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Airbus
A318/A319/A320/A321

ATA 26
Fire Protection

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EASA Part-66
B1/B2

Training Manual

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ATA 26 FIRE PROTECTION

26–00 FIRE PROTECTION GENERAL

FIRE PROTECTION INTRODUCTION

Definition

The design of the fire detection system is different according to the area which is monitored.

Overheat and Fire Detection

The fire and overheat detection elements are installed in each engine nacelle and in the APU compartment.

Smoke detection

The function of the smoke detection system is to monitor each lavatory, the avionics compartment and cargo compartments.

System Description

- **Fire and Overheat Detection**

  Thermo sensitive loops detect fire or overheat conditions. They trigger the warning by means of the FDU (**F**ire **D**etection **U**nit) when the temperature reaches the threshold of the monitored area.

- **Engine**

  Two independent loops are installed in each engine nacelle. They are connected in parallel and according to an AND logic.

  The purpose of this logic is to prevent spurious FIRE warnings.

  The engine overheat and fire detection system is detailed in ATA chapter 26–12–00.

- **APU**

  The detection system monitors the APU compartment where fuel and bleed air systems are possible fire sources.

  The detection system comprises two independent loops. They are connected in parallel and according to an AND logic.

  The purpose of this logic is to prevent spurious FIRE warnings.

  The APU fire and overheat detection system is detailed in ATA chapter 26–13–00.

- **Smoke Detection**

  Smoke detectors are used to detect the visible and invisible combustion particles.

  When the preset threshold is reached, the smoke detector triggers a warning via the SDCU (**S**moke **D**etection **C**ontrol **U**nit).

- **Avionics compartment**

  In the avionics compartment, smoke detection system sensing is provided with one smoke detector.

  The smoke detector is installed on the ventilation air extraction duct.

  When the warning is triggered, the crew members must initiate the smoke procedure.

  The avionics compartment smoke detection is detailed in ATA chapter 26–15–00.

- **Lower deck cargo compartment**

  In the lower deck cargo compartment there are ambient smoke detectors. They function by pair to prevent spurious smoke warnings.

  The ambient smoke detectors are installed in the forward, aft and bulk cargo compartment.

  When a warning is triggered, the corresponding ventilation and heating system closes automatically.

  The lower deck cargo compartment smoke detection is detailed in ATA chapter 26–16–00.

- **Lavatories**

  Each lavatory is equipped with one ambient smoke detector.

  The lavatory smoke detection system is detailed in ATA chapter 26–17–00.

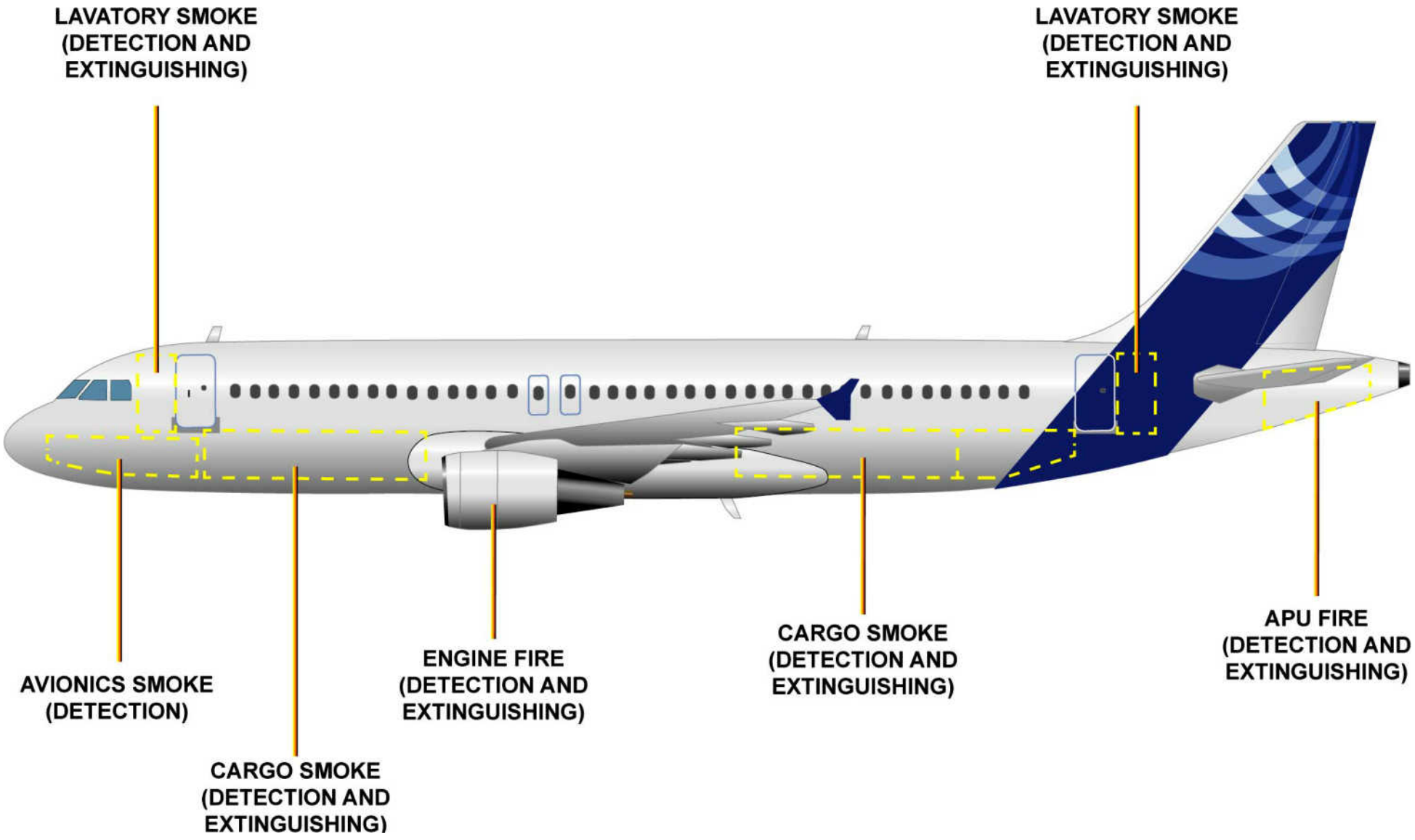


Figure 1 Fire Detection/Extinguishing System Overview

26–10 DETECTION

ENG/APU FIRE DETECTOR GENERAL DESCRIPTION

FIRE DETECTOR

Fire Detectors

- Pylon Fire Detectors
- Fan Fire Detectors
- Core Fire Detector
- APU compartment fire detectors

Fire Detectors

Each fire and overheat detector has a sensing element and responder assembly.

- **Sensing element**

  A sensing element is a tube 0.063 in. (1.6 mm) in outer diameter and 0.018 in. (0.46 mm) in thickness.

  It contains a hydrogen–charged titanium core with a spiral wound around it. This spiral is made of an inert material which has a special property: it can give off and absorb a gas.

  The gap between the sensing–element outer–tube wall and the core is filled with helium.

  The initial pressure of the helium is related to the pre–set temperature threshold selected for each sensing element.

  The sensing element reacts according to the ideal gas law.

  One end of the sensing element is hermetically soldered and the other one is connected to a 1 in. (25.4 mm) diameter stainless steel body called responder.

- **Responder assembly**

  The responder contains a chamber connected to two pressure switches:

  an ALARM switch and a MONITOR switch. The free end of the responder is connected to the aircraft electrical circuit.

  The detector has two sensing functions. It responds to an overall ”average” temperature threshold or to a highly localized ”discrete” temperature caused by impinging flame or hot gases. This results in the ALARM switch closure. the ”average” and discrete temperatures cannot be adjusted.

  In addition, the averaging and discrete functions are reversible.

  When the sensor tube has cooled, the average gas pressure decreases and the core material absorbs the discrete hydrogen gas.

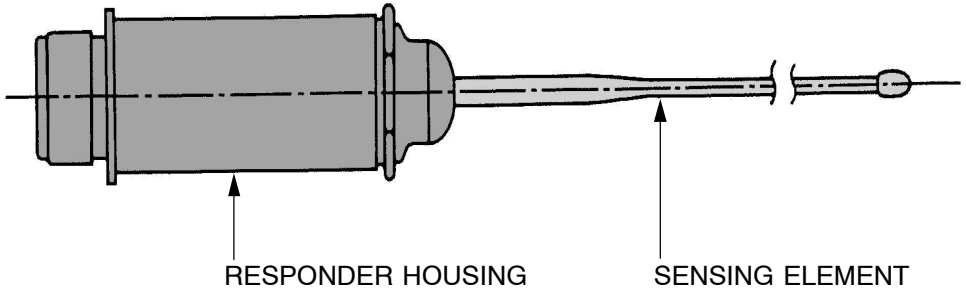
  If the detector leaks, the gas pressure decrease causes the MONITOR switch to open and generates a detector fault signal.

