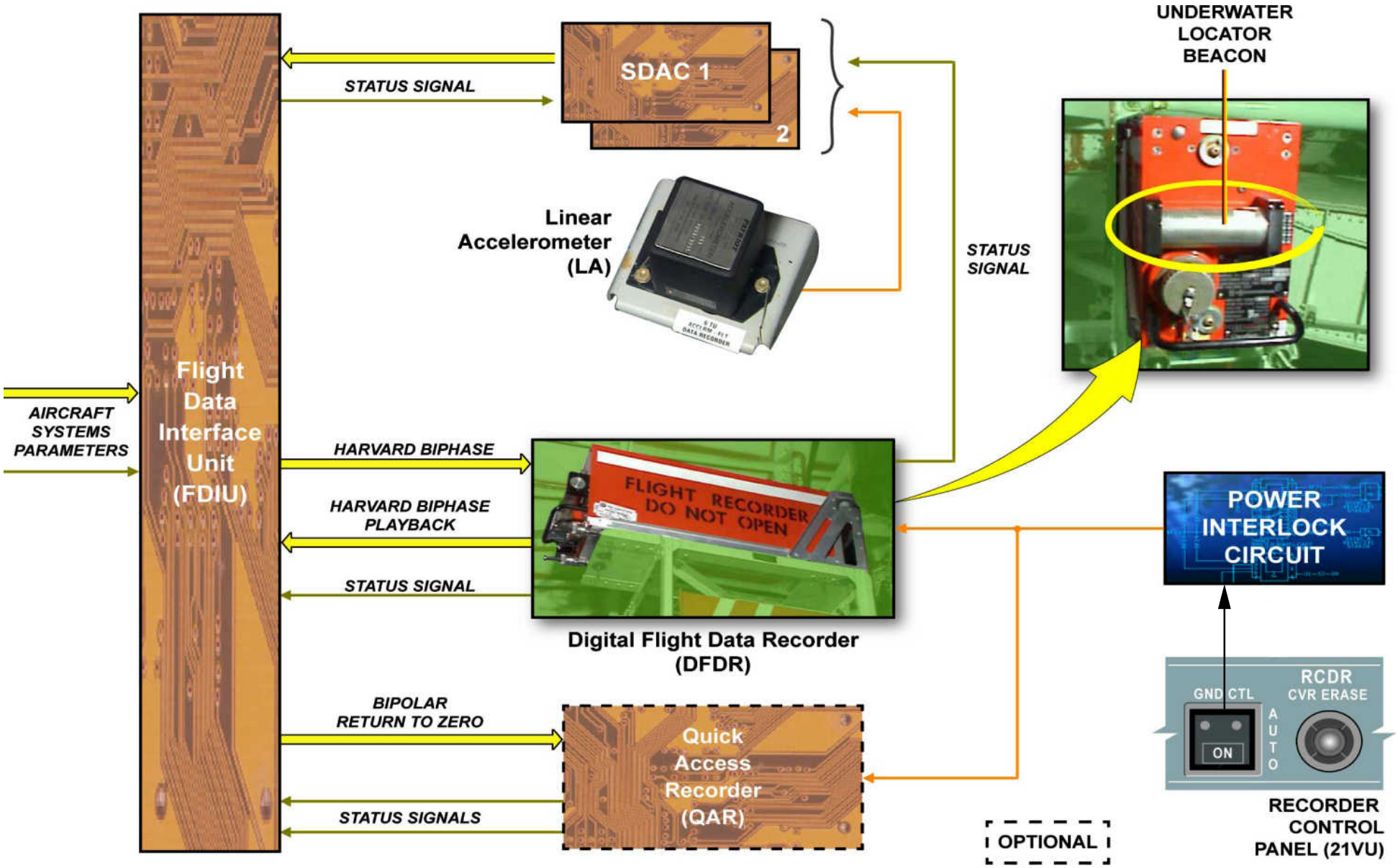


Figure 3 DFDRS System Architecture

FDIU INTERFACES

ARINC 429 INPUTS

Most information are given to the FDIU (**F**light **D**ata **I**nterface **U**nit) through ARINC 429 buses. The FDIU receives 12 ARINC 429 buses and it has provision for 4 additional input buses.

NOTE: The LA (**L**inear **A**ccelerometer) sends an analog signal to the SDACs (**S**ystem **D**ata **A**cquisition **C**oncentrator**s**), which digitalizes it before sending it to the FDIU.

ARINC 429 OUTPUTS

2 ARINC 429 output buses are given. The output bus to the CFDIU (**C**entralized **F**ault **D**isplay **I**nterface **U**nit) is used for BITE (**B**uilt–**I**n **T**est **E**quipment) information and test operation. The output bus to the DMU (**D**ata **M**anagement **U**nit) enables the AIDS (**A**ircraft **I**ntegrated **D**ata **S**ystem) to record the mandatory parameters.

DISCRETE INPUTS

55 discrete inputs are given for the aircraft identification coding. 4 other inputs are given for the DFDR (**D**igital **F**light **D**ata **R**ecorder) status, event mark, QAR (**Q**uick **A**ccess **R**ecorder) FAIL and QAR MEDIA LOW information.

NOTE: The QAR is optional.

DISCRETE OUTPUT

1 discrete output is used by the SDACs for showing the FDIU FAULT message on the ECAM (**E**lectronic **C**entralized **A**ircraft **M**onitoring).

NOTE: To display the DFDR FAULT message on the ECAM, a DFDR status signal is directly sent by the DFDR to the SDACs.

HARVARD BIPHASE OUTPUT

The FDIU sends the data to record into the DFDR in Harvard biphase format on an output bus.

HARVARD BIPHASE INPUT

For verification purposes, the FDIU receives the DFDR playback data in Harvard biphase format on an input bus.

BIPOLAR RETURN TO ZERO OUTPUT

The FDIU sends the data to record into the QAR in bipolar return to zeroformat on an output bus.

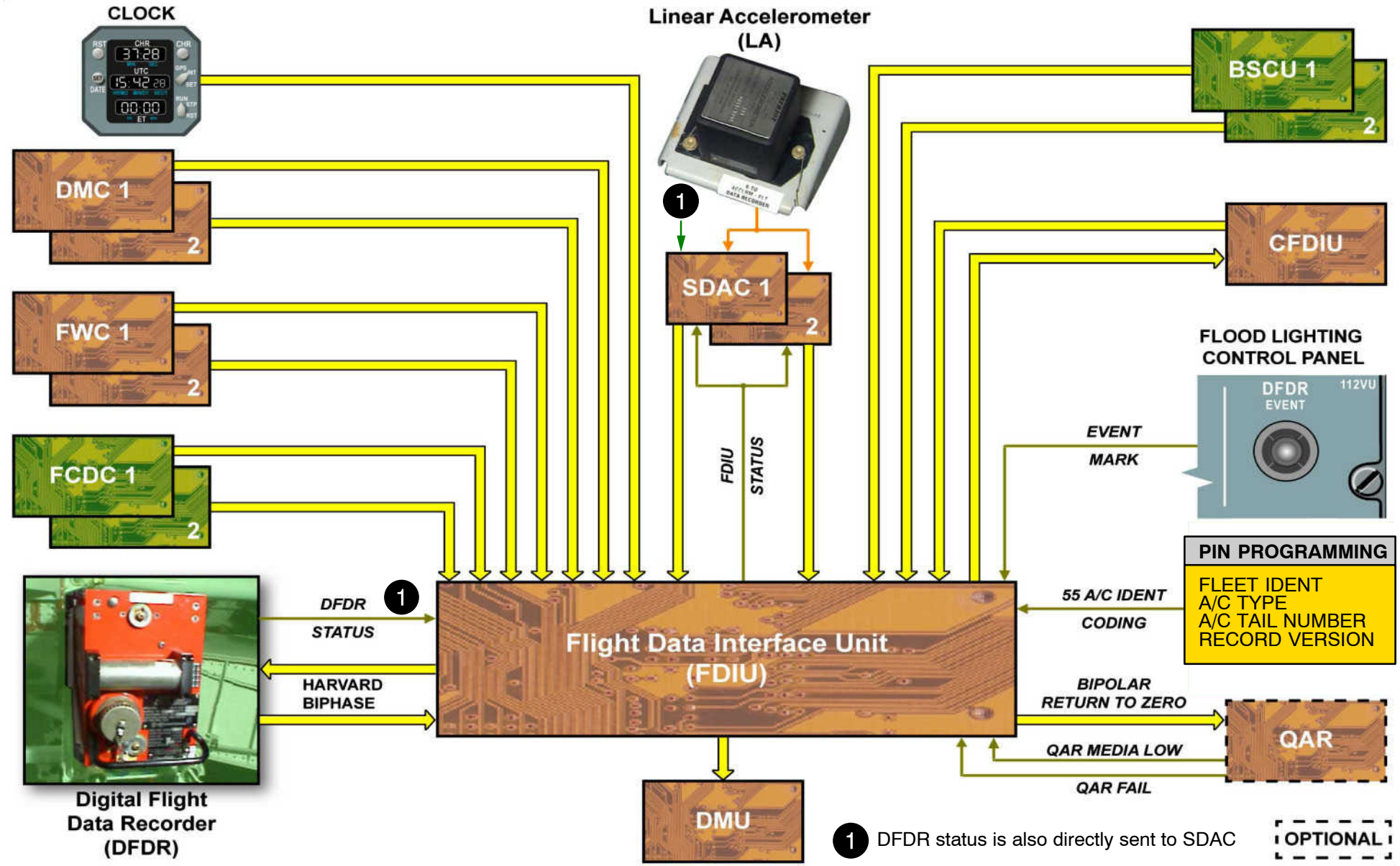


Figure 4 FDIU Interfaces

FDIU-COMPONENT DESCRIPTION

Flight Data Interface Unit

The FDIU is a microprocessor controlled unit with modules for the collection of discrete and digital parameters and for their conversion to a recordable form. The function and the electrical interface complies with ARINC 717.

If more than one data bus with the same content, e.g. SDAC 1 and SDAC 2, is connected to the FDIU, the data from system 1 is recorded on the DFDR. This is as long as the appropriate SSM bits are valid and the data is updated. Invalid data from system 1 is replaced with the appropriate data from system 2. If one system has bad SSM bits or unrefreshed data, data from the other system are recorded. If no valid data is available for the DFDR recording, then related data bits are set to zero and in the next mainframe period the respective data bits are set to one.

The record versions fulfil the different authority's requirements:

- Version 1: 64 Words/sec
- Version 2: 128 Words/sec

FDIU Input Sources

The following systems are connected to the FDIU:

- Electrical Flight Control System (Ref. 27–90–00)
  - FCDC1, FCDC2 (3CE1, 3CE2)
- Independent Instruments System (Ref. 31–20–00)
  - GMT CLOCK (2FS).
- Central Warning System (Ref. 31–50–00)
  - FWC1, FWC2 (1WW1, 1WW2)
  - SDAC1, SDAC2 (1WV1, 1WV2).
- Electronic Instrument System (Ref.31–60–00)
  - DMC1, DMC2 (1WT1, 1WT2).
- Wheel and Brakes (Ref. 31–60–00)
  - BSCU (10GG).

System Inputs:

- DFDR playback data input (playback of the DFDR data for verification),
- DFDR BITE IN (status line from DFDR),
- QAR FAIL (status line from the QAR),
- QAR MEDIA LOW (media indication from the QAR).

Output Characteristics

One DITS–ARINC 429 output port (Low speed)

One DFDR bus, harvard biphase code – 64/128 words/sec, 12 bit each

One QAR bus, RZ code – 64/128 words/sec., 12 bit each RS 232 characteristic

One status line, a discrete output to send the FDIU status via SDAC to the CFDS

One asynchronous output for test purposes in RS 232 characteristic

One audio output for time synchronization of DFDR and Cockpit Voice Recorder (CVR) via the AMU.

Verification of DFDR Playback Data

To verify the recorded data, the FDIU receives the playback data via a serial data bus. The sync word is checked every 64th/128th input for the proper sync pattern. If a defective sync pattern is detected, the DFDR PLAYBACK fault flag will be written into the fault memory of the FDIU. The FDIU also accepts DFDR data without playback

Identification of Location

The FDIU recognizes its location on different aircraft by decoding the aircraft identification and aircraft type, the fleet and the DFDR format version. Parameter selection and data processing depends on this identification code.

DFDR–CVR Synchronization

The full 32 bit data word received from the GMT clock bus is used to generate a frequency modulated output. This time code word is send to the CVR via audio output at a rate of 768 bit/sec every four seconds (at a beginning of each data frame) with Least Significant Bit (LSB) transmitted first.

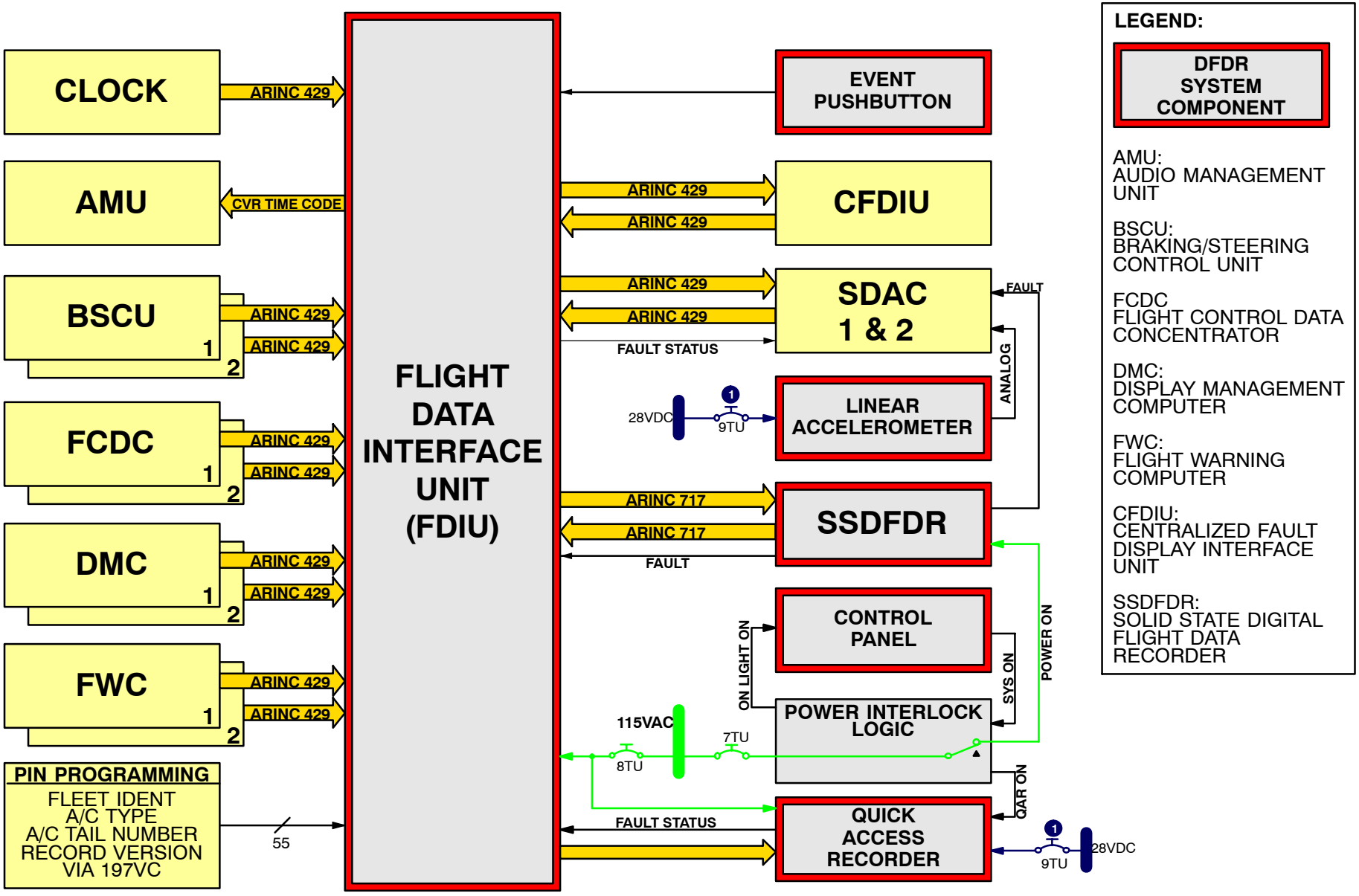


Figure 5 FDIU Input/Output Schematic

POWER INTERLOCK LOGIC FUNCTIONAL OPERATION

Energization

With the oil pressurization of one or both engines or flight condition, the power interlock is released for supply of the DFDR with 115V/400 Hz.

The FDIU is supplied directly from the busbar. A dimmable power bus supplies the CTL PNL indicators.

For maintenance and test purposes on the ground and for preflight checks there is an override function to supply the DFDR.

When the GND/CTL button on the CTL PNL is pushed an electric latch holds the override function. The blue 'ON' pushbutton light comes on. The override function supplies the equipment until the GND/CTL button is pushed again or the automatic power interlock becomes active.

Control

Override of Power Interlock

With the electrically latched GND/CTL button it is possible to override the power interlock, so that the system can be supplied for preflight checks or for maintenance and test purposes.

The GND/CTL button is installed on the CTL PNL. To prevent the erasure of stored data, you must not unnecessarily activate the override function of the power interlock.

Event Mark

An EVENT BUTTON is installed to record an EVENT MARK on the DFDR.

Indicating

If you push the GND/CTL button on the control panel, an electric latch holds the override function. The blue GND/CTL button light comes on .

The status line of the DFDR and the QAR are connected to the FDIU.

In case of a Class II fault the FDIU transmits a failure message to the CFDS. These failures are not indicated to the crew in flight but are the subject of an ECAM report on the ground after shut down of the engines.

If a Class III fault occurs the related flag is set in the fault memory of the FDIU (up to 30 faults). This fault information is sent to the CFDIU. These Class III faults can be displayed on the MCDU screen via menu function (System Report/ Instruments/FDIU). These faults can wait until the next scheduled maintenance check.

In case of malfunction of the CFDS, DFDR FAIL and FDIU FAIL are sent directly via SDAC to the ECAM screen.

The status signal DFDR FAULT and FDIU FAULT are suppressed in flight phase 3,4,5,7 and 8 by the FWC.

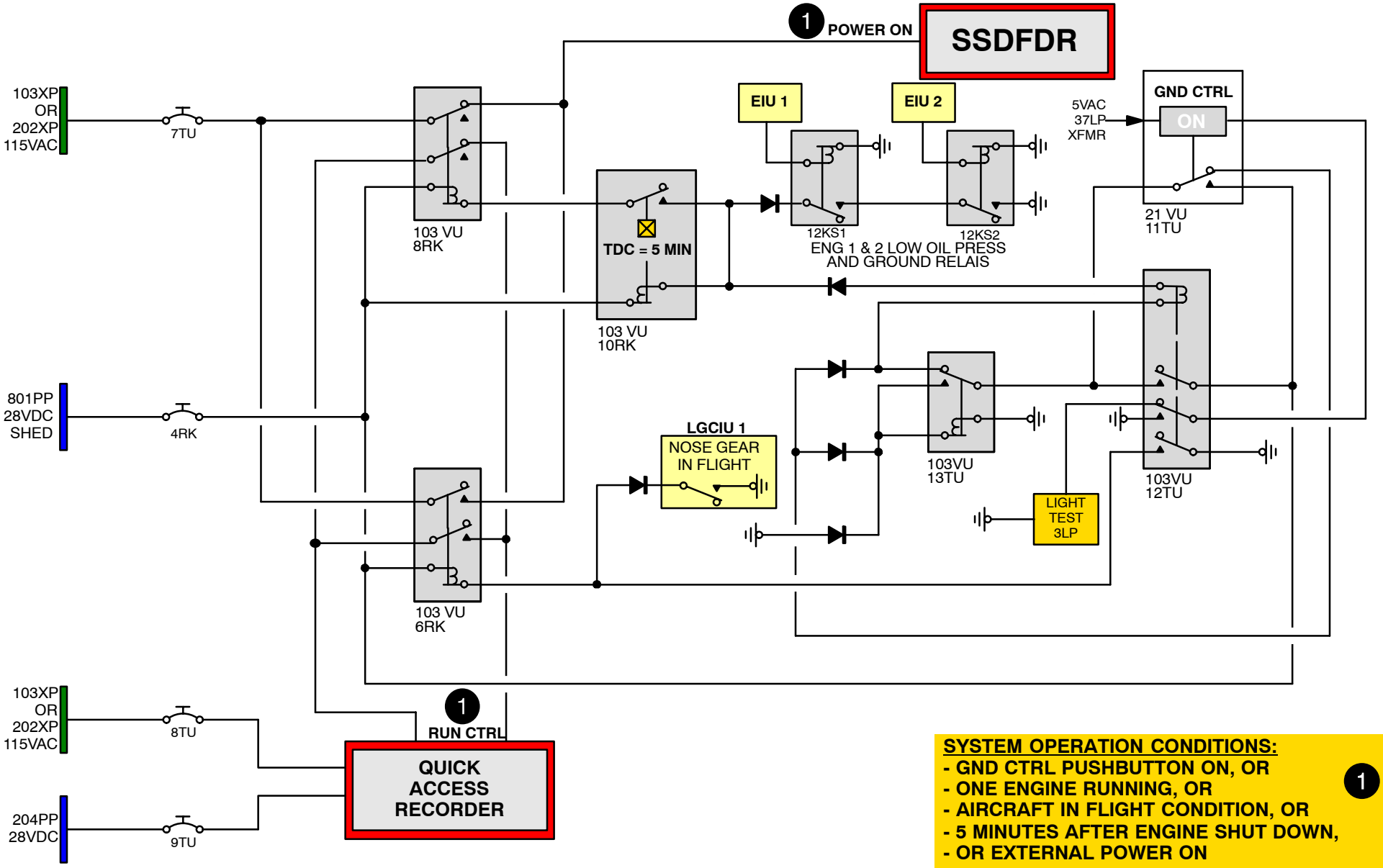


Figure 6 DFDR - Power Interlock

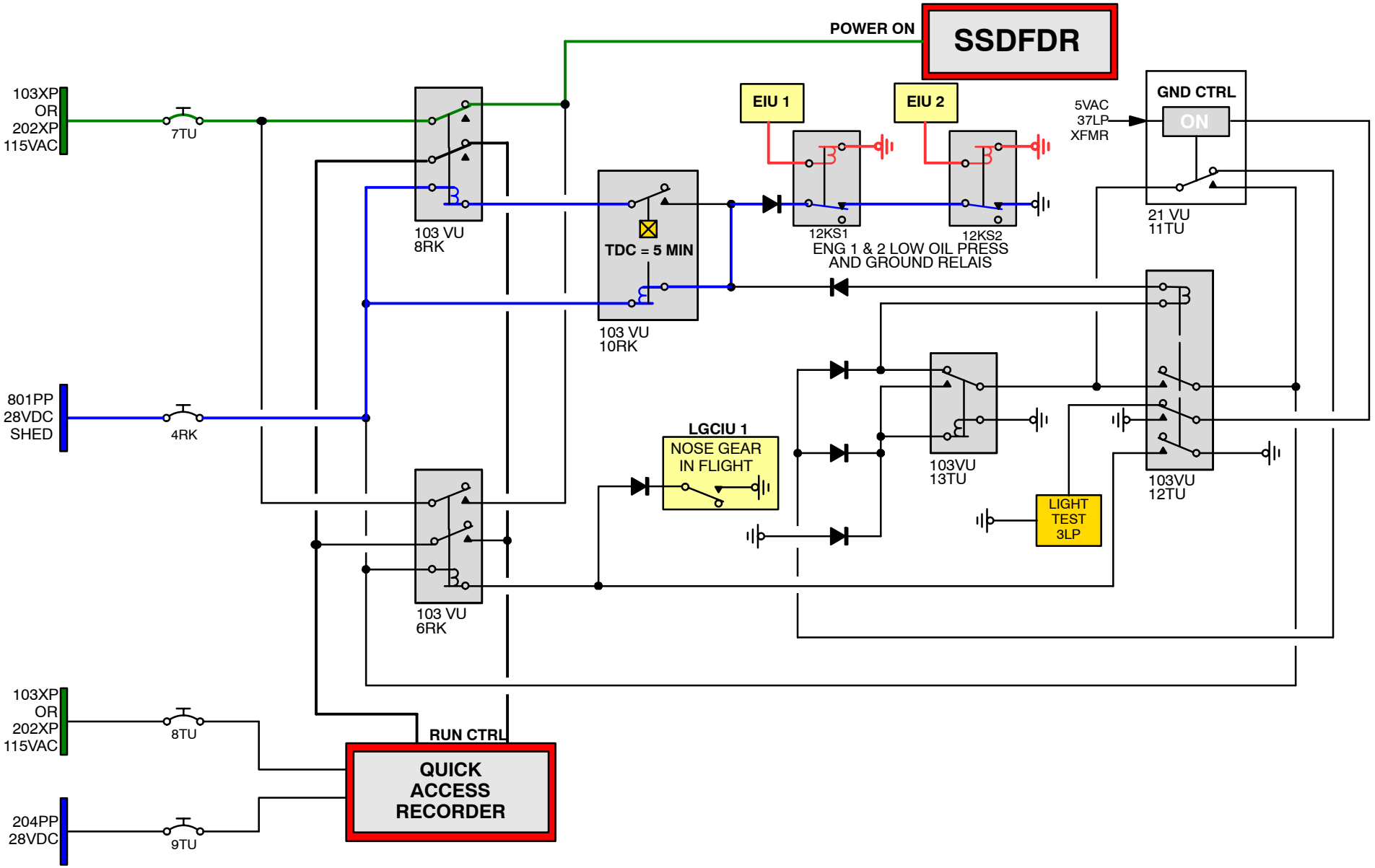


Figure 7 DFDR - External Power On

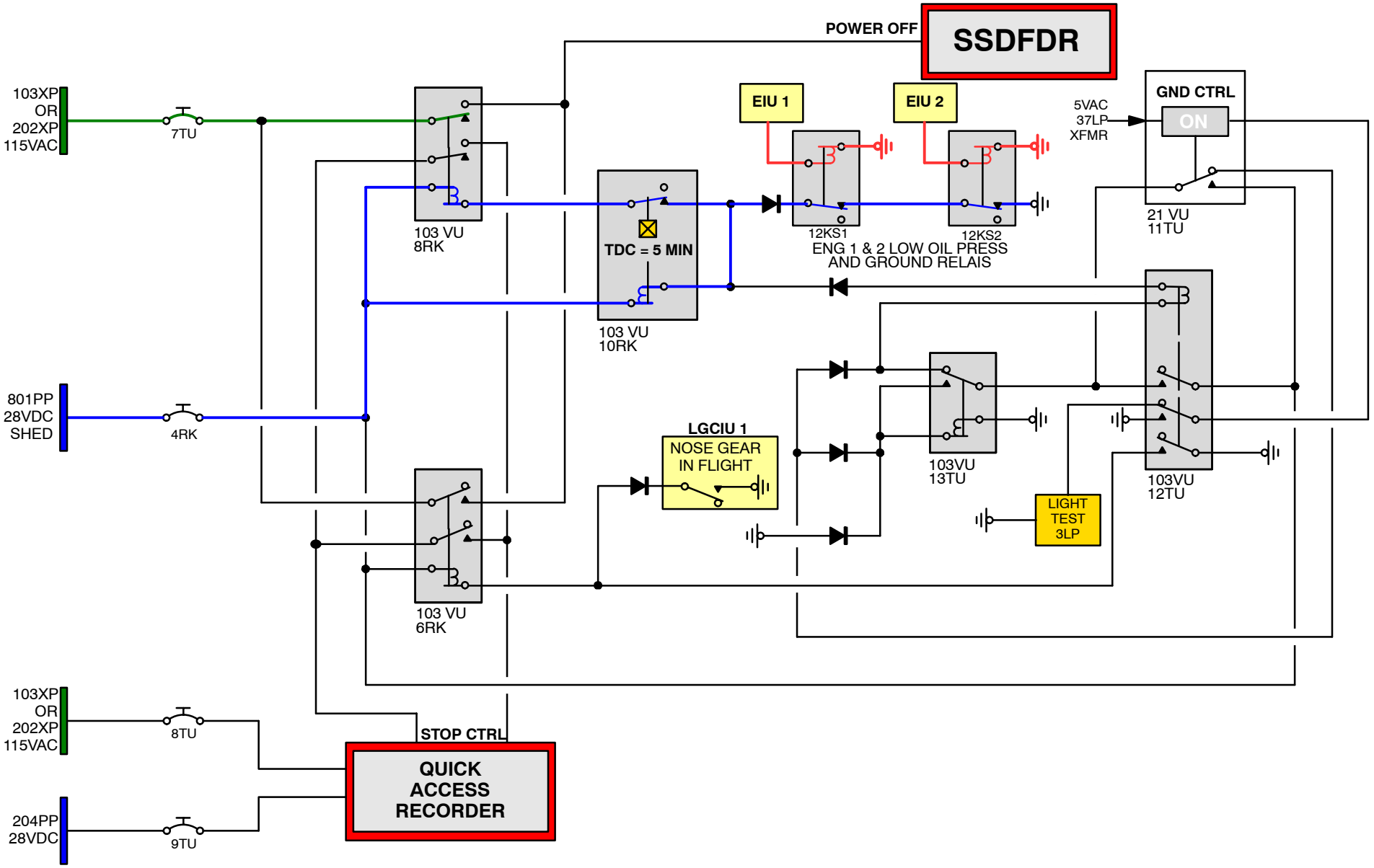


Figure 8 DFDR - 5 Minutes After Power On

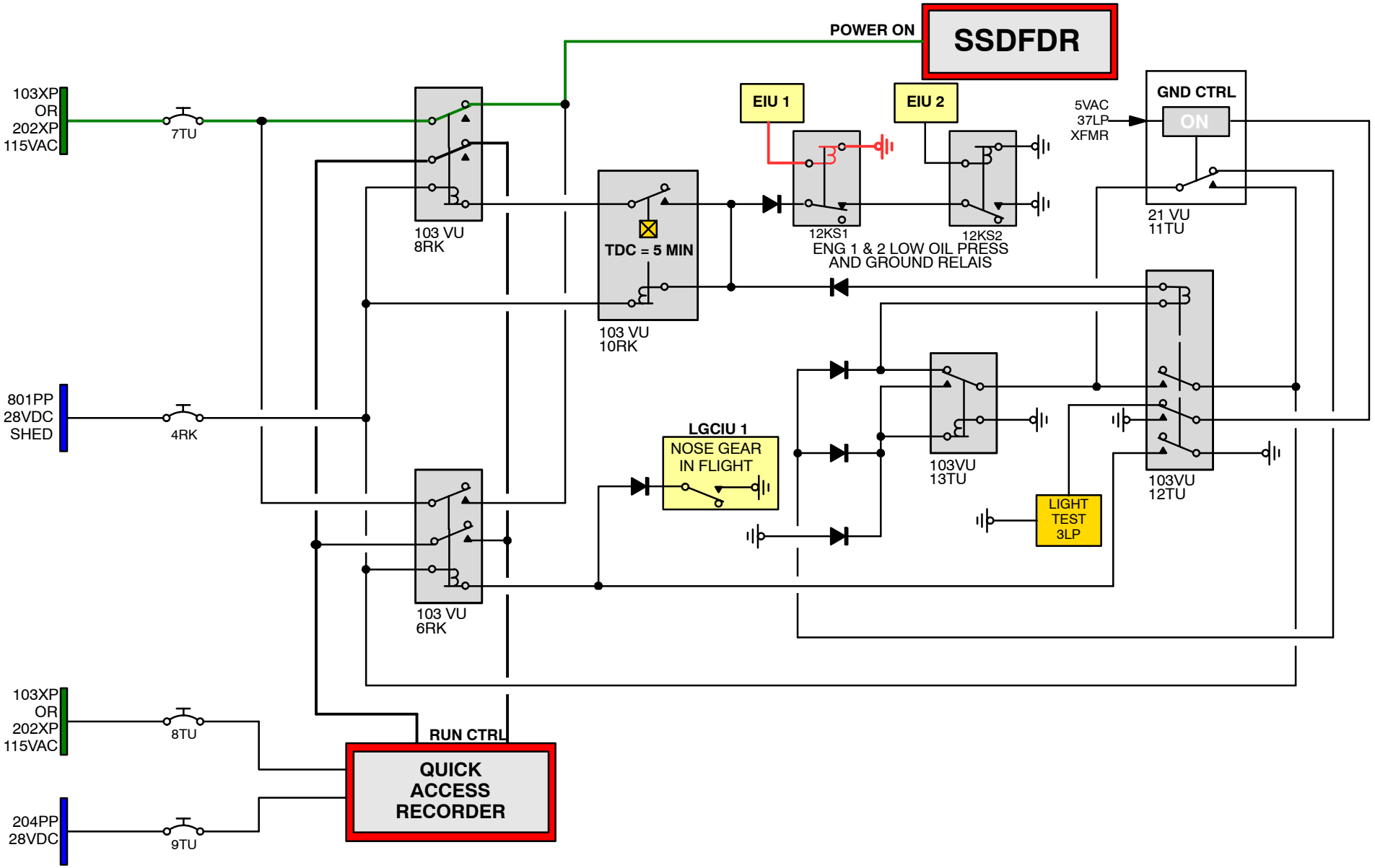
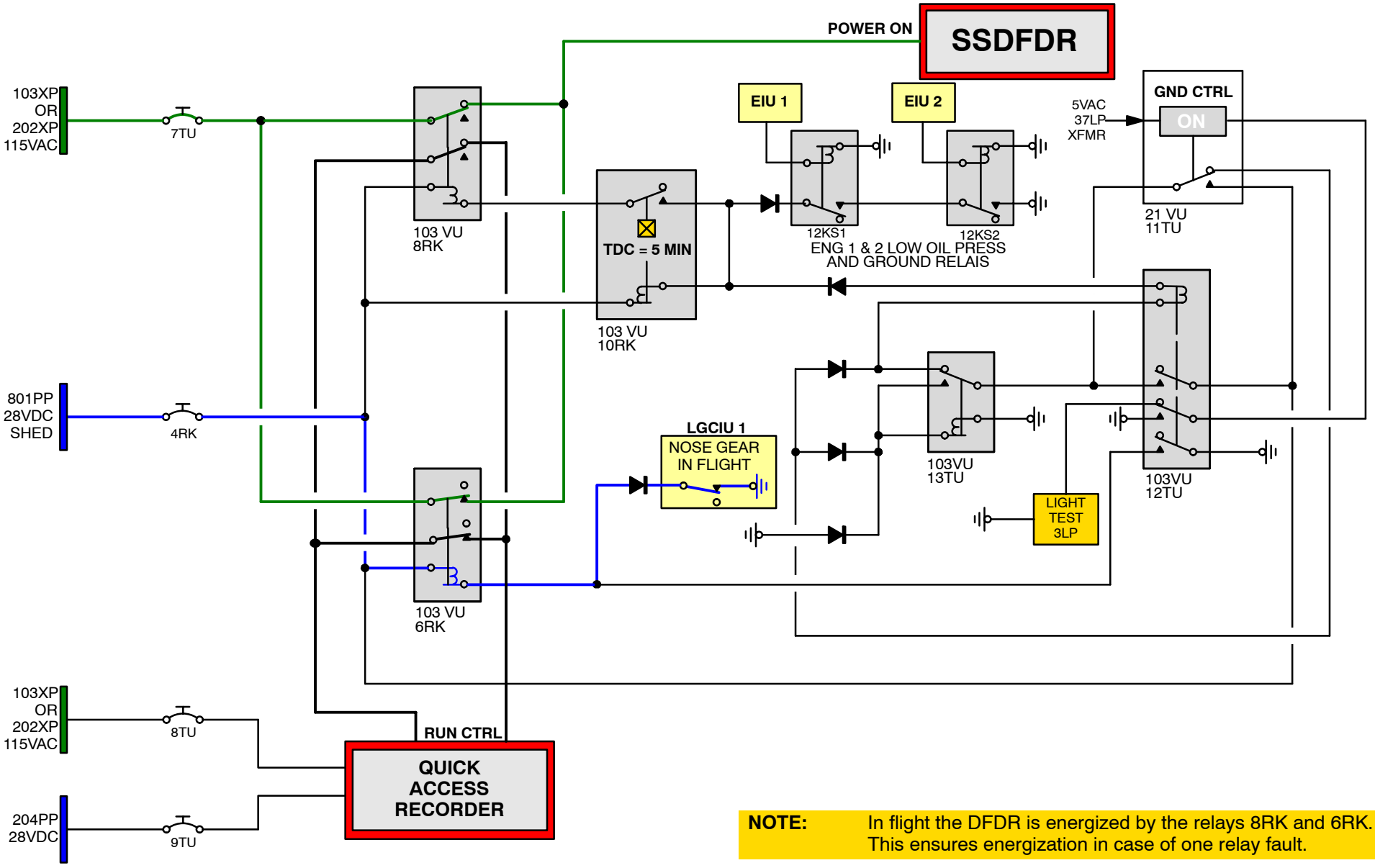


Figure 9 DFDR - Minimum 1 Engine Running



NOTE: In flight the DFDR is energized by the relays 8RK and 6RK. This ensures energization in case of one relay fault.

Figure 10 DFDR - Aircraft in Flight

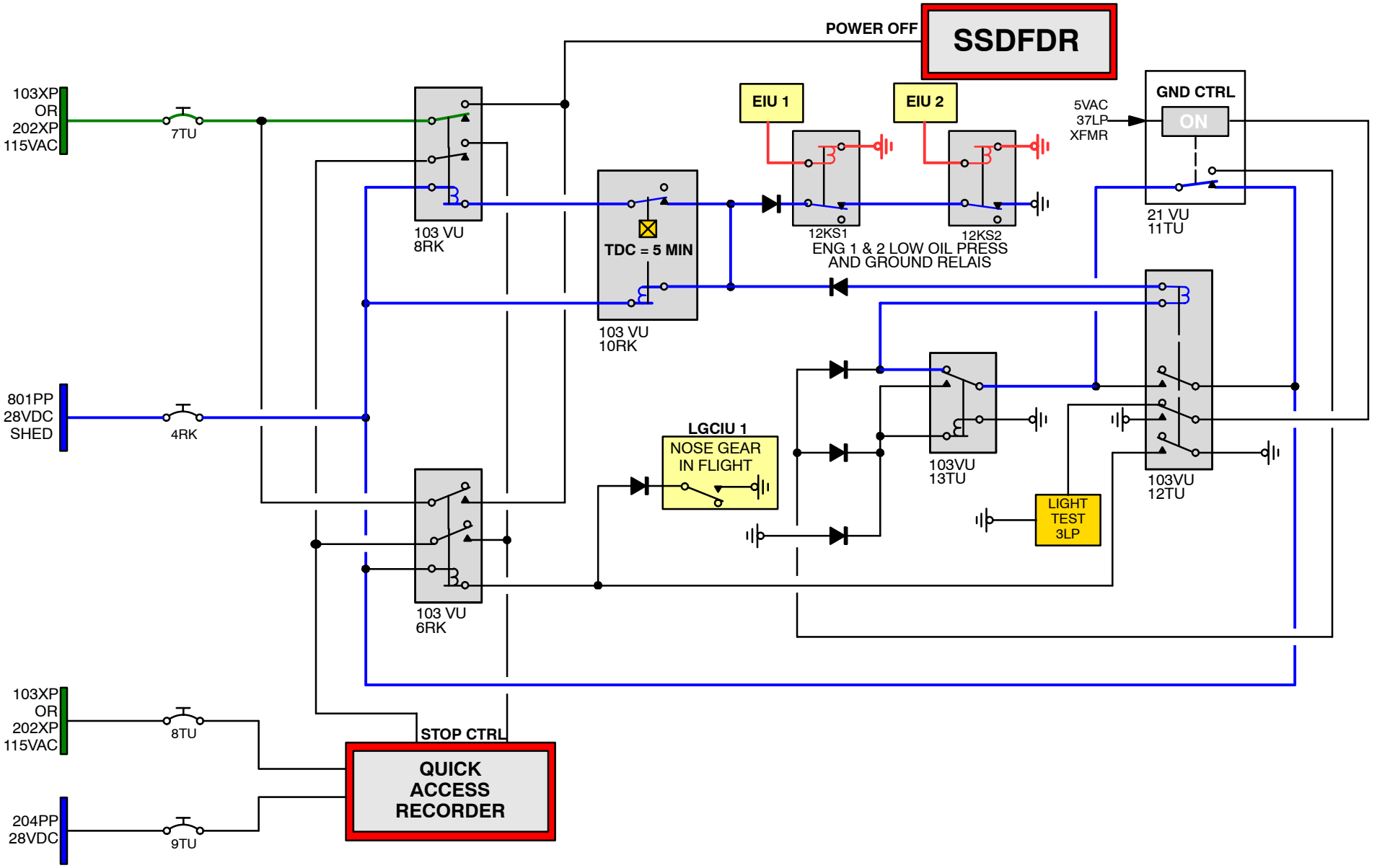


Figure 11 DFDR - Ground CTRL P/BSW Pressed

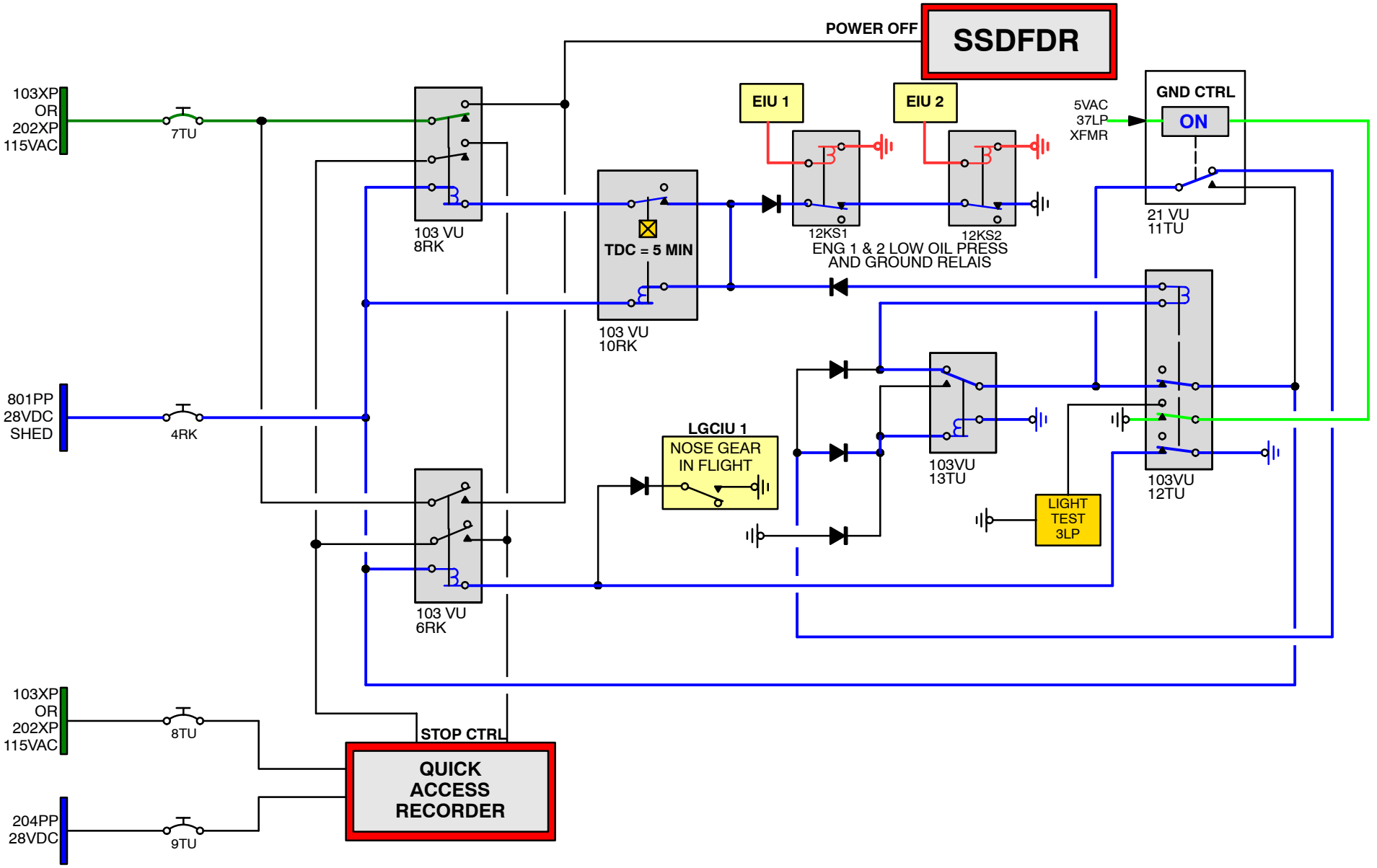


Figure 12 DFDR - Ground CTRL P/BSW Released (Part1)

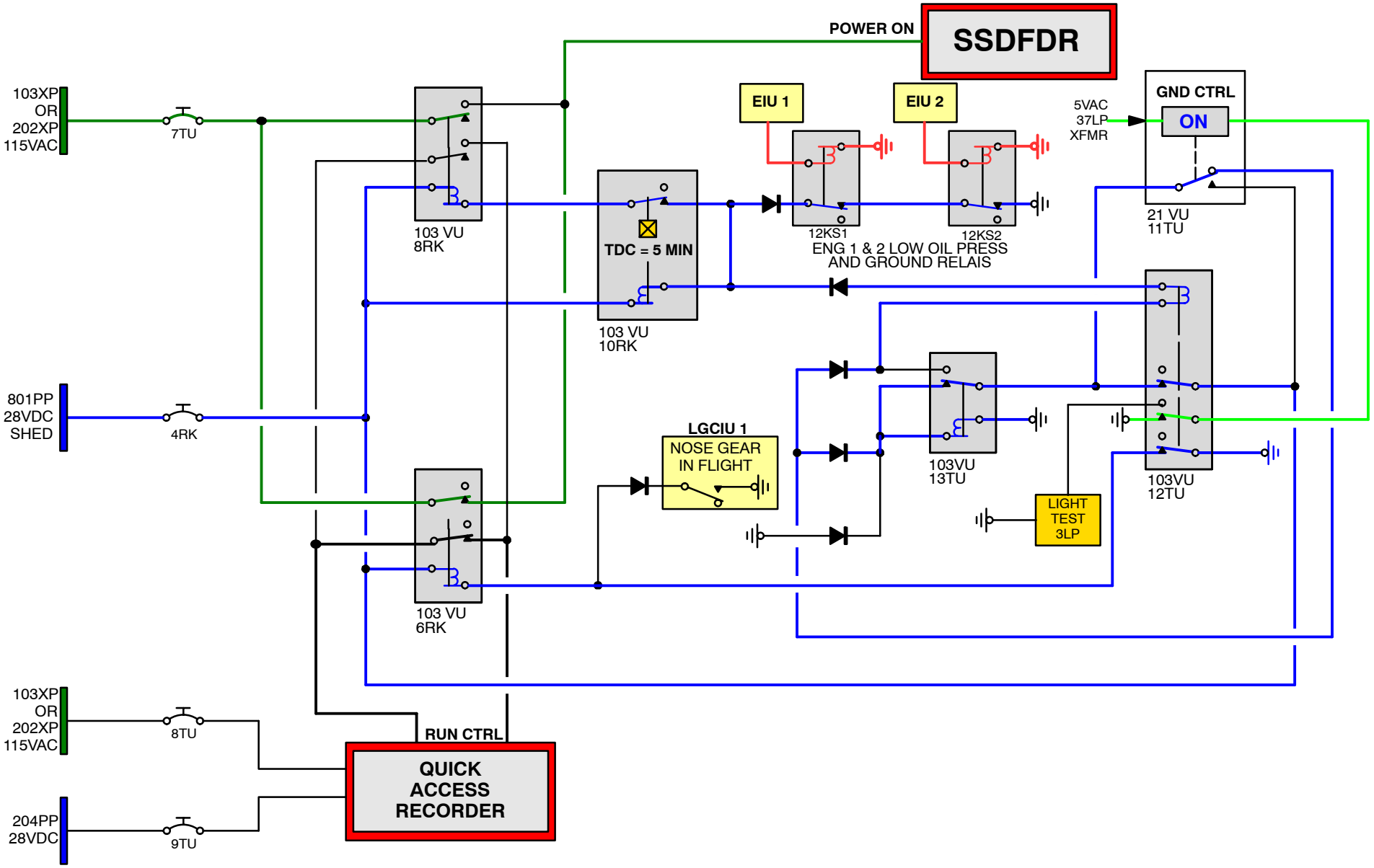


Figure 13 DFDR - Ground CTRL P/BSW Released (Part2)

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DFDR PRESENTATION

DFDR (Digital Flight Data Recorder)

The DFDR is a solid state flight data recorder in compliance with ARINC 717.

The DFDR stores all aircraft information in CMOS bulk erasable EEPROM devices. Being a solid state device, the DFDR has no moving parts.

The recorder has the capability to store all data which the FDIU has collected over the last 25 hours.

It is possible to get a storage capability of greater than 25 hours if the correct combination of SSFDR capacity and data rate is used.

ULB (Underwater Locator Beacon)

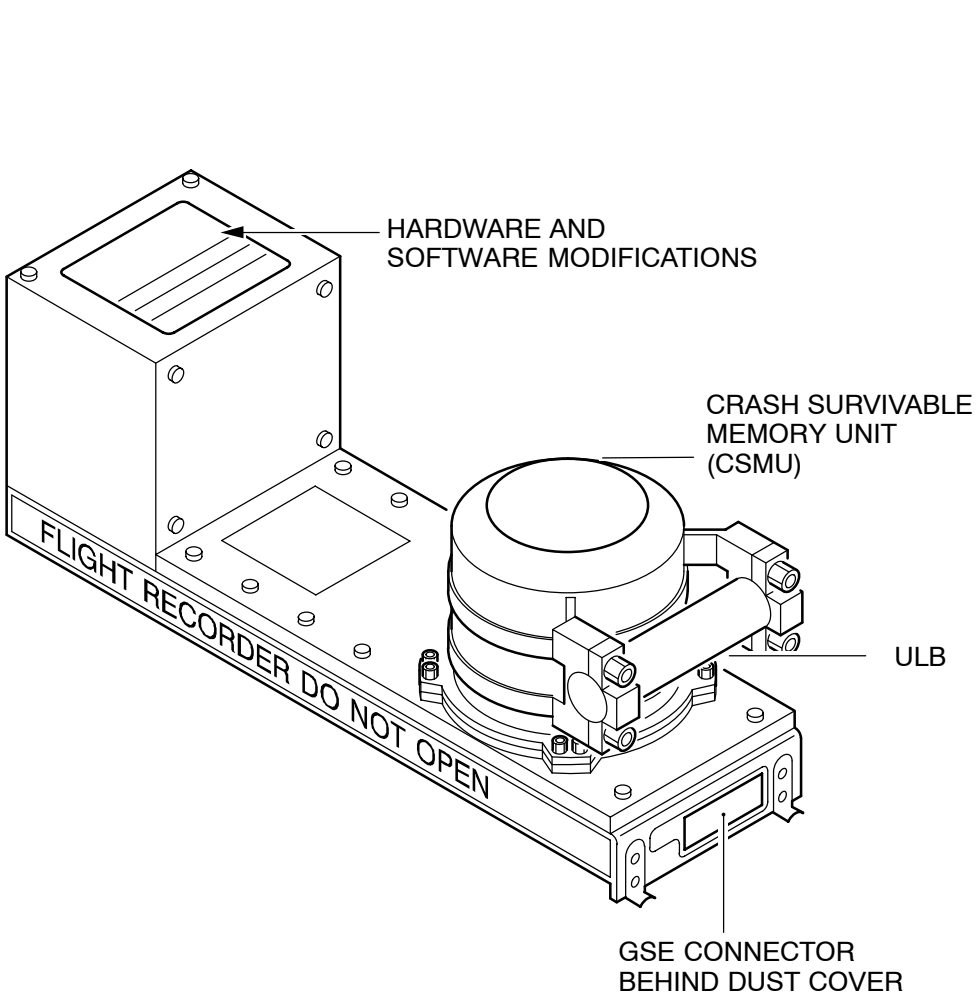
An ULB is attached directly to the front–panel of the DFDR.

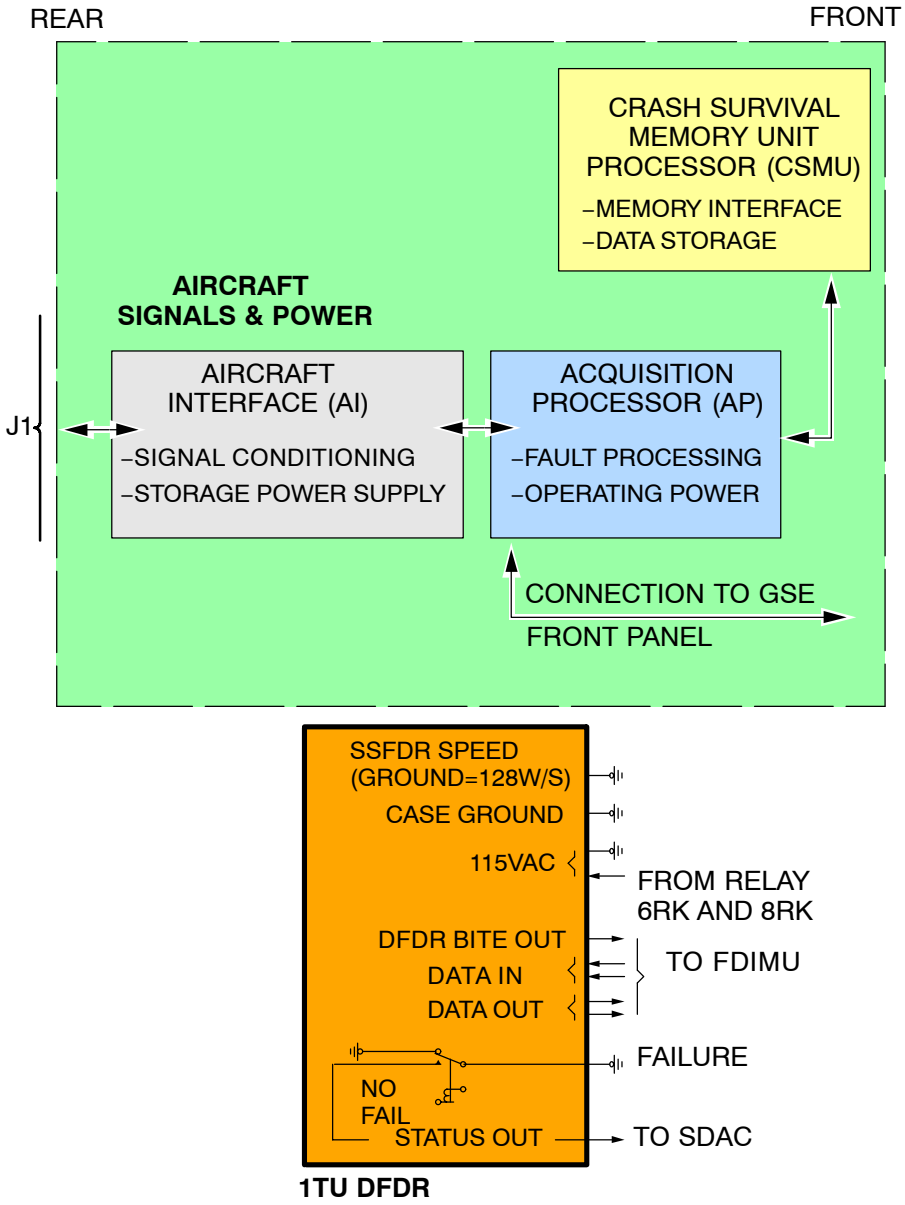
The ULB transmits a radio–signal. The ULB starts its operation if it gets in contact with water.

- It has a detection range of **1800 to 3600 meter.**
- The ULB operates in water at a **depth of 6000 meter**.

You can service the ULB without disassembly of the DFDR. Maintenance has to be done at set times to replace the battery of the ULB.

Figure 14 Flight Data Recorder Location





GSE: GROUND SUPPORT EQUIPMENT
(E.G. NOTEBOOK)

Figure 15 Digital Flight Data Recorder

LINEAR ACCELEROMETER COMPONENT DESCRIPTION

LA (Linear Accelerometer)

The task of the LA is to measure the acceleration of the aircraft in all three axis.

The acceleration force moves a pendulum in the sensing mechanism.

A proximeter senses the movement which generates a signal proportional in amplitude to the movement.

A servo–amplifier amplifies the signal to excite a torque coil installed on the pendulum. The current which flows through the torque coil produces a force which is directly proportional to the acceleration force. The voltage drop across a load resistor connected in series with the torque coil is an accurate analog signal of the acceleration and gives the input signal to the SDAC.

The null offset circuit lifts the null output signal to the required level. At no acceleration, the lateral and longitudinal axis output signal is 2.6 V DC and the vertical axis output signal is 1.8 V DC.

Range of measurement:

- Vertical axis (z) = –3g to +6g
- Longit. axis (x) = –1g to +1g
- Lateral axis (y) = –1g to +1g

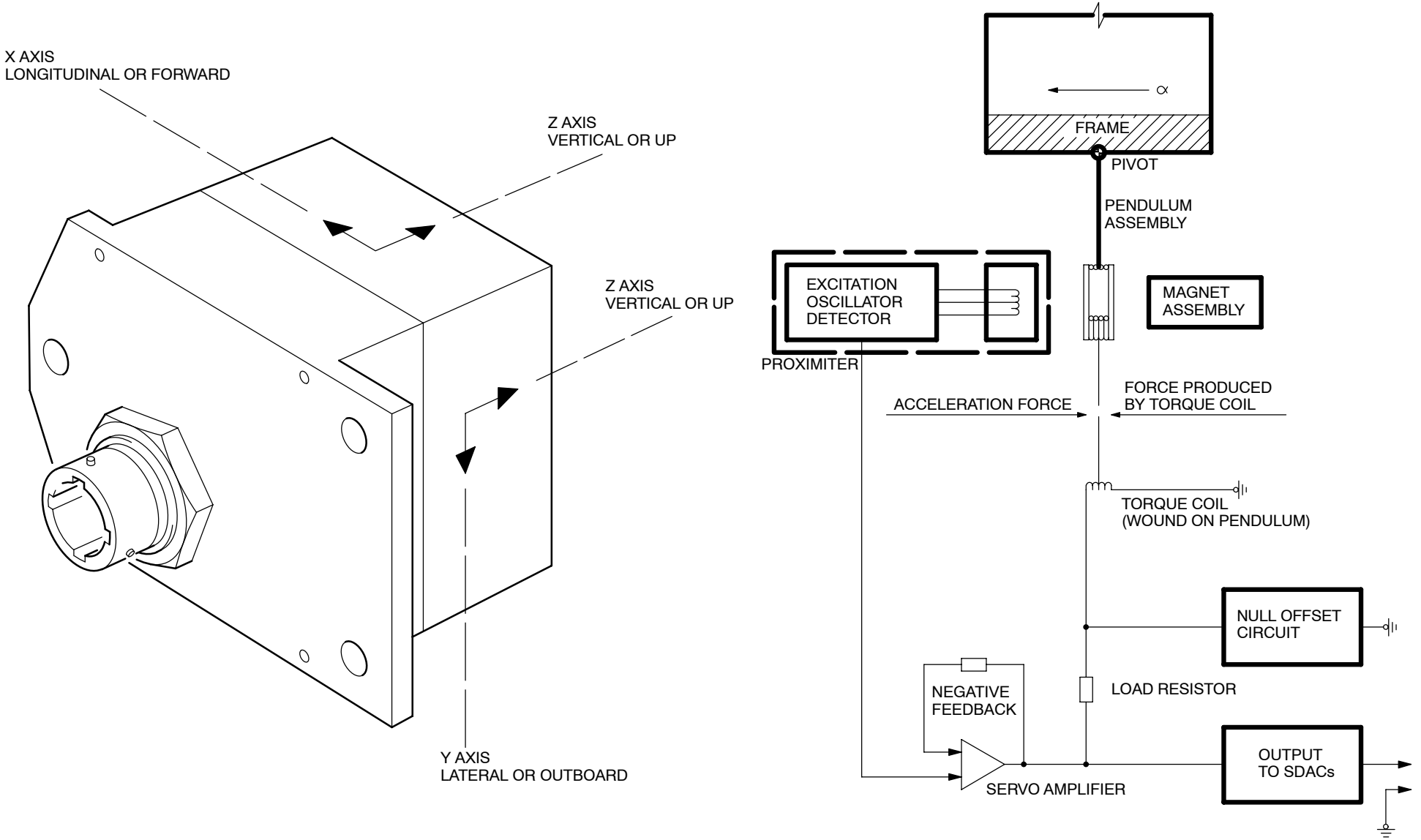


Figure 16 Linear Accelerometer

QAR PRESENTATION (OPTION) VERSION 1

QAR (Quick Access Recorder)

The purpose of the QAR is to store serial data on a optical disc for on–ground performance, maintenance or condition monitoring tasks (equivalent to the DFDR).

The QAR can store data on an on–board rewritable optical disk. The quick access to the disk and the EJECT pushbutton is through a door, which is in the front panel of the QAR.

The disk medium is a standard of 3 1/2” and a large storage capacity of 128M bytes per disk.

NOTE: lufthansa doesn’t use the qar system for trend monitoring. Here it is part of the foda project. (Flight operational data analysis Project)

QAR Functions

The RZ bipolar data from the FDIU are received in the interface board and then switched to the respective magnetical record head in the read/write board. Another weaker laser in the read/write board, reads the received data from the optical disk.

The drive and control board controls the speed and direction of the disk motion.

A BITE logic monitors the reel rotation, the disk speed and presence of data and disk. In case of discrepancies, the status output is received by the FDIU.

The disk must be formatted to store the data.

Change of the Optical Disk

The operational procedure to change the optical disk is as follows:

- unlock and open the front door
- press the EJECT pushbutton, the optical disk is automatically ejected
- remove the optical disk
- insert a new formatted optical disk gently into the aperture, (with the arrow on the left side).
- close and lock the recorder door.

NOTE: The optical disk insertion is only possible when the recorder has power.

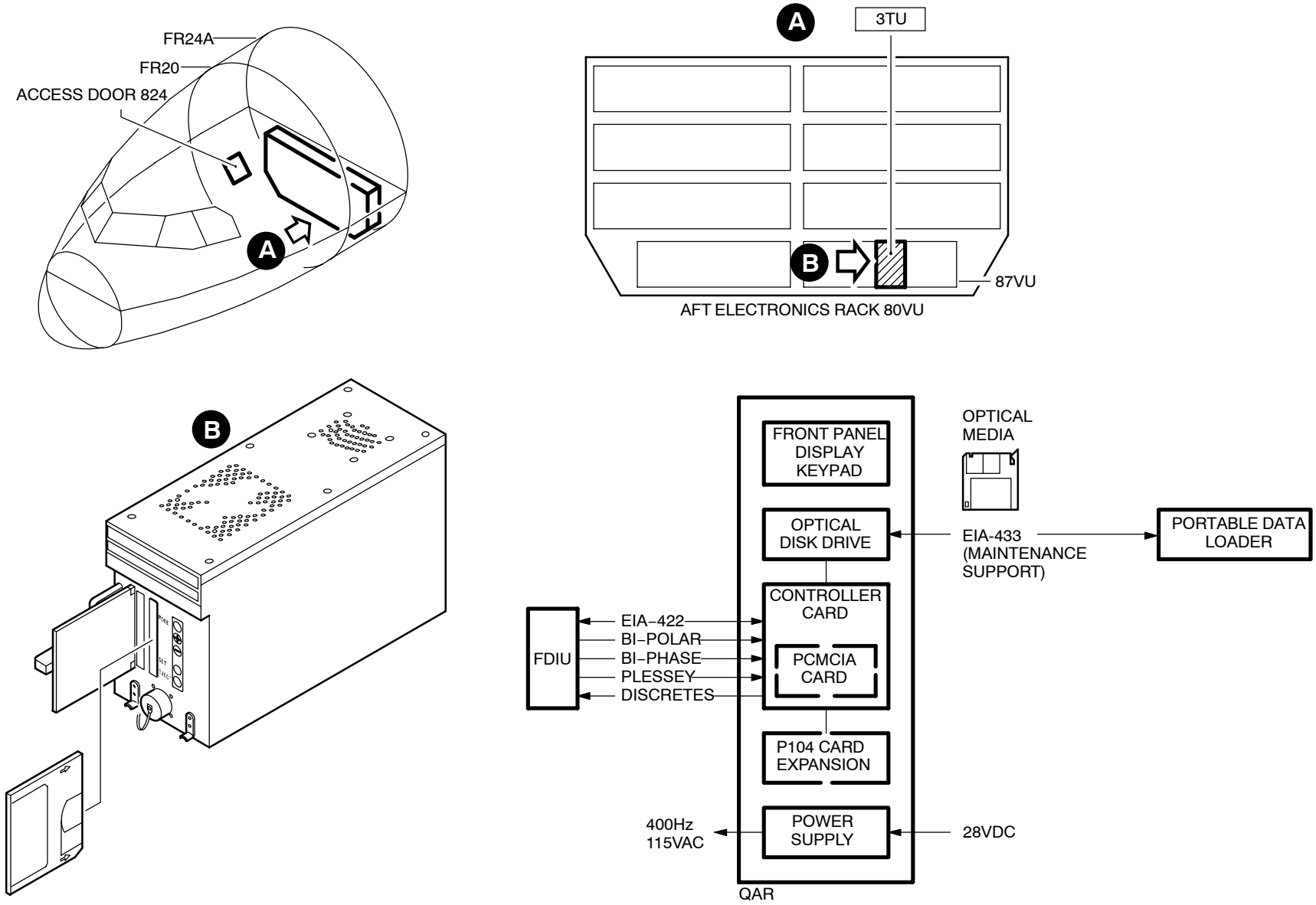


Figure 17 Quick Access Recorder

WQAR PRESENTATION VERSION 2

INTRODUCTION

The Teledyne Controls Wireless Ground Link – Quick Access Recorder (**W**ireless Groundlink **Q**uick **A**ccess **R**ecorder) provides convenient airborne data recording on standard PCMCIA media (removable PC Card) and automated wireless transfer of the recorded data when the aircraft is on the ground.

It interfaces with the FDIMU (**F**light **D**ata **I**nterface and **M**anagement **U**nit)

User interface with the WQAR is accomplished via a front panel keypad and 32–character alphanumeric display.

NOTE: The WQAR configuration with no radios is also identified as a PQAR (**P**C Card **Q**uick **A**ccess **R**ecorder).

OVERVIEW

The primary purpose of the WQAR is to record, store and transmit (wireless) digital flight data provided by various aircraft equipment.

This data is generally provided to the WQAR by the FDIMU.

The data received by the WQAR is recorded on a standard PCMCIA media (removable PC Card).

While the aircraft is on the ground, the recorded data is compressed, encrypted and transmitted securely over the wireless cellular/PCS data link.

SYSTEM OPERATION

Upon cold start, the WQAR initialization software, based on the current configuration data entered into the WQAR, determines the active data input line and its speed and synchronization pattern.

The WQAR then adapt to these characteristics for operation.

The WQAR uses a removable PCMCIA PC Card (Solid State flash memory) as the storage media. The PC Card can be prepared with the recording files at the factory or by the engineering department

The configuration data includes the selection of the input data type.
In addition, the configuration data will include aircraft tail number, WQAR serial number, wireless/cellular related information such as radio type, number of radios, cellular network ID, ISP dialup and log–in information and the WQAR base station address

Recorded raw data is stored on the PC Card in a single raw data file.

A corresponding tag file is used to record the state of raw data recording.

A message file is used to record report data generated from FDIMU (AIDS Part) .

When wireless transfer is enabled and upon aircraft being on the ground, the recorded data is compressed prior to transmission.

The compressed data is encrypted, packed up and transmitted via commercial cellular/PCS phone modules over the Internet to a WGL Ground Base Station.

NOTE: Cellular Transmission is disabled via hardware interlock while airplane is not on the ground.
(Any engine senses low oil pressure.)

NOTE: If the LRU is not configured with radios (or wireless operation is disabled), the PC Card can be removed from the WQAR for off–line processing. The PC Card may then be recycled using the media preparation utility prior to being returned to the unit.

MALFUNCTIONS

In the event of a hardware/software failure, the WQAR failure indicator will illuminate.

The WQAR failure indicator will also iluuminate when power is initially applied, when a PC Card is not installed, or when the PC Card is full.

The WQAR will set a STATUS discrete output to the open state if a fault is detected.

The WQAR also provides a Media Low discrete output to identify if a pre–configured percentage of the recorded data file has been used.

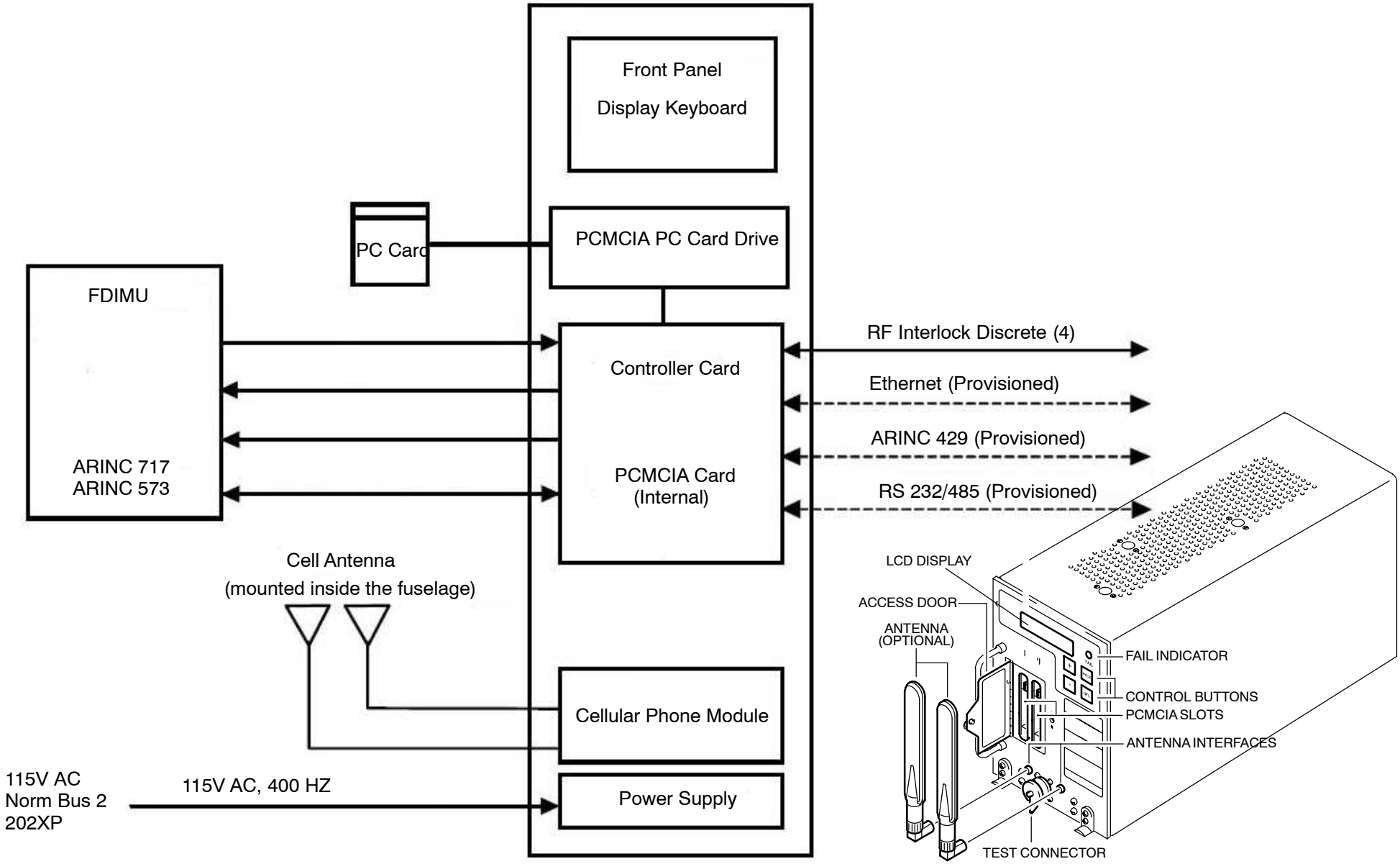


Figure 18 System Architecture

WQAR COMPONENT DESCRIPTION VERSION 2

WQAR OVERVIEW OF OPERATION

Once a PCMCIA PC Card has been installed and power has been applied, operation of the WQAR is controlled by the Flight Data Recorder system with virtually no operator interaction required.

However, capabilities via the front panel display and keypad are provided to allow the user to monitor the operation of the LRU and to make certain changes to the configuration of the unit.

The various functions are accessed through a series of menus that are displayed on the alphanumeric front panel display of the WQAR.

The menu items increment or decrement by pressing the + and – keys, respectively. Menu items are selected by pressing the SEL key.

Menu selections or submenus are exited by pressing the MODE key, which will return the WQAR display to the higher level submenu or to the main menu, as applicable.

INITIAL POWER UP AND PC CARD INSTALLATION

A latched access door protects the PC Card drive. The door must be opened to gain access to PC Card slot. The alphanumeric display and Fail indicator are both visible while the access door is closed.

POWER-ON SELF TEST

Upon application of primary power, the WQAR executes a series of POST (**P**ower–**O**n **S**elf–**T**ests) to verify the fidelity of critical processor support functions.

If an error is detected, the alphanumeric display will show an advisory message.

If the POST is successful, the two line alphanumeric display will show the status message:

- Line 1> RUN DISABLED
- Line 2> RecCmplDly ILOn

NOTE: This display assumes that the serial data input is off, that the run control discrete to the WQAR is enabled and is off, that the aircraft is on the ground with the RF interlocks active, radios enabled and the recording completion delay is one minute or longer. Other messages may be displayed based on the current system status.

If either or both PC Cards are not installed on the WQAR when power is applied, the FAIL lamp will illuminate, and a message will be displayed prompting the operator to insert the missing PC card or cards. After inserting the missing card or cards, the WQAR will continue booting.

MEDIA PC CARD REMOVAL

CAUTION: FAILURE TO FOLLOW THESE INSTRUCTIONS MAY RESULT IN LOSS OF RECORDED DATA.

This operation is performed when aircraft power is applied to the WQAR. From the main menu, press the – or + keys to get to “CARTRIDGE EJECT“ menu. Press the SEL key to change message to display “TO CONTINUE PRESS +“. Press the + key to continue.

The WQAR will display the message “WAITING FOR CLEANUP“ for several seconds, followed by the message “EJECT CARTRIDGE NOW“.

The cartridge (media) can be ejected now, using the eject button on the PC Card drive.

NOTE: It is NOT recommended that the Media PC Card be removed from the unit with power applied unless the CARTRIDGE EJECTION procedure is used.

MEDIA PC CARD INSERTION

Once the WQAR displays the message:

- Line 1> INSERT NEW
- Line 2> CARTRIDGE NOW

and the FAIL light is on, the PC Card may be inserted.

Open the access door to gain access to the PCMCIA PC Card Drive.

Insert a properly prepared PC Card into the PC Card drive and close the access door (installing the RF antenna if necessary).

At this time, the WQAR will display the message „SYSTEM WILL NOW REBOOT“ and automatically reboots.

After rebooting the WQAR is ready for operation, and requires no further user interaction.

TROUBLESHOOTING PROCEDURES

For detailed troubleshooting information refer to AMM 31–33–52 Airline Comment „Trouble Shooting Guide (EO 155600)“

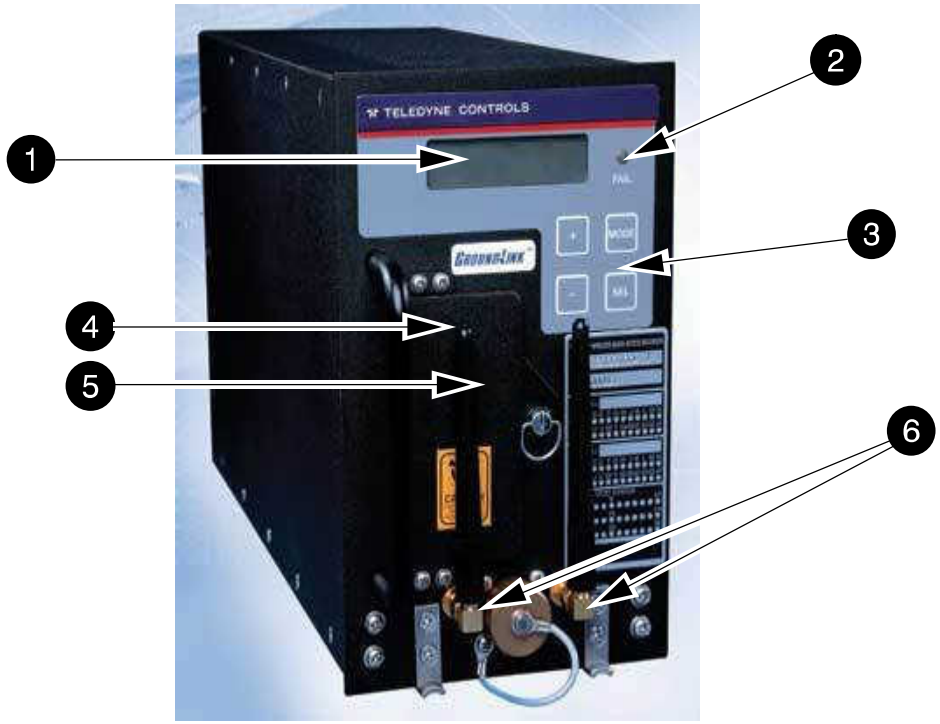


Figure 19 WQAR Frontpanel

1 **Alphanumerical display**

The displays shows the various menus, displays and messages

2 **Fail Indicator**

Indicates a WQAR failure.

NOTE: The Fail indicator will also light when power is initially applied, PC card is not inserted and PC card memory is low or full.

3 **Control Buttons (Mode, +, -, SEL)**

4 **Internal PC Card slot**

Provides internal storage for use by the WQAR software.

NOTE: This slot is not accessible to the user.

5 **Media PC Card slot**

Allows installation of the PC Card

6 **Cellular Antenna**

NOTE: This is an option.

OPERATION/CONTROL AND INDICATING

Energization

With the oil pressurization of one or both engines or flight condition, the DFDR will be supplied with 115V/400 Hz.

For maintenance and test purposes on the ground and for preflight checks there is an override function to supply the DFDR.

When the GND/CTL button on the CTL PNL is pushed the blue 'ON' pushbutton light comes on. The override function supplies the equipment until the GND/CTL button is pushed again or the automatic power interlock becomes active.

Control

Override of Power Interlock

With the electrically latched GND/CTL button it is possible to energize the system for preflight checks or for maintenance and test purposes.

The GND/CTL button is installed on the CTL PNL.

Event Mark

An EVENT BUTTON is installed to record an EVENT MARK on the DFDR.

Indicating

If you push the GND/CTL button on the control panel, the blue GND/CTL button light comes on .

The status line of the DFDR and the QAR are connected to the FDIU.