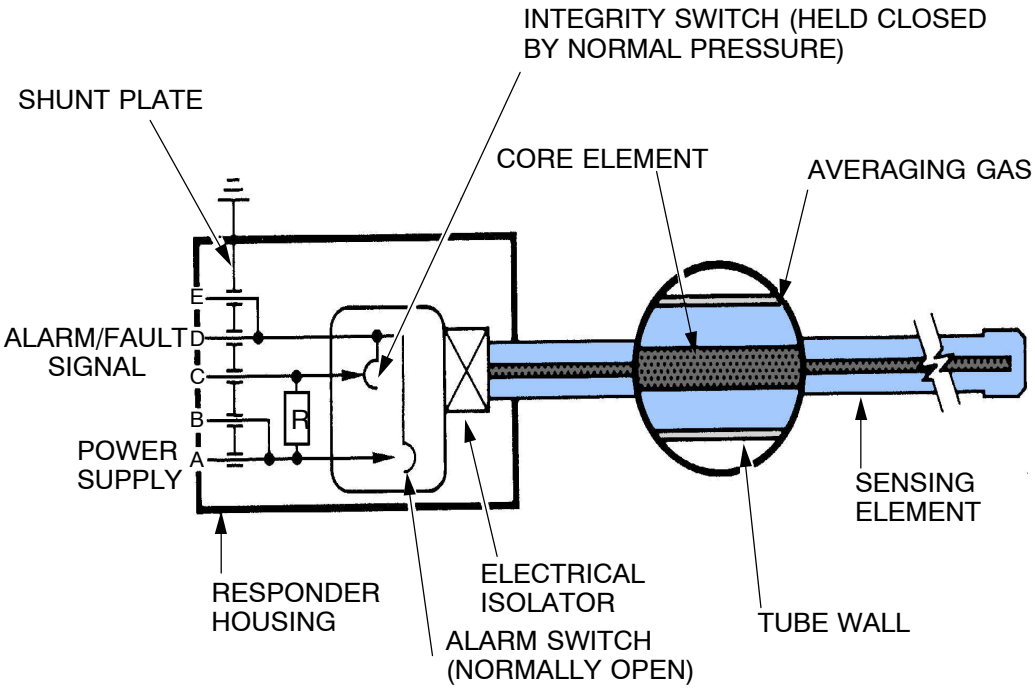
  The system then does not operate during test.

Safety Precautions

CAUTION: THE DETECTOR RESPONDER IS HERMETICALLY SEALED, AND AS SUCH, IS NOT FIELD REPAIRABLE.

ANY ATTEMPT TO DISASSEMBLE A DETECTOR RESPONDER WILL CAUSE SERIOUS DAMAGE TO THE UNIT AND RENDER IT INOPERATIVE.





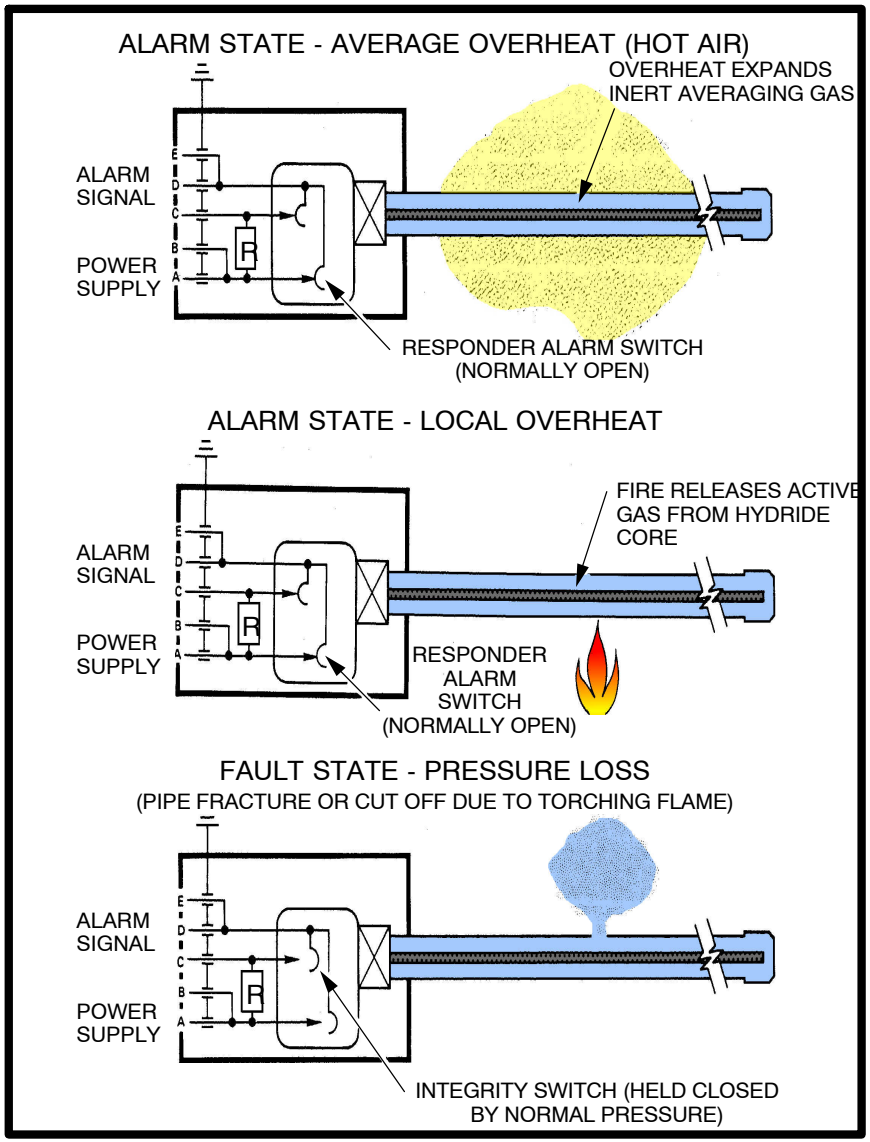


Figure 2 Fire Sensing Element Schematic

LAVATORY, CARGO & AVIONICS SMOKE DETECTOR INTRODUCTION

GENERAL DESCRIPTION

Classic Ionization Smoke Detectors (PRE SB 26–1052):

All smoke detectors are based on the ionization principle. They ionizes the air particles that pass between the electrodes. As smoke causes the electrical resistance of the circuit to increase, the voltage in the measurement chamber increase to a higher level than the reference chamber.

At a set difference level the detector sends a signal. The reference chamber makes allowances for differential pressure. It makes sure that the detector operates on the ground and in flight within the same level of sensitivity.

NOTE: Also in classic aircraft types optical smoke detectors may be installed. Airbus released service bulletins for exchanging ionization detectors by optical ones.

Optical Smoke Detector (POST SB 26–1052):

The smoke detectors operates on the principle of scattered light. The light source, the labyrinth and the photocell are set out in a horizontal plane so that the photocell cannot receive light. But when there is smoke, the smoke particles reflect and scatter a part of the light beam. The photocell receives this light and gives an analog signal and set of the alarm.

Performance Differences between both Types

Optical or ”toast–proof” smoke detectors are generally quicker in detecting particulate (smoke) generated by smoldering (cool, smokey) fires.

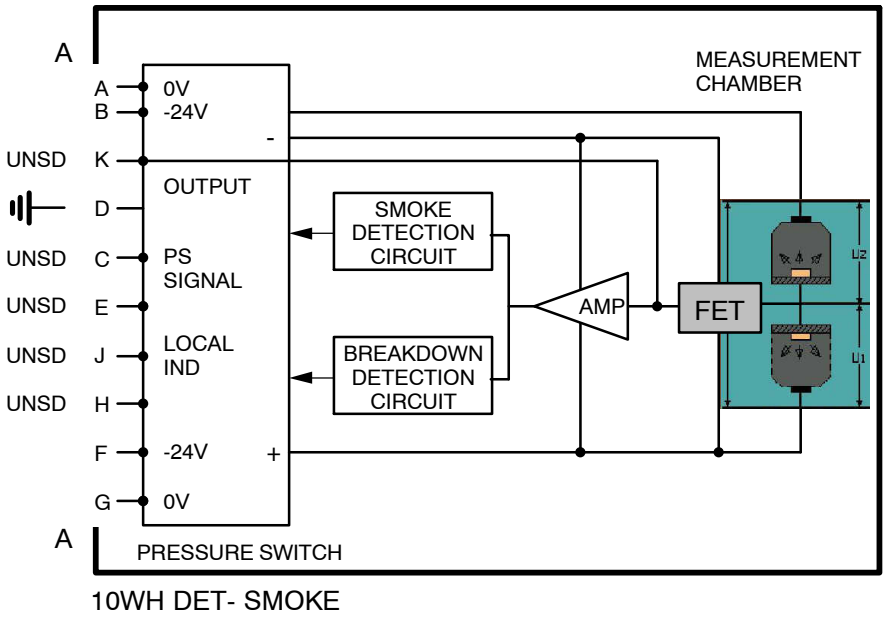
Ionization smoke detectors are generally quicker in detecting particulate (smoke) generated by flaming (hot) fires.

Many independent tests indicate that optical smoke detectors typically detect particulate (smoke) from hot, flaming fires approximately 30 seconds later than ionization smoke alarms, and that ionization smoke alarms detect particulate from smoldering (cool, smokey) fires 30 minutes later than photoelectric smoke detectors.

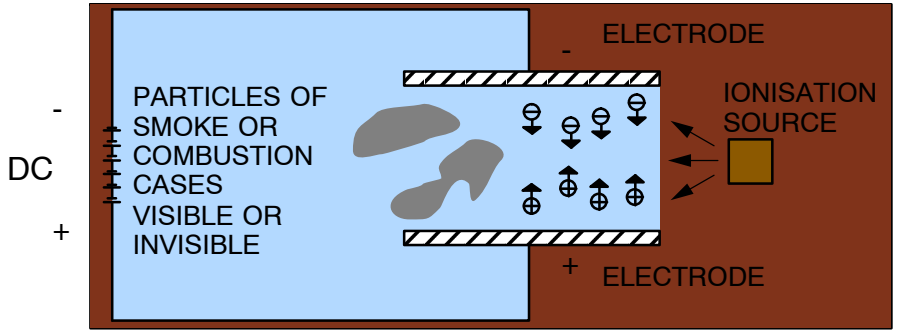
Tests have also been performed in which particulate generated by a smoldering fire has reduced the visibility within the test room to almost zero, and where the ionization smoke detector did not triggered an alarm.

There is also a bigger effort to discard the ionization type smoke detectors, because of their radioactive contents (Radium 226 or Americium 241).