In case of a Class II fault the FDIU transmits a failure message to the CFDS. These failures are not indicated to the crew in flight but are the subject of an ECAM report on the ground after shut down of the engines.

If a Class III fault occurs the related flag is set in the fault memory of the FDIU (up to 30 faults). This fault information is sent to the CFDIU. These Class III faults can be displayed on the MCDU screen via menu function (System Report/ Instruments/FDIU). These faults can wait until the next scheduled maintenance check.

In case of malfunction of the CFDS, DFDR FAIL and FDIU FAIL are sent directly via SDAC to the ECAM screen.

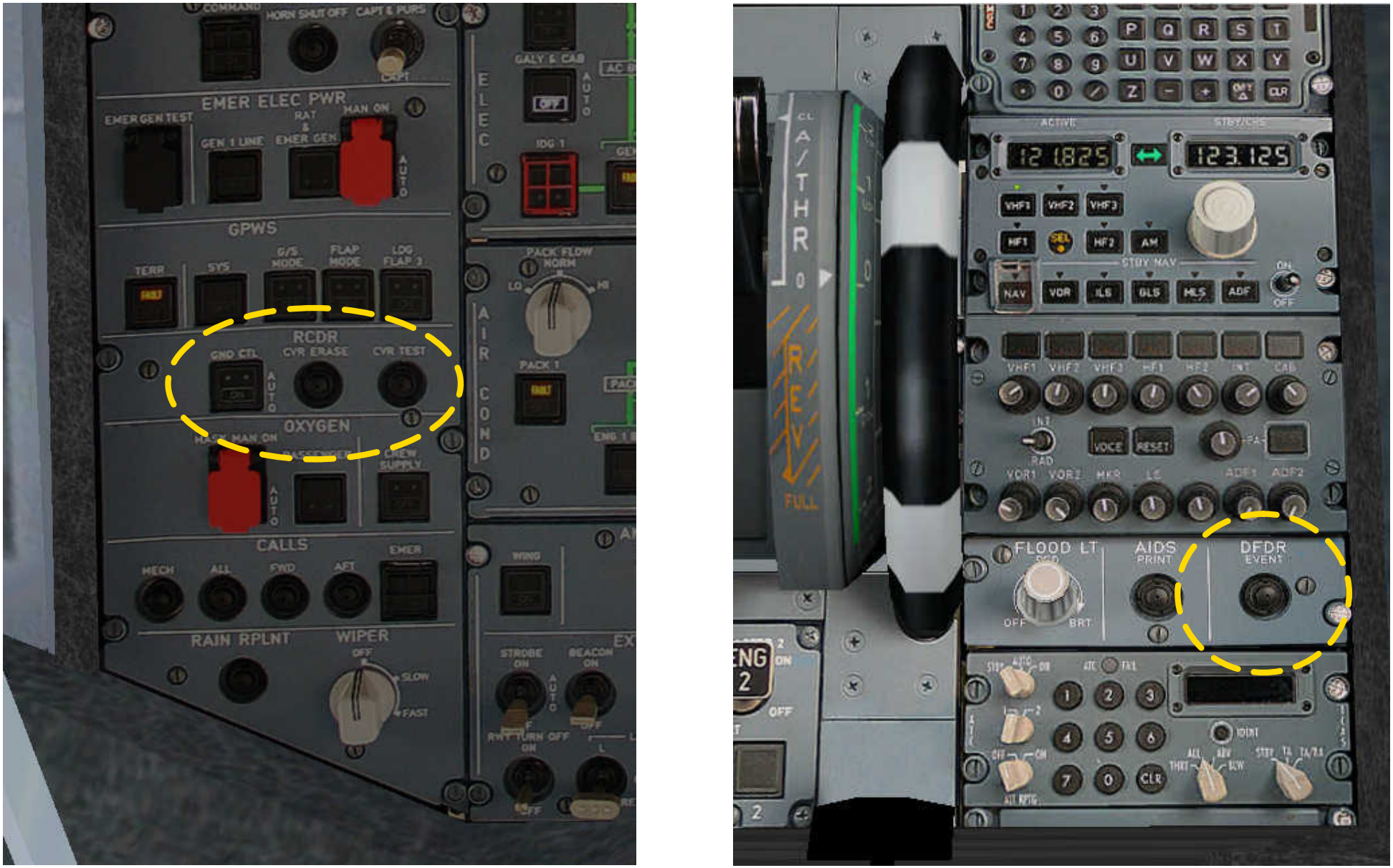


Figure 20 DFDRS Controls

31–36 AIRCRAFT INTEGRATED DATA SYSTEM

GENERAL DESCRIPTION

AIDS (Purpose of the Aircraft Integrated Data System)

With the integration of modern, state–of–the–art technology like the fly–by–wire or the FADEC (**F**ull **A**uthorized **D**igital **E**ngine **C**ontrol) the complexity of the aircraft systems leads to the development of the CFDS (**C**entral **F**ault **D**isplay **S**ystem) and the AIDS (**A**ircraft **I**ntegrated **D**ata **S**ystem).

While the CFDS is intend to assist the line maintenance in isolating faults, detected by the BITE functions of the individual aircraft system, the main objectives for the AIDS are more of a preventative nature.

Long term trend monitoring of the engines and the APU avoid expensive unscheduled maintenance actions outside the main base of the aircraft operator. Continuous monitoring of the engines and the APU is also intended to substitute fixed interval inspections by on demand maintenance.

In addition the AIDS is used for various tasks like hard landing detection, crew proficiency monitoring and any type of special investigations and trouble shooting on system level.

Realization of the Aircraft Integrated Data System

The AIDS is organized around the DMU which interfaces with other aircraft systems.

Approximately 13000 parameters from the 50 ARINC 429 data lines are fed into the DMU.

Based on these parameters, the DMU performs several tasks, the result of which are either found on the SAR, on PDL floppy disks, on the MCDU screen or if they are downloaded through ACARS directly at the GSE (**G**round **S**ervice **E**quipment) computer in the airline ground station.

The SAR (**S**mart **A**ccess **R**ecorder) shall be retrieve via the PDL (**P**ortable **D**ata **L**oader).

Abbreviation Used in the Figure:

- CFDIU: Centralized Fault Display and Interface Unit
- ATSU: Air Traffic Service Unit
- ACARS MU: Aircraft Communication Addressing and Reporting System Management Unit
- PCMCIA: Personal Computer Memory Card International Association

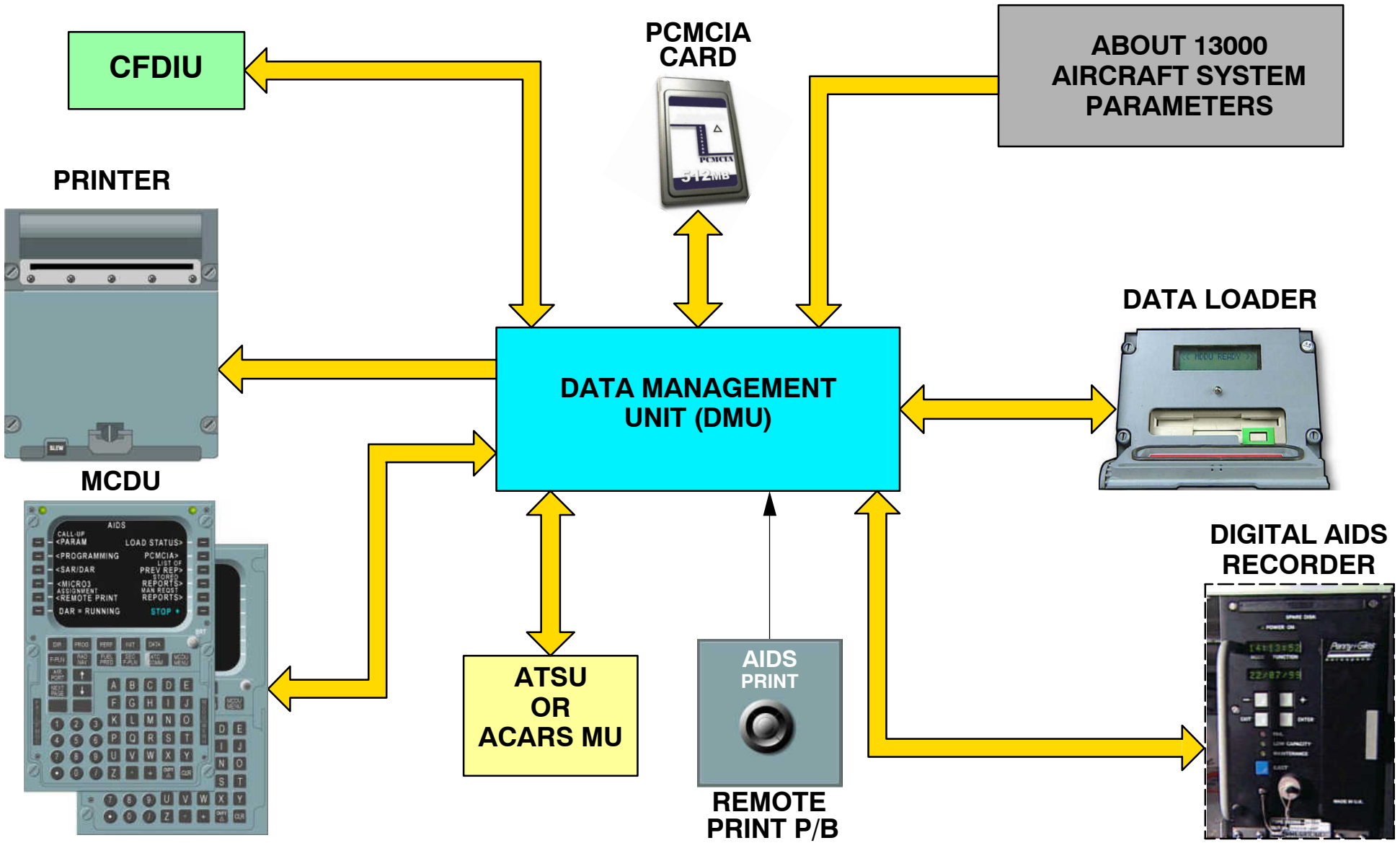


Figure 21 Aircraft Integrated Data System

SYSTEM ARCHITECTURE

Hardware

The hardware consists of

- a DMU (**D**ata **M**anagement **U**nit)
- a DAR (**D**igital **A**IDS **R**ecorder) (option)
- a in the DMU integrated SAR (**S**mart **A**ccess **R**ecorder)

Software

- Boot Software
- DMU Operational Software
- DMU Database Software

Generic function of the DMU

One of the generic functions of the DMU is the generation of reports as a result of specific events defined by trigger conditions.

The following AIDS standard reports are defined:

- Engine Cruise Report <01> (Ref. 31–37–73)
- Cruise Performance Report <02> (Ref. 31–37–73)
- Engine Take–Off Report <04> (Ref. 31–37–73)
- Engine Report O/R <05> (Ref. 31–37–73)
- Engine Gas Path Advisory Report <06> (Ref. 31–37–73)
- Engine Mechanical Advisory Report <07> (Ref. 31–37–73)
- Engine Divergence Report <09> (Ref. 31–37–73)
- Engine Start Report <10> (Ref. 31–37–73)
- Engine Run Up Report <11> (Ref. 31–37–73)
- APU MES/IDLE Report <13> (Ref. 31–37–49)
- APU Shutdown Report <14> (Ref. 31–37–49)
- Load Report <15> (Ref. 31–37–51)
- ECS Report <19> (Ref. 31–37–21).

Most of these reports allow a change in the trigger limits or in the length of the report. In addition user specific trigger conditions can be created for each report by the use of the GSE based reconfiguration software.

In addition to the above listed standard reports additional complete new reports can be programmed by the airline user.

The DMU is able to record AIDS data either by the use of the DAR or the integrated SAR. The storage medium of the DAR is a magnetic tape cartridge or an optical disk while the SAR stores the data in an Solid State Mass Memory. To read out the SAR data, use a floppy disk via the PDL.

The DMU provides various communication interface for operator dialogue and ground communications. The usage of these communication channels is mostly programmable. For example, reports can be either printed out, transmitted to the ground via ACARS or retrieved by the use of a floppy disk via the MDDU. That means each airline user can setup the DMU to support most efficiently the airline specific data link structure.

DMU file transfer interfaces:

MCDU (Multipurpose Control Display Unit)

- Manual request of reports and SAR/DAR recording
- Display of list of stored reports and SAR files
- Online display of selected aircraft parameters
- Various control and reprogramming menus

Printer

- Automatic print out of reports
- Manually initiated (by MCDU) print out of reports
- Print out of MCDU screens
- Print out of software load messages

PDL (Portable Data Loader)

- Manually initiated (by MCDU) retrieval of reports and SAR files
- Automatic retrieval of reports and SAR files
- Load of DMU software

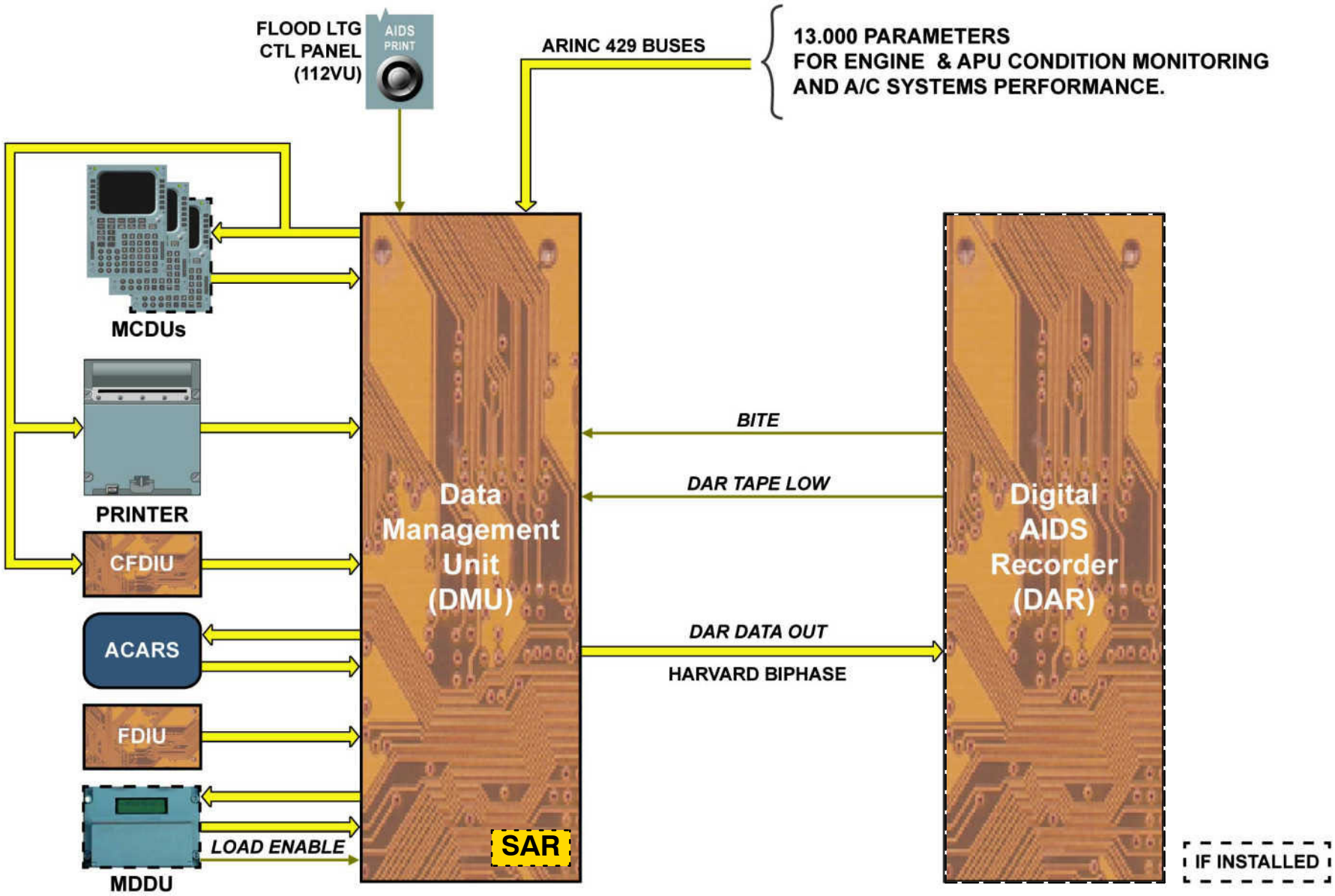


Figure 22 System Architecture

AIDS SYSTEM OPERATION

DMU FILE TRANSFER INTERFACES

ACARS

- Manually initiated (by MCDU) download of reports
- Automatic download of reports
- Upload of request for report generation
- Upload of reprogramming messages

DAR (**D**igital **A**ccess **R**ecorder) (optional)

- Manually initiated (by MCDU) recording of AIDS data
- Automatic recording of AIDS data

GSE (Ground Support Equipment)

For the individual programming of the DMU functions, the DMU is reprogrammable either with the assistance of the A320 AIDS GSE (**G**round **S**upport **E**quipment) or partially through the MCDU's (very limited).

The data from the SAR data storage buffer are retrievable through the MDDU.

To initiate manually some specific reports a remote print button is located on the pedestal in the cockpit. Also SAR recording is triggered through the print button. The report/SAR channel assignment of the remote print button is GSE programmable.

PCMCIA

The PCMCIA (**P**ersonal **C**omputer **M**emory **C**ard **I**nternational **A**ssociation) Interface is an integrated part of the DMU. This interface accepts high capacity and removable PCMCIA disks.

Independently from the recording in the DAR (**D**igital **A**ids **R**ecorder) and the DMU, the DAR and SAR (**S**mart **A**ids **R**ecorder) data as well as the reports can be automatically recorded in the inserted PCMCIA disk.

A PCMCIA disk space ratio reserved for DAR, SAR and reports recording is programmable by the GSE (**G**round **S**upport **E**quipment). As a default, the whole disk space is allocated for DAR recording.

The PCMCIA interface can also be used as a portable data loader to upload the DMU operational software and customer database and to download the SAR data and reports.

Smart AIDS Recorder

The SAR (**S**mart **A**ids **R**ecorder) is an integrated part of the DMU.

The purpose of the SAR is to record parameters relating the particular flight events detected by the DMU.

The recording of the parameters is performed in a compressed form on the 2 Mbytes of the SSMM reserved for SAR memory.

ACARS

If installed, the ACARS MU (**Aircraft C**ommunication **Addressing** and **R**eporting **S**ystem **M**anagement **U**nit) can be used to send reports and to broadcast parameters generated by the DMU to a ground station via radio transmission.

The download of reports can be automatically initiated by the DMU or manually initiated from the MCDU.

The ACARS MU can also receive from the ground requests for report generation and reprogramming messages and send them to the DMU.

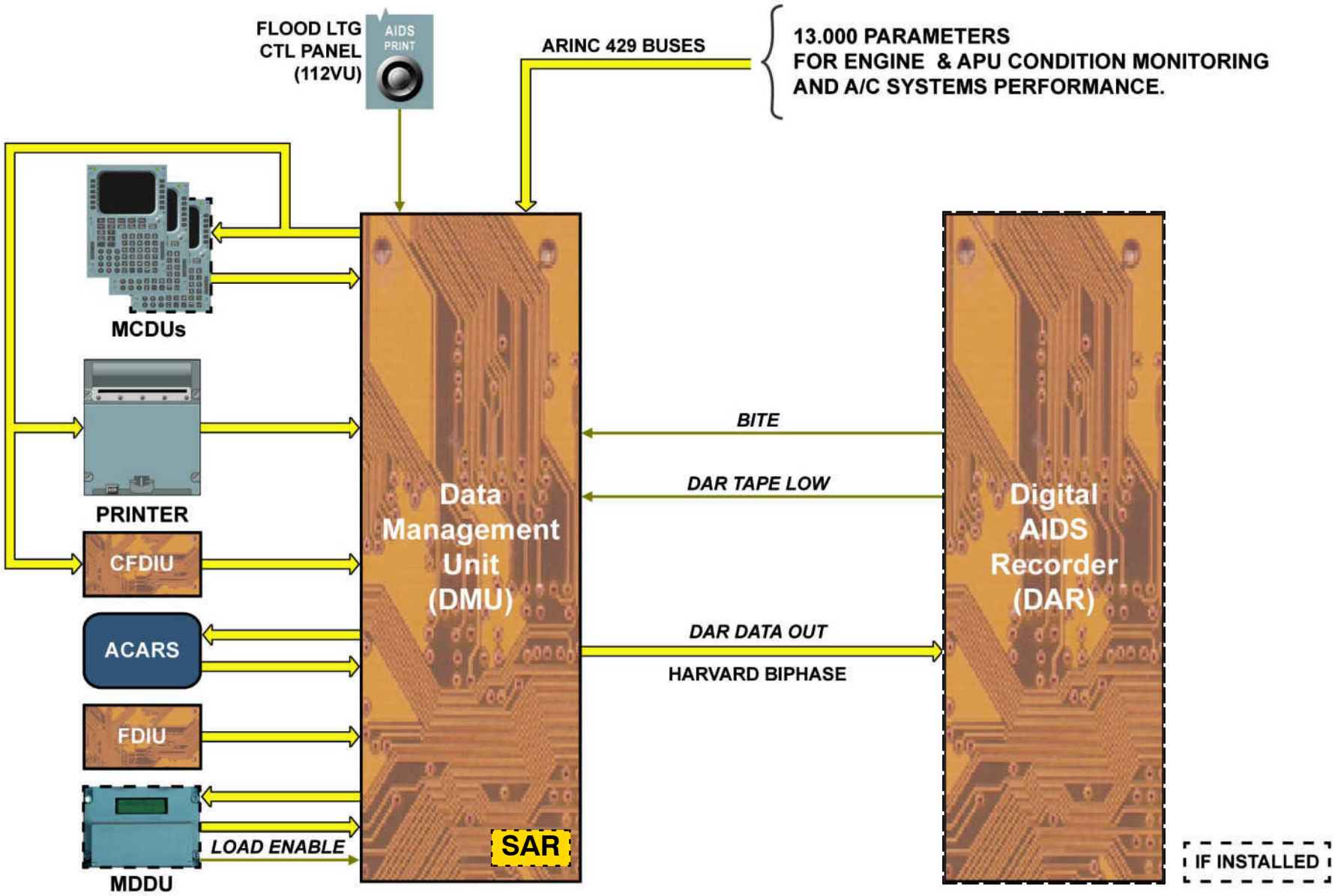


Figure 23 DMU Data XFER

AIDS INTERFACE

SYSTEM INTERFACE

The DMU receives approximately 13.000 parameters from various A/C systems through ARINC 429 data lines. These parameters can be recorded by the DAR.

NOTE: In addition, spare inputs are provided. Among these ARINC 429 inputs data lines, some of them are selectable for high or low speed from system computers.

PARAMETER CALL–UP

Parameters transmitted on the connected data buses can be shown on the MCDU in binary code with the label call–up function. At DMU delivery, 200 parameters are already defined with alpha call–up code and can be shown on the MCDU in engineering units. Approximately 1.500 parameters can be added to the initial alpha call–up list by programming.

DMU Input Parameters

All DMU parameters are listed in the parameters list. The DMU uses these parameters to perform the various functions. Also the DMU internal parameters and parameters on Output Bus A+B are listed in the parameters list.

For all calculations, logical decisions and parameters to be included in a print report only valid parameters are used. If there is no valid parameter available, the corresponding parameter column is filled with '<'.

If a parameter, which is defined to be included in a print report, is not transmitted on the appropriate 'ARINC' bus, the corresponding data field is filled with '>'. If a parameter, which is used for a logical decision, is invalid or not transmitted during the whole flight phase, (in which it is intended to be used), this causes a class 3 fault.

For average calculations valid parameters only are used. The validity of a parameter is detected by monitoring the SSM bits. Also the parity bit of the appropriate ARINC 429 word. If a parameter fail is detected, the alternative system 2 parameter is used if possible. If an alternative parameter is used, this is indicated by an associated to the parameter number, for all the various functional descriptions.

If a parameter which is used for logics is invalid or not transmitted, or an alternative parameter is not available, the previous good value is used for up to three reads. After three consecutive reads this parameter is marked as failed and the logic is not performed.

Means are provided to observe also those busses which are not permanently used for the logics or reports.

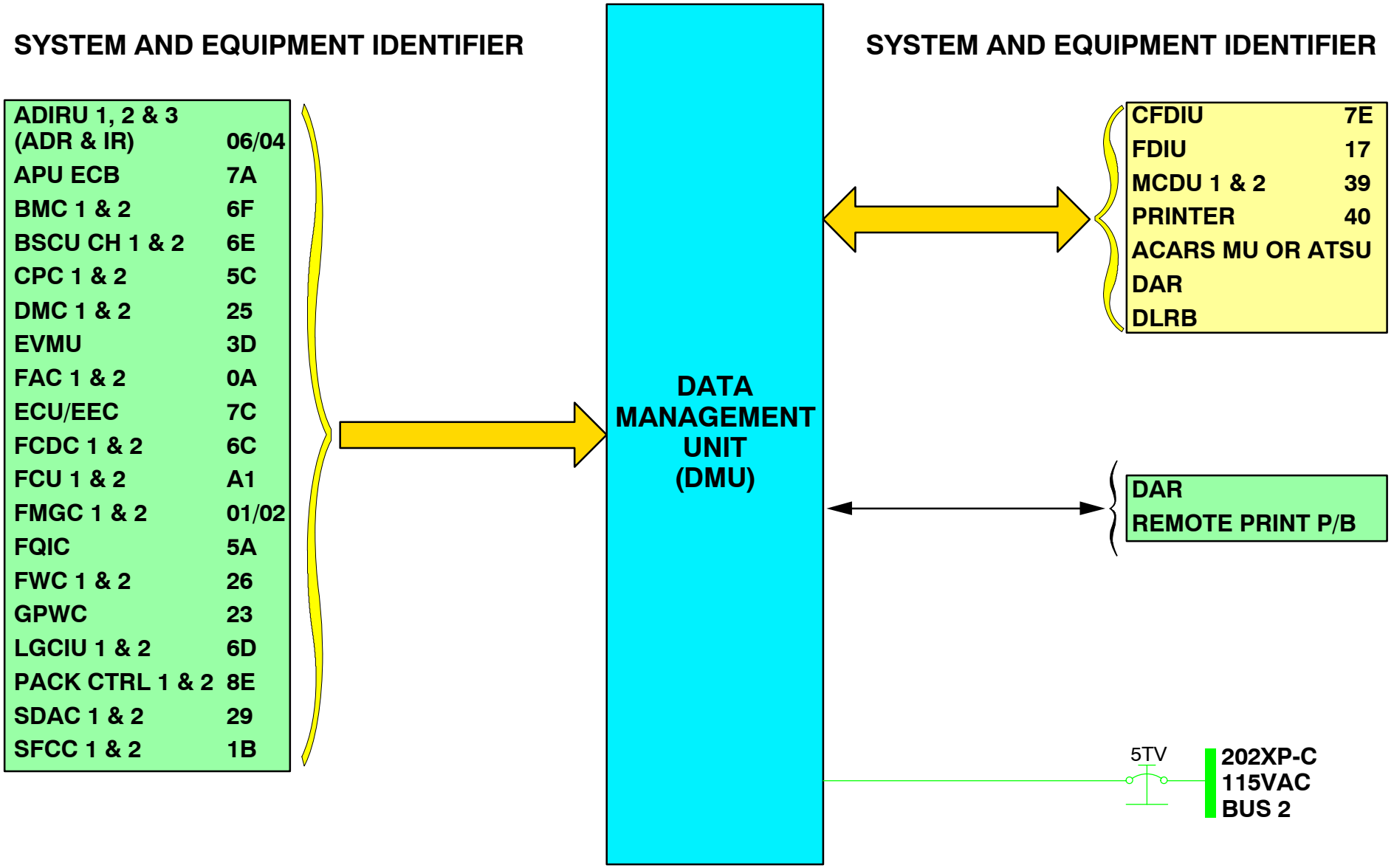


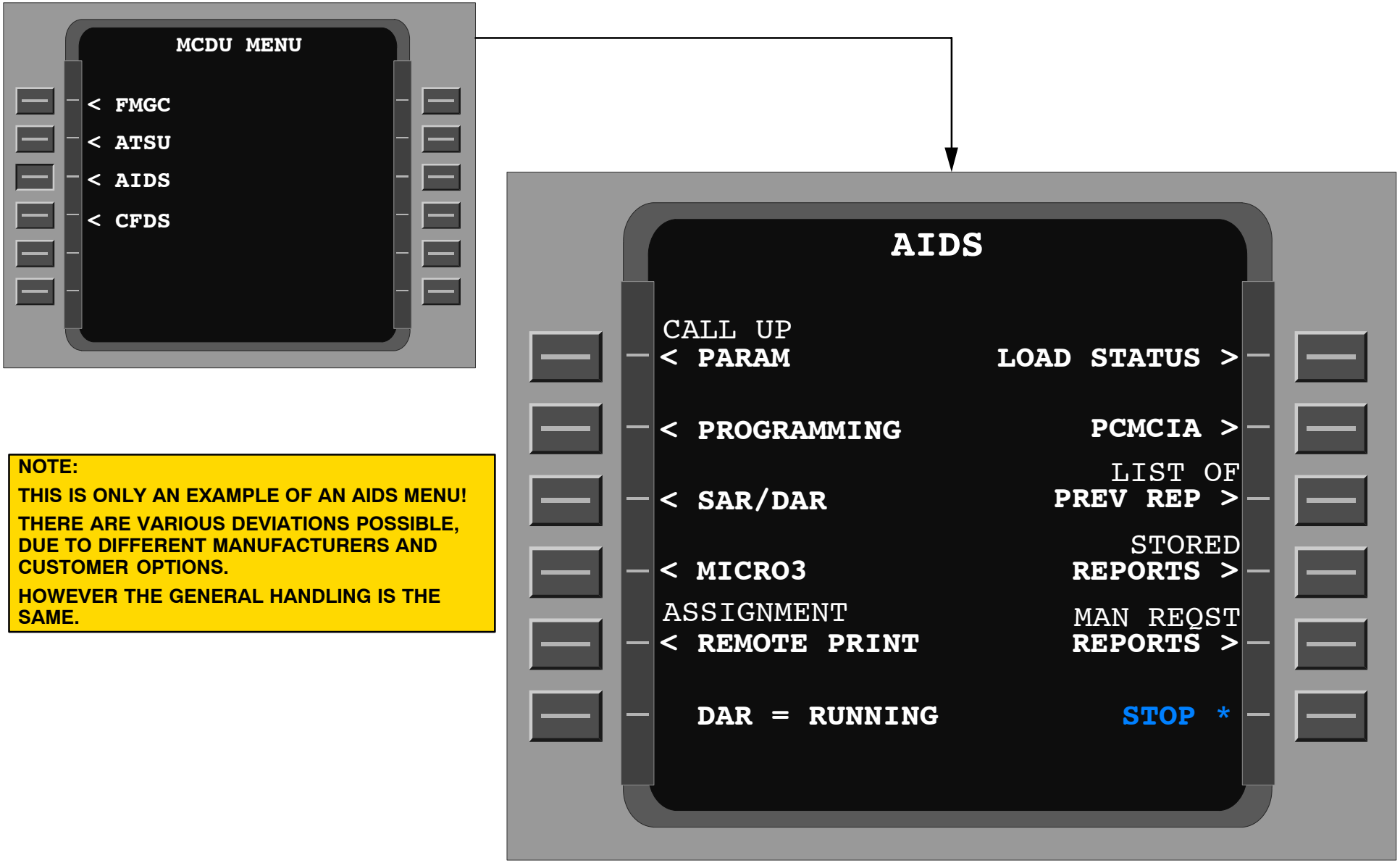
Figure 24 DMU Interconnections

CONTROL AND INDICATING PRESENTATION

MCDU Controlled DMU Function

The AIDS main menu gives access to these functions:

- Parameter Callup:
  - Parameter Label Call–Up
  - Parameter Alpha Call–Up
  - Parameter Menus
- Load Status Display
- List of Previous Reports
- List of Stored Reports
- Manual Report Request
- Assignment of Remote Print
- SAR/DAR Functionality
  - SAR Summary
  - List of SAR stored Records
  - SAR Manual Request
  - DAR PCM
  - DAR Run Control Switch
- DMU Programming
  - Report Inhibition
  - Report Limits
  - Report Internal Counters
  - Statistic Counters
- Micro 3 (user programmable functions on the 3rd micro processor board)
- PCMCIA
  - Disk Identification
  - Disk Directory
  - DAR Recording



NOTE:

THIS IS ONLY AN EXAMPLE OF AN AIDS MENU!

THERE ARE VARIOUS DEVIATIONS POSSIBLE, DUE TO DIFFERENT MANUFACTURERS AND CUSTOMER OPTIONS.

HOWEVER THE GENERAL HANDLING IS THE SAME.

Figure 25 AIDS Main Menu Example

INDIVIDUAL PRINT REPORT PRESENTATION

GENERAL

A report is a comprehensive set of data related to a specific event (e.g. limit exceedance of engine parameters). The parameters contained in the reports are among the parameters provided with an alpha call–up (refer to AMM (**A**ircraft **M**aintenance **M**anual) 31–36–00 for the detailed parameter list associated to each report). The DMU (**D**ata **M**anagement **U**nit) processes up to 23 different types of report:

- 13 standard reports for basic aircraft, engine and APU monitoring. These reports have fixed trigger mechanism, fixed data collection and fixed output formatting. Nevertheless, certain constants and limits within fixed trigger logics are reprogrammable. Specific trigger conditions can be created for each report by means of the GSE (**G**round **S**upport **E**quipment).
- up to 10 additional reports, numbered from 31 to 40, for airline specific investigation and trouble shooting. These reports are user programmable with the GSE for trigger conditions, data collection, report format and output destination.

In addition to the automatic trigger logics, all the reports can be manually generated:

- via MCDU,
- via AIDS (**A**ircraft **I**ntegrated **D**ata **S**ystem) PRINT P/B (according to flight phase associations, if programmed),
- via ATSU (**A**ir **T**raffic **S**ervice **U**nit) (uplink request). Refer to AMM 31–36–00 for the detailed trigger logics associated to each report.

A non–volatile memory for storage of at least 10 reports per different type of report is provided within the DMU.

NOTE: in this example, reports <01> to <11> are given for a CFM engine. They may be slightly different to your aircraft configuration.

Depending on the DMU, which is fitted on your aircraft, the LOAD REPORT <15> may not be applicable.

REPORT EXAMPLE (ENGINE CRUISE REPORT <01>)

This report is a collection of data over a period of time in which the aircraft met the appropriate stability criteria. The required stability period is 100 seconds (programmable value). Basically, whatever the number of times the stability is detected, only one report is generated per flight leg.

This report contains the data with the best engine quality number (QE) over the whole flight leg. If no stability is detected, then a report is generated with the following message in its last line: ”NO STABLE FRAME CONDITION”.

The report mainly contains operating data of both engines, including vibration data. The report data are averages over the required stability period, except:

- ESN, EHRS, ERT, ECYC: Engine general data (serial number, flight hours, running time, cycle),
- AP: Autopilot status,
- QE: Engine quality number used as stability indicator for this report (00: best stability, 99: worst stability),
- OIQH: Oil consumption from the previous flight,
- EVM, ECW1, SSEL: Engine vibration status word, engine control word,
- and status of Full Authority Digital Engine Control (FADEC) sensors,
- data lines V3, V4: Averaged values taken from the last stable descent (i.e. descent of the last leg),
- data lines V5, V6: Averaged values taken from the last stable climb (i.e. climb of the current leg).

NOTE: For engine health monitoring purposes, 3 additional sensors can be optionally connected to the FADEC to permit recording of the following parameters: PS13 (fan tip discharge pressure), P25 (High Pressure (HP) compressor inlet pressure), T5 (Low Pressure (LP) turbine discharge temperature).

NOTE: In this example, as well as in the AMM, generic symbols for the value fields are used:

– ”1” = 0 or 1,

– ”A” = Any character in the range from A. to.Z,

– ”9” = Any digit in the range from 0.to.9,

– ”X” = Any character or digit in the range from A.to.Z or 0.to.9.

E.g.: TAT value is symbolized by ”X999”.

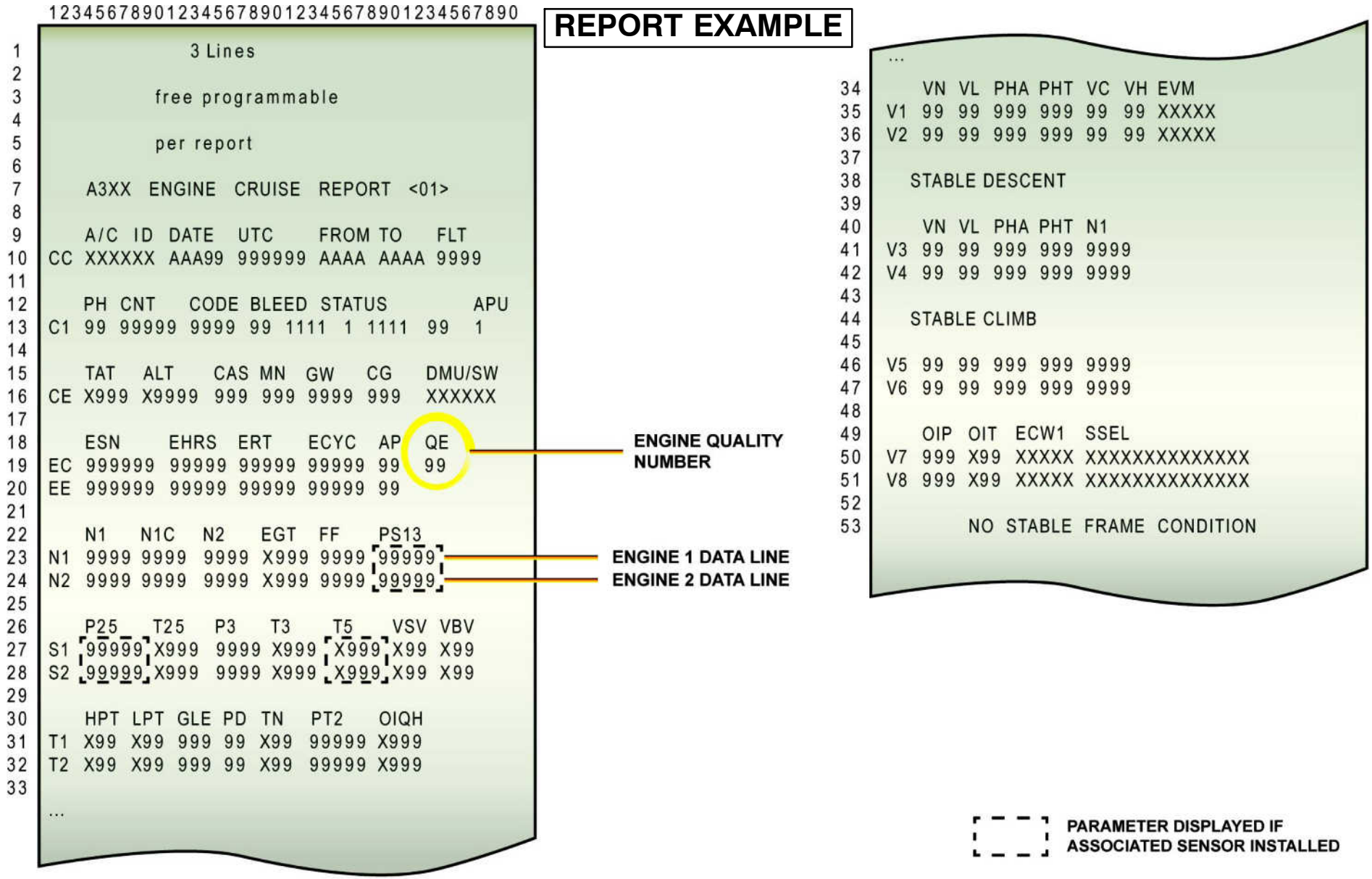


Figure 26 AIDS Report Example

INTRODUCTION OF AIDS REPORTS

Engine Cruise Report <01>

The engine cruise report is a collection of aircraft and engine information averaged over a period of time in which both the engine and the aircraft met the appropriate stability criteria.