Ionization Type



10WH DET- SMOKE



Photoelectrical Type

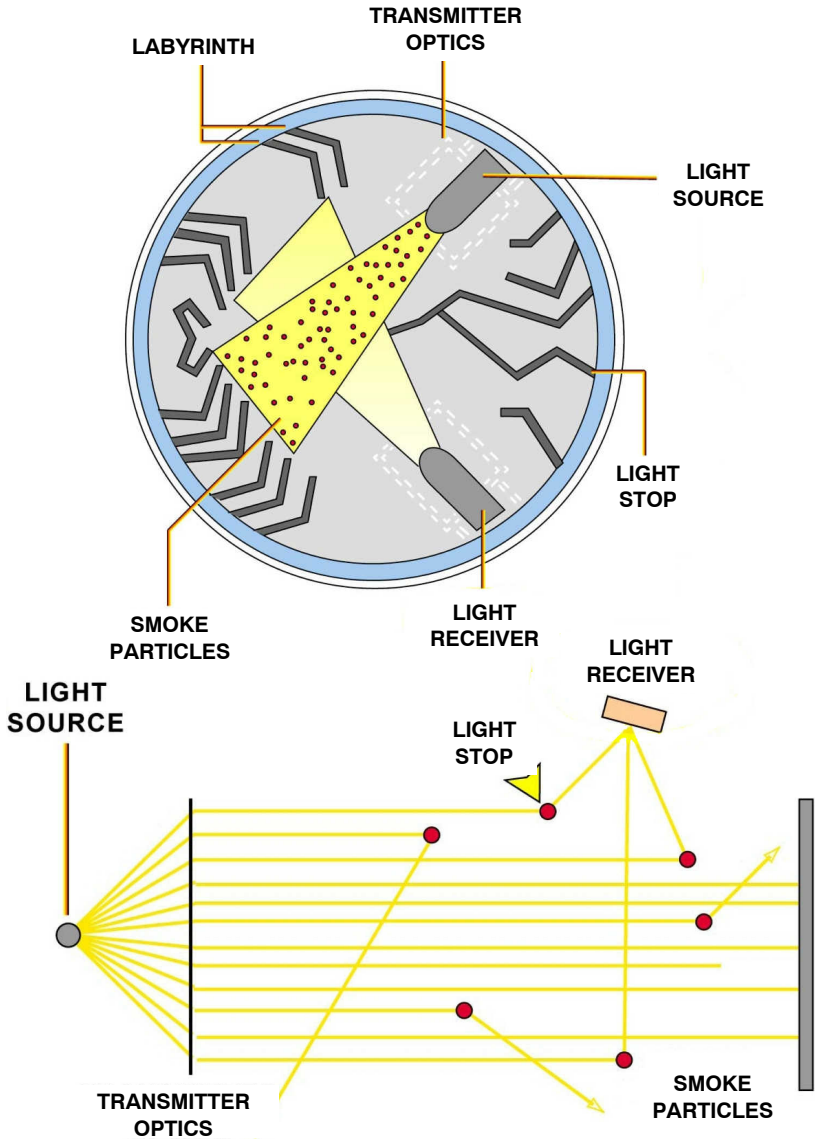


Figure 3 Smoke Detector

26–20 EXTINGUISHING

EXTINGUISHING GENERAL DESCRIPTION

GENERAL

There are several different fire extinguishing methods.
The methods depend on:

- the area in which the fire occurs
- whether the aircraft is in flight or on the ground

The fire extinguishing systems are either fixed extinguishing bottle(s) or portable fire extinguisher(s).

The fixed extinguishing bottle(s) are operated either automatically and manually and portable fire extinguishers are operated manually

SYSTEM DESCRIPTION

Fixed Fire Extinguishing Bottles

The function of the fixed fire–extinguishing bottle(s) installed on board is to extinguish fire occurring in the following areas:

- **Engine**
  - There is a fire extinguishing system in each nacelle. The system is supplied by two bottles. The percussion of the bottles is controlled from the cockpit.

    The engine nacelle fire extinguishing system is detailed in ATA chapter 26–21–00
- **APU**
  - The APU fire extinguishing system is supplied by one bottle.

    The percussion of the bottle on the ground can be controlled manually or automatically. In flight, the percussion is manually activated from the cockpit.

    The APU fire extinguishing system is detailed in ATA chapter 26–22–00.
- **Cargo Compartment**
  - the cargo compartment fire extinguishing system is supplied by one bottle. The extinguishing agent can be sprayed in the cargo compartment.

    The percussion of the bottle is controlled from the cockpit.

    The cargo compartment fire extinguishing system is detailed in ATA chapter 26–23–00.
- **Lavatories**
  - A bottle located above the waste bin can extinguish a fire in the lavatory waste bin.

    The lavatory fire extinguishing system is detailed in ATA chapter 26–25–00

Portable Equipment

The portable extinguishers are operated manually and are used if there is a fire in the cockpit or the cabin.

The portable extinguishers are detailed in ATA chapter 26–24–00.

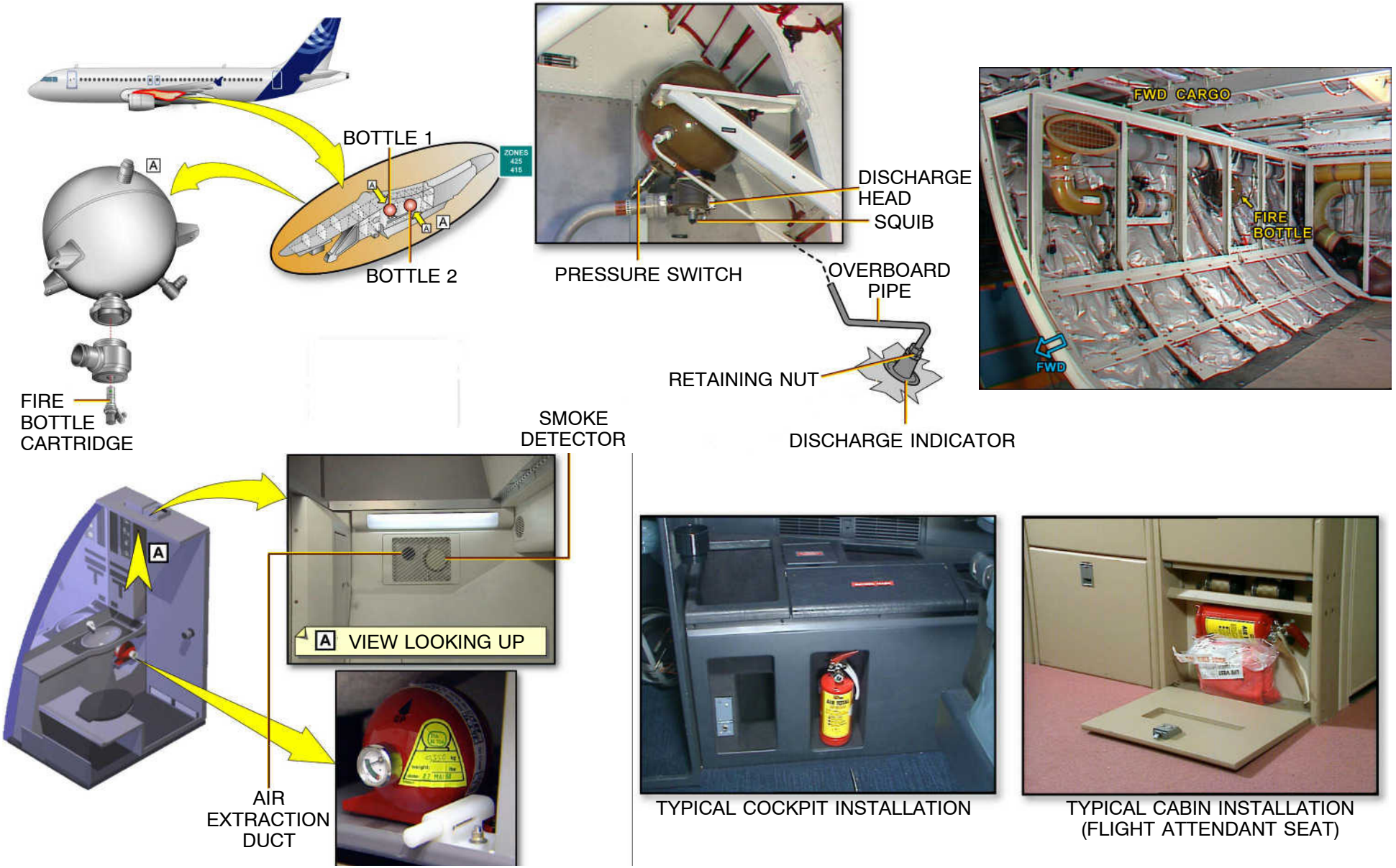


Figure 4 Extinguishing Systems

26-12 ENGINE FIRE AND OVERHEAT DETECTION

GENERAL DESCRIPTION

The fire detection system is of the electro–pneumatic type. On each engine there are two continuous loops for the fire detection.

The loops are connected in parallel to a FDU (**F**ire **D**etection **U**nit). The connection is made through an AND logic to avoid spurious FIRE warnings. In case of failure of one loop, the AND logic becomes an OR logic. The aircraft can be released in this configuration.

The fire detection loops are monitored by the FDU. The monitoring device indicates the loss of a fire detection loop to the crew members (Flight Warning System).

For one engine, each loop:

- comprises three fire detectors connected in parallel. The detectors are installed in the nacelle and pylon fire zones.
- is connected to a separate channel of the FDU
- is connected through the related channel, to four of the eight lamps in a red warning light common to the two loops. This warning light is integral with the ENG/FIRE pushbutton switch located on the ENG/FIRE control panel (overhead panel).

The fire detection system can be tested using the TEST pushbuttons on the ENG/APU fire control panel (OVHD pnl).

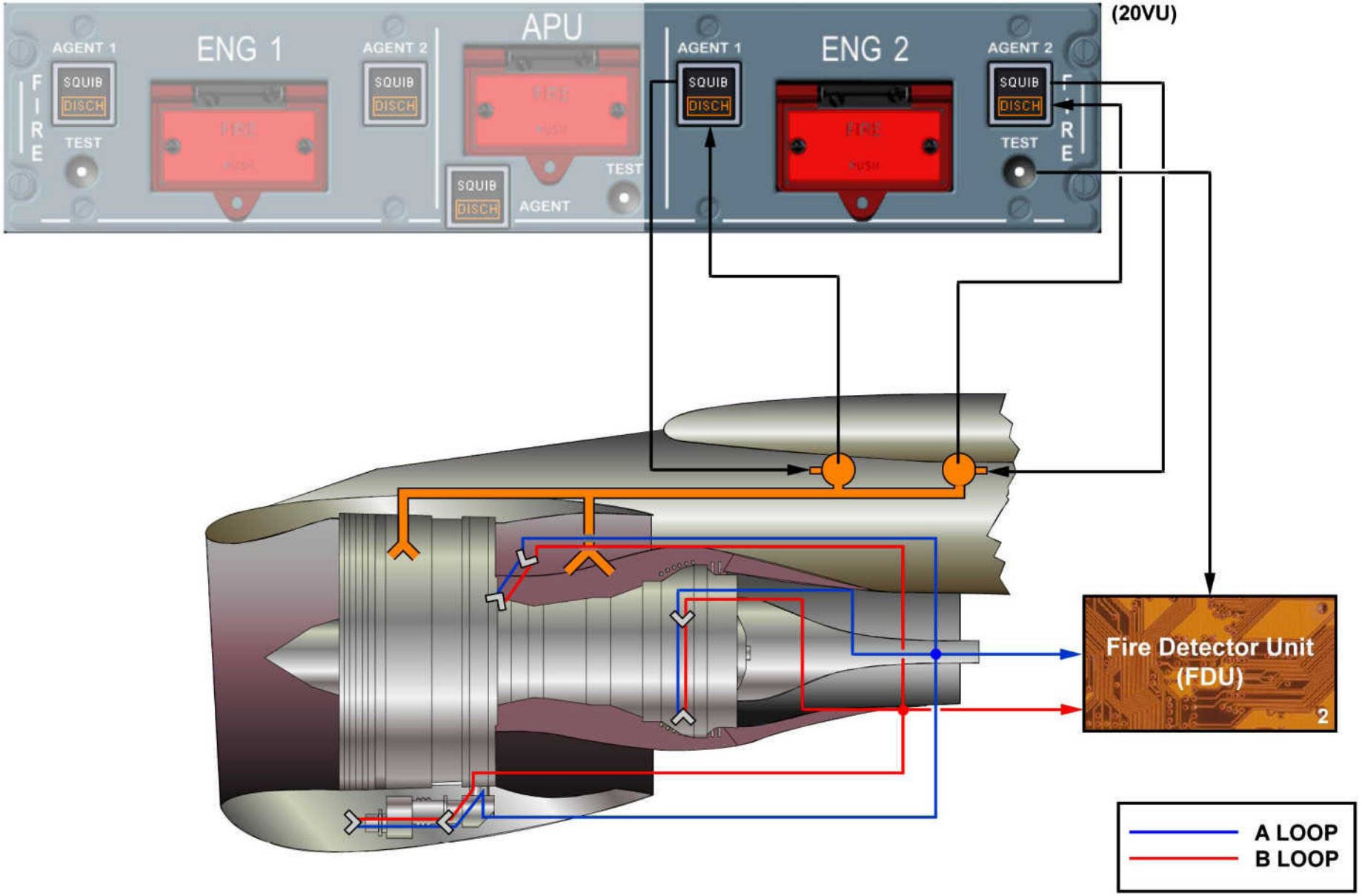


Figure 5 Engine Fire Detection Schematic

ENGINE FIRE DETECTION LOOP COMPONENT LOCATION

Location

The fire detection loop has three fire detectors connected in parallel. They are installed at the engine–to–pylon forward mount, in the fan compartment close to the accessories gearbox and vertically in the aft part of the core compartment.

Installation

The fire detectors are installed in pairs on pre–formed, stainless steel supports on the engine (loop A and loop B).

The sensing elements are installed with quick–release clamps which have teflon bushings and are designed for continuous high temperature operation.

Temperature Chart:

Compartment	Discrete Temperature	Average Temperature
FAN	500 deg.C (932 deg.F)	221 deg.C (430 deg.F)
CORE	565 deg.C (1050 deg.F)	302 deg.C (575 deg.F)
PYLON	675 deg.C (1247 deg.F	400 deg.C (752 deg.F)

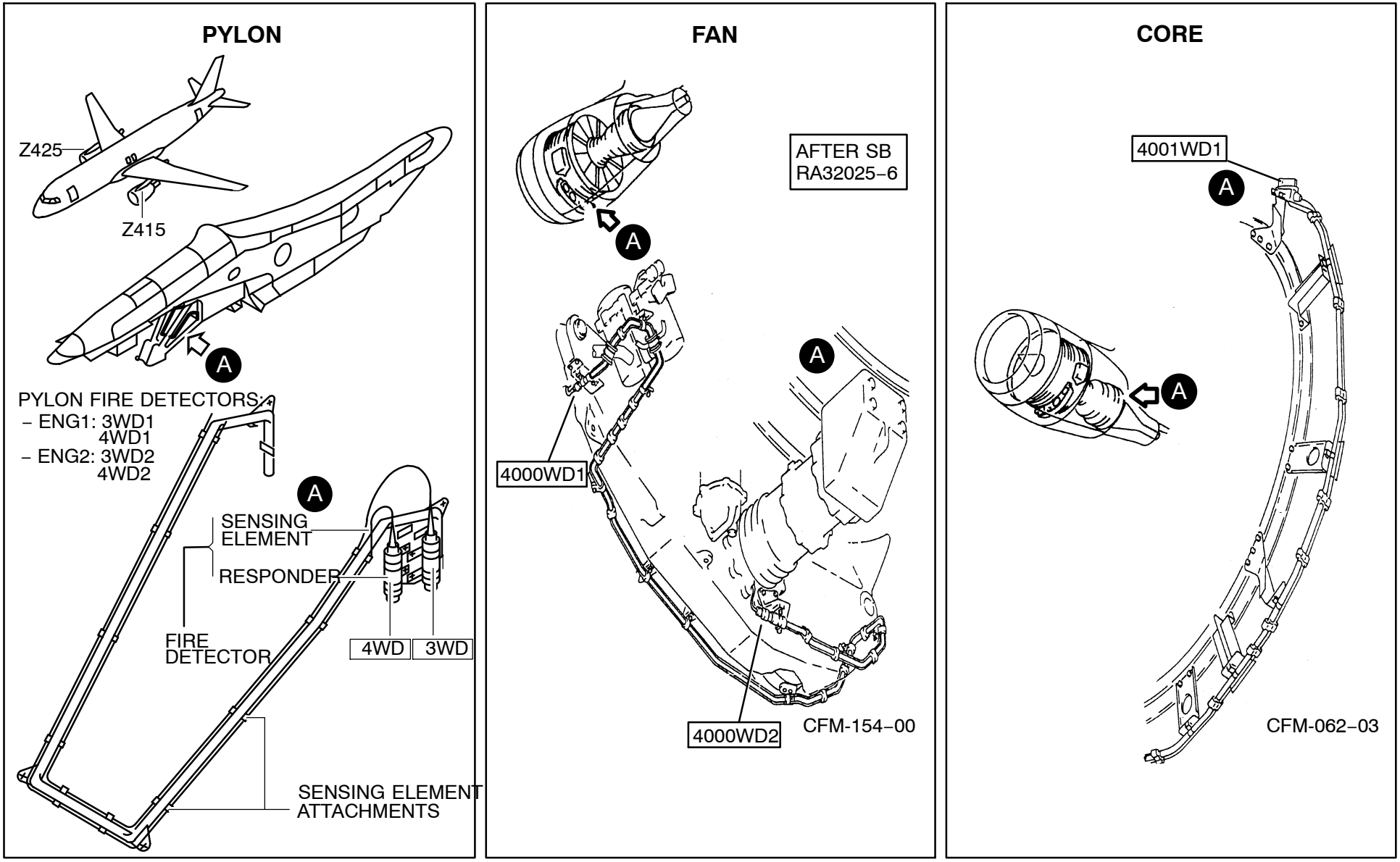


Figure 6 Fire Detection Loops-Location

FIRE DETECTION UNIT- GENERAL DESCRIPTION

Description

The FDU (**F**ire **D**etection **U**nit) processes the signals received from the fire detection loops.

There are three functional modules:

- two independent channels (1 for each detection loop)
- one monitoring circuitry (for maintenance purpose only)

The channels

Each channel has its own power supply.

The two channels normally operate together, with an AND logic, for the fire detection. However, if one loop is inoperative, the other loop can operate independently.