The required stability period is 100 seconds (programmable value). Basically, whatever the number of times the stability is detected, only one report is generated per flight leg. This report contains the data with the best engine quality number (QE) over the whole flight leg. If no stability is detected, then a report is generated with the following message in its last line: ”NO STABLE FRAME CONDITION”.

Cruise Performance Report <02>

This report is similar to ENGINE CRUISE REPORT <01> except that more information is provided about the aircraft, such as inner cell fuel quantity, elevator position, corrected Angle–Of–Attack and side slip angle, last DMU calculated flight path acceleration and inertial vertical speed, Roll angle and body axis yaw rate (average), True heading, longitude and latitude positions, wind speed and direction (average), fuel temperature and density (average), flight controls positions (average). E.g. RSP5: Roll spoiler 5 position.

Engine Take–Off Report <04>

The Engine Take–Off Report is an average data collection of aircraft and engine around the point of peak N1 while in take–off flight phase

Engine Report O/R <05>

The engine on request report is a time series collection of aircraft and engine parameters as a function of a manually initiated trigger.

Engine Gas Path Advisory Report <06>

The Engine Gas Path Advisory Report shall be a collection of engine related information when there has been an exceedance of one of the primary engine parameters. In particular STALL, FLAME–OUT, SHUTDOWN, EGT, N1 and N2 shall be monitored for exceedance conditions.

Engine Mechanical Advisory Report <07>

The Engine Mechanical Advisory Report shall be a collection of engine related information when there has been an exceedance of one of the secondary engine parameters. In particular engine oil pressure, engine oil temperature, engine oil consumption, engine nacelle temperature and engine vibrations shall be monitored for out of tolerance conditions.

Engine Divergence Report <09>

The Engine Divergence Report shall be a time series collection of engine related information prior to and after the detection of an engine divergence condition. The engine divergence logic is intended to detect rapid degradation in engine performance over the course of a few hours.

Engine Start Report <10>

The Engine Start Report shall be a time series collection of engine related information as a function of number of flights and when an abnormal condition has been detected during a main engine start.

Engine Run Up Report <11>

The Engine Run Up Report shall be an average collection of engine related parameters. The report will be primarily triggered manually via MCDU menu and the Remote AIDS Print Button.

APU MES/IDLE Report <13>

The APU MES/IDLE Report is an average collection of APU related parameters during the starting of each main engine as well as during APU idle conditions. This information will be primarily used by ground APU performance analysis program.

APU Shutdown Report <14>

The APU Shut Down Report is a time series collection of APU related parameters during the abnormal Shut Down of the APU.

Load Report <15> (Option)

The Load report shall be a snapshot collection of aircraft data before, at, and after an abnormal Load condition either in the air or at touchdown.

ECS Report <19>

The ECS (**E**nvironmental **C**ondition **S**ystem) Report is a time series collection of ECS related parameters when an abnormal ECS condition has been detected.

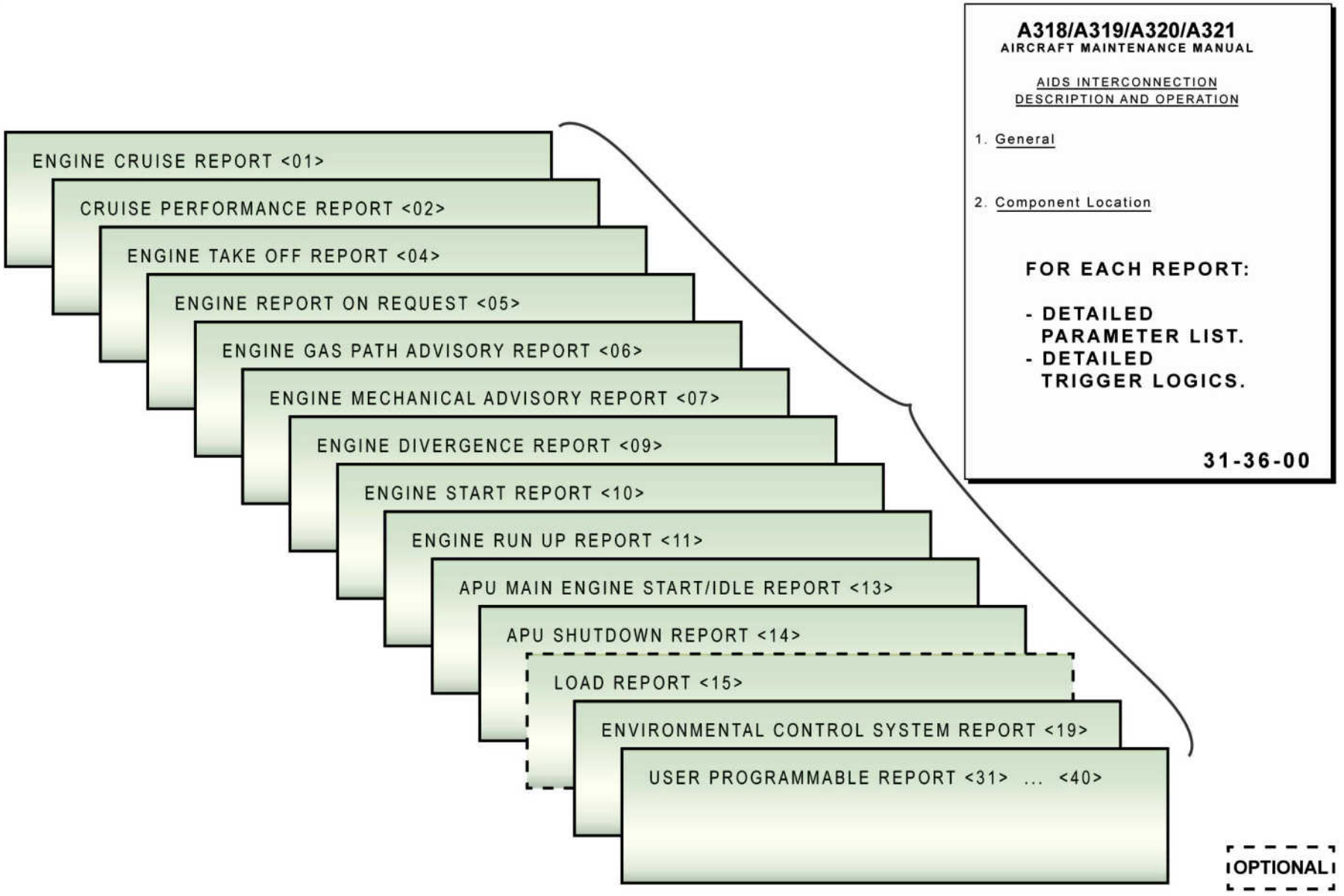


Figure 27 AIDS Reports

STANDARD HEADER (PRINT REPORTS) MAINTENANCE PRACTICES

STANDARD HEADER FOR PRINT REPORTS

A standard header is printed on each report. It is composed of information about the report at the top, information about the aircraft and the flight in the middle and general data at the bottom. The header data is taken at the time when the respective report is generated.

Report Value Presentation

Each data line starts with two identification letters. The presentation of the values in the data lines is according to:

their sign: Negative values begin with ”N” and, for positive values, ”N” is replaced by ”0” or another digit,

their operational range without decimal point as listed in the parameter list associated to the header and each report (for these lists, refer to Aircraft Maintenance Manual (AMM) 31–36–00).

E.g.: The operational range of the Total Air Temperature (TAT) is from –60.0 to 99.9 DEG C. Therefore, –32.0 DEG C is printed out N320 and +26.5 DEG C is printed out 0265. In addition, a parameter, which is invalid or not updated, is replaced with ”_” or ”X” characters.

Report Information

3 free programmable lines are available for airline specific messages.

Another line contains the report name and number

Aircraft and Flight Information

Line CC contains the following data:

- A/C ID: Aircraft identification (tail number),
- DATE (month/day),
- UTC: Universal Time Coordinated (hours/minutes/seconds),
- FROM TO: City pair identification,
- FLT: Flight number.

  The flight number is defined by up to 8 characters but only the last 4 numbers are used. Only numbers are possible and the not used positions are filled with zeros. E.g. Flight Management and Guidance Computer (FMGC) flight number AI067 is printed out 0067.

General Data

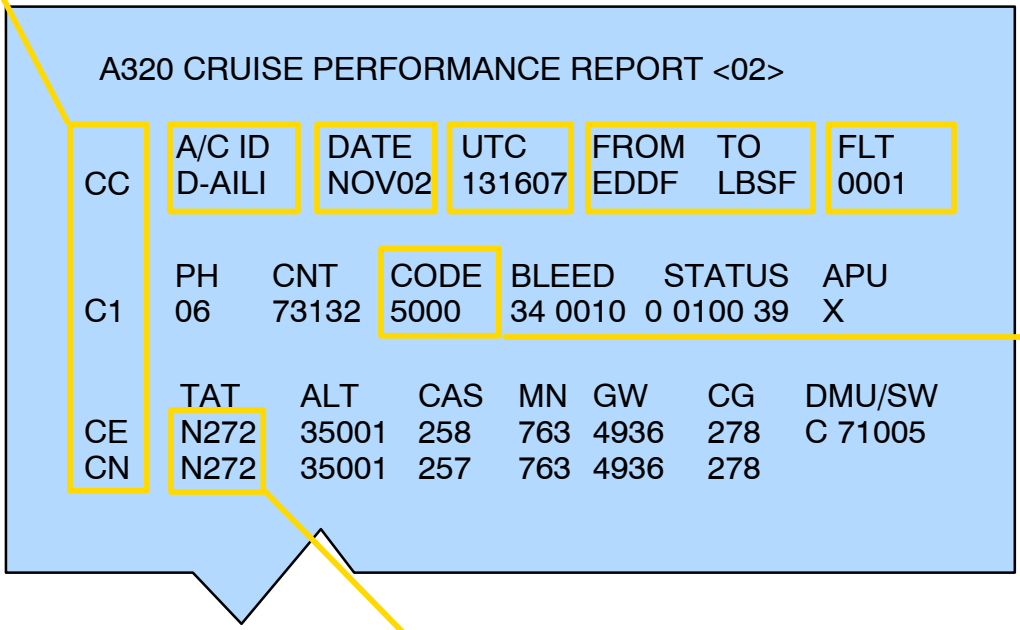
Lines C1 and CE contain the following data:

- PH: Data Management Unit (DMU) flight phase, based on flight phase from Flight Warning Computer (FWC),
- CNT: Counter of the reports previously generated (first 3 digits) and previous report number (last 2 digits),
- CODE: Trigger condition code,
- BLEED STATUS:
  - 04 LH Pack Flow (0 to .99 kg/sec)
  - 1 LH Wing AI/V Pos (AI Pos. Closed =0)
  - 0 Eng.1 Nacelle AI Pos. (AI Pos. Open =1)
  - 1 Eng.1 PRV Pos. (Fully Closed =0)
  - 0 Eng.1 HPV Pos. (Fully Closed =0)
  - 0 Cross Bleed Valve Pos. (Fully Closed =0)
  - 0 Eng.2 HPV Pos. (Fully Closed =0)
  - 1 Eng.2 PRV Pos. (Fully Closed =0)
  - 0 Eng.2 Nacelle AI Pos. (AI Pos. Open =1)
  - 1 RH Wing AI/V Pos (AI Pos. Closed =0)
  - 04 RH Pack Flow (0 to .99 kg/sec)
- APU: APU bleed valve state,
- TAT: Total Air Temperature,
- ALT: Standard altitude,
- CAS: Computed air speed,
- MN: Mach number,
- GW: Gross Weight,
- CG: Center of Gravity,
- DMU/SW: DMU software (S/W) Part Number (PN).

Trigger Conditions Code

To identify the trigger condition that caused the generation of a report, a numerical code is given.

DATA LINE IDENTIFIERS



TRIGGER CONDITION CODE

- 1000: Manual selection via MCDU,
- 2000: Flight phase dependent manual selection via AIDS PRINT P/B when programmed by the airline,
- 3000: Start logic programmed by the airline,
- 4000 to 7000: Report triggered by a combination of logic conditions
- 8100 and 8200: ATSU uplink request.

E.G. N320 (- 32.0 C)
OR 0265 (+ 26.5 C)

Figure 28 Standard Header for Print Reports

MAINTENANCE PRACTICES (EXAMPLE)

BLEED STATUS

Bleed status is indicated with discrete coded information and numerical values.
In the discrete coded information, 0 indicates that the valve is closed and 1 indicates that the valve is open.

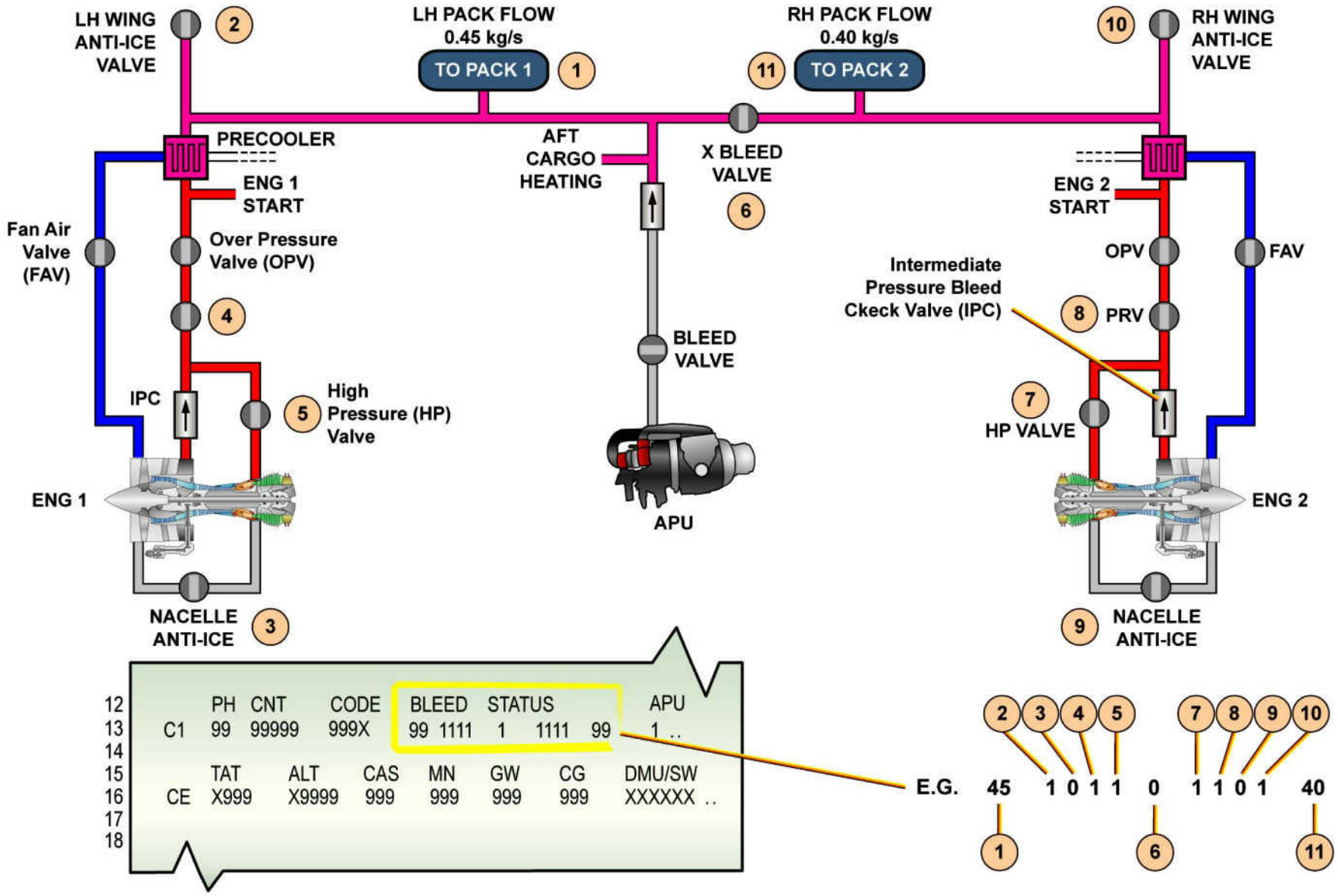


Figure 29 Bleed Status (Example)

CRUISE PERF. REPORT (02) TROUBLESHOOTING

Purpose of this item is, to get a briefly overview about the contents of the AIDS reports on example of the Cruise Performance Report.

The Standard Header of this report was already described on the two pages before.

NOTE: The following described report will be for information only.

A320 Cruise Performance Report (02)

The cruise performance report is a collection of aircraft and engine information averaged over a period of time in which both the engine and the aircraft met the appropriate stability criteria.

Detailed information concerning the Cruise Performance Report and all other Reports you will find in the Aircraft Maintenance Manual Chapter 31–37.

Line: ESN, EHRS, ERT, ECYC, AP, QA, QE

- **ESN**: Engine Serial Number (000000 to 999999)
- **EHRS**: Engine Flight Hours (00000 to 99999 hours)
- **ERT**: Engine Running Time (00000 to 65536 hours)
- **ECYC**: Engine Cycle (00000 to 99999)
- **AP**: Auto Pilot Status (00 to G8)
  FMGC 1 and 2 (FGC part) for Auto Pilot AP1 and AP2
  XY: X -Longitudinal Modes
  XY: Y - Lateral Modes
  – (Example 73:
    7 - Longitudinal Mode: = ALT
    3 - Lateral Mode: = NAV)
    Auto Pilot Status DMU:
    AP1 printed in report line EC, AP2 printed in report line EE
- QA: Aircraft Quality Number, Report Stability (00 to 99)
- QE: Engine Quality Number, Report Stability (00 to 99)

Line: N1, N1C, N2, EGT, FF, PS13

- **N1**: Selected N1 Actual (0 to 120.0 %rpm)
- **N1C**: N1 Command (0 to 120.0 %rpm)
- **N2**: Selected N2 Actual (0 to 120.0 %rpm)
- **EGT**: Selected T494 (–55 to 999.9 C)
- **FF**: Engine Fuel Flow (0 to 7000 kg/h)
- **PS13**: Static Air Pressure at Position 1.3 (0.0 to 30.000 psi)

Line: P25, T25, P3, T3, T5, VSV, VBV

- **P25**: Total Air Pressure at Position 2.5 (0.0 to 50.000 psi)
- **T25**: Selected T25 (–55.0 to 120.0 C)
- **P3**: Selected PS3 (0.0 to 450.0 psia)
- T3: Temperature at Position 3 (–55.0 to 850.0 C)
- **T5**: Temperature at Position 5 (–55.0 to 850.0 C)
- **VSV**: Variable Stator Vane Position (–5.0 to 45.0 deg)
- **EVM**: Engine Vibration Status Word
- **VBV**: Variable Bleed Valve Position (–9.9 to 40.0 deg)

	ESN	EHRS	ERT	ECYC	AP	QA	QE
EC	731945	00178	03617	00140	73	14	08
EE	731543	00693	04216	00511	73		

	N1	N1C	N2	EGT	FF	PS13
N1	0834	0834	0890	5836	1028	06485
N2	0834	0834	0890	5475	1049	06151

	P25	T25	P3	T3	T5	VSV	VBV
S1	12114	0510	1097	3898	3938	034	001
S2	11959	0505	1109	3969	3662	022	012

Figure 30 A320 Cruise Performance Report (Part 1)

CRUISE PERFORMANCE REPORT PART 2

Line: HPT, LPT, GLE, PD, TN, PT2, OIQH

- **HPT**: High–Pressure Turbine Clearance Position(–10 to 100 %)
- **LPT**: Low–Pressure Turbine Position (–10 to 100 %)
- **GLE**: Engine Generator Load (0 to 100 %)
- **PD**: Precooler Inlet Pressure (0 to 50 psi)
- **TN**: Nacelle Temperature
- **PT2**: Total Air Pressure at Position 2 (0.0 to 25.000 psia)
- **OIQH**: Oil Consumption from the previous flight(–9.99 to 20.00 qts/h)

Line: VN, VL, PHA, PHT, VC, VH, EVM

- **VN**: FAN Pick Up N1 Track Vibration (0.0 to 10.0)
- **VL**: TRF Pick Up N1 Vibration (0.0 to 10.0)
- **PHA**: FAN Pick Up Phase Angle (0 to 360 deg)
- **PHT**: TRF Pick Up Phase Angle (0 to 360 deg)
- **VC**: FAN Pick Up N2 Track Vibration (0.0 to 4.0)
- **VH**: TRF Pick Up N2 Track Vibration (0.0 to 4.0)

Line: OIP, OIT, ECW, SSEL

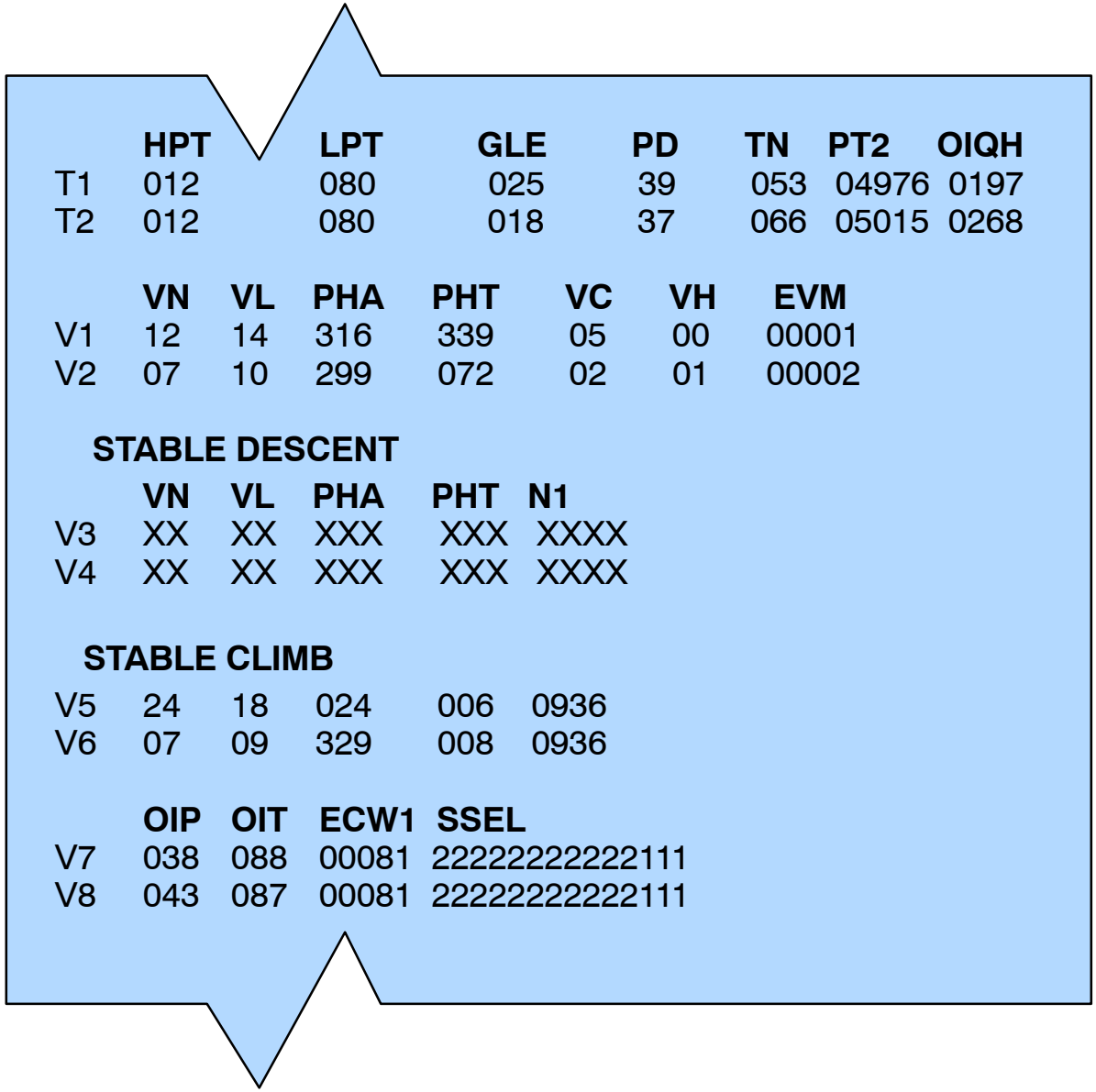
- **OIP**: Engine Oil Pressure (0 to 400 psia)
- **OIT**: Engine Oil Temperature (–60 to 250 C)
- **ECW** (xxxxx):

  Engine Control Word 1 (hexadecimal coded) Each 'X' represents 4 Bits in hexadecimal code of a defined ARINC 429 word:

  X X X X X
  | | || |_____Bits: 14,13,12,11 –> HEX 0..F
  | | ||_____Bits: 18,17,16,15 –> HEX 0..F
  | | |_____Bits: 22,21,20,19 –> HEX 0..F
  | |_____Bits: 26,25,24,23 –> HEX 0..F
  |_____Bits: 29,28,27 –> HEX 0..7

Bit	Parameter Description	
11	Auto Thrust Active	(Active =1)
12	VSV Position Fault	(Fault =1)
13	SPARE	
14	SPARE	
15	Fuel Flow Measurement Invalid	(Invalid =1)
16	N1/N2 Control Active	(Active =1)
17	Channel A Active	(Active =1)
18	Channel A Active	(Active =1)

- **SSEL**: Engine Control Word 1 Status of different FADEC sensors



	HPT	LPT	GLE	PD	TN	PT2	OIQH
T1	012	080	025	39	053	04976	0197
T2	012	080	018	37	066	05015	0268

	VN	VL	PHA	PHT	VC	VH	EVM
V1	12	14	316	339	05	00	00001
V2	07	10	299	072	02	01	00002

STABLE DESCENT

	VN	VL	PHA	PHT	N1
V3	XX	XX	XXX	XXX	XXXX
V4	XX	XX	XXX	XXX	XXXX

STABLE CLIMB

V5	24	18	024	006	0936
V6	07	09	329	008	0936

	OIP	OIT	ECW1	SSEL
V7	038	088	00081	22222222222111
V8	043	087	00081	22222222222111

Figure 31 A320 Cruise Performance Report (Part 2)

CRUISE PERFORMANCE REPORT PART 3

Line: WFO, ELEV, AOA, SLP, CFPG, CIVV

- **WFO**: Fuel Quantity Inner Cell (0 to 99999 kg)
- **ELEV**: Elevator Position (–30 to 15 deg)
- **AOA**: Corrected Angle of Attack (–30 to 85 deg)
- **SLP**: Side Slip Angle (–32.0 to 32.0 deg)
- **CFPG**: Calculated Flight Path Acceleration (–0.9999 to 4.0000 g)
- **CIVV**: Calculated Inertial Vertical Speed (–999 to 999 ft/min)

Line: RUDD, RUDT, AILL,AILR, STAB, ROLL, YAW

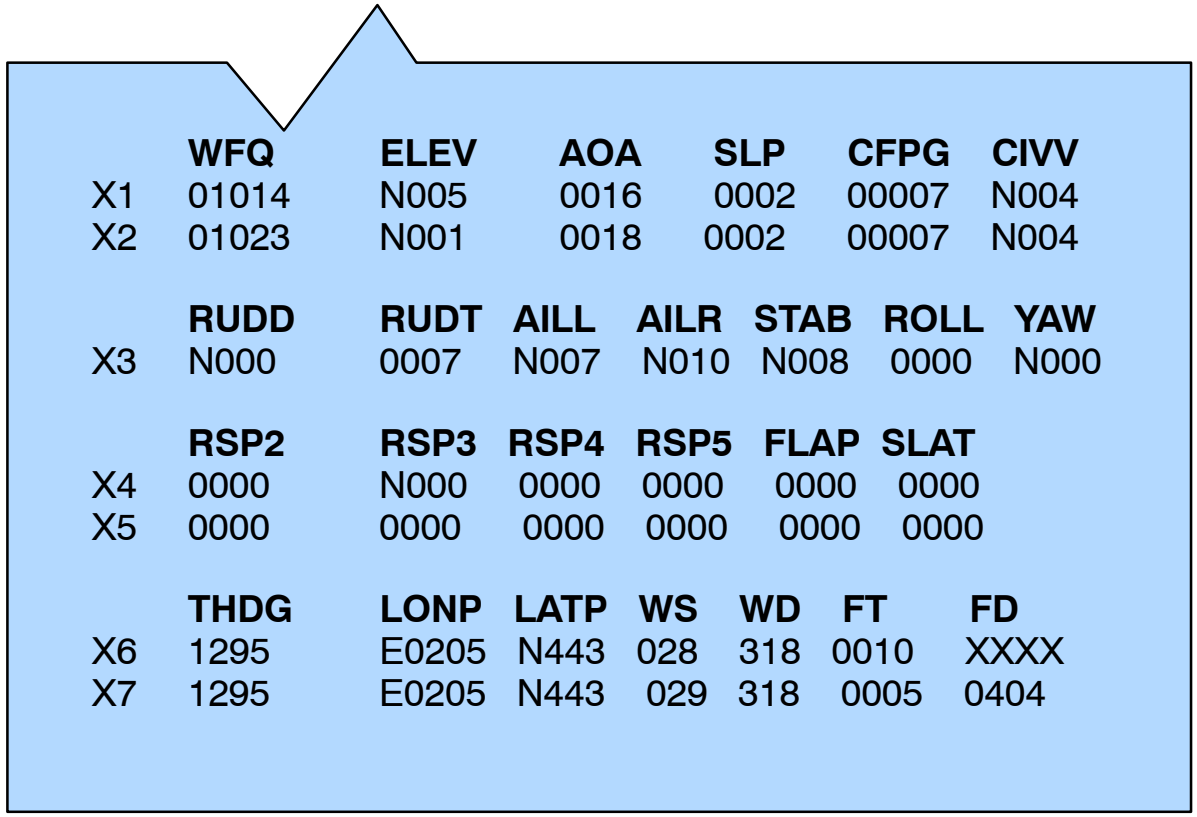
- **RUDD**: Rudder Position (–30.0 to 30.0 deg)
- **RUDT**: Rudder Trim Position (–25.0 to 25.0 deg)
- **AILL**: Left Aileron Position (–25.0 to 25.0 deg)
- **AILR**: Right Aileron Position (–25.0 to 25.0 deg)
- **STAB**: Stabilizer Position 1 (–13.5 to 4.0 deg)
- **ROLL**: Roll Angle (–90.0 to 90.0 deg)
- **YAW**: Body Axis Yaw Rate (–45.0 to 45.0 deg/sec)

Line: RSP2, RISP3, RSP4, RSP5, FLAP, SLAT

- RSP2: Roll Spoiler 2 Position (–45.0 to 0 deg)
- RSP3: Roll Spoiler 3 Position (–45.0 to 0 deg)
- RSP4: Roll Spoiler 4 Position (each –45.0 to 0 deg)
- RSP5: Roll Spoiler 5 Position (each –45.0 to 0 deg)
- Flap: FLAP Actual Position (–9.0 to 40.0 deg)
- Slat: SLAT Actual Position h (–9.0 to 27.0 deg)

Line: THDG, LONP, LATP, WS, WD, FT, FD

- THDG: True Heading (0 to 359.9 deg)
- LONP: Longitude Position (East 179.9 deg to West 179.9 deg)
- LATP: Latitude Position(North 89.9 deg to South 89.9 deg)
- WS: Wind Speed (0 to 100 kts)
- WD: Wind Direction – True (0 to 359 deg)
- FT: Fuel Temperature (–60.0 to 170.0 C)
- FD: Fuel Density (0 to 0.999 kg/l)



	WFQ	ELEV	AOA	SLP	CFPG	CIVV
X1	01014	N005	0016	0002	00007	N004
X2	01023	N001	0018	0002	00007	N004

	RUDD	RUDT	AILL	AILR	STAB	ROLL	YAW
X3	N000	0007	N007	N010	N008	0000	N000

	RSP2	RSP3	RSP4	RSP5	FLAP	SLAT
X4	0000	N000	0000	0000	0000	0000
X5	0000	0000	0000	0000	0000	0000

	THDG	LONP	LATP	WS	WD	FT	FD
X6	1295	E0205	N443	028	318	0010	XXXX
X7	1295	E0205	N443	029	318	0005	0404

Figure 32 A320 Cruise Performance Report (Part 3)

PREVIOUS REPORTS MENU MAINTENANCE PRACTICES

List of Previous Reports

A list of the last 20 reports, initiated automatically or by the remote print button are stored in a nonvolatile memory.

The list contains the report number trigger logic code, date, time and flight leg of report generation.

This information is printed by MCDU request.

The Menu can be displayed on the MCDU.

The procedure is as follows:

- select 'AIDS' on the MCDU Menu,
- select 'List Of PREV REP>' on the AIDS Main Menu,
- the AIDS Previous Report List comes on.

The information for each report consists of:

- NO : number of the report, e.g. 01 means cruise report
- CODE : describes the logic which has triggered the report
- DATE : generation date
- UTC : generation time
- LEG : flight leg when the report was generated e.g. –01 (means report was generated during previous leg.)

Scrolling displays the rest of the list of previous reports.

ATTENTION: To print out these reports the "Stored Reports" Menu has to be entered!

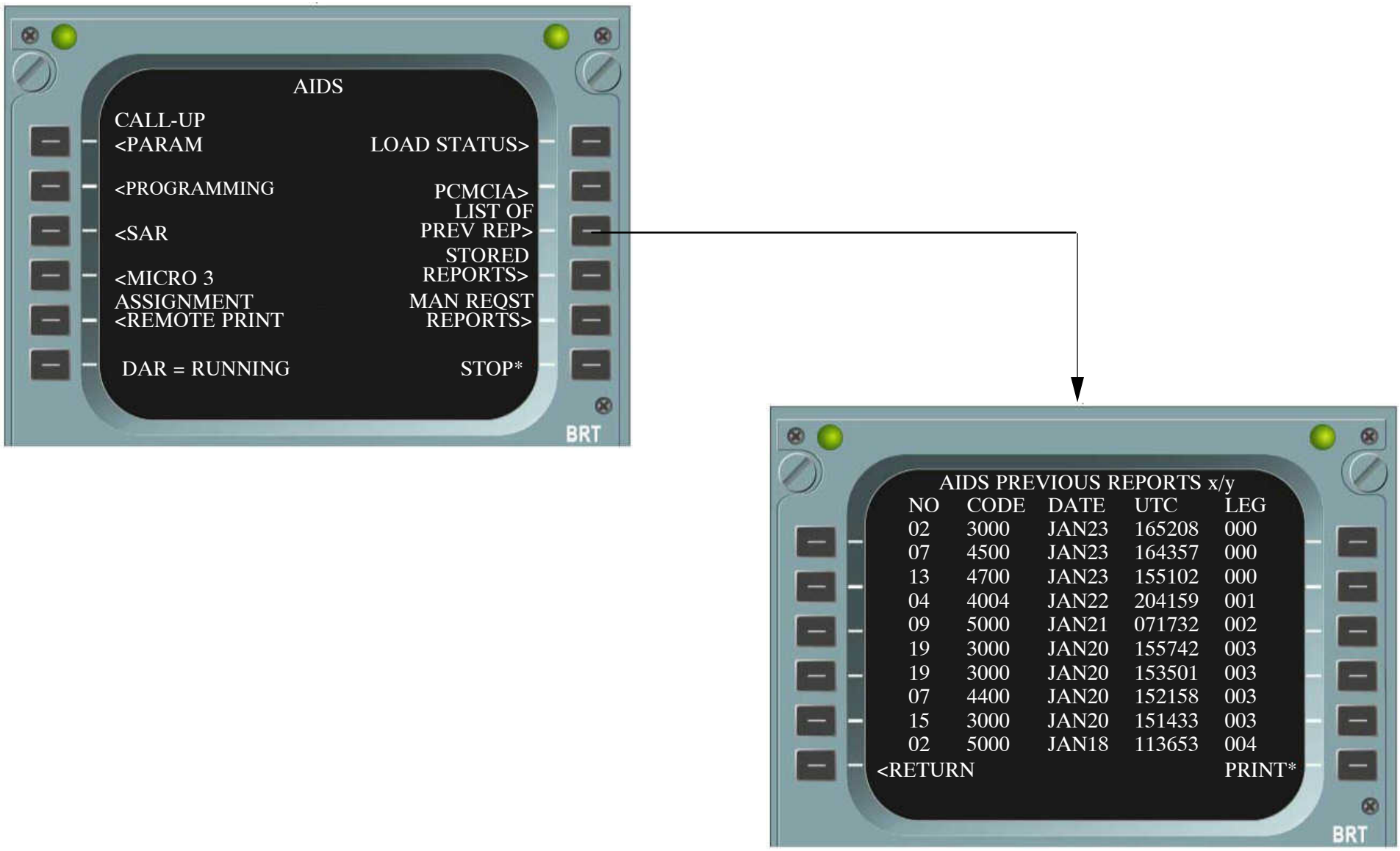


Figure 33 List of Previous Reports

STORED REPORTS MENU MAINTENANCE PRACTICES

List of Stored Reports

Each report, triggered automatically or by the remote print button, is stored in a report buffer.

As soon as a report is printed this report is declared free for deletion, if the print report buffer is full. The oldest free declared report is deleted to enable the storage of an actual report. If the print report buffer is full, with no free declared reports, the oldest report is printed out. Then deleted if storage capacity is required. According to the polling procedure of the printer it may take some time to get a report printed. Therefore, the memory keeps a report at least 120 s.

This permits printing of the oldest report before the actual report is stored in the report buffer.

NOTE: All stored reports are deleted as soon as a new A/C ident is recognized by the DMU.

When a report is stored in the buffer, the following are included in the list of the stored reports:

- the related report with its title and identification number,
- the flight leg in which the report was made
- down link information and a print

The list is presented on MCDU request in menu form as shown in 'AIDS STORED REP'. The menu enables report call for printing and/or link via ACARS. Printing or downlinking is also possible for those reports which are already printed or sent to ACARS.

Print-Out Rules

AIDS reports which are stored in the print report buffer (maximal 10 reports), may be printed and/or transmitted to ACARS by manual request via the MCDU. The procedure is as follows:

- select 'AIDS' on MCDU Menu,
- select 'Stored Rep SEND/PRINT>' on the AIDS Main Menu,
- the AIDS Stored Report Page comes on.

A list of all stored AIDS reports is presented on the screen.

Activating the scroll key will cause all 10 lines to be rotated, in the direction indicated in order to present the next 5 reports.

Below each report some remarks can be displayed described as follows:

'DNLKD' means that the report was successfully downlinked by ACARS.

'IN ACARS' means that the report was sent from 'AIDS' to the 'ACARS MU' but reception from the ground station was not yet confirmed.

'LEG – 01' e.g. means that the report was generated during the previous flight leg. 'PRINTED' means that the report was already printed.

If the printer is available and not busy, an asterisk appears besides each report on the right side. If ACARS is available, an asterisk appears besides each restart the print out of the desired report by activating the appropriate LS key on the right side of the screen (below 'PRINT').

Initiate sending a report to ACARS by activating the appropriate LS key on the left of the screen (below 'SEND'). The asterisk then disappear from the screen as long as the printer or ACARS are occupied.