Input Signals

Each channel receives and analyses continuously the signal from its related detection loop. Three comparators are used for this analysis:

- the FIRE comparator
- the CONTAMINATION comparator
- the INTEGRITY comparator

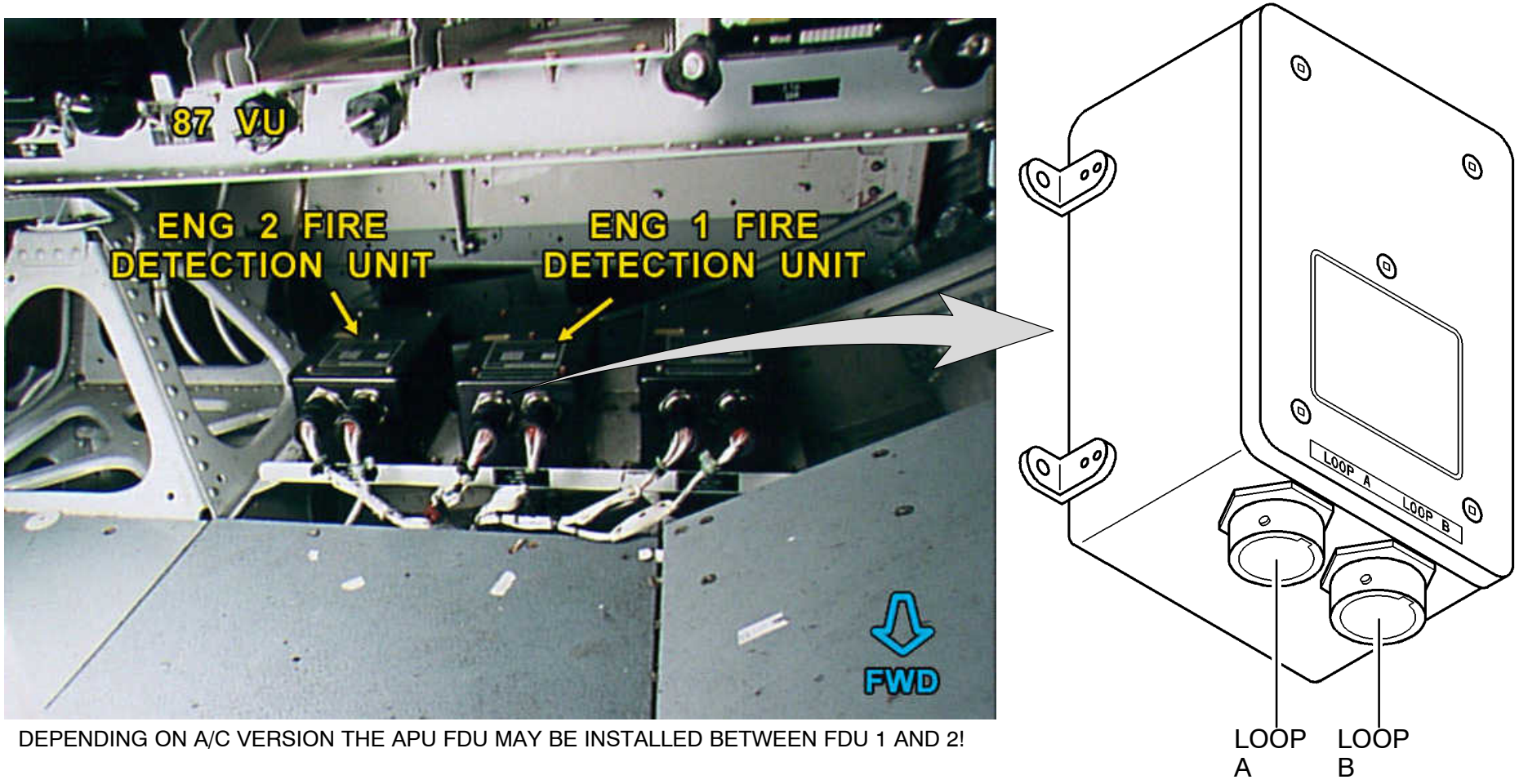
Output Signals

The output signals are generated via discrete signals and/or the ARINC 429 bus. The fire warning signals (aural and/or visual) thus generated are transmitted to the cockpit.

Monitoring circuitry

The monitoring circuitry analyses and monitors continuously the fire detection system. In case of failure of the system the monitoring circuitry:

- memorizes the fault in a non–volatile memory
- isolates the faulty channel
- generates the appropriate discrete signals,
  (i.e. LOOP A(B) INOP ENG 1 (2) to the FWC 1(2))
- transmits continuously a system status message to the CFDIU 1(2) via the ARINC 429 bus



DEPENDING ON A/C VERSION THE APU FDU MAY BE INSTALLED BETWEEN FDU 1 AND 2!

Figure 7 Engine Fire Detection Unit Location

FIRE DETECTION UNIT-OPERATION

Operation of the channels

Channels A and B are identical and particular to each fire detection loop.

The input section of each channel comprises a bridge circuit with:

- a reference voltage,
- a variable loop voltage made of the three fire detectors in parallel.

The reference voltage is sent to the three comparators (FIRE, INTEGRITY and CONTAMINATION) and forms the thresholds values. A resistor, upstream of each comparator, adjusts this reference voltage which becomes the comparator threshold value.

Each fire detector resistance is 4.5 KΩ, thus the equivalent resistance of each fire detection loop is 1.5 KΩ.

The equivalent resistance varies when a change of state occurs in the monitored areas of the engine. This generates a variable loop voltage at the three comparators.

The comparator outputs are sent on the FIRE and FAULT logic gates. The logic gates generate the alarm outputs.

Normal conditions

In normal conditions (no failure, no fire, no test), the variable voltage of the loop is:

- higher than the threshold 1 of the integrity comparator
- lower than the threshold 2 of the fire and contamination thresholds

Unnormal Conditions

The following conditions are possible:

- Integrity fault,
- Contamination fault,
- Fire detected.l

Controller Circuit

The controller circuit operating software:

- monitors the two detection loops,
- isolates the failed detector and loop circuit and memorizes the failures in a non–volatile memory,
- does a check of the fire test circuity when it is activated,
- does the self–test at the first power–up of the FDU,
- does the built–in test and transmits the test results on the ARINC 429 bus,
- transmits the failure signals to the CFDIU via the ARINC 429 bus,
- continuously transmits current and/or previous system status on the ARINC 429 bus,
- provides a serial bus interface and does command and data transmissions.

Indicating

FAULT warnings are generated via discrete signals.

There is an INOP signal if any of the following conditions occurs:

- an electrical failure (loss of power, connector not connected)
- a failure in a detector
- a failure in a detection circuit
- the detection of a single fire detection loop for a time greater than 16 sec while the other loop is in normal condition.

The FAULT warning signals thus generated are transmitted to the cockpit, at the following locations:

- MASTER CAUT light
- Upper ECAM display unit: ENG 1 (2) LOOP A (B) FAULT or ENG 1 (2) DET FAULT.

The Single Chime (SC) sounds.

In addition, the failure message in plain language is transmitted continuously via the ARINC 429 bus to the CFDIU.

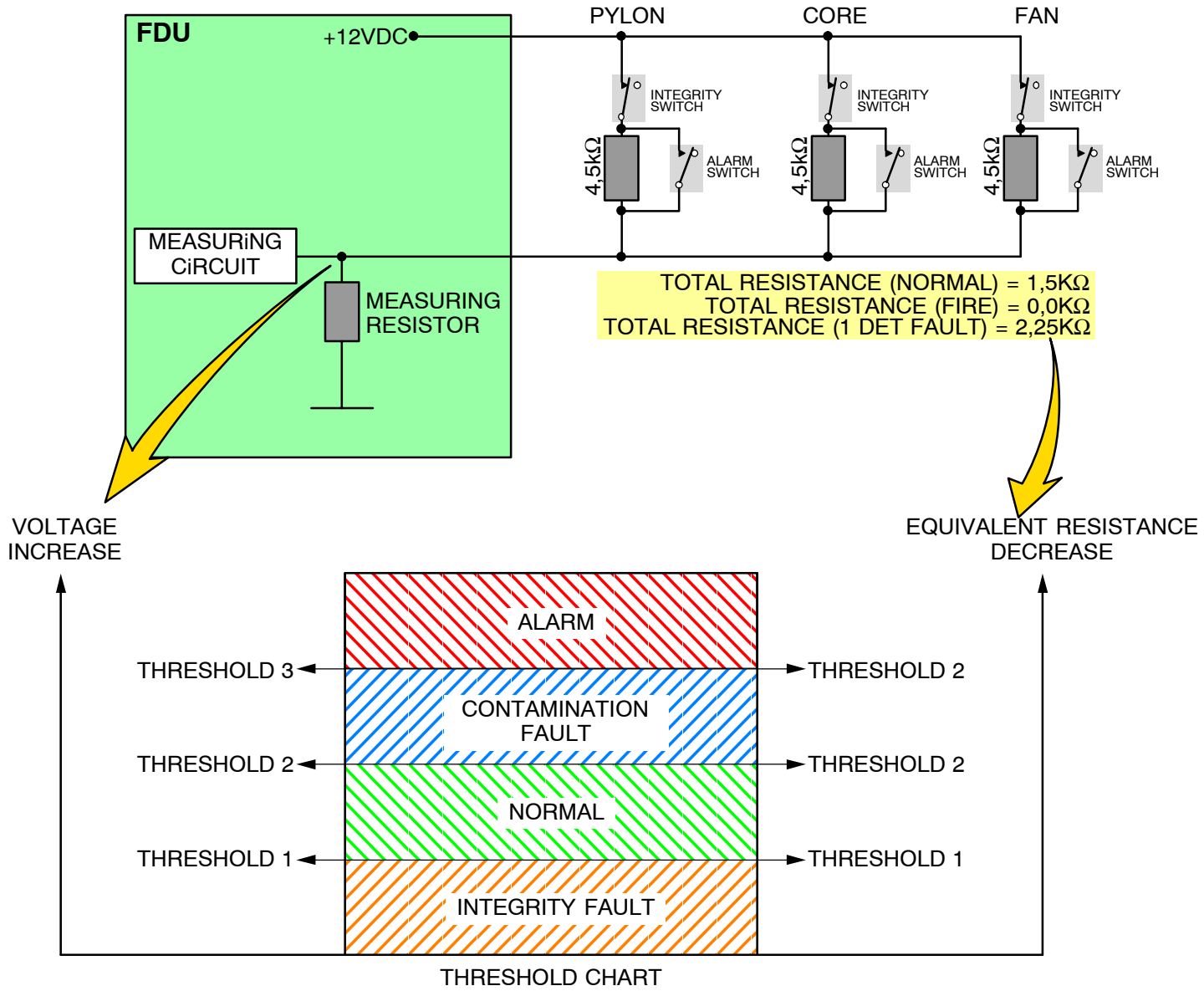


Figure 8 Engine Fire Detection Unit

ENGINE FIRE WARNING SYSTEM PRESENTATION

There is a FIRE warning signal if any of the following conditions occurs:

- FIRE A and FIRE B
- FIRE A and FAULT B
- FAULT A and FIRE B
- FAULT A and FAULT B in less than 5 seconds

The FIRE warning signals thus generated are transmitted to the cockpit, at the following locations:

- ENG/FIRE control panel: ENG/FIRE pushbutton switch
- ENG MASTER control panel: ENG/FIRE/FAULT annunciator
- MASTER WARN lights
- EWD: ENG 1 (2) FIRE and fire extinguishing procedure
- SD: engine page
- The CRC (**C**ontinuous **R**epetitive **C**hime) sounds.