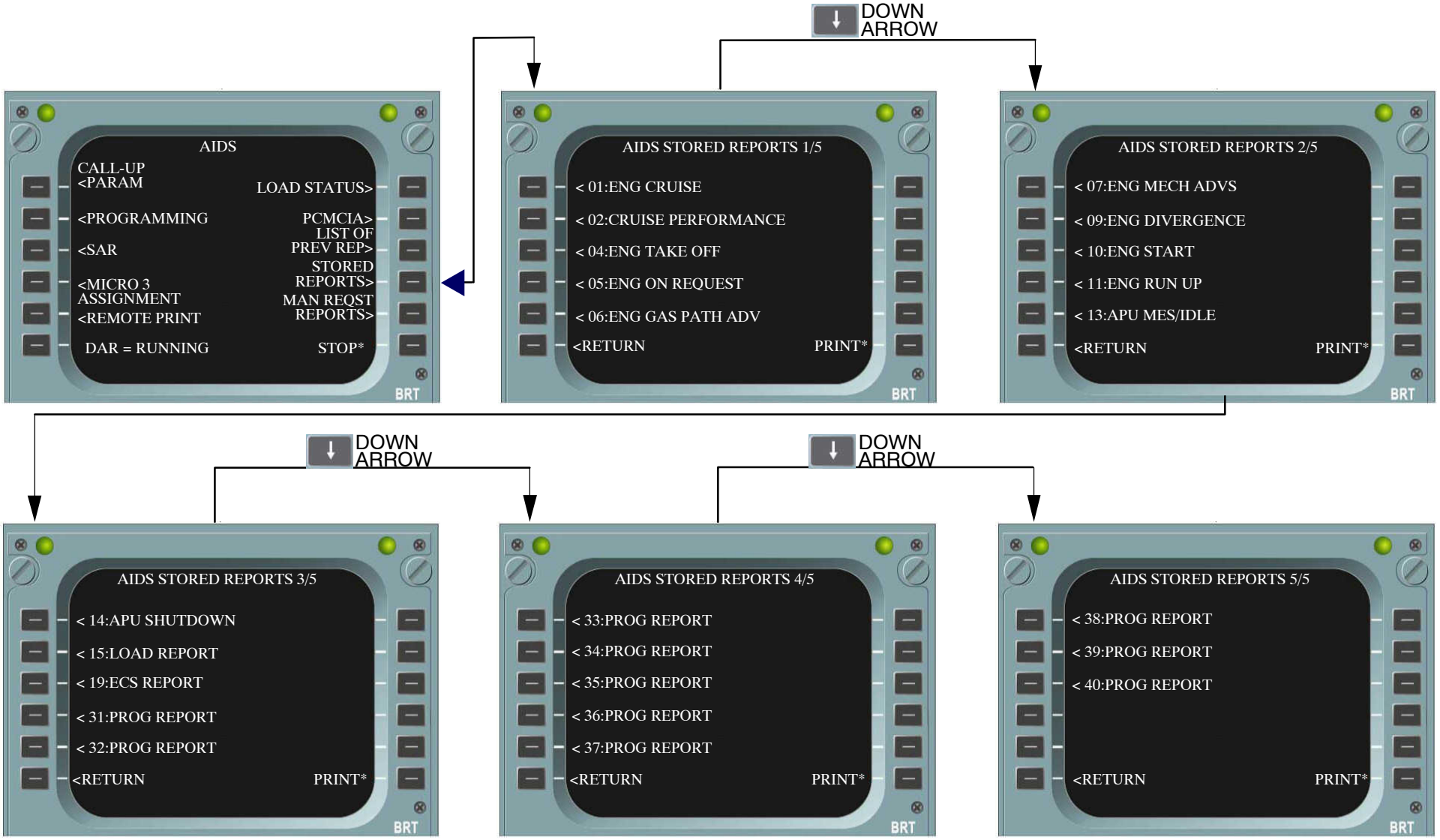


Figure 34 List of Stored Reports

MANUAL REQUEST REPORTS MAINTENANCE PRACTICES

Manual Request Reports

The 'MAN REQST REPRT' page shows a list of all AI reports, which is generated, if you push the adjacent line key.

The 1L key is used to roll options 'PRINT, SEND (ACARS) or STORE'

An asterisk '*' is displayed at the beginning of each report, if only a single data set or format is defined for the related report.

If multiple formats or data sets are defined for a report, the '<' character is displayed instead of the asterisk

If the report storage is full and a generated report is stored in the report buffer, the oldest free declared report is deleted to enable the storage on an actual report. In case that the report storage is full with no free declared reports the oldest report is printed and deleted if stored capacity is required.

When a report is set and complete generated it is printed or sent via ACARS.

The procedure to get access to the MANUEL REQUEST REPORT is as follows:

- Set 'AIDS' on the MCDU Menu.
- Set 'MAN REQST REPORTS' on the AIDS Main Menu.

Possible Scratchpad Messages:

Message	Explanations
NOT ALLOWED	– Invalid LSK or – Invalid MCDU Mode Key or – Up, Down – Arrow Key
GENERATION IN PROGRESS	– Display after selection of a report for manual request and until report is printed or downlinked via ACARS
REPORT NOT READY	– Selected report can not be currently generated because, generation of this report is in progress due to an automatic trigger
PRINTER NOT AVAILABLE	– Printer not operative ––> Print Out aborted
PRINTER BUSY	– Printer used by other system ––> DMU waits for print out
QUEUED TO PRINTER	– Report is in the printer queue ––> Ready to print out
ACARS NOT AVAILABLE	– ACARS–MU not operative ––> Downlink aborted
ACARS BUSY	– ACARS–MU is busy with other systems ––> DMU waits for downlink
QUEUED TO ACARS	– Report is in the ACARS queue ––> Ready to be downlinked

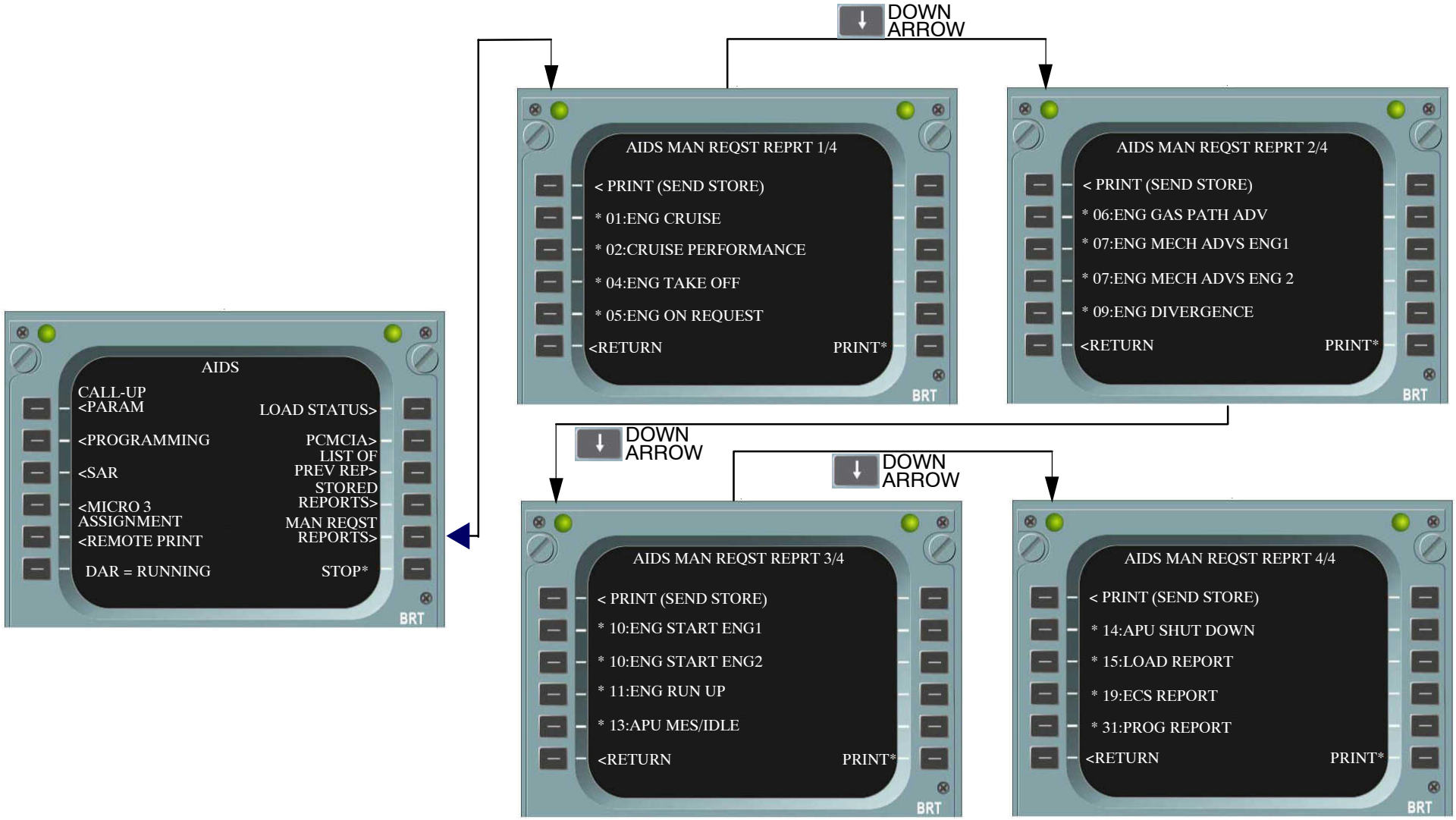


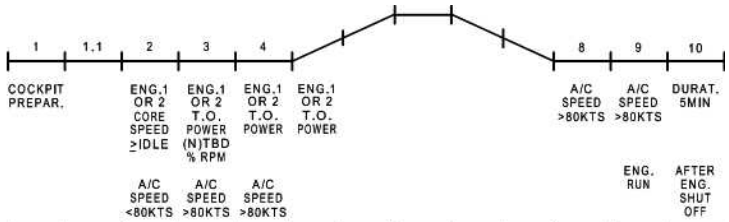
Figure 35 Manual Request Reports

DMU FLIGHT PHASE DETECTION OPERATION

The DMU divide the flight leg into separate flight phases.

The flight phase determination is mainly based on the FWC (Param. 26.1.126.01 or 26.2.126.10 Bits 14 to 11).

The determination of a new flight phase is independent from the previously encountered flight phase.



PARAMETER NO		ELEC. POWER ON	ENGINE START	TAXI OUT	TAKE OFF ROLL1	TAKE OFF ROLL2	TAKE OFF CLIMB	CLIMB	CRUISE	DECENT	FINAL APPR.	LANDG. ROLL	TAXI IN	ENGINE SHUT DOWN
6D.1.021.01.12 6D.1.021.01.13 6D.1.021.01.14	NOSE GEAR LH GEAR RH GEAR	GROUND		GROUND	GROUND	GROUND	AIR	AIR	AIR	AIR	AIR	GROUND	GROUND	GROUND
26.1.126.01 BIT 11-14	FWC FLIGHT PHASE	0001		0010	0011	0100	0101	011O	0110	0110	0111	1000	1001	1010
SEE PAGE 114	STARTER AIR VALVE		EITHER OPEN											
04.1.365.01	IVV INTERT. VERT. VELOCITY							>=IVV1	<=IVV3	<=IVV2				
06.1.203.01	ALT								>=ALT1	<=ALT2				
1B.1.127.01	SLAT							<SLAT1						
7C.1.133.01 7C.2.133.10	THROTTLE RESOLVER ANGLE													

IVV1= 400FT/M
IVV2= -400FT/M
IVV3= 400FT/M

ALT1=10000FT
ALT2=10000FT
SLAT1=5°

EACH FLIGHT PHASE SHALL BE STABLE UNTIL THE CONDITIONS FOR A NEW FLIGHT PHASE IS MET

Figure 36 DMU Flight Phase Chart

Special Rules for KG and Deg C.

All parameters for which an alpha acronym is defined in the parameter list is available for alpha call–up. With a single call–up system 1 and 2 parameters are displayed in engineering units.

The DMU is observe bit 18 and bit 27 of DMC label 305.

If bit 18 = 1, then the parameter values are shown in print out and alpha call–up in the following units:

- fuel flow (eng 1 and 2):
  - lbs/hours instead of Kg/hours (7C.1.244.01, 7C.2.244.10)
- gross weight:
  - lbs instead of Kg (02.1.075.00, 02.2.075.00)
- pack flow:
  - lbs/sec instead of Kg/sec (8E.1.126.11, 8E.2.126.00)
- bleed air flow:
  - lbs/sec instead of Kg/sec (7A.1.123.01)
- fuel quantity:
  - lbs instead of Kg (5A.2.256.10, 5A.2.257.10, 5A.2.260.10, 5A.2.261.10, 5A.2.262.10, 5A.2.247.10)

If bit 27 = 1, then the parameter values are shown in print out and alpha call–up in following units:

- comfort temperatures ckpt, cab temp:
  - deg F instead of deg C (29.1.242.01, 29.2.242.01, 29.1.244.01, 29.2.244.01, 29.1.245.01, 29.2.245.01)

FLIGHT PHASES 1.1, 5.1 & 7.1 INTERNALLY CALCULATED BY THE DMU.
ALL OTHER FLIGHT PHASES TAKEN FROM THE FWC 1

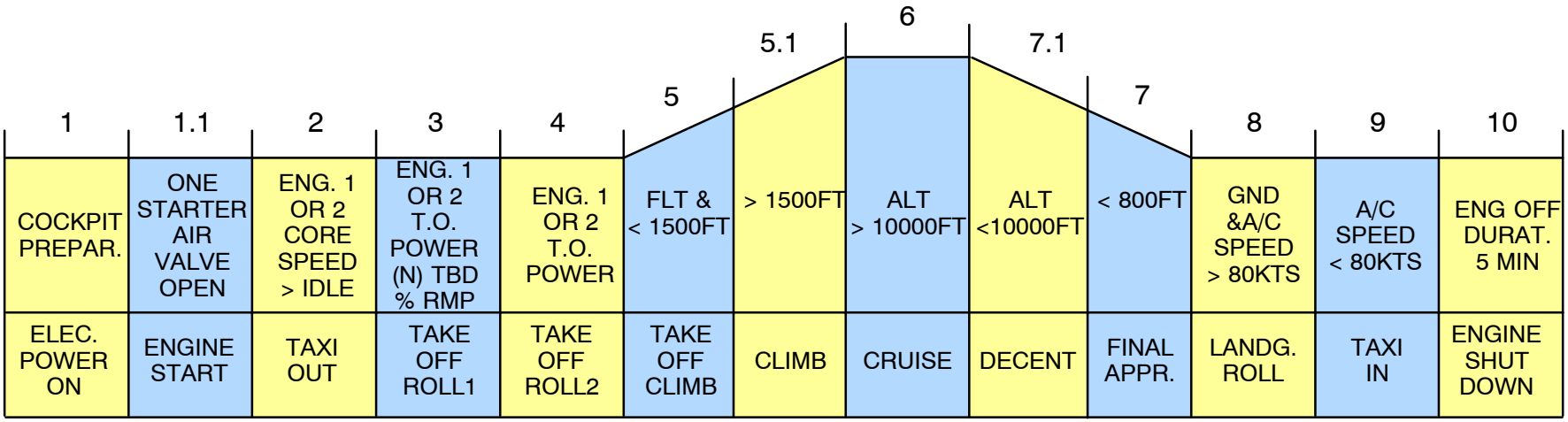


Figure 37 DMU - Flight Phase Detection

REMOTE PRINT OPERATION

Remote Print Assignment Menu

The 'Remote Print' page displays the Report Number, Engine Number, DMU Internal PH and Incrementation of report counter (Y=incremented N=not incremented).

To initiate manually some specific reports a remote print button 3TV (AIDS PRINT) is located on the pedestal in the cockpit.

Also SAR recording is triggered through the print button. The report/SAR channel assignment of the remote print button is GSE programmable.

Procedure to select the Remote Print Page

The procedure to select the Remote Print page is as follows:

- Set 'AIDS' on the MCDU menu.
- Set 'REMOTE PRINT' on the AIDS main menu.

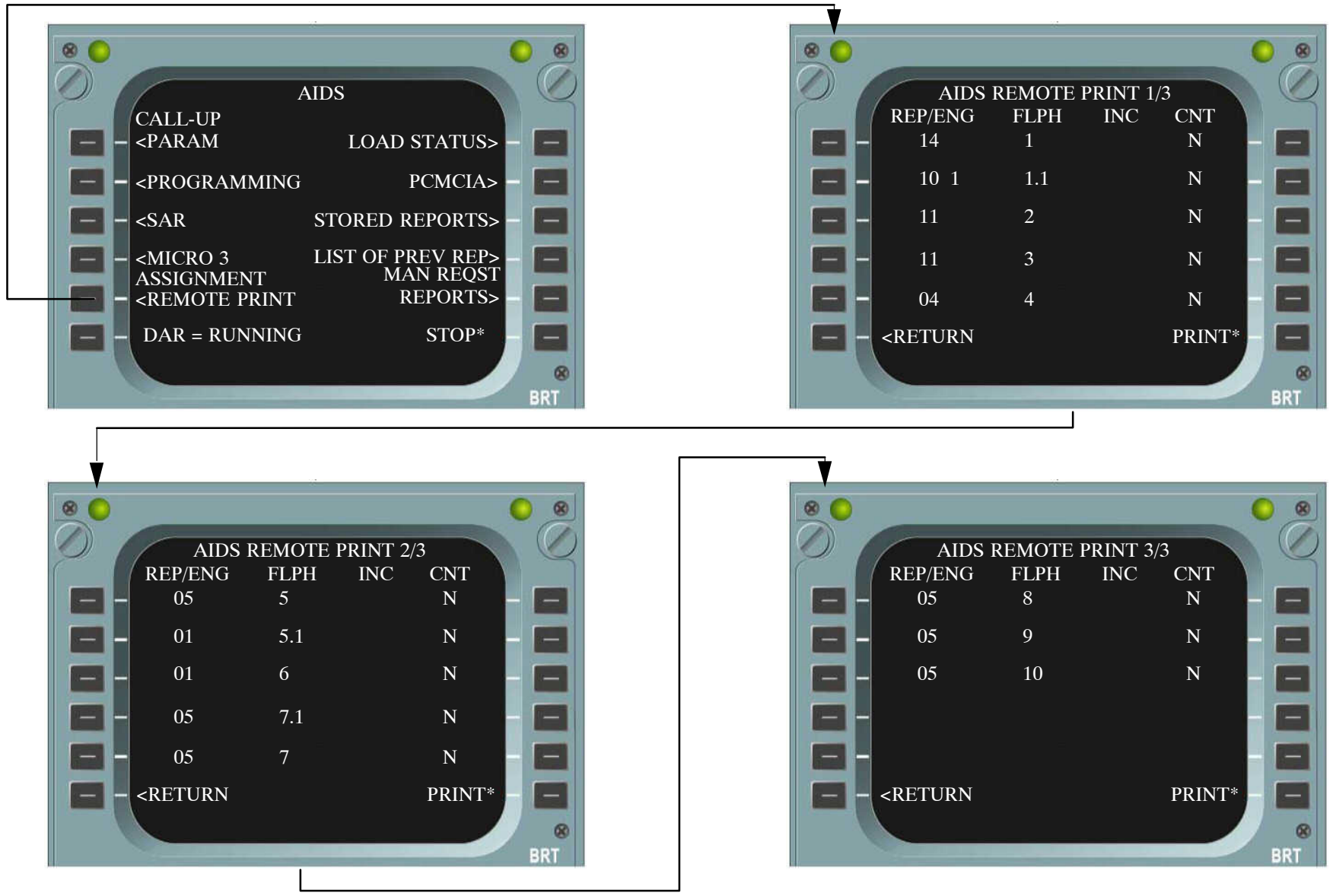


Figure 38 Remote Print Assignment Menu

DMU COMPONENT DESCRIPTION

General Functions of the DMU

The design of the DMU allows its use in A/C with different input parameters and different tasks for data evaluation, if the appropriate programs are implemented.

To ensure this capability, the unit is able to identify A/C type information on the FDIU ARINC 429 DITS data bus.

Depending on the occurrence of specific conditions or events, the DMU is trigger predefined actions.

As a result of specific trigger conditions AIDS reports may be generated or data may be recorded on the DAR (optional) or stored in the DMU internal SAR (**S**mart **A**ccess **R**ecorder). Print reports can be either printed out on the cockpit printer or transmitted via ACARS (optional).

SAR data are also retrieved via the PDL (**P**ortable **D**ata **L**oader).

Functions which are specific to A/C type (CFMI or IAE engines) are indicated in the respective logic definition.

The A/C type coding, parameter 17.1.304.00, is shown below:

Engine Type	Bit 16	Bit 15	Bit 14	Bit 13	Bit 12
For CFM 56–5	0	1	0	0	1
For IAE V2500	0	1	0	1	0
No Code Programming	0	0	0	0	0

If the code for no programming is received, the DMU works according to the A/C type code from the last flight. If there is no coding from the last flight, the DMU works with the CFMI type code.

Parameter Label Call Up

Each parameter (ARINC 429 data word) transmitted on one of the connected data buses is selectable, you use: EQ, source system, label, SDI and number of data bits for display on the MCDU. The number of data bits can be omitted.

The displayed parameters are updated once per second.

The menus are shown in 'AIDS PARAM LABEL CALL–UP'. Up to 2 parameters can be displayed on one page. 8 pages can be selected via slew up/slew down button, which leads to a maximum number of 16 parameters to be monitored simultaneously.

Parameter Alpha Call-up

A parameter alpha call up is possible for all the parameters for which an alpha code is mentioned in the parameter list. The selection is performed by their alpha codes via the MCDU.

If parameters from two systems are available, both parameters are displayed on the MCDU upon a single alpha call–up code entry.

The display values will refreshed once per second.

All numeric type alpha call–up parameters will displayed on the MCDU in engineering units.

The display format is a floating point representation of max. 6 characters including the decimal point and the '–' sign, if applicable.

In case of positive numbers without decimal point all 6 characters shall be available for digits. Display of leading zero shall be suppressed.

The applicable units shall be displayed below the alpha call–up code on the MCDU screen.

Alpha call–up parameters, which consist of a combination of several discrete bits or packed discretes will displayed in HEX.

Discrete alpha call–up parameters shall be displayed using English status indications of max. 6 characters together with the actual bit status. The unit indication on the MCDU screen shall be 'DISCRETE'.

Additional Parameter Programming

If a new label (parameter) is used in the DMU (for other than a parameter label call–up) it must be programmed via the GSE (**G**round **S**upport **E**quipment).

EUC (Engineering Unit Conversion)

The DMU provide an 'Engineering Unit Conversion Table' to convert a selected group of input parameters (same as supplied with alpha call–ups) into the applicable engineering units. The EUC table is associated to the alpha call–up table.

The GSE reconfiguration software allow to add or modify the conversion constants. Modifications are made by specifying a single scale constant, number of data bits and sign.

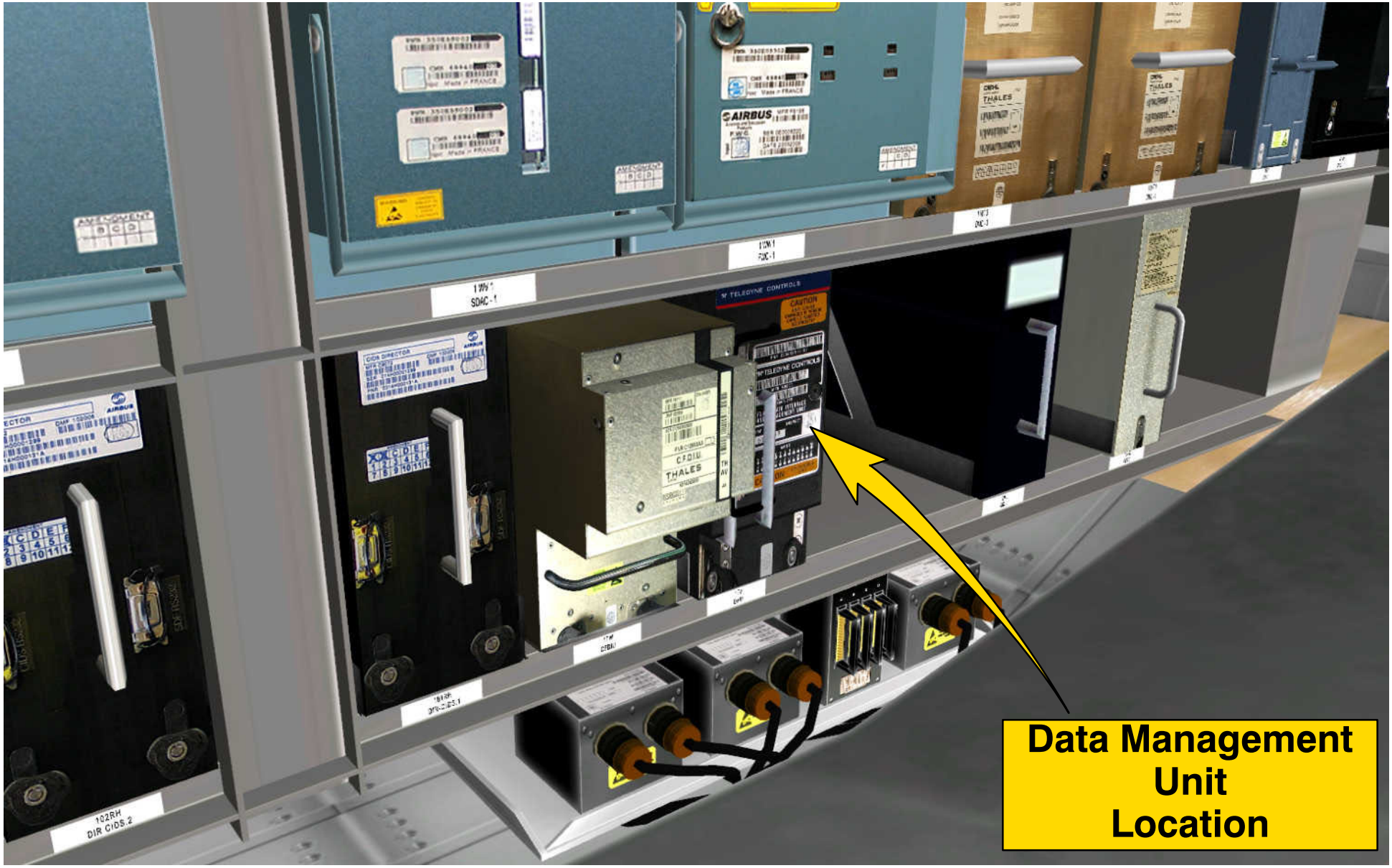


Figure 39 Data Management Unit (Aft Avionics Compartment)

PARAMETER ALPHA CALL-UP MAINTENANCE PRACTICES

Parameter Alpha Call-up

The Parameters and Abbreviations are listed in the alpha call–up table.

The selection is possible by their alpha codes.

If parameters from two systems are available, both parameters are displayed on the MCDU upon a single alpha call–up code entry.

The displayed parameter values are refreshed once per second.

All numeric type alpha call–up parameters are displayed on the MCDU in engineering units. The display format is a floating point representation of max. 6 characters including the decimal point and the '–' sign if applicable.

In case of positive numbers without decimal point all 6 characters are available for digits. Display of loading zeros are suppressed.

The applicable units are shown below the alpha call–up code on the MCDU screen.

Alpha call–up parameters, which consist of a combination of several discrete bits or packed discretes are displayed in hexadecimal representation. In this case the indication of the applicable units of the parameter are 'HEX'.

Procedure to select the Parameter Alpha Call-Up Menu

The procedure to select the Parameter Alpha Call–Up Menu is as follows:

- Set 'AIDS' on the MCDU Menu.
- Set 'PARAM' on the AIDS Main Menu.
- Set 'PARAM ALPHA CALL–UP' on the AIDS Parameter Call–Up Menu.
- Enter the Alpha Call–Up Code on the adjacent LSK

Display Indications:

ALPHA	Alphanumeric name for specific aircraft parameter
SOURCE	Name and system number of the source computer of sub-system
POSITION	Position identifier referenced to the aircraft
VALIDITY	Validity of Alpha Call–up parameter: – ':' (white) parameter has been updated and contains valid SSM – '>' (green) parameter has not been updated – '<' (green) parameter contains invalid SSM
VALUE	Value of parameter in engineering units
UNITS	Units associated with parameter

Possible Scratchpad Messages:

Message	Explanations
NOT ALLOWED	– Invalid LSK or – Invalid MCDU Mode Key or – Up, Down – Arrow Key
UNKNOWN ALPHA CODE	– No valid Alpha Call–Up ASCII code up to 5 characters. – Any further undefined characters – Alpha Call–Up code is not defined within the DMU Database Software

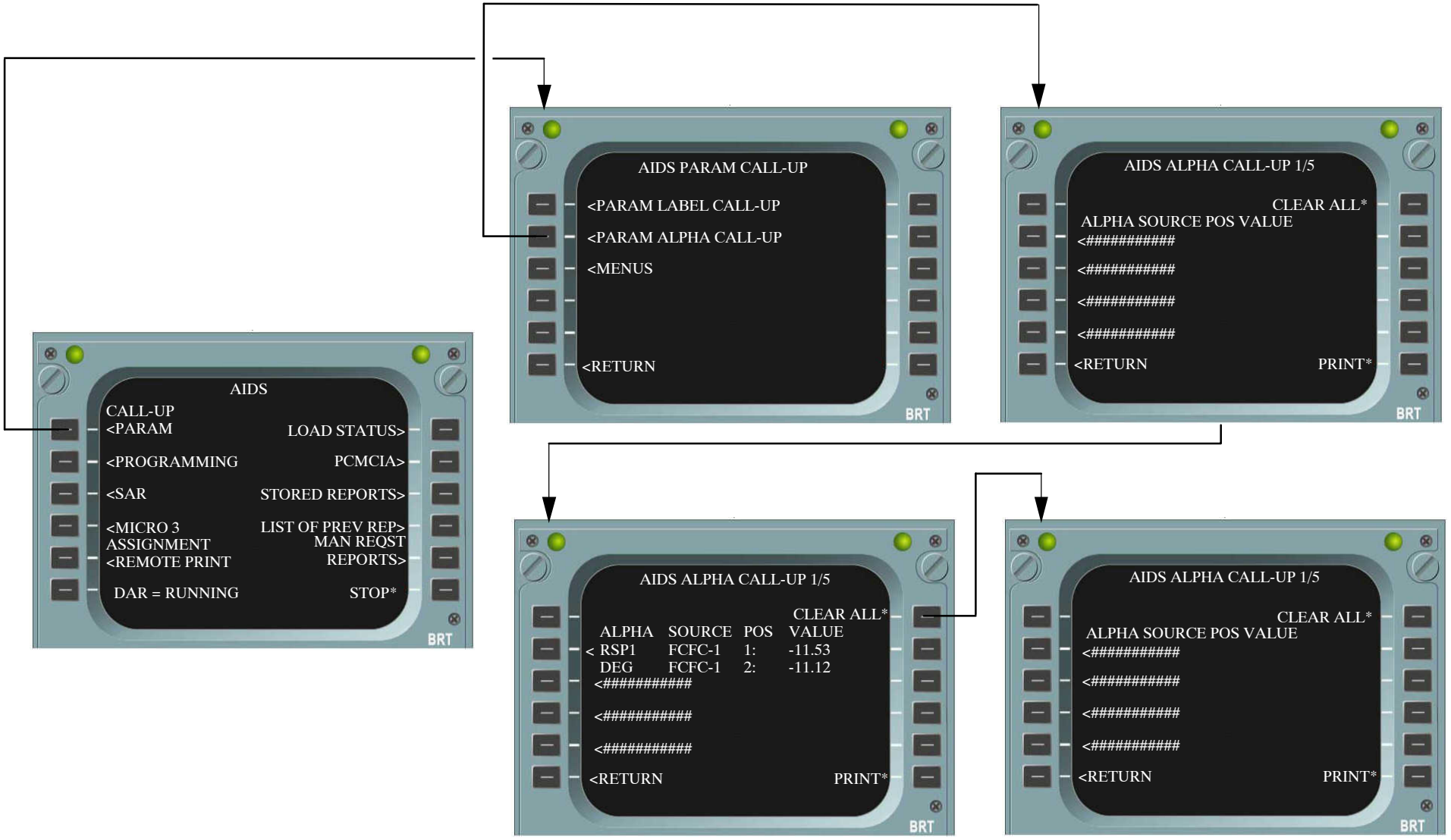


Figure 40 Parameter Alpha Call-Up

PARAMETER ALPHA CALL-UP - EXAMPLE

Read out of Thrust Lever Position and EGT

Both engines are started and in GRD Idle.

- On the MCDU we get access to the Aids Menu.
- Select Call-UP Param.
- Select Param Alpha Call Up.
- Enter TLA in scratchpad.
- Select LSK 2L.
- Enter EGT in scartchpad.
- Select LSK 3L.

Alpha Call Up List

The complete list of available Alpha Call Ups can be found in the AMM Chapter 31–37–00 System Description

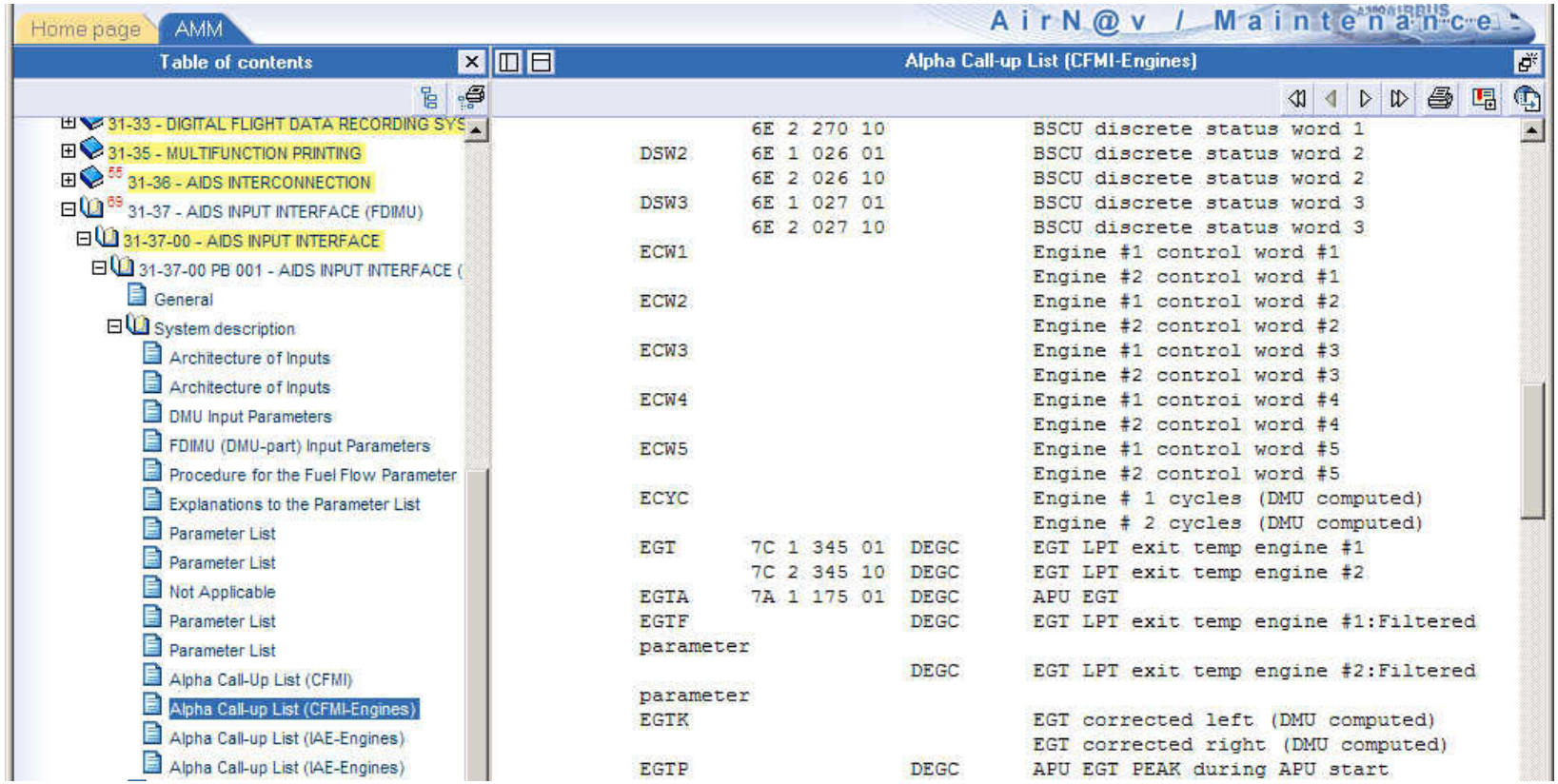


Figure 41 Alpha Call up List in the AMM

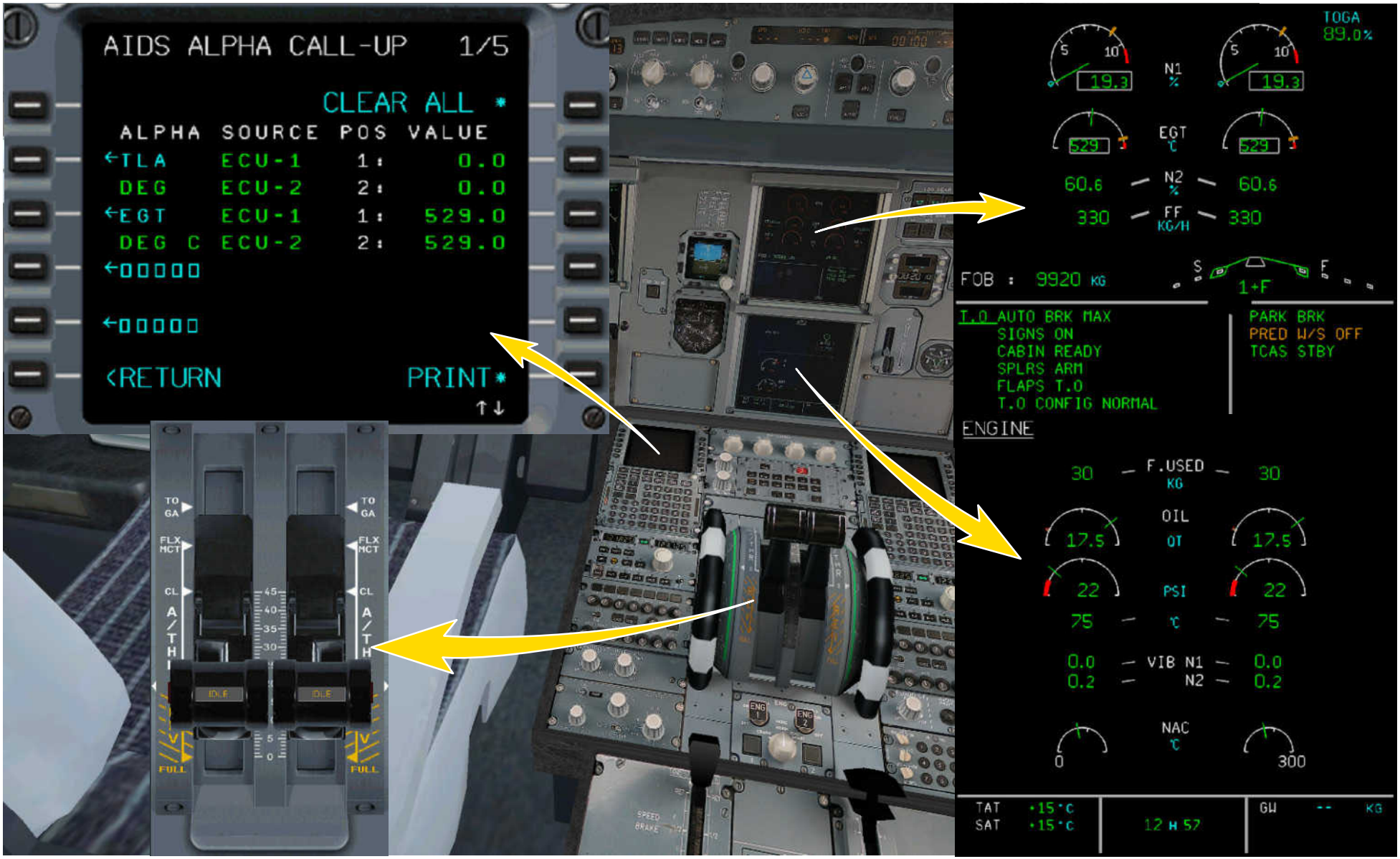


Figure 42 Alpha Call-Up Example (IDLE)

Read out of Thrust Lever Position and EGT

Push thrustlever 1 to Climb Thrust.

EGT values change with short time delay.

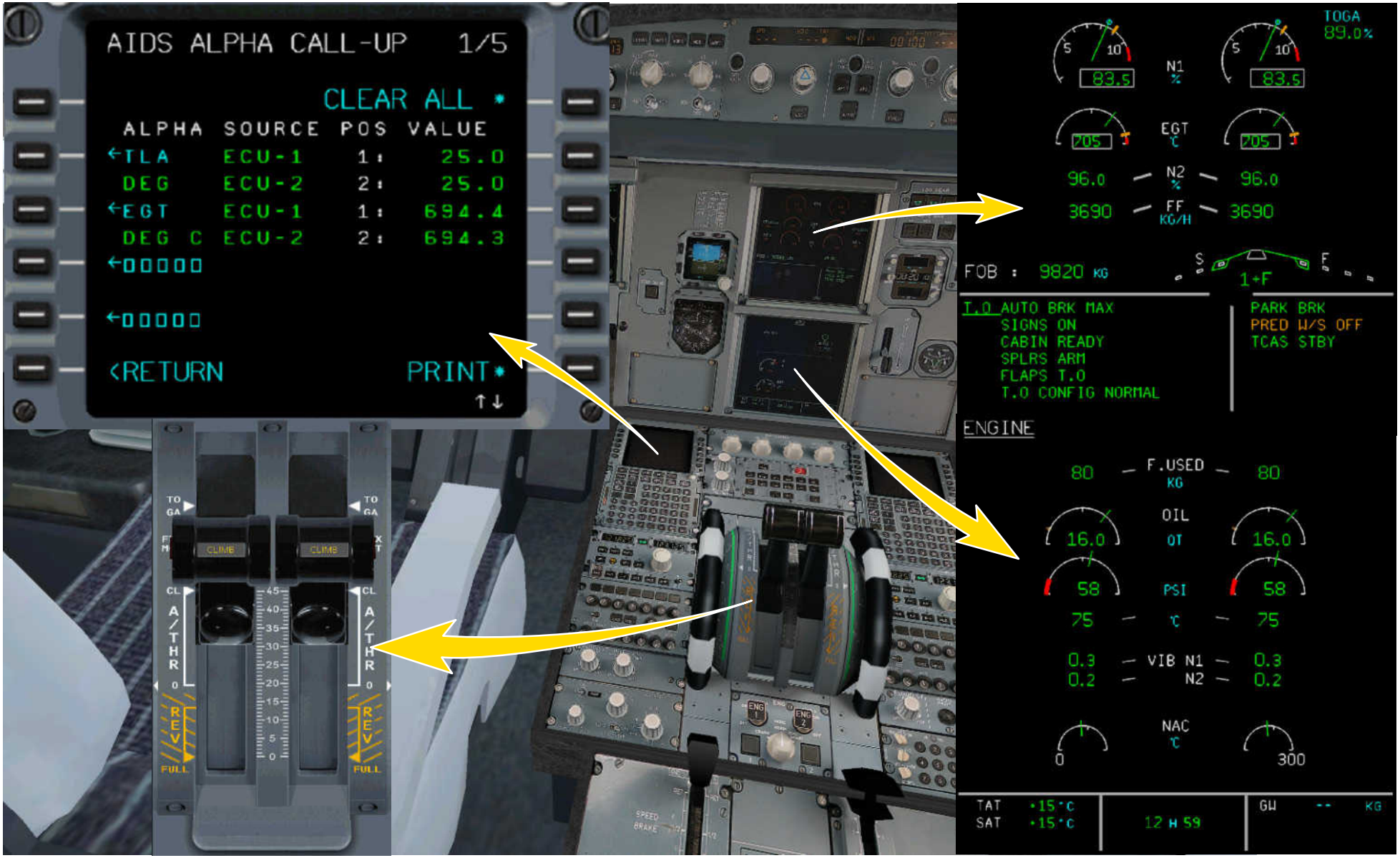


Figure 43 Alpha Call-Up Example (CLIMB)

PARAMETER LABEL CALL UP TROUBLE SHOOTING

Parameter Call Up

Each parameter transmitted on one of the up to 64 ARINC 429 connected data buses are selectable for display on the MCDU screen.

The selection are made using EQ, source system, label and SDI.

Additionally the number of data bits to be used for decimal representation are selectable.

The parts of the parameter number are isolated with a slash '/'.

The number of the data bits can be omitted. The default value is 18.

The displayed parameters are updated once per second. Up to 2 parameters are displayed on one page. 8 pages can be selected via slew up/slew down button, which leads to a maximum number of 16 parameters to be monitored simultaneously.

Example : Parameter Call–Up with EQ and System Number
EQ/SYS/LAB/SDI = 1A/2/156/01

Procedure to select the Parameter Label Call-up Menu

The procedure to select the Parameter Label Call–Up Menu is as follows:

- Set 'AIDS' on the MCDU Menu.
- Set 'PARAM' on the AIDS Main Menu.
- Set 'PARAM LABEL CALL–UP' on the AIDS Param Call–Up Menu.
- Enter the parameter (e.g. 1C/1/344/01/12) on the scratchpad
- Set the 1L key

Menu Definitions:

- EQ ARINC 429 equipment identification:
  two–digit hexadecimal character e.g. 1B (for SFCC)
- SYS System Number: one character (only 1 to 4)
- LAB ARINC 429 Label:
  three–digit octal character (valid entries 000 – 377)
- SDI Source Destination Identifier:
- valid entries 00, 01, 10, 11 and XX
  (XX represents a case in which the DMU samples the parameter without looking at the SDI field)
- DATABITS identifies which ARINC 429 bits to extract from the label call–up parameter and show as decimal value
  (valid entries1 to 20)
- VALIDITY validity of the requested parameter:
  '>' parameter has not been transmitted/updated.
  Blank' parameter has been updated.
- SSM Sign Status Matrix: is taken from bits 31 to 29 of the parameter and shows in binary form.
- DECIMAL Decimal value of the parameter calculated using the 'DATABITS' VALUE entry to specify the number of bits to use as data. The decimal value is calculated assuming the extracted data bits as a whole represent a 2's complement value. For example 'DATABITS' of 12 results in the decimal display of ARINC 429 bits 28 to 17. A 'DATABITS' entry of 20 results in a decimal display of ARINC 429 bits 28 to 09.
  If bit 29=0, then the decimal equivalent of the two complement of the 'DATABIT' value will be preceded with a negative sign.
- BINARY Binary Data (bits 28 to 11) of the parameter are shown on the DATA on the line below the label 'DATABITS 28–11'

Possible Scratchpad Messages

- NOT ALLOWED
- INVALID ENTRY
- UNKNOWN EQ/SYS IDENT

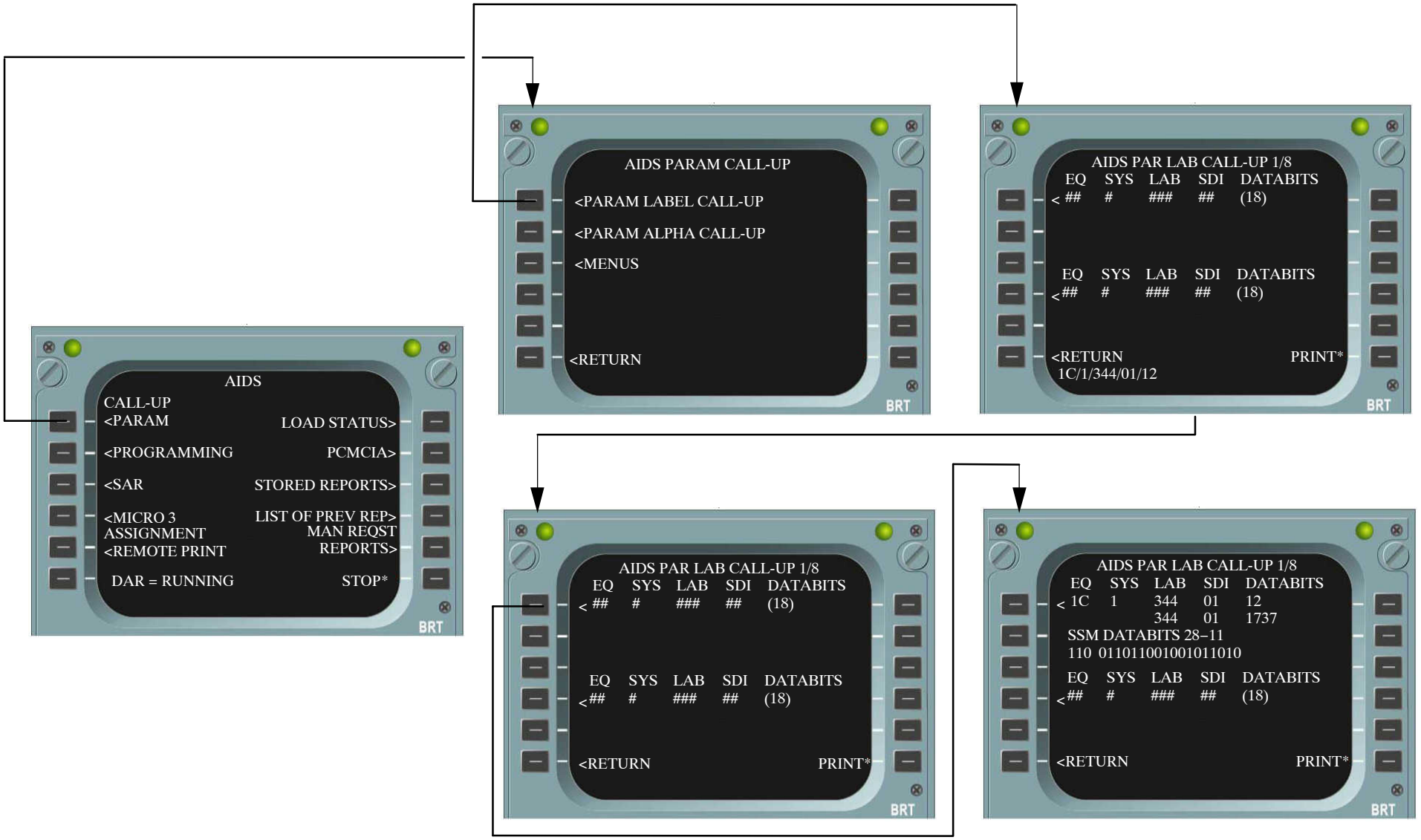


Figure 44 Parameter Label Call-Up

PARAMETER LABEL CALL UP-EXAMPLE TROUBLE SHOOTING

NOTE: This Example can be performed on the Cockpit Maintenance Simulator

Starter Air Valve

During this example we will check the correct working of the starter shut off valve during an engine start sequence.

WARNING: THIS EXAMPLE IS ONLY FOR TRAINING AND WILL NOT PRESCRIBE A VALID TASK FROM THE MAINTENANCE MANUAL.

Background

The starting system of the engine utilizes pressurized air to drive a turbine at high speed. This turbine drives the engine high pressure rotor through a reduction gear and the engine accessory drive system.

The air which is necessary to drive the starter comes from:

- either the APU,
- or the second engine,
- or a ground power unit.

The starter supply is controlled by a starter SOV (**S**hut–**O**ff **V**alve) pneumatically operated and electrically controlled. In case of failure, the SOV can be operated by hand.

The starter valve closes when the N2 speed reaches 50 percent.

Engine starting is controlled from the ENG start panel 115VU located on center pedestal and ENG/MAN START switch on the overhead panel.

The starting sequence may be interrupted at any time by placing the MASTER control lever in OFF position which overrides the FADEC.

Normal Starting Procedure (automatic)

The starting sequence is fully controlled by the FADEC and is selected when the ENG/MODE/CRANK/NORM/IGN START selector switch is in IGN/START position and the MASTER control lever in ON position. Start can be aborted on ground only by the FADEC in case of failure.

Parameter List

A list of all AIDS Parameter Label Call-Ups you find in ATA 31–37–00, AIDS Input Interface - System Description - Parameter List

The course of events

Referring to ATA 31–37–00 we find the Parameter List.

The Starter Valve will be controlled from the ECU (**E**ngine **C**ontrol **U**nit).

As given in the Parameter List get the Equipment Identifier „7C“ for ECU 1&2.

For further details we have to refer to Chapter 73–25–00.

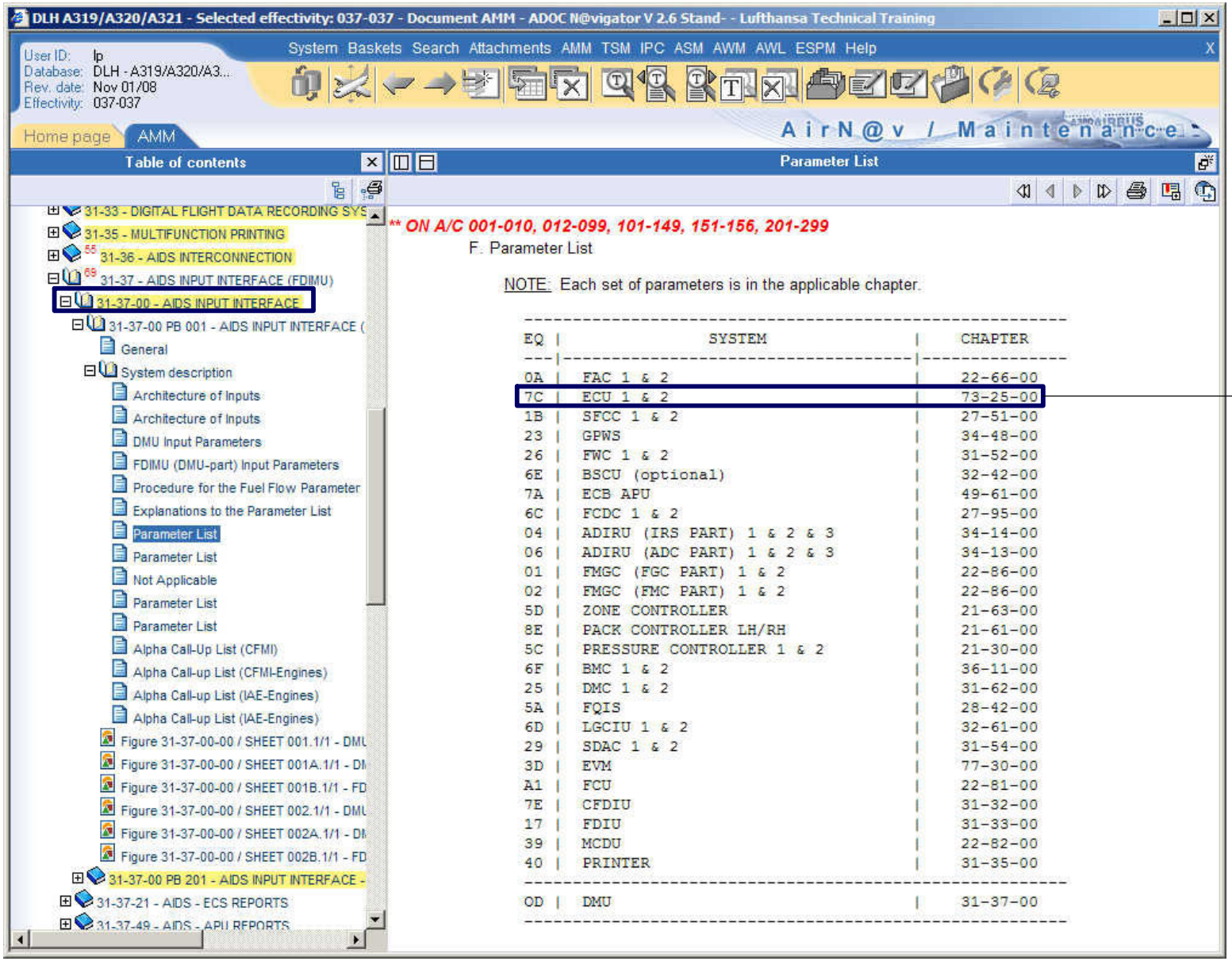


Figure 45 AIDS Parameter List - Label Call-Up

The course of events (cont)

In the Chapter 73–25–00 we refer to the Item „Functional Interfaces“ PG Block 001, „System Descriptions“, „EIU/ECU Interface“.

In the Menu „EIU/ECU Interface“ we will find various of Parameter Lists.

One of them is the table:

ECU STATUS Word 1 - LABEL 270

ECU ARINC Output Bus Data (Discrete)

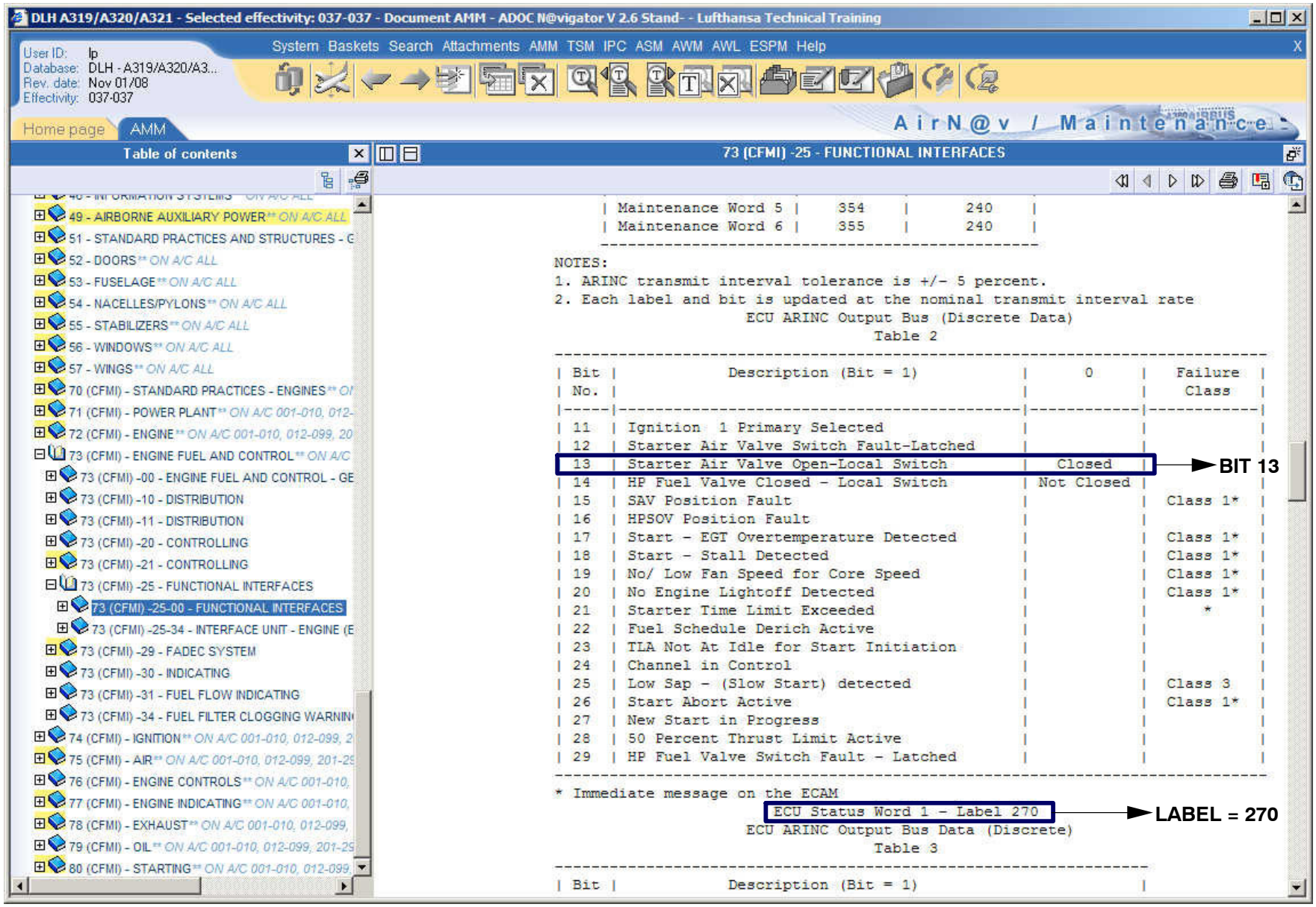


Figure 46 Label 270/BIT 13

The course of events (cont)

Data known:

Equipment Identifier - 7C (ECU)

System - 1 (We take Engine 1 (ECU1))

Label - 270

Source Destination Identifier SDI - 01

BIT 13 - Starter Valve

- „1“ Not Closed
- „0“ Closed

Now we get access to the MCDU and we select AIDS.

After that we have to select the menu

- „Call UP Param“
- „Param Label Call Up“

to get access to the Label Call-Up Menu.

Here we type in: 7C/1/270/01

NOTE: To get an indication, you must energize the FADEC first.

Background Information: ARINC 429 Data Word

An ARINC 429 data word always has 32 Bits, even when not all of them are needed.

These 32 Bits are divided as follows:

- Bit 1–8: Label / Address,
- Bit 9–10: Source / Destination Identifier,
- Bit 11–28 (29): System Data,
- Bit (29) 30–31: Sign/Status Matrix,
- Bit 32: Parity Bit (Odd Parity)

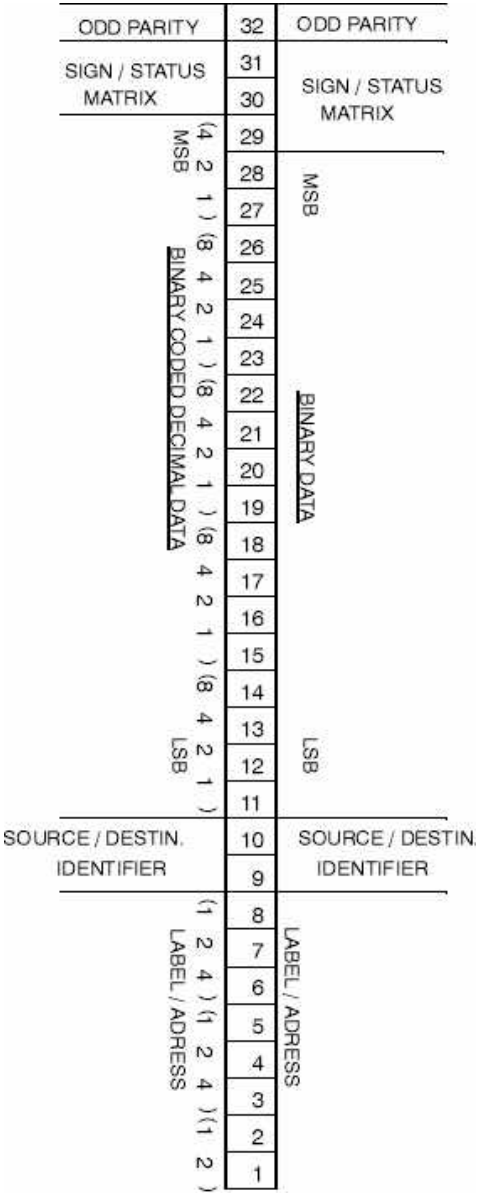


Figure 47 ARINC 429 Data Word

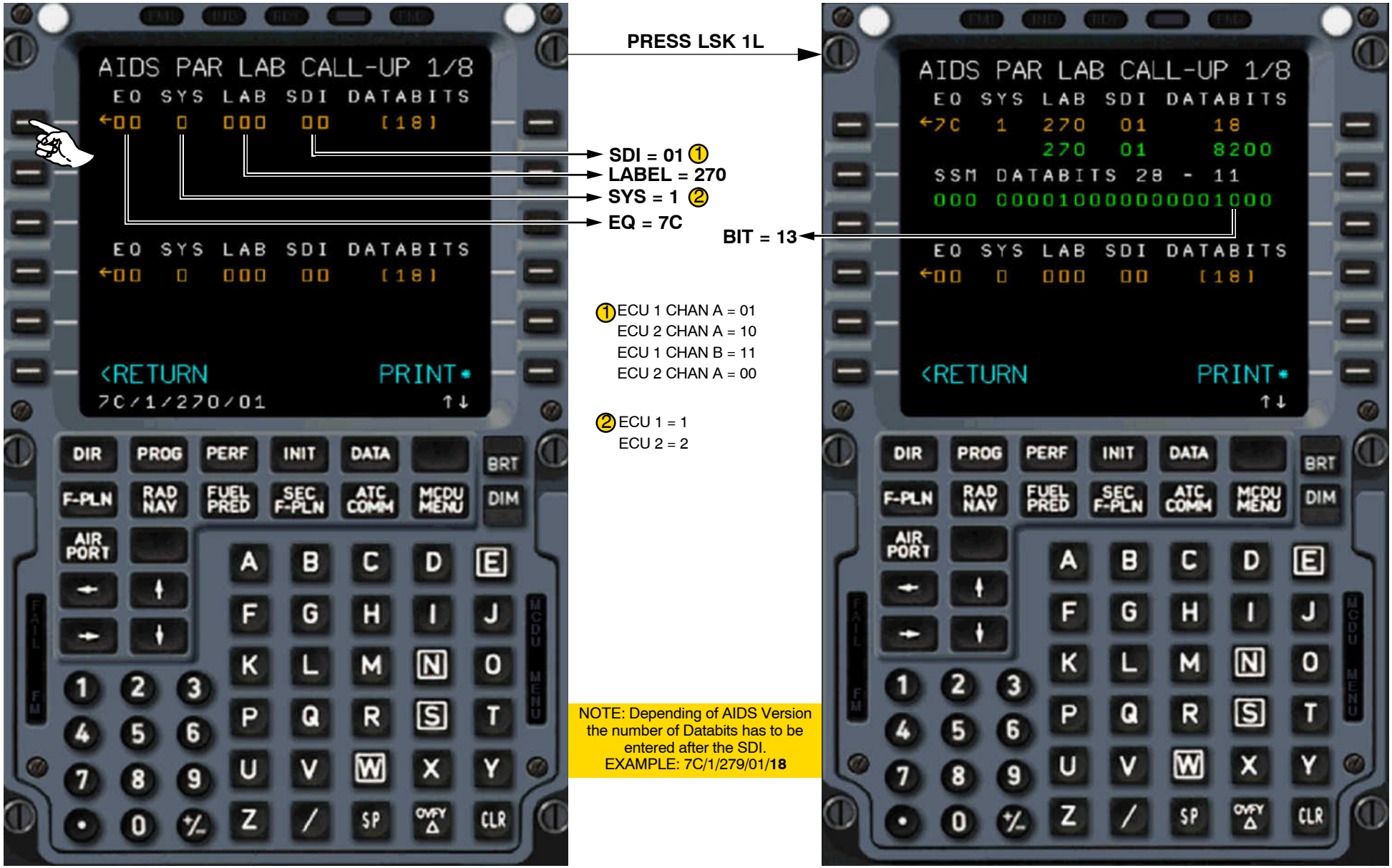


Figure 48 AIDS Parameter Label Call-Up-Menu

COURSE OF EVENTS TROUBLE SHOOTING

The course of events

Now we start the engine.

Immediately we see that Bit 13 changes from 0 to 1.

The Starter Air Valve is now open.

The Starter Motor turns on the Engine.

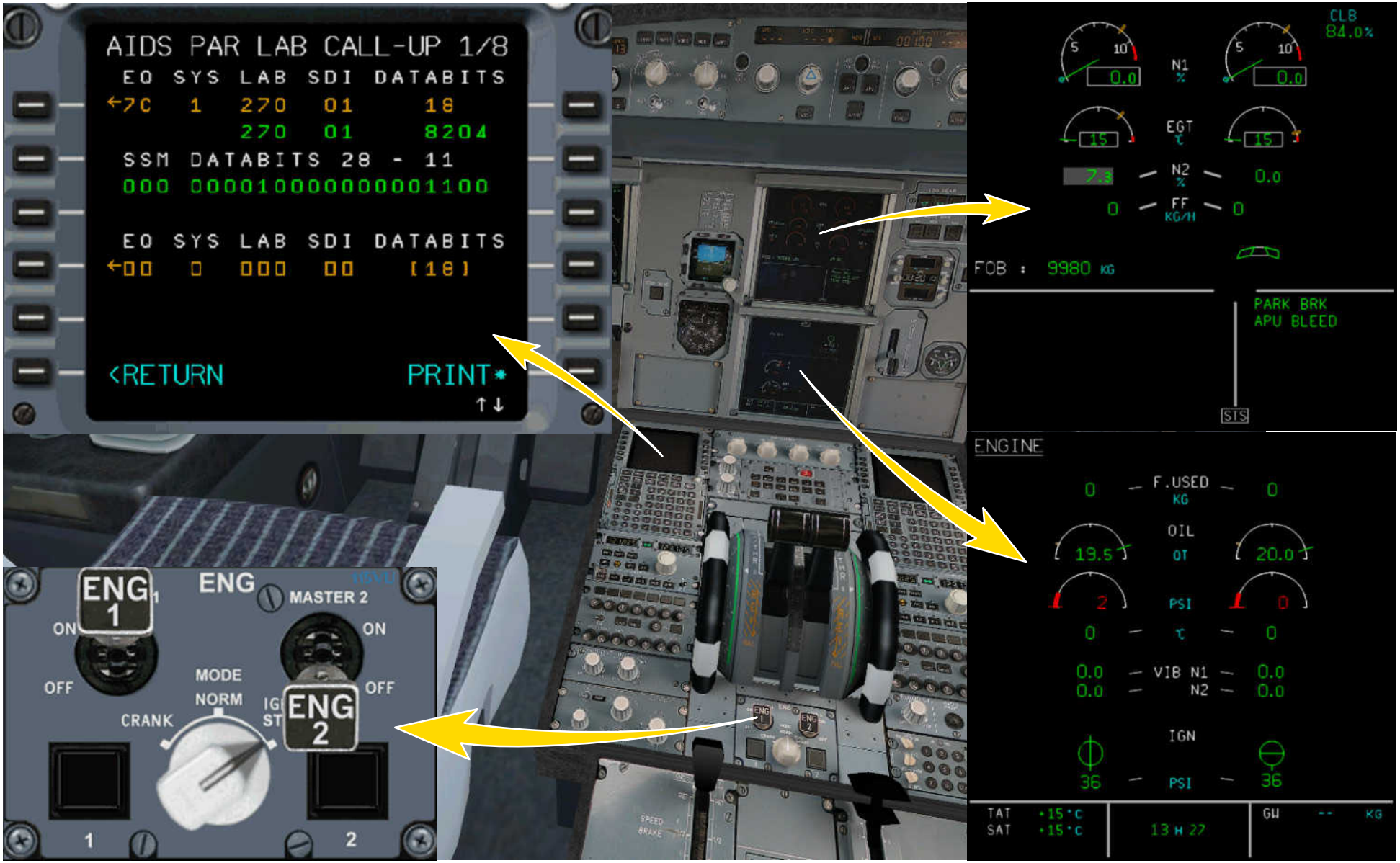


Figure 49 Engine Start Valve Opens - Bit 13 = 1

The course of events

AT 50% N2 you see Bit 13 changing from 1 to 0.

The Starter Air Valve closes.

The Starter Motor performs an Cut Out.

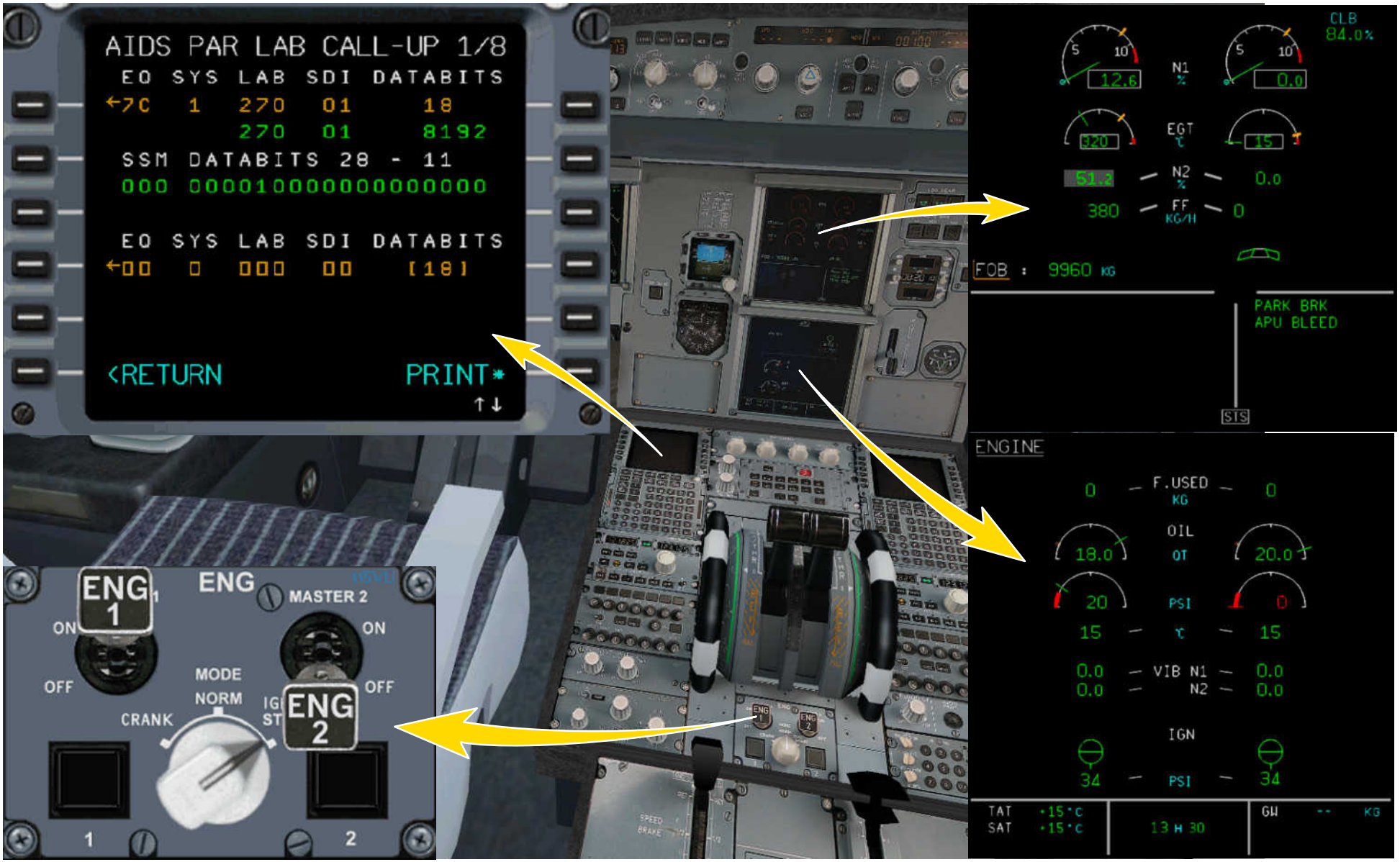


Figure 50 Engine Start Valve Closes - Bit 13 = 0

AIDS PROGRAMMING MAINTENANCE PRACTICES

GENERAL

The DMU (**D**ata **M**anagement **U**nit) is reprogrammable either with the assistance of the optional GSE (**G**round **S**upport **E**quipment) or partially (very limited) through the MCDU.

GSE

The GSE is based on a compatible personal computer and is divided into different S/W (**S**oft**W**are) modules. A major module is the programming of the DMU functions.

It mainly enables:

- the adjustment of the standard reports (e.g. report limits),
- the addition of customer reports (numbered from 31 to 40),
- the addition of trigger conditions,
- the configuration of the SAR (**S**mart **A**ccess **R**ecorder) and DAR (**D**igital **A**IDS **R**ecorder) recording channels (DAR is optionally installed).

In particular, the GSE user has the possibility to program trigger conditions for:

- standard reports (additional conditions),
- programmable reports,
- SAR,
- DAR.

This programming is made by means of logics defined in a specific language. In the example given here, report 31 is associated to logic 300 and will be triggered when the EGT (**E**xhaust **G**as **T**emperature) of engine 1 is greater than 850 C for more than 3 seconds while in cruise flight phase. Once the programming is completed, another GSE module generates the associated database (i.e. setup/customer database). The database is stored on a floppy disk or a PCMCIA (**P**ersonal **C**omputer **M**emory **C**ard **I**nternational **A**ssociation) disk then transferred to the DMU through a PDL (**P**ortable **D**ata **L**oader) or the optional PCMCIA interface.

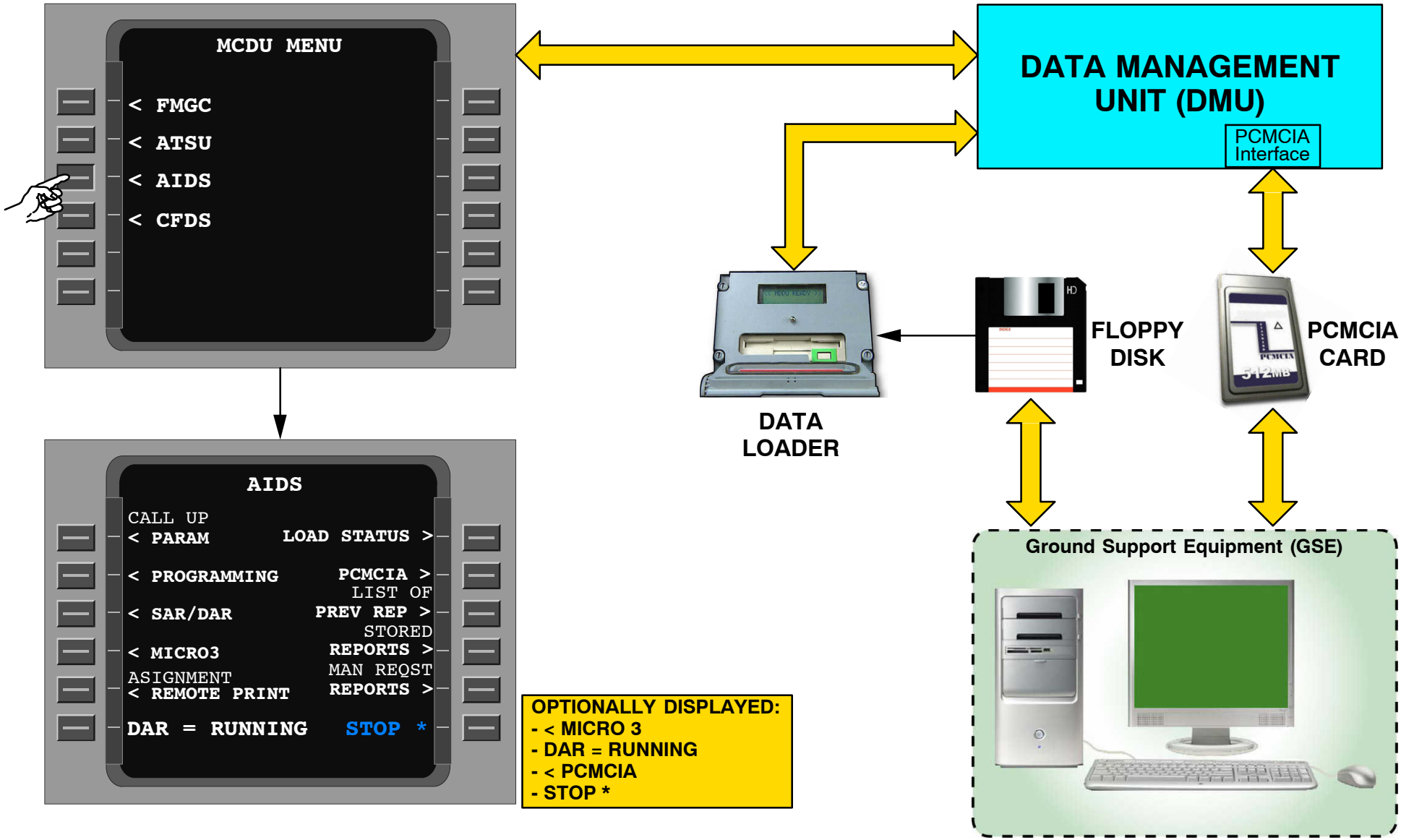


Figure 51 AIDS Programming

MCDU PROGRAMMING MENU MAINTENANCE PRACTICES

Programming with the MCDU is possible by pressing the PROGRAMMING line select key on the AIDS MENU page. A first page is displayed with the DMU–part of the FDIMU (**F**light **D**ata **I**nterface and **M**anagement **U**nit) H/W (**H**ard**W**are) and S/W references:

- P/N is the Part Number of the DMU,
- D1 P/N is the Part Number of the operational S/W,
- the 3 following items of information concern the setup/customer database: VVVV is the version number, LLLL is the revision level, DDMMYY is the generation date.