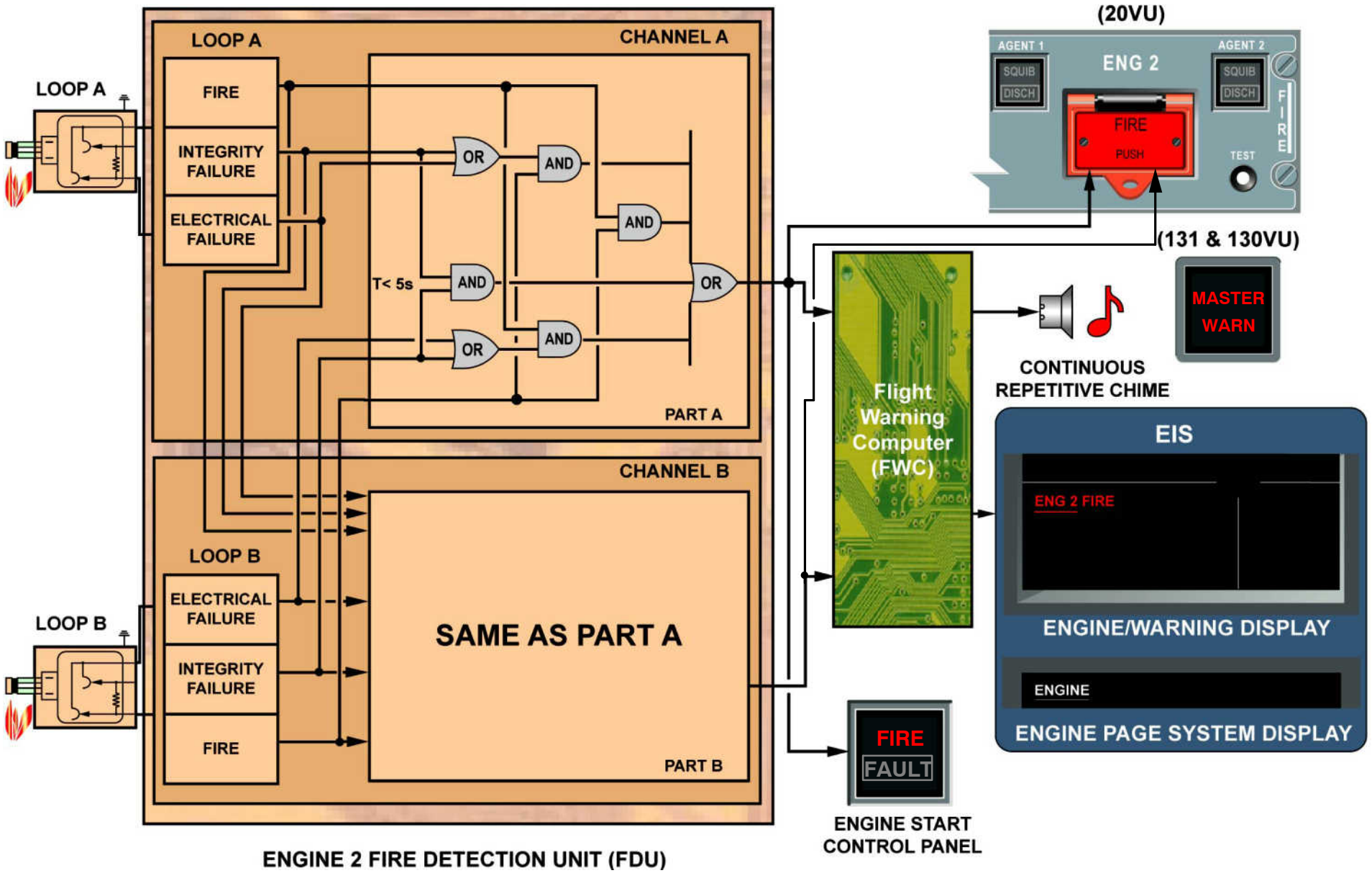


Figure 9 Engine Fire Detection Logic

LOOP FAULT DETECTION SYSTEM OPERATION

LOOP FAULT WARNINGS

FAULT warnings are generated via discrete signals.

- There is an inoperative signal if any of the following conditions occurs:
  - an electrical failure (loss of power, connector not connected)
  - a failure in a detector
  - a failure in a detection circuit
  - the detection of a single fire detection loop for a time greater than 16 sec while the other loop is in normal condition.
- the following indication occurs:
  - EWD: ENG 1 (2) LOOP A (B) FAULT

NOTE: In addition the BITE failure message in plain language is transmitted continuously via the ARINC 429 bus to the CFDS.

Fault Circuit

Integrity Fault

Any failure of the fire detector (responder/sensing element) causes an increase of the equivalent resistance of the three other fire detectors.

A detector can be unserviceable because of:

- the opening of a MONITOR switch installed in series with an integral resistance
- or the loss of the electrical signal.

The loop voltage decreases and falls under the threshold 1 of the INTEGRITY comparator: this generates a LOOP A(B) INOP signal. This failure description is also applicable in case of accidental grounding of the responder.

Contamination Fault

If the responder or the connectors of FDU are contaminated:

- the equivalent resistance decreases
- the loop voltage is higher than threshold 2 and lower than 3

the CONTAMINATION comparator supplies the logic gates and generates a FAULT signal.

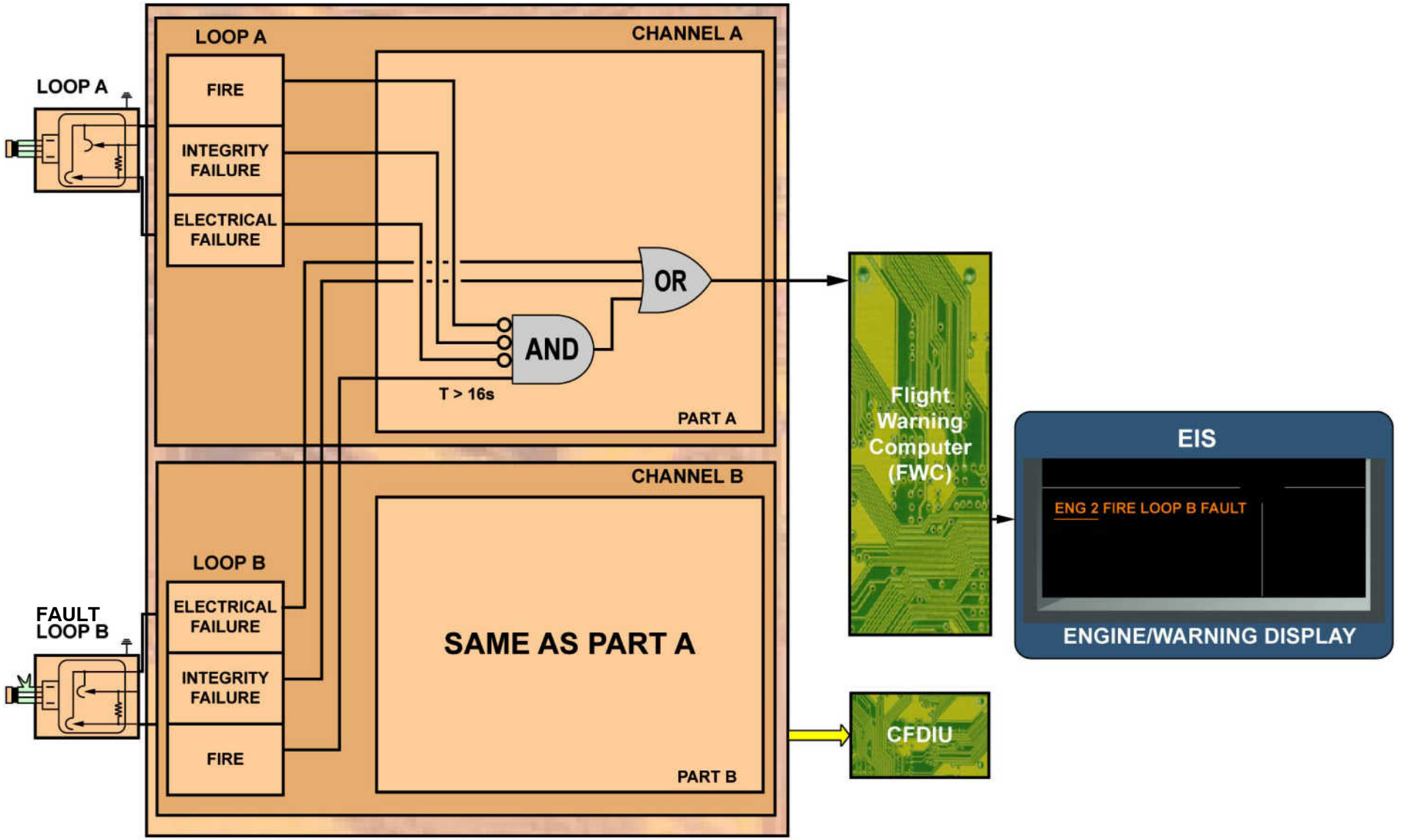


Figure 10 Engine Fire Loop Fault

ENGINE FIRE DETECTION FAULT SYSTEM OPERATION

DETECTION FAULT WARNINGS

Break in both loops occuring over 5 seconds.

- The FAULT warning signals thus generated are transmitted to the cockpit, at the following locations:
  - MASTER CAUTION light
  - EWD: ENG 1 (2) FIRE DET FAULT
  - The SC (**S**ingle **C**hime) sounds.

NOTE: In addition the BITE failure message in plain language is transmitted continuously via the ARINC 429 bus to the CFDS.

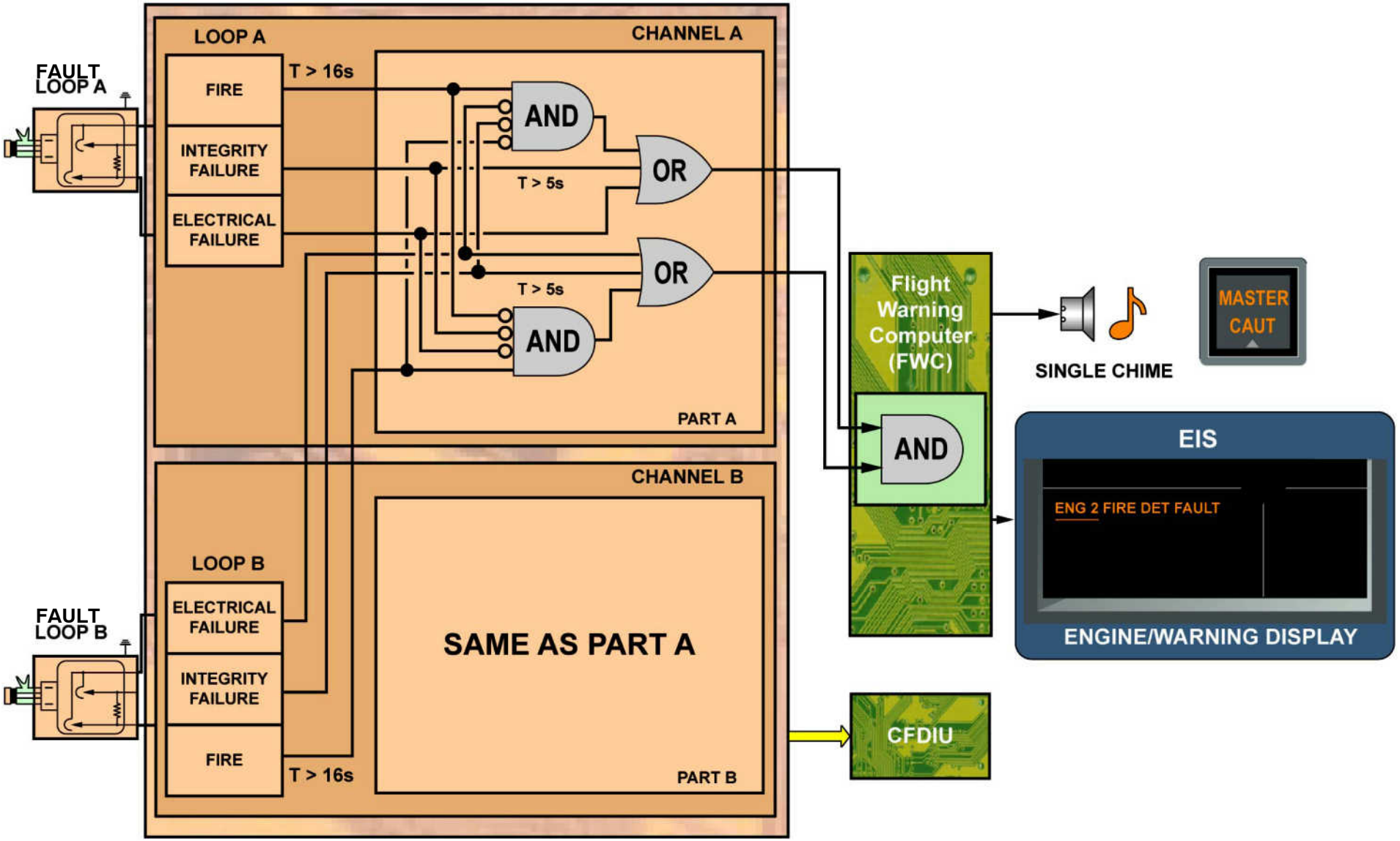


Figure 11 Engine Fire Detection Fault

FDU INTERFACES

FIRE WARNINGS-OPERATION

There is a FIRE warning signal if any of the following conditions occurs:

- FIRE A and FIRE B
- FIRE A and FAULT B
- FAULT A and FIRE B
- FAULT A and FAULT B in less than 5 seconds

The FIRE warning signals thus generated are transmitted to the cockpit, at the following locations:

- ENG/FIRE control panel : ENG/FIRE pushbutton switch
- ENG MASTER control panel : ENG/FIRE/FAULT annunciator
- MASTER WARN lights
- EWD: ENG 1 (2) FIRE and fire extinguishing procedure
- SD: engine page
- The CRC (**C**ontinuous **R**epetitive **C**hime) sounds.

A3

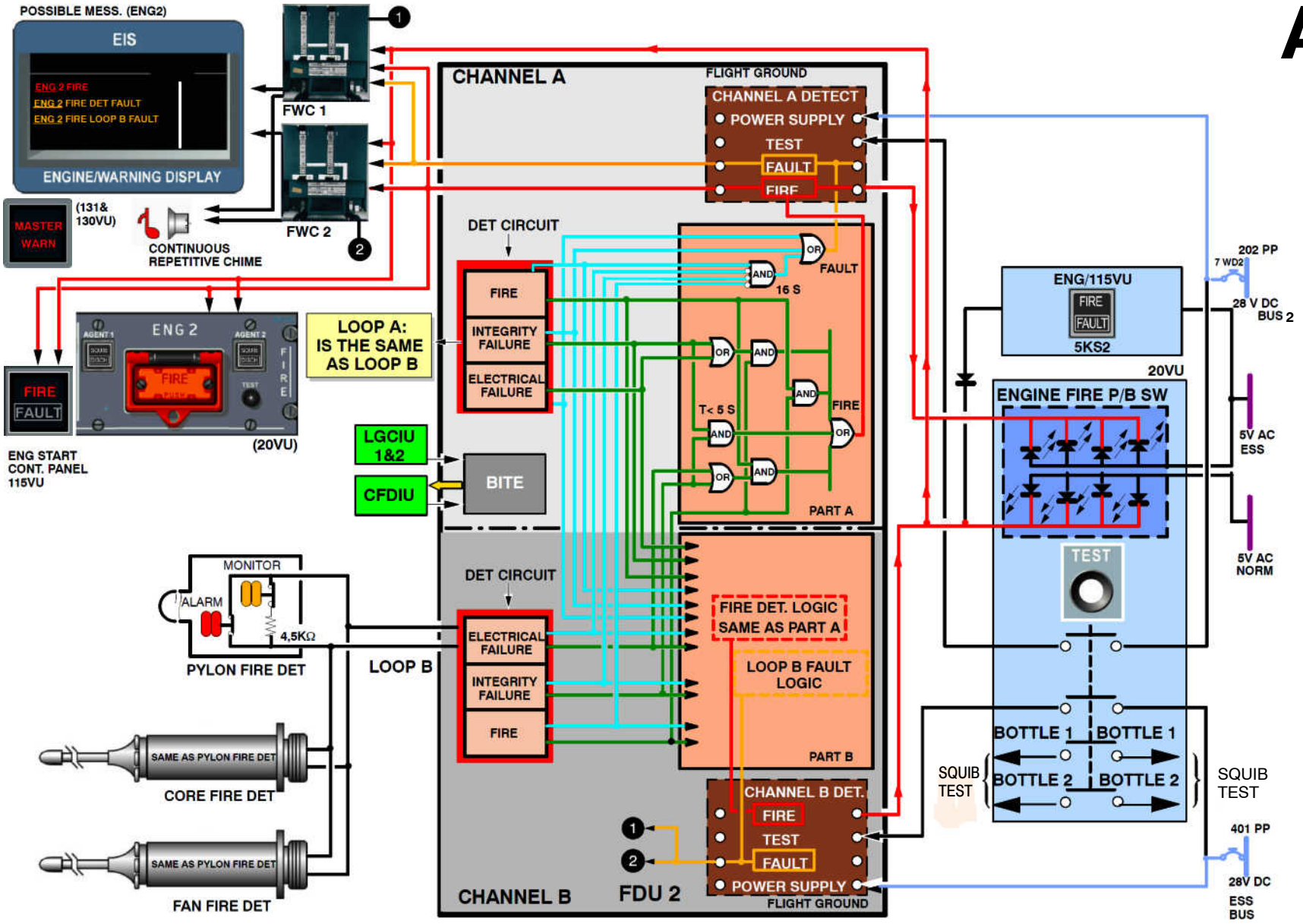


Figure 12 Engine Fire Detection Logic

26–21 ENGINE FIRE EXTINGUISHING

GENERAL DESCRIPTION

General

The fire extinguishing system is activated when fire is detected by the fire and overheat detection system (Ref. ATA 26–12–00).

The system has two main functions:

- to extinguish at its early stage any fire occurring in the nacelle protected zones.
- to prevent engine fire from spreading the engine is isolated from the rest of the aircraft ; the various supplies such as hot air, fuel, hydraulics, electrical power are closed for the purpose.

System Description

For each engine, two fire extinguisher bottles contain fire extinguishing agent.

The fire extinguisher bottles located in the aft section of the engine pylon are connected to the extinguishing system.

This system is routed in the pylon and leading to the nacelle.

The fire extinguisher bottles are controlled from the cockpit.

Their firing is possible only if the ENG 1(2) FIRE pushbutton switch (located on the ENG/APU FIRE panel (1WD) is already pushed and released out.