A password, defined with the GSE, is required to access the following programming menus.

Report Inhibit

Inhibition for all the reports of the printing and/or linking to the ATSU (**A**ir **T**raffic **S**ervice **U**nit). The inhibition is effective until the next DMU power off.

Report Limits

Change, in a temporary way, of some report limits that are programmable by the GSE. The change is effective for a predefined number of days or legs (refer to the VALIDITY field).

Report Counters

Setting of the report internal counters at their corresponding limit value.

Statistic Counters

Initialization and visualization of the engine/APU hours and cycles. The DMU resets the engine/APU hours and cycles in case of engine/APU change (engine/APU serial number change detection). The menu then allows the correct values to be programmed for an engine or APU after it has been changed.

Example

An Example is given in the TSM TASK 34–11–00–810–861 (Different Angle of Attack Value on the three ADIRUs) in Paragraph 4.C.

There the Pitch Angle and the Flight Path Angle will be recorded on an AIDS programmable report.

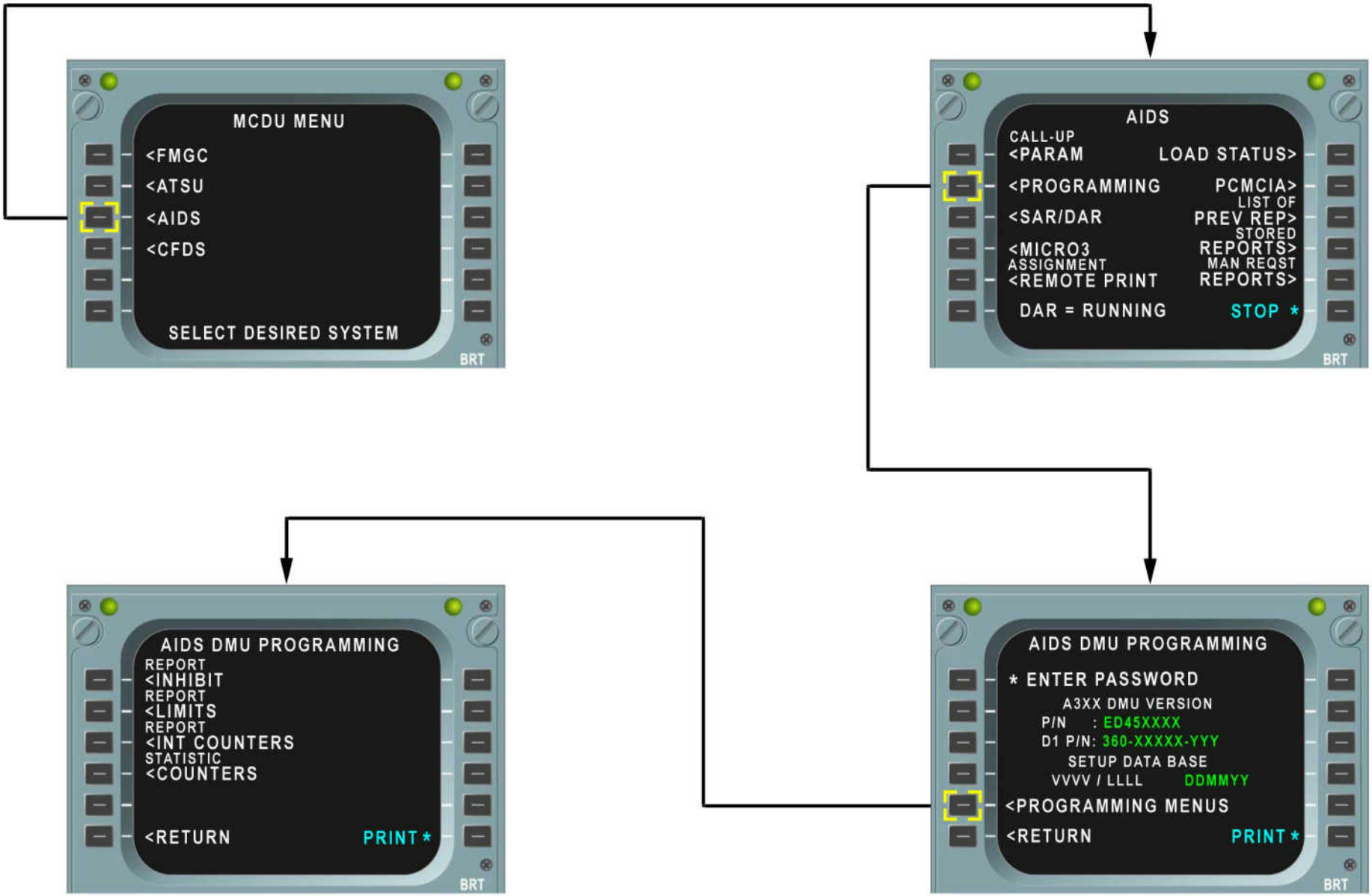


Figure 52 MCDU Programming Menu/Statistic Counters

DFDRS/AIDS BITE

General

Access to the BITE of the FDIU and DMU is achieved via the “SYSTEM REPORT/TEST/INST“ Menu of the CFDS.

FDIU BITE

The ARINC 429 transmitter sends the BITE data from the DFDRS to the CFDIU.

Conditions of Power–Up Test Initialization:

- How long the computer must be de–energized: One second
- A/C configuration: A/C on ground and engines stopped

Progress of Power–up Test:

- Duration: 25 seconds max
- Cockpit repercussions directly connected with power–up test accomplishment (some other repercussions may occur depending on the A/C configuration but these can be ignored):
  - ECAM warnings: ”RECORDER FDIU FAULT” is shown for 3 seconds

Results of Power–up Test

- Test passed: None
- Test failed:
  - ECAM warnings: ”RECORDER FDIU FAULT”

DMU BITE

The DMU contains a Built–in Test Equipment (BITE) according to ARINC 604. The BITE is able to detect failures occurring in the DMU. The board, the functional block or the integrated circuit in which the failure appears is described by the failure message.

All facilities of the already existing hardware and software that can reasonably be used to detect faults of systems or system components are made available for the fault isolation and detection function.

In order to recognize transmission faults the ARINC 429 inputs of the DMU are monitored continuously for update, sign status matrix and if necessary parity. The BITE of the DMU is able to distinguish between system internal faults (DAR and DMU) and external faults (connected systems).

The equipment supplier proposes a fault isolation and detection concept that finally accepted by the purchaser.

Power Up Test

After each Power–On–Reset (POR) due to a power interrupt greater than 200 msec the DMU perform a POR Built–In–Test (BITE).

The POR BITE is done after each POR independent of ’On Ground’ or ’In Flight’ condition.

The POR BITE is performed before the DMU application software is started and is complete after 2 seconds.

If the ’<DMU POWER–UP TEST’ LSK is pushed the DMU initiates a complete BITE procedure.

If the test is longer than 1 second, the display shows TEST IN PROGRSS XS (X= approximate maximum waiting time in seconds).

DMU Battery Test

If the ’<DMU BATTERY TEST’ LSK is pushed the DMU initiate a battery test which does not interfere with the normal DMU operation.

If the test is longer than 1 second, the screen shows the TEST IN PROGRSS xS.

Software Load Status

If you push the ’<SOFTWARE LOAD STATUS’ LSK, the display shows:

- The system software partnumber
- The date when the system software was loaded

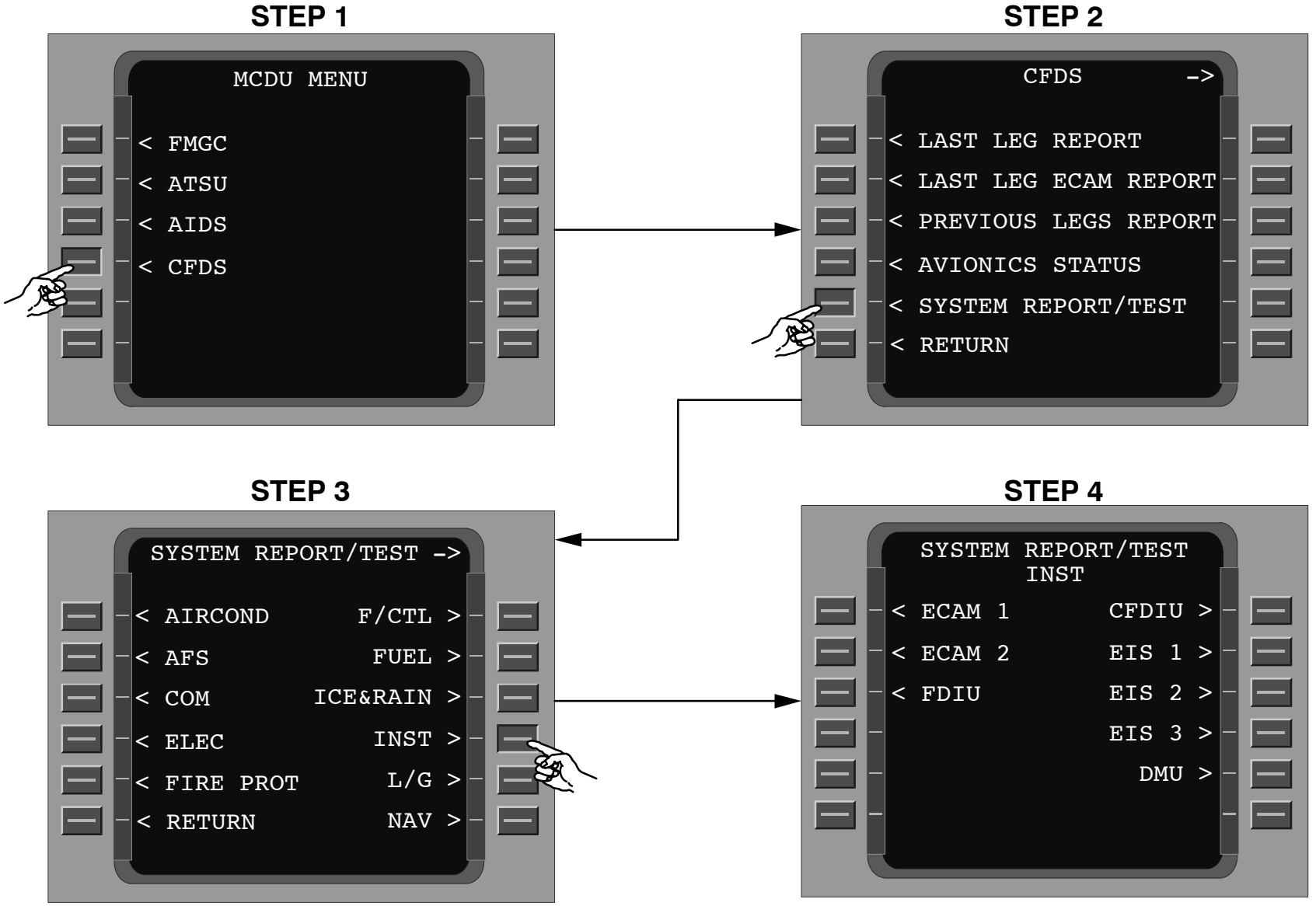


Figure 53 Access to the System BITE Menu

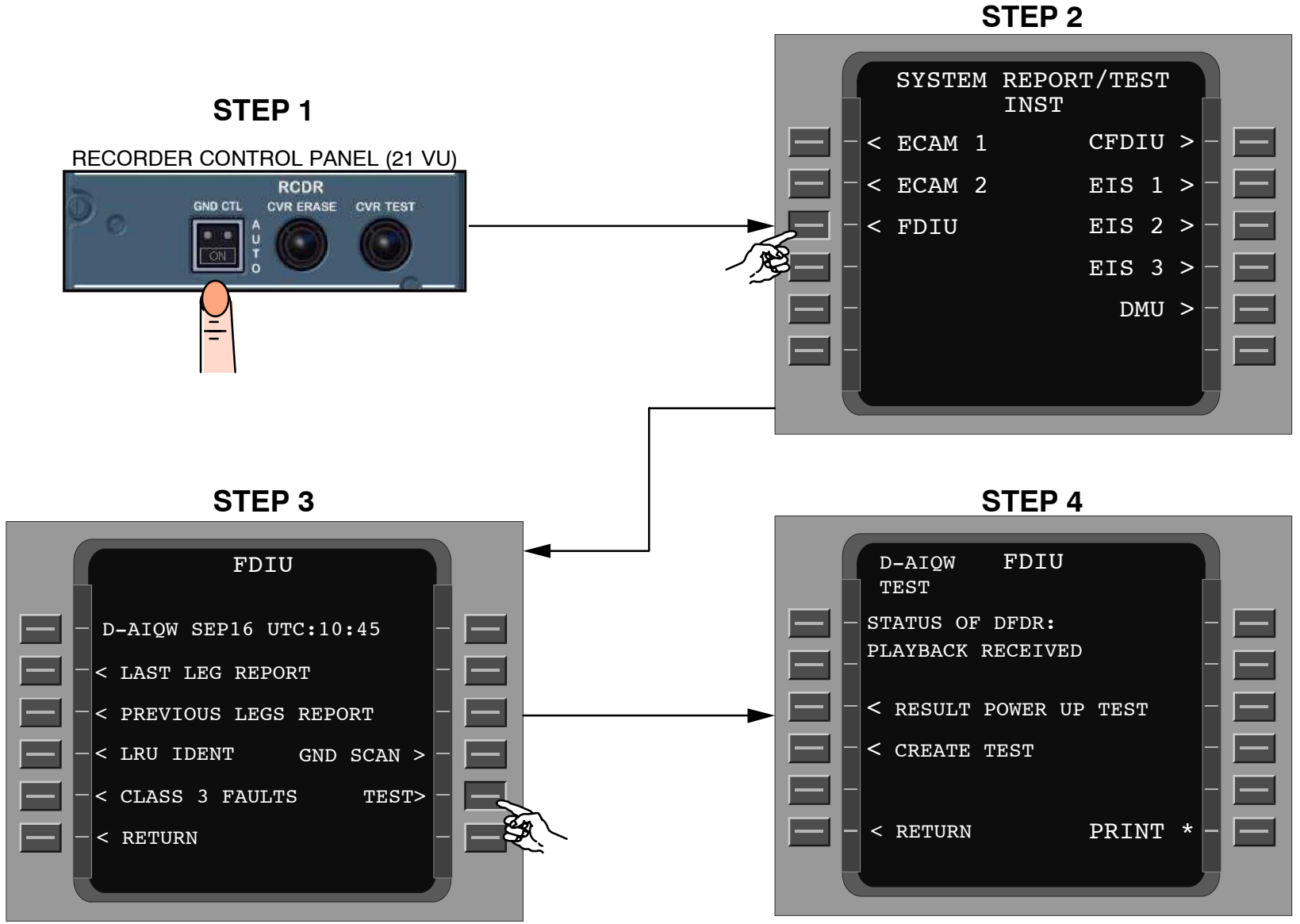


Figure 54 FDIU BITE Menu

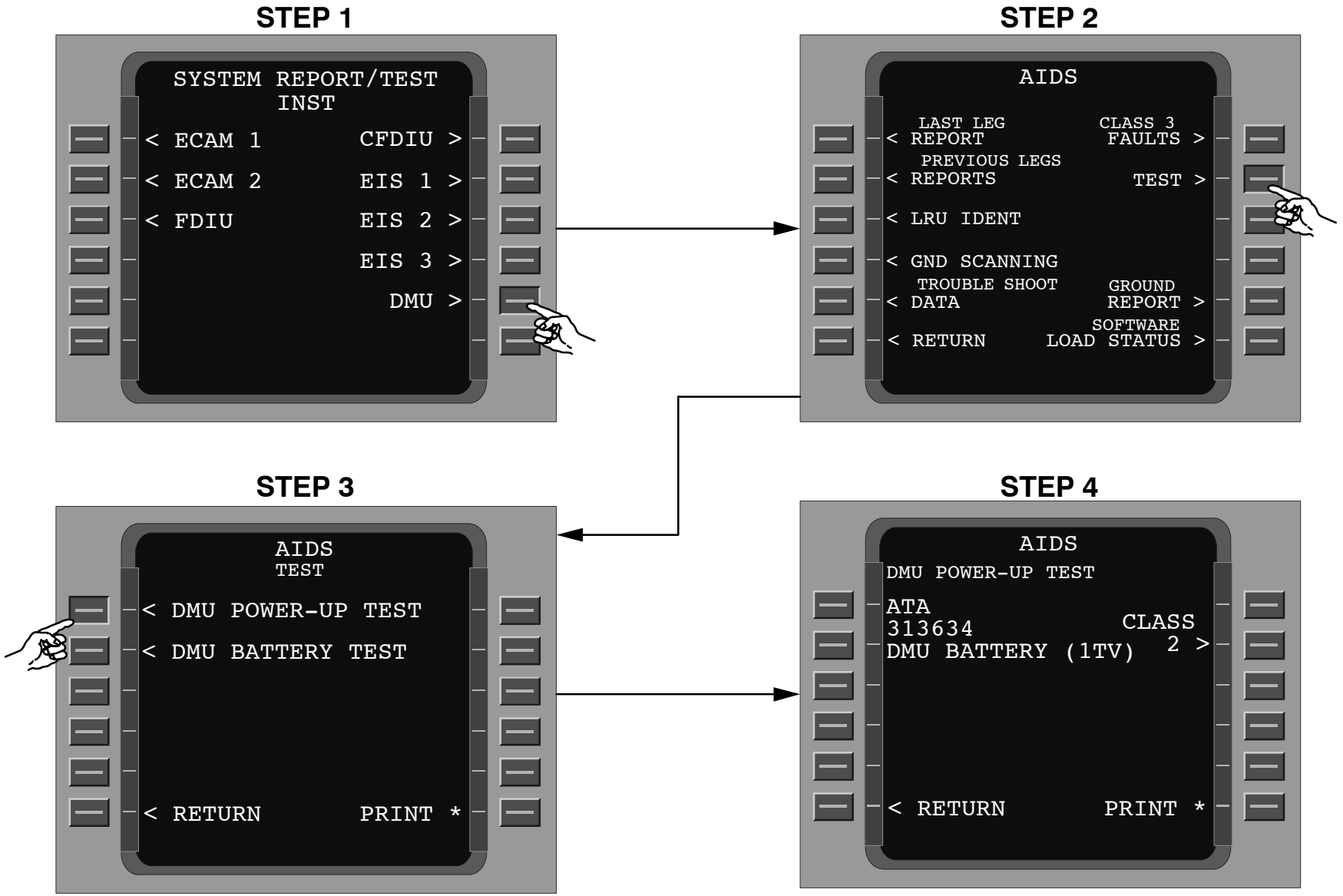


Figure 55 DMU BITE Menu

31–37 AIDS INPUT INTERFACE (FDIMU)

FDIMU PRESENTATION (ENHANCED)

General

The FDIMU (**F**light **D**ata **I**nterface and **M**anagement **U**nit) puts together the functions of the DFDRS and the AIDS into a single LRU (**L**ine **R**eplaceable **U**nit). These two functions are controlled inside the FDIMU by two separate processor–units (FDIU–part, DMU–part), which operate independently from each other. An Internal data–bus connects the FDIU–part to the DMU–part. The function of the FDIU–part is:

- To collect, format and supply the DFDR with various critical flight parameters,
- To supply an output, which is encoded with GMT, to the CVR (**C**ockpit **V**oice **R**ecorder),
- To do an integrity check for acceleration parameters each flight,
- To receive linear acceleration via SDAC,
- To do a maintenance dialog with the CFDS in the form of a menu,
- To supply a QAR (**Q**uick **A**ccess **R**ecorder) if installed with the same data frame as the DFDR.

The function of the DMU–part is to generate AIDS reports:

- To supply a digital frame to the DAR (**D**igital **A**IDS **R**ecorder) (if installed),
- To collect all of the information, which comes from various A/C equipment (ARINC 429 busses and discrete inputs),
- To communicate with specific equipment (MDDU/PDL, MCDU, CFDIU, ACARS (if installed), PRINTER).

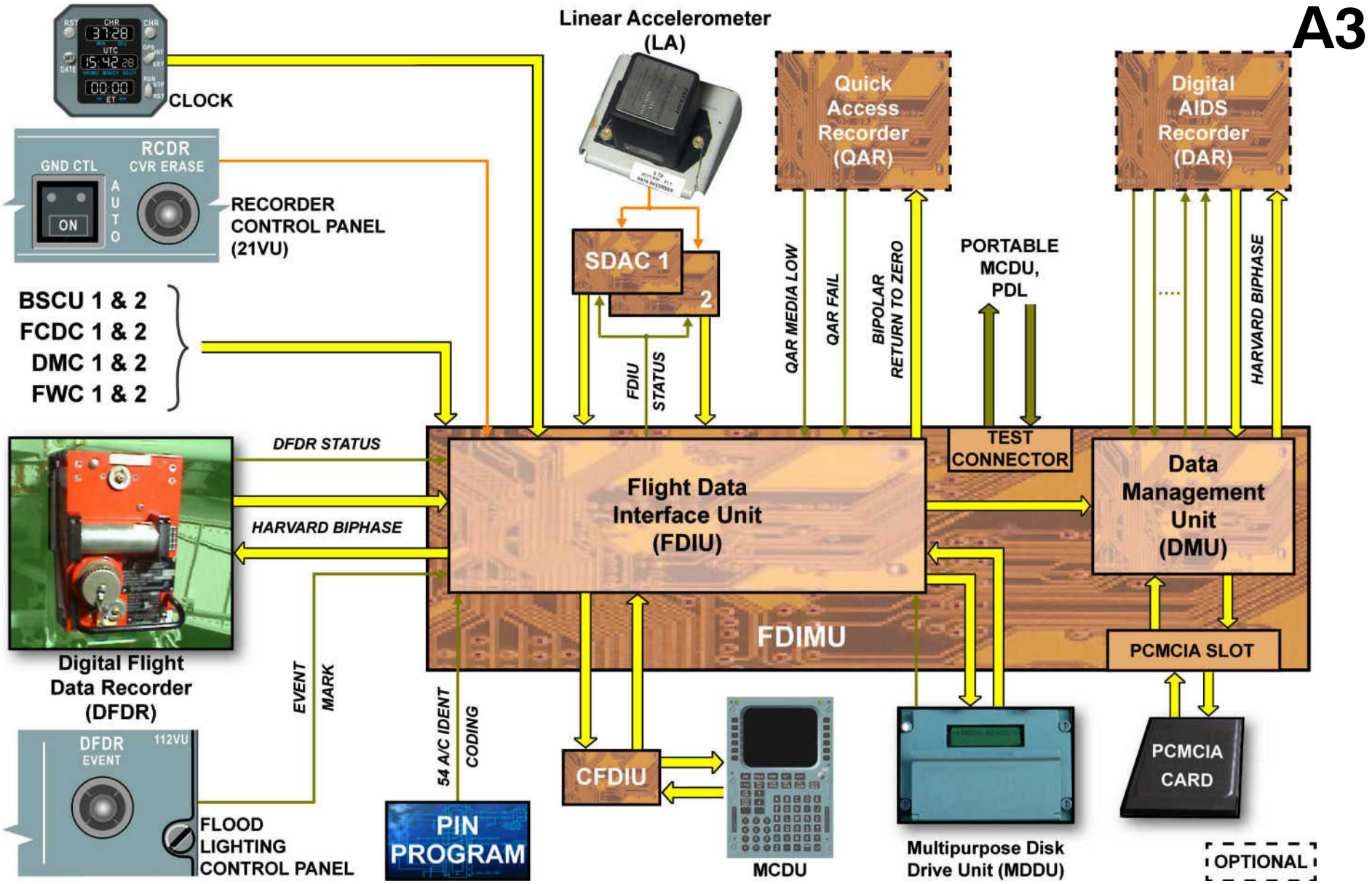


Figure 56 FDIMU System Architecture

FDIMU COMPONENT DESCRIPTION (ENHANCED)

General

The FDIMU is a microprocessor controlled unit, used for the collection of discrete and digital A/C parameters and for their conversion to a recordable form. The FDIMU puts together the functions of the DFDRS and the AIDS (REF: 31–36–00). It has two internal main parts. These parts are:

- The FDIU–part, which controls the DFDRS
- The DMU–part, which controls the AIDS (Refer to 31–36–00).

The function and the electrical interface complies with ARINC 717.

If more than one data bus with the same content, e.g. SDAC 1 and SDAC 2, is connected to the FDIUpart, the data from system 1 is recorded on the DFDR. This is as long as the appropriate SSM bits are valid and the data is updated. Invalid data from system 1 is replaced with the appropriate data from system 2. If one system has bad SSM bits or unrefreshed data, data from the other system are recorded. If no valid data is available for the DFDR recording, then related data bits are set to zero and in the next mainframe period the respective data bits are set to one.

The FDIU–part can record five different versions (frames) of parameters on the DFDR. The selection for one version is made by the A/C Pin–Programming. If a version is not set, the FDIU–part uses the code from the last flight. In case of missing information from the last flight, the FDIU–part works with Version 2 (CFMI frame) and record speed 128 W/s. The five record versions fulfil the different authority's requirements:

- Version 1 and 2: ED55 parameter frame (1 to 57 parameters), record speed 128 Words/sec
- Version 3,4 and 5: FAR 121.344 parameter frame (1 to 88 parameters), record speed 256 Word/sec.

Location

The FDIMU front panel is equipped with:

- A pivoting flap providing access to the test connector and PCMCIA inter face,
- A FDIU Fail LED and a DMU Fail LED.

The integrated PCMCIA interface contains an optional DAR recording function, and is able to store SAR (**S**mart **A**IDS **R**ecorder) generated files and AIDS standard reports. In addition it is possible to emulate a data loader function. When using theses functions, a PCMCIA card must be inserted in the PCMCIA interface. A test connector is installed on the front panel of the FDIMU.

The test connector is used for:

- PDL (**P**ortable **D**ata **L**oader) connection,
- Maintenance test equipment connection (dialogue with laptop computer).

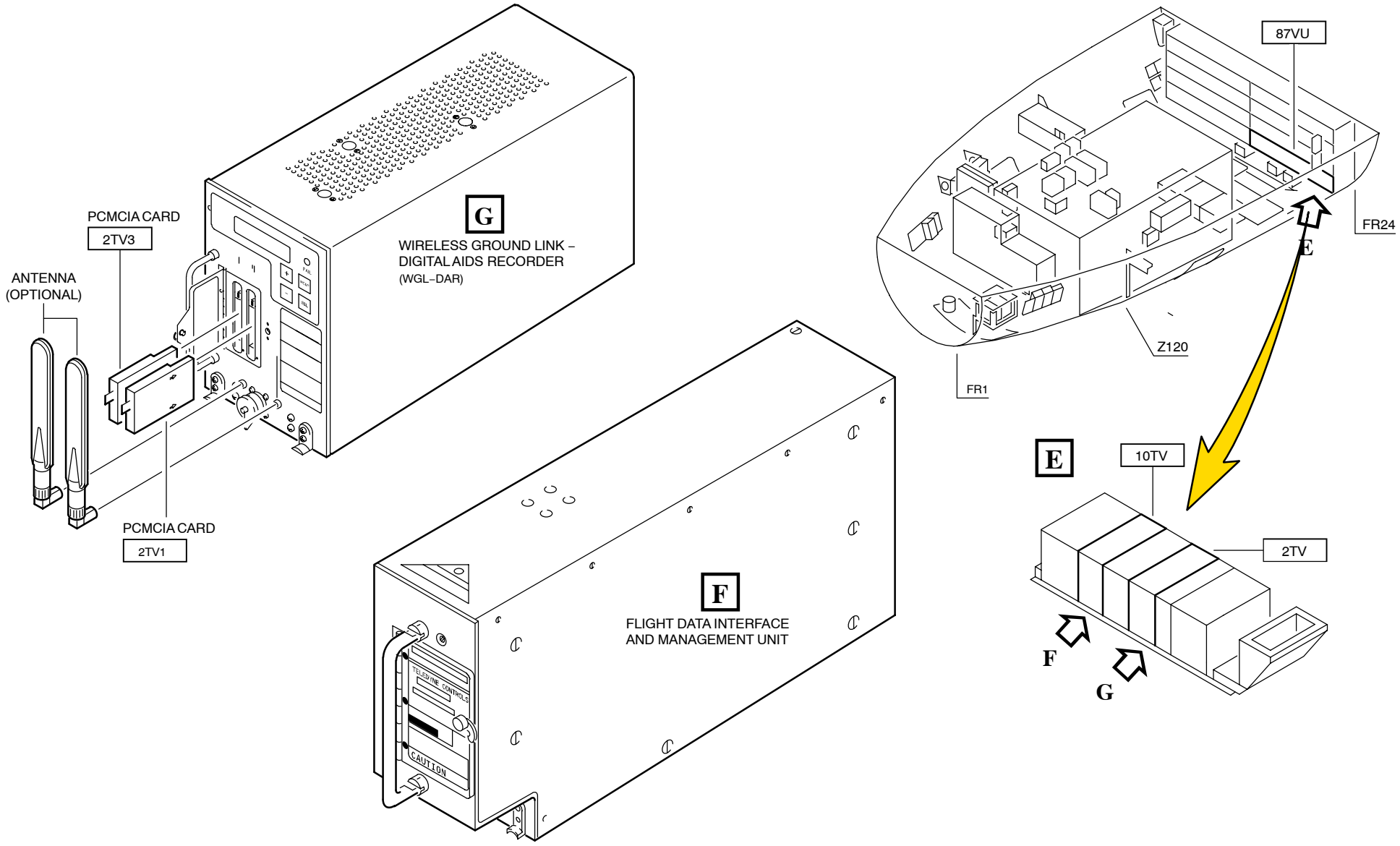


Figure 57 FDIMU

FDIMU BITE TEST (ENHANCED)

Test BITE

The DMU contains an BITE (**B**uilt–**I**n **T**est **E**quipment) according to ARINC 604. The BITE is able to detect failures occurring in the DMU.

The board, the functional block or the integrated circuit in which the failure appears is described by the failure message.

General Rules for the BITE

All facilities of the already existing hardware and software that can reasonably be used to detect faults of systems or system components are made available for the fault isolation and detection function.

In order to recognize transmission faults the ARINC 429 inputs of the DMU are monitored continuously for update, sign status matrix and if necessary parity.

The BITE of the DMU is able to distinguish between system internal faults (DAR and DMU) and external faults (connected systems).

The equipment supplier proposes a fault isolation and detection concept that finally accepted by the purchaser.

BITE Tests

For detailed information refer to Aircraft Maintenance Manual 31–36 Page Block 500.

FDIMU CFDS PAGES

FDIMU Access Menu

Via the MCDU you can get access to the CFDS menu of the FDIMU. The process for access to the FDIU menu or DMU menu is the following:

- Select the INST menu on the SYSTEM REPORT/TEST menu.
- Select the FDIU menu or DMU menu on the SYSTEM REPORT/TEST menu.

NOTE: Like in the classic system there are „**FDIU**“ and „**DMU**“ shown on the CFDS INST-page although here is one LRU installed.

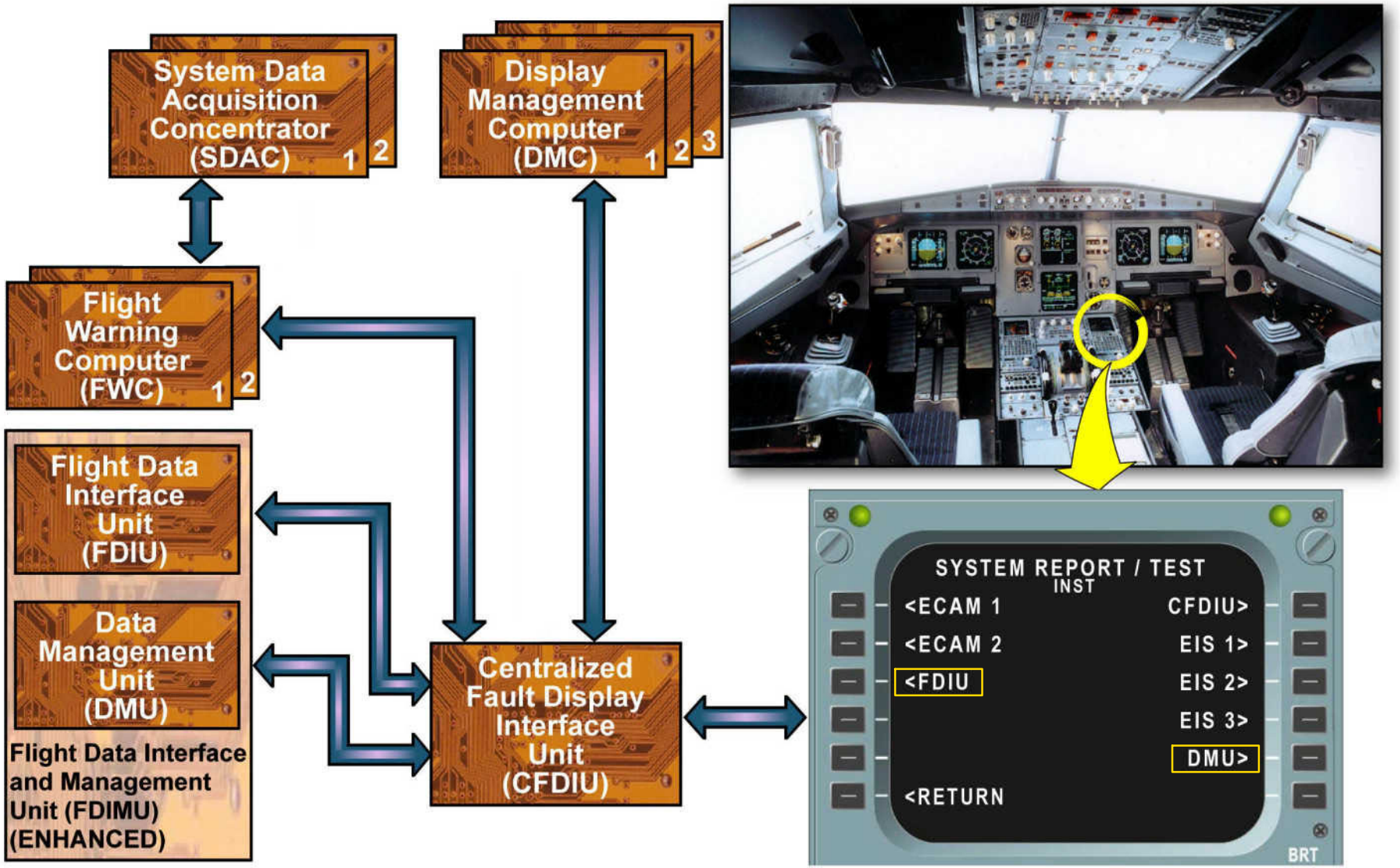


Figure 58 CFDIU Interface

DFDRS BITE (ENHANCED)

DFDRS BITE Test

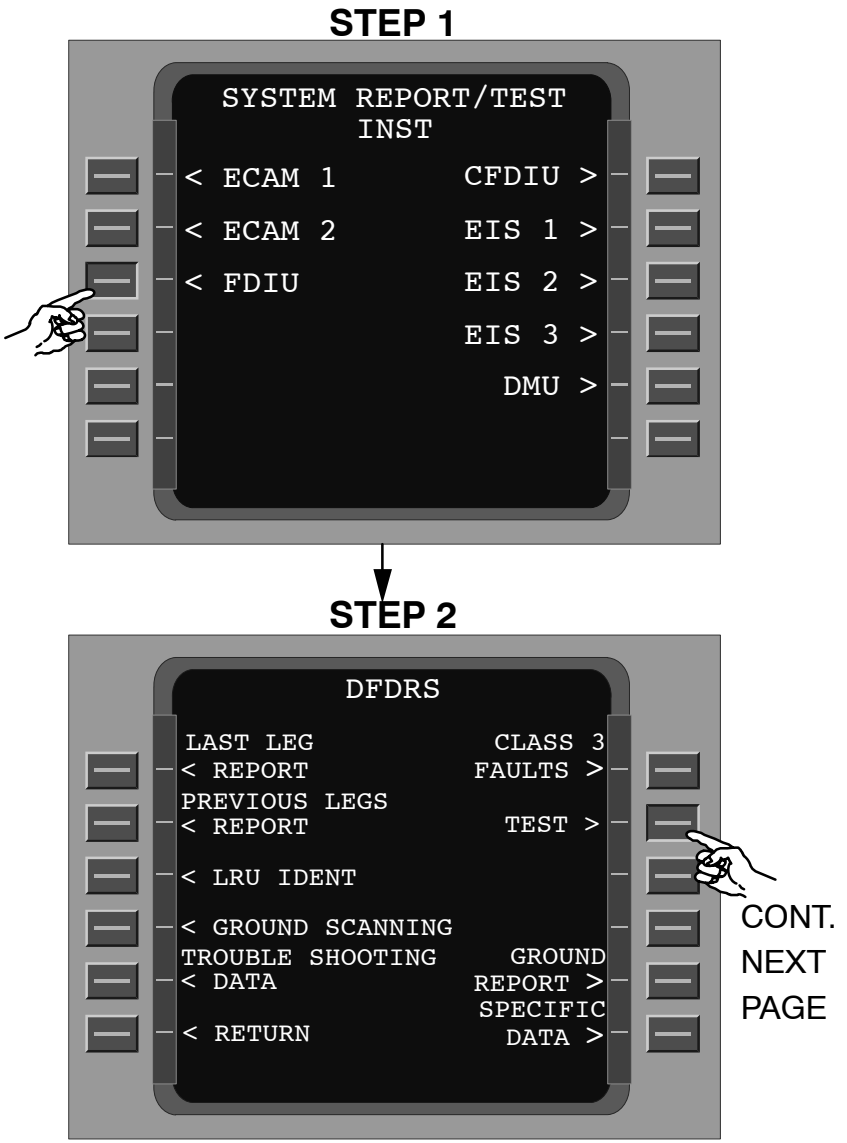
The power interlock and status monitoring can be partially tested by pushing the GND/CTL button and selecting the related CFDS menu (SYSTEM REPORT/INST/FDIU) on the MCDU.

When the GND/CTL button is pushed it activates the power interlock and the DFDR with playback will give a message on the TEST menu STATUS OF DFDR: PLAYBACK RECEIVED.

If a fault occurs or a DFDR is not installed the message FAULT/NOT INSTALLED comes into view. A second push on the GND/CTL button deactivates the power interlock and the DFDR stops. Now the message DFDR OFF/ON PLAYBACK comes into view on the TEST menu. The function of a DFDR without playback, cannot be tested.

The BITE of the DFDR can be checked by activating the GND SCAN menu. To check the correct functioning of the system during operation the monitoring function in each unit (BITE) must be continuously active.

For test purposes a line test connector is installed on the FDIMU and DFDR front side. With a separate test, the set internal functions of the FDIMU and the DFDR can be checked. It is possible to print out the BITE memory of the FDIMU. The DFDR playback data is also available on the FDIMU test connector.



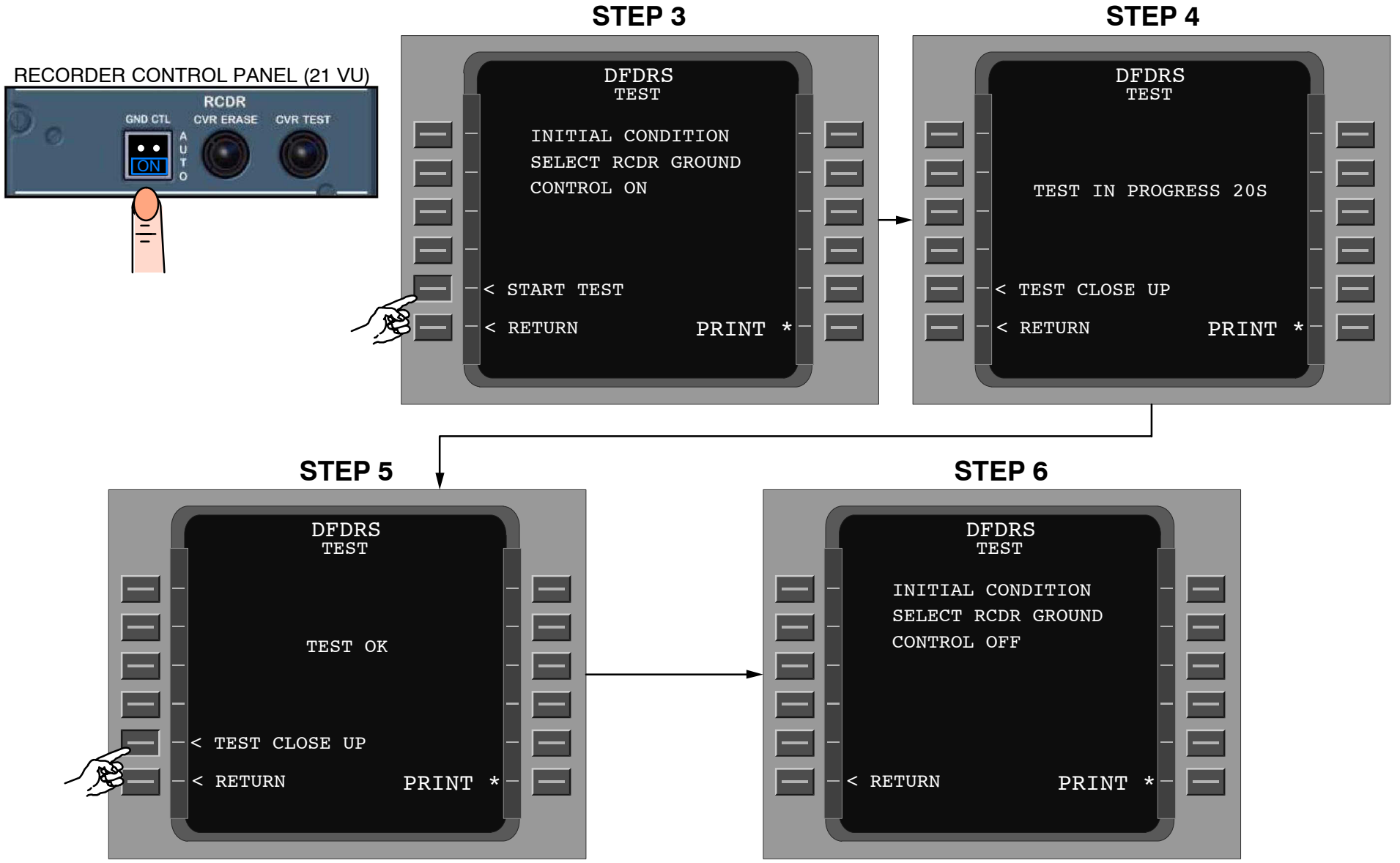


Figure 59 DFDR BITE Test

AIDS BITE (ENHANCED)

BITE DMU Part

Push the line key adjacent to

- < DMU

on the SYSTEM REPORT/TEST menu. Push the line key adjacent to

- < LRU IDENT

the DMU P/N, the customer database number (DIP/N) and the system database number are displayed.

DMU/Software load status

Push the line key adjacent to

- < DMU

on the SYSTEM REPORT/TESTmenu.Push the line key adjacent to

- < SOFTWARE LOAD STATUS:

The display shows the customer database number and load date. The system database number and load date.

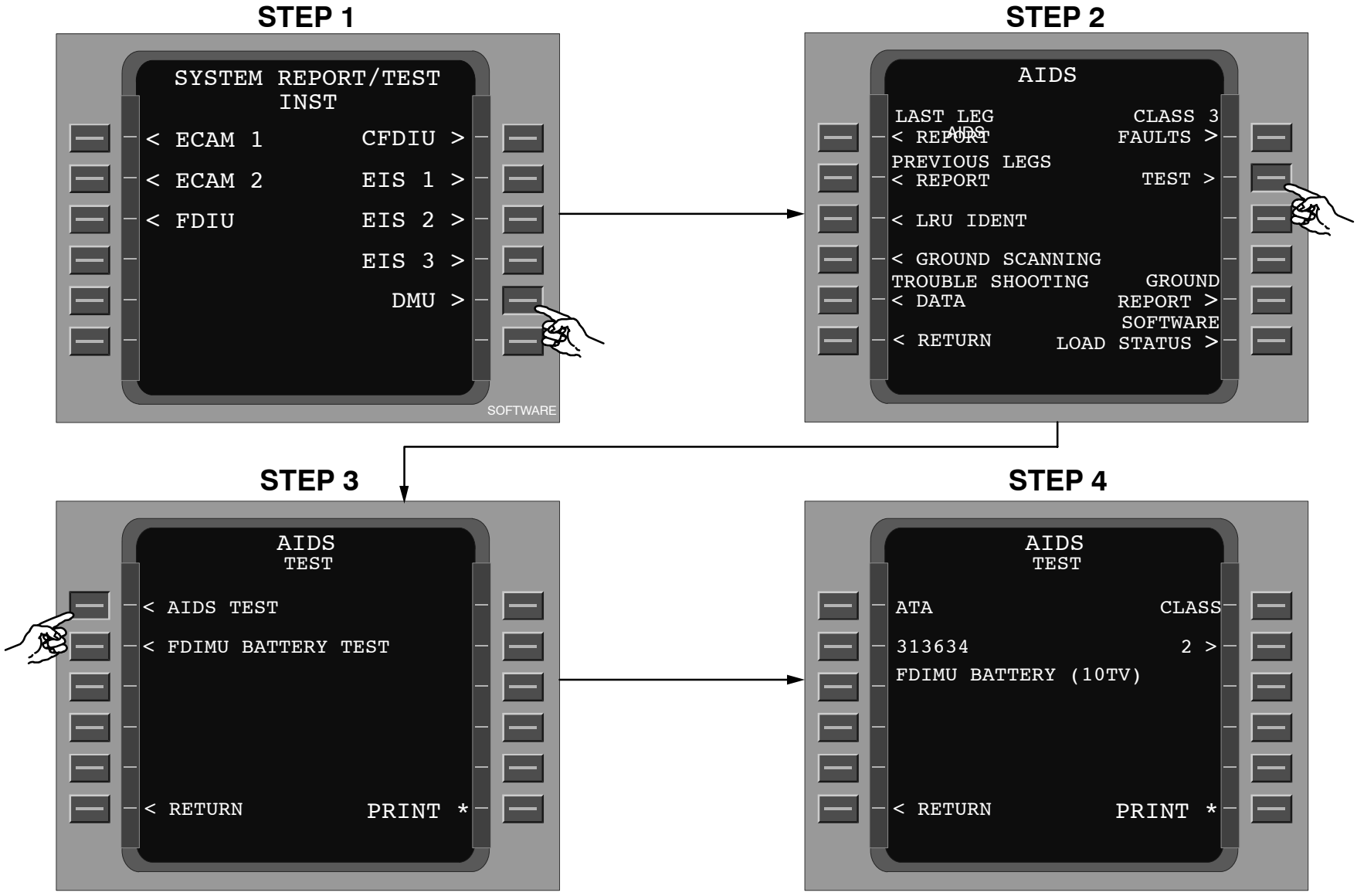


Figure 60 AIDS BITE

31–33 DIGITAL FLIGHT DATA RECORDING SYSTEM

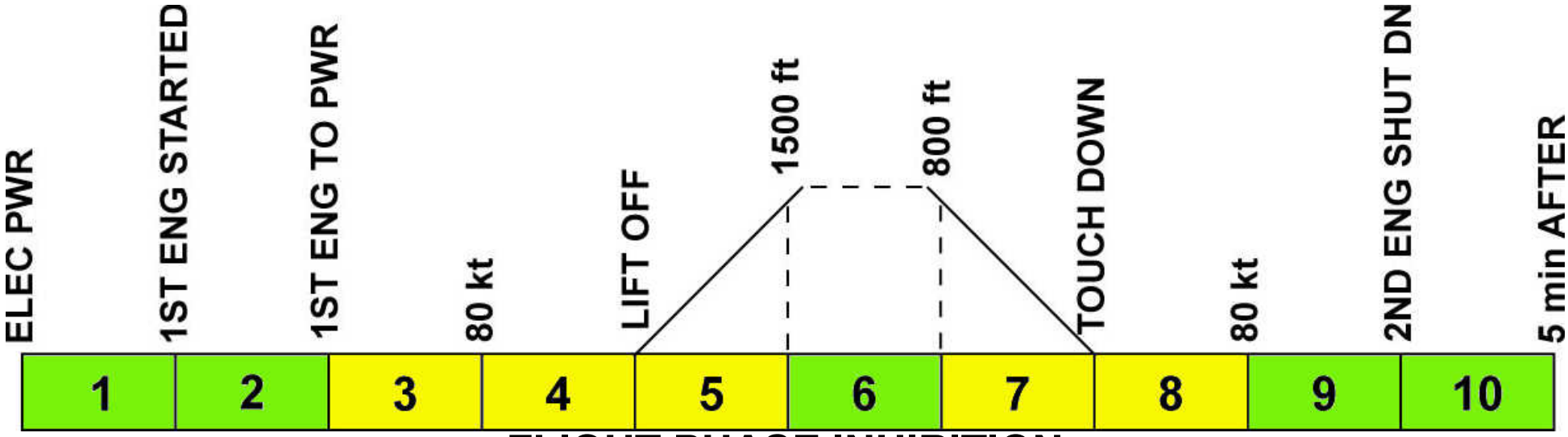
DFDRS WARNINGS SYSTEM OPERATION (ENHANCED)

DFDR FAULT

Flight safety is not affected by the failure of the DFDR (**D**igital **F**light **D**ata **R**ecorder) although there is only one. In this case, only an ECAM (**E**lectronic **C**entralized **A**ircraft **M**onitoring) message is provided. There is no MASTER light and aural warning triggered.

FDIU FAULT

Flight safety is not affected by the failure of the FDIU (**F**light **D**ata **I**nterface **U**nit) although there is only one. In this case, only an ECAM message is provided. There is no MASTER light and aural warning triggered.



E/WD FAILURE MESSAGE	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLIGHT PHASE INHIBIT
RECORDER DFDR FAULT	NIL	NIL	NIL	NIL	3,4,5,7,8
RECORDER FDIU FAULT OR ON ENHANCED SYSTEM RECORDER SYS FAULT					

Figure 61 FDIU Fault

COMPONENT LOCATION (ENHANCED)

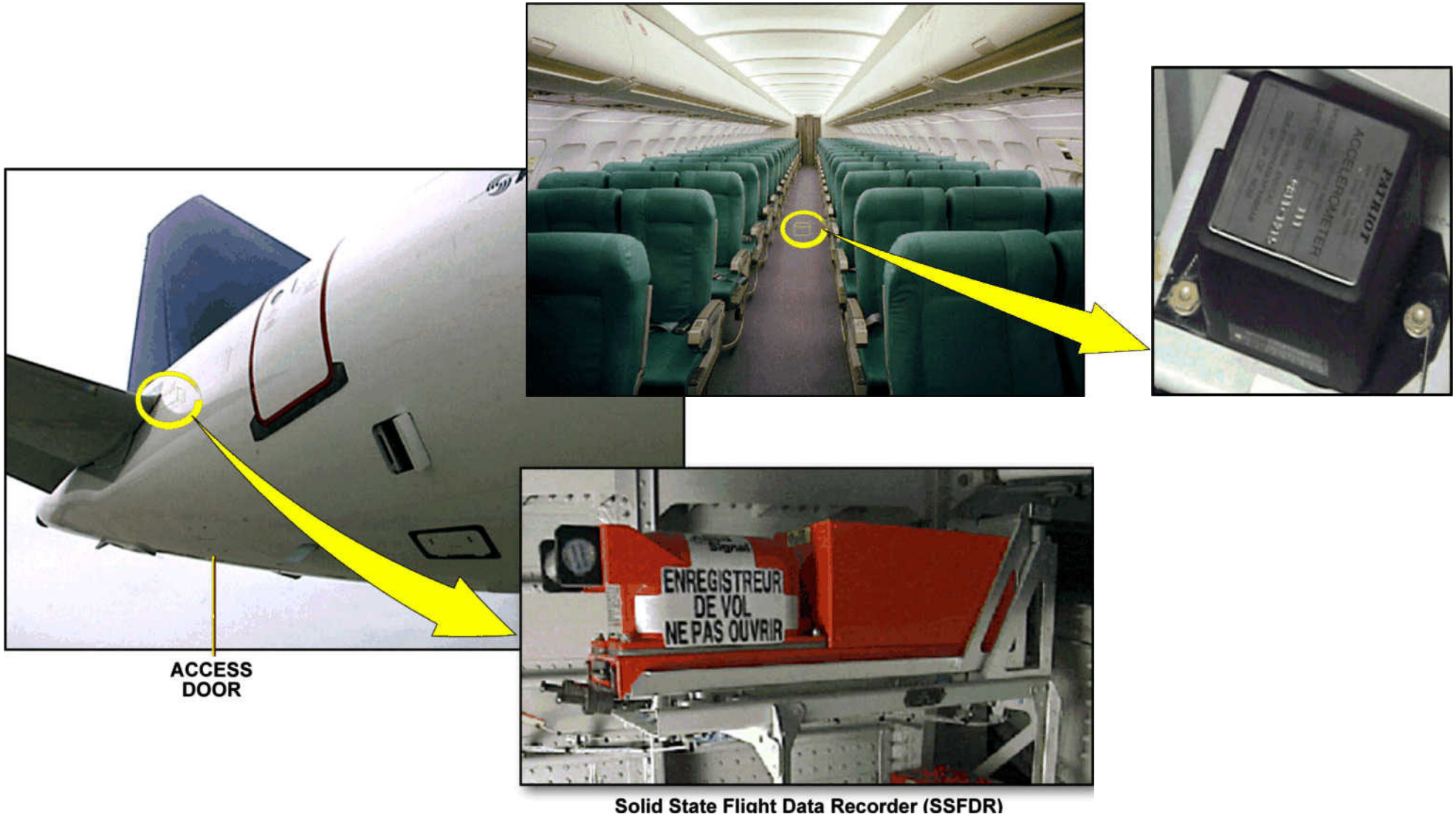


Figure 62 Component Location

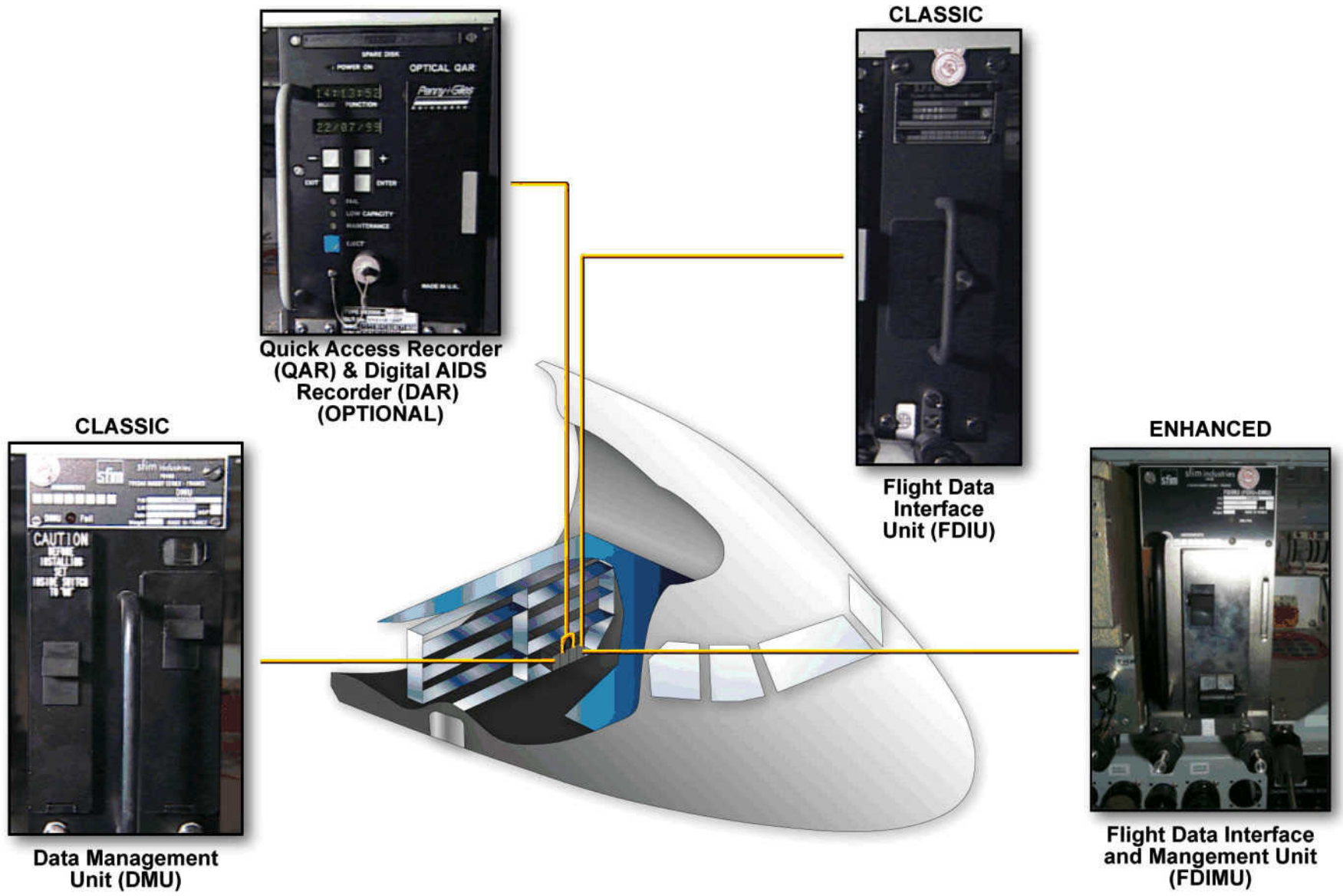


Figure 63 Component Location

31–35 MULTIFUNCTION PRINTING

PRINTER

General

The printer (PRTR) is designed to achieve the print out on ”high contrast low abrasive” paper of reports coming from various systems.

The reports come from:

- the Centralized Fault Display and Interface Unit (CFDIU),
- the Aircraft Integrated Data System (AIDS),
- the Air Traffic Service Unit (ATSU),
- the Flight Management and Guidance System (FMGS),
- the Engine Vibration Monitoring Unit (EVMU).

Paper

Simple ”one hand” in flight or on ground paper roll loading allows 90 feet printing, 3 rolls being stowed on the left rear cockpit wall.

The paper can be inserted via an access door incorporated in the front–panel. The printer is loaded with a 4.4 inch wide (109 mm) paper roll.

Monitoring

The printer face features a locking system and a SLEW P/BSW. The SLEW switch is used to exit paper. In case of malfunctioning leading to incapability to achieve any print–out, the printer transmits a message to the CFDS as long as the defect is present.

System Description

The thermal line PRINTER provides on board print outs for various aircraft systems, one at a time.

When power is applied, the PRINTER determines which inputs are active and which specific system is connected to each active port. Also after a sequence of active port polling, a single inactive port is monitored so that a system which became active after initialization can be added to the active system list.

The PRINTER then switches on each system in order of their priorities (port one has the highest priority, port 12 has the lowest one) and using a hand shake protocol asks the systems for a data transfer.

These data are formatted within each system (including the parity bit) and are transmitted on low speed buses. The printer provides a storage capability of 8 kbytes and is able to generate 120 forty character lines per minute.

After printing the last message block the paper is advanced automatically.

The PRINTER recognizes the printable ASCII character set and several control characters, and is capable to print 80, 64 or 40 characters per line formats, the 80 characters per line by 24 lines being printed in the Y axis.

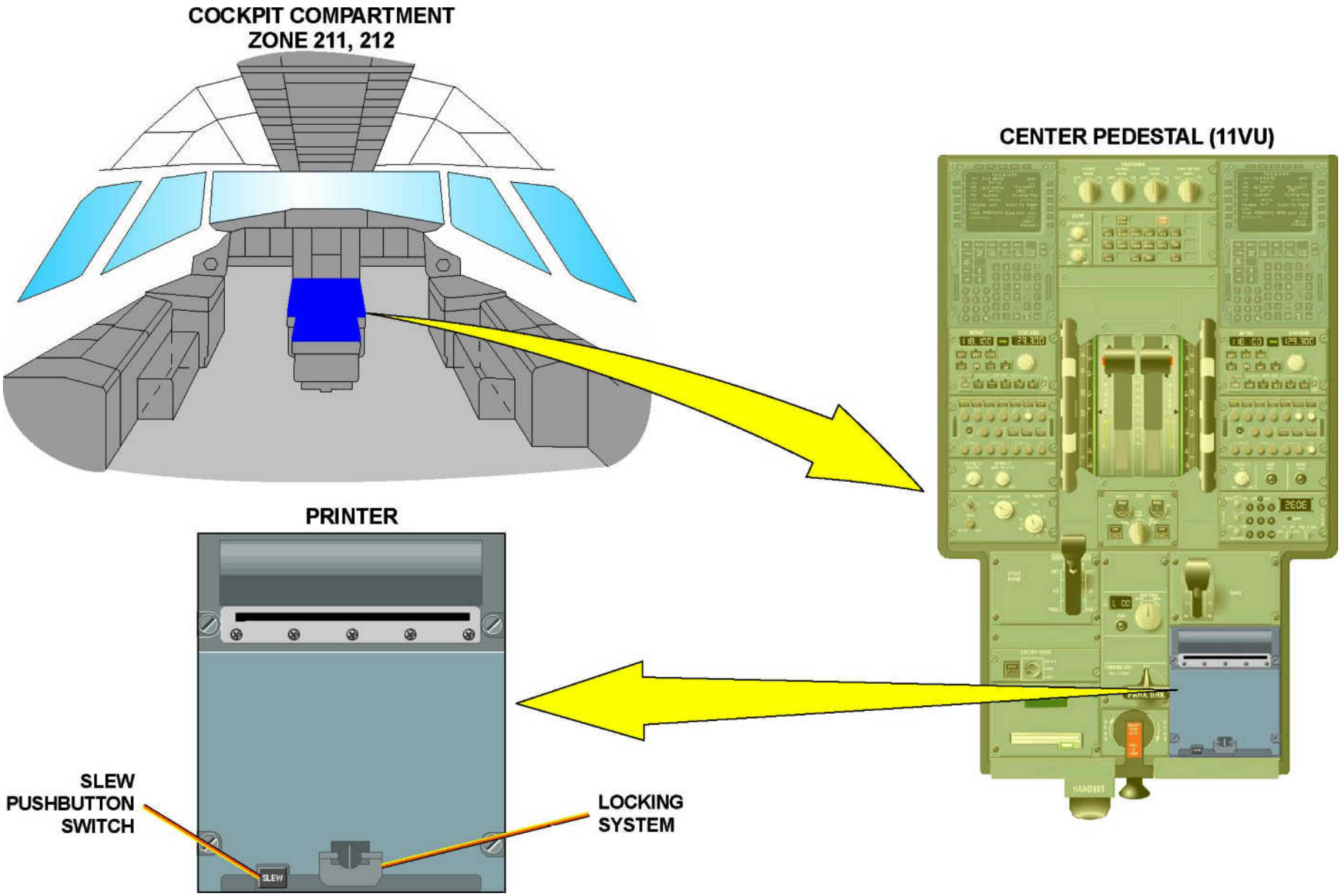


Figure 64 Printer Location

PRINTER INTERFACES

GENERAL

Printer Capability

The printer provides onboard printouts concerning various aircraft systems one at a time. The printer is capable to print 80, 64 or 40 characters per line format. It provides a storage capability of 8 Kilobytes (Kb) and is able to generate 120 forty–character lines per minute.

Users

Data to be printed is formatted within the various system users. The printer determines which input is active and switches on each system in order of their priorities.

Manual Print

In manual mode, prints are triggered from the MCDU. The MCDU initiates printing of data displayed on MCDU screen or data stored in system reports.

Automatic Print

Some reports are automatically printed provided that the automatic printing function has been programmed in the corresponding system computer.

Example:

- Automatic printing of the Centralized Fault Display System (CFDS) POST FLIGHT REPORT upon engine shutdown.

INTERFACE

Inputs

Data is transmitted via Low Speed (LS) ARINC 429 buses, one at a time using a handshake protocol. 12 inputs are available on the printer, but only 6 are allocated. Input 1 has the highest priority; input 12 has the lowest one.

Outputs

The printer has a single ARINC 429 output bus to control the various connected systems.

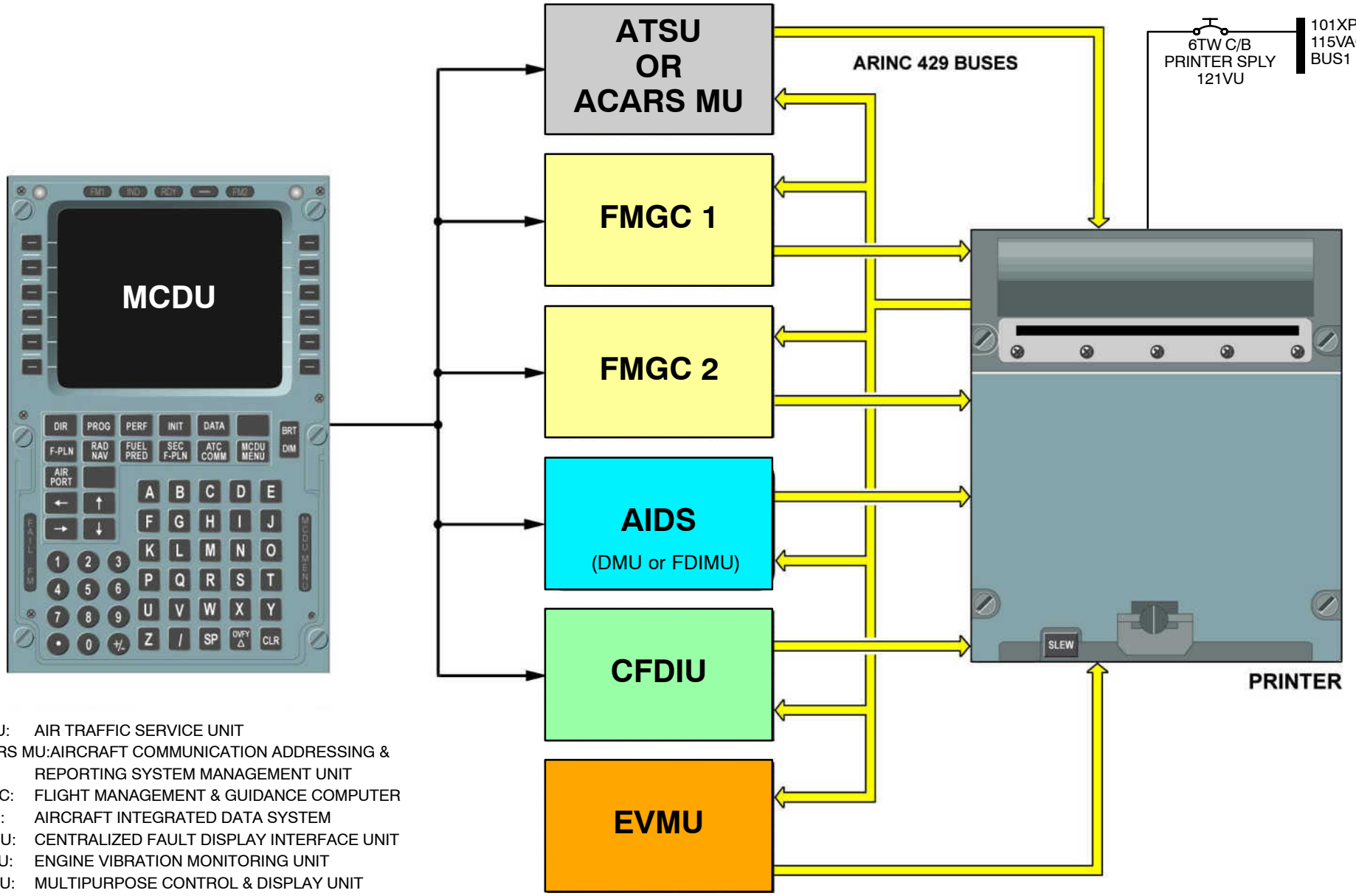
Monitoring

The printer provides continuous monitoring of critical internal parameters.

Monitored parameters:

- no buffer overrun,
- no inhibit mode,
- door closed,
- no out of page,
- internal circuitry,
- power supply circuitry,
- operating temperature.

In case of one of those malfunctions a message is sent to the Centralized Fault Display Interface Unit (CFDIU).



ATSU: AIR TRAFFIC SERVICE UNIT
ACARS MU:AIRCRAFT COMMUNICATION ADDRESSING & REPORTING SYSTEM MANAGEMENT UNIT
FMGC: FLIGHT MANAGEMENT & GUIDANCE COMPUTER
AIDS: AIRCRAFT INTEGRATED DATA SYSTEM
CFDIU: CENTRALIZED FAULT DISPLAY INTERFACE UNIT
EVMU: ENGINE VIBRATION MONITORING UNIT
MCDU: MULTIPURPOSE CONTROL & DISPLAY UNIT

Figure 65 Printer Interfaces

PAPER LOADING PROCEDURE SERVICING

1 STEP 1

Job Set Up

- Energize the aircraft electrical circuits.
- Push the SLEW P/BSW to remove the remaining paper from the printer.
- Make sure that the circuit breaker 6TW PTR/SPLY is closed

2 STEP 2

Procedure

- Turn the locking system to release the door.
- Lift the door and discard the empty roll.
- Clean the remaining paper off the paper cutter.
- Install a new roll of paper on its support and check that the paper roll turns correctly.
- Engage the paper under drive roller and check that paper is held tight.
- Close and lock the printer door.
- Push the SLEW pushbutton switch to move the paper out of the slot of the paper cutter.
- Use the cutter to remove unwanted paper.

3 STEP 3

Close Up

- Put the aircraft back to its initial configuration.
- De–energize the aircraft electrical circuits (if not needed anymore).
- Make sure that work area is clean and clear of tools and other items.

NOTE: Using the SLEW P/B move the paper out of the slot of the paper cutter and cut off the unwanted paper.

1

Servicing of the Printer

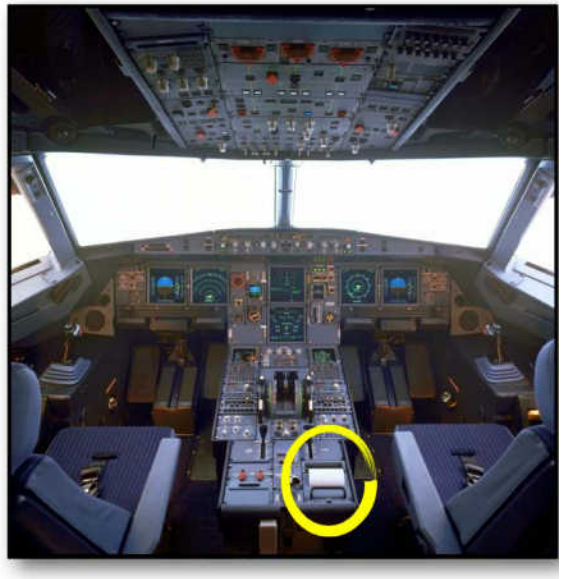
Job set-up

- **Push the SLEW pushbutton switch to remove the remaining paper from the printer.**
- **Make sure that the circuit breaker 6TW is closed.**

Procedure

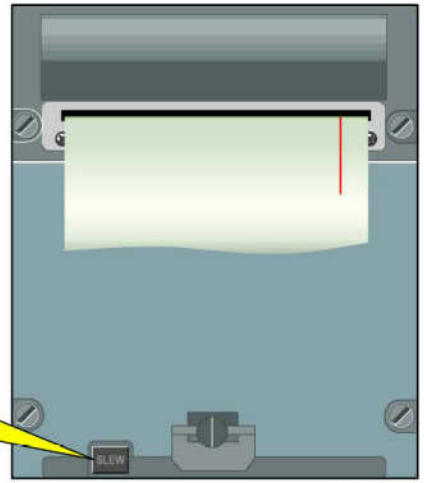
Servicing of the Printer:

Close-up



REAR C/B PANEL
(121VU)

A red stripe on the paper side indicates end of roll.



PRINTER

Figure 66 Printer Paper Loading - Job Set Up

Servicing of the Printer

Job set-up 2

Procedure

Servicing of the Printer:
(1)Release the door with the locking system.
(2)Lift the door.
(3)Move the empty roll from the right to the left to disengage it from its support.
(4)Clean the remaining paper off the paper cutter.
(5)Install the new roll of paper on its support.
(6)Manually engage the end of the paper under the drive roller.
(7)Close the door.
(8)Lock the door with the locking system.
(9)Push the SLEW pushbutton switch to move the paper out of the slot of the paper cutter.
(10)Use the cutter to remove unwanted paper.

Close-up

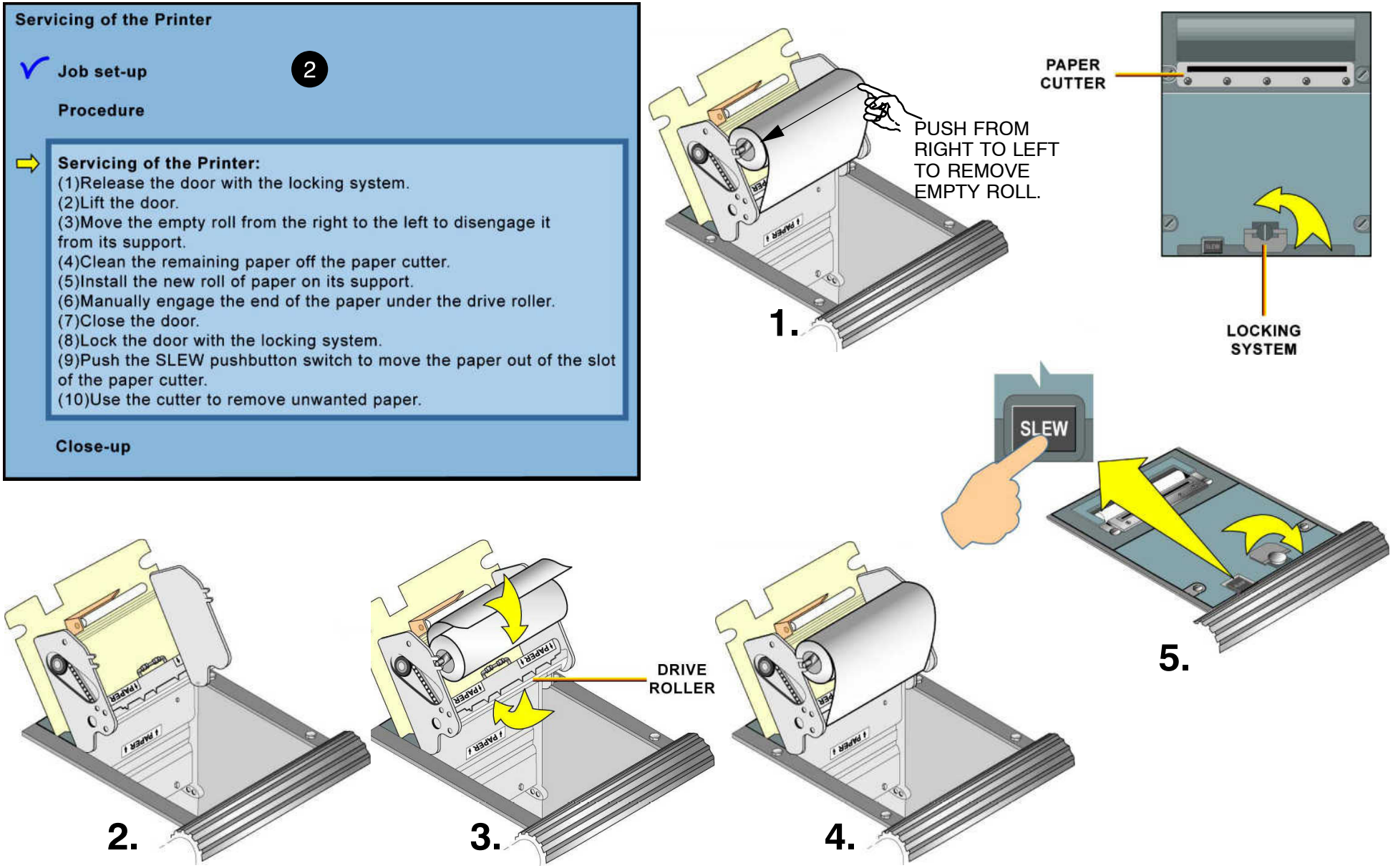


Figure 67 Printer Paper Loading - Procedure

Servicing of the Printer

3

✓ Job set-up

✓ Push the SLEW pushbutton switch to remove the remaining paper from the printer.

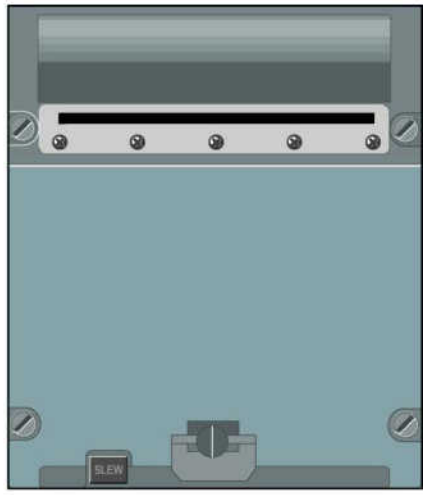
✓ Make sure that the circuit breaker 6TW is closed.

Procedure

✓ Servicing of the Printer:

✓ Close-up

TASK COMPLETED



A paper roll allows a 90 feet printing.

REAR C/B PANEL
(121VU)

Figure 68 Printer Paper Loading - Close Up

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