During the extinguishing procedure, the extinguishing agent flows in the rigid pipes and is immediately sprayed in the engine protected zones: fan and core compartments.

Thirty seconds later (after the first bottle discharged), if the fire is still present, the pilot fires the second bottle.

The fire extinguishing procedure is given by the ECAM display unit.

Interface

The engine fire extinguishing system has an interface with the following systems:

- Air Conditioning (PACKS) (Ref. 21–51–00),
- Electrical Power: AC Main Generation (Ref. 24–22–00)
- Electrical Power: DC Ancillary Equipment (Ref. 24–68–00)
- Engine LP Fuel shut off (Ref. 28–24–00)
- Green Main Hydraulic Power (Ref. 29–11–00
- Yellow Main Hydraulic Power (Ref. 29–13–00)
- FWC (**F**ight **W**arning **C**omputer) (Ref. 31–52–00)
- Annunciator Light Test and Dimming (Ref. 33–14–00)
- Engine Bleed Air Supply System (Ref. 36–11–00)
- Functional Interfaces (Ref. 73–25–00)

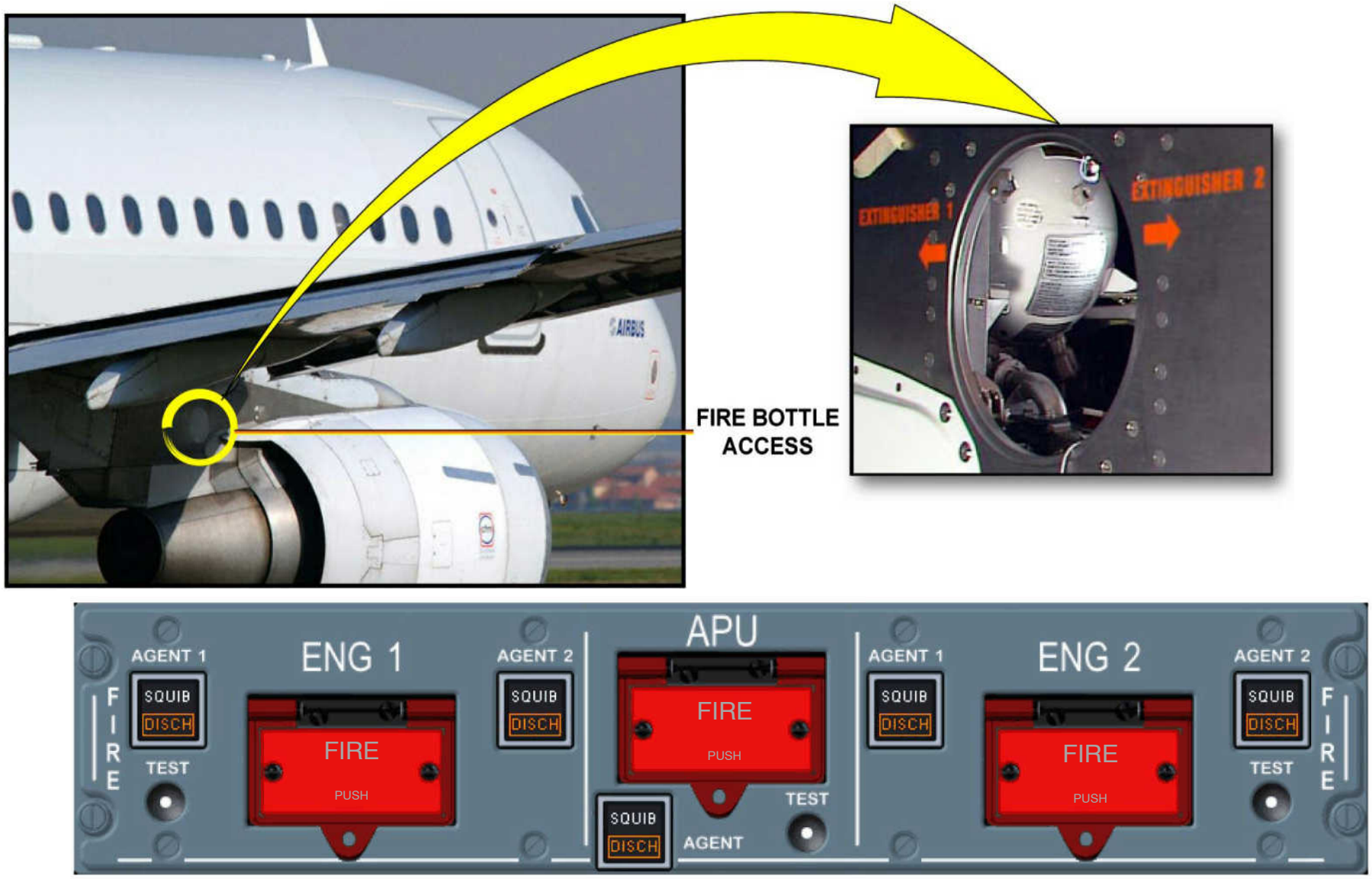


Figure 13 Engine Fire Extinguishing-General

CONTROL AND INDICATING GENERAL DESCRIPTION

Operation of the Fire Extinguishing System

The FIRE warning signals generated by the FDU (**F**ire **D**etection **U**nit) are transmitted to the cockpit, at the following locations:

- ENG/APU FIRE panel (1WD): ENG 1(2) FIRE pushbutton switch
- ENG MASTER control panel (115VU): ENG/FIRE/FAULT annunciator
- MASTER WARN light
- ECAM: ENG 1(2) FIRE and fire extinguishing procedure
- SD: engine page

The CRC (**C**ontinuous **R**epetitive **C**hime) sounds.

When you push the ENG 1(2) FIRE pushbutton switch, you arm the cartridge firing system. The SQUIB legend (white) comes on after this action. At the same time the engine is isolated and the CRC is stopped.

During the extinguishing procedure, the extinguishing agent flows in the rigid pipes and is immediately sprayed in the engine protected zones: fan and core compartments.

The DISCH legend (amber) comes on when the fire extinguisher bottle is completely discharged

NOTE: the ENG 1(2) fire pushbutton switch come on as long as the fire warning is generated by the FDU (**F**ire **D**etection **U**nit)

Thirty seconds later (after the first bottle discharged), if the fire is still present, the pilot fires the second bottle.

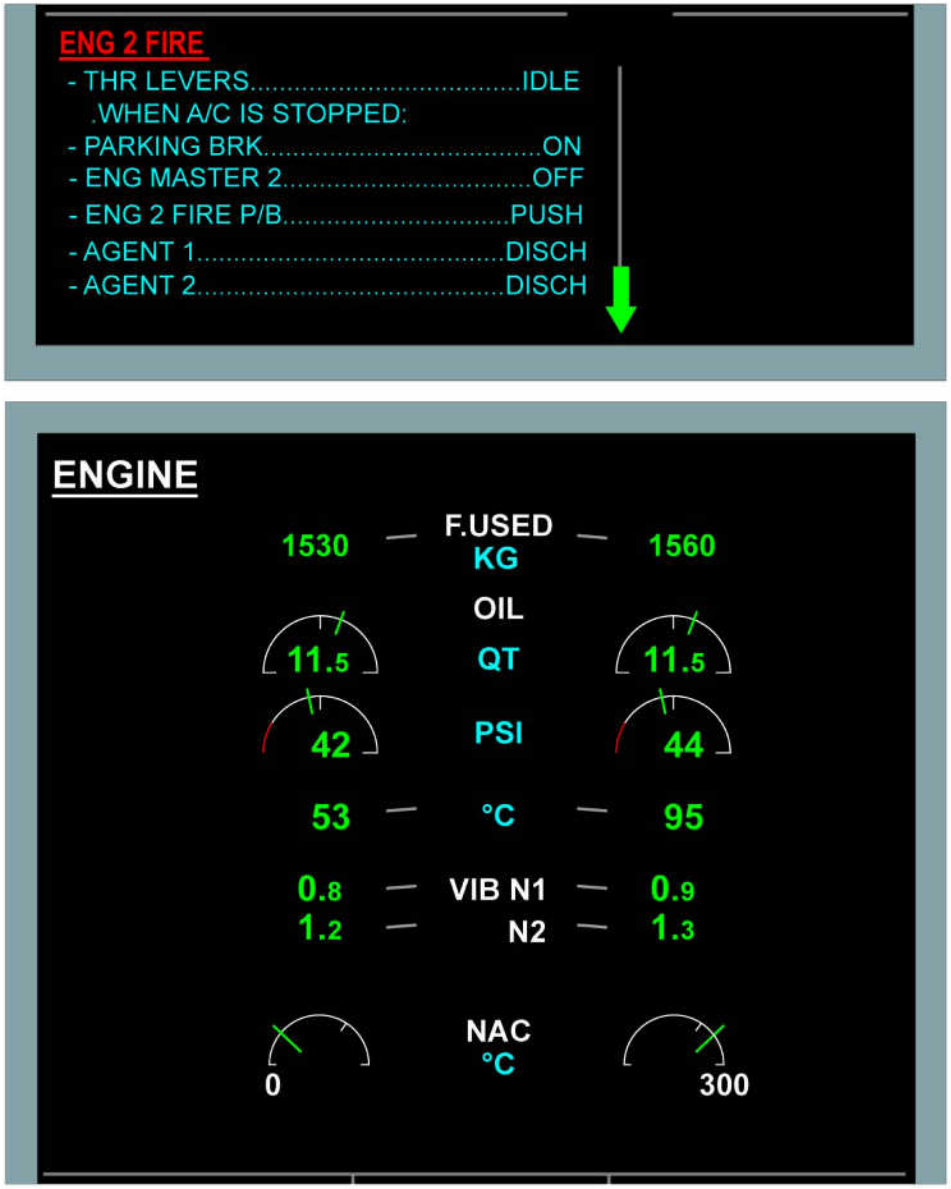
Fire Extinguishing Procedure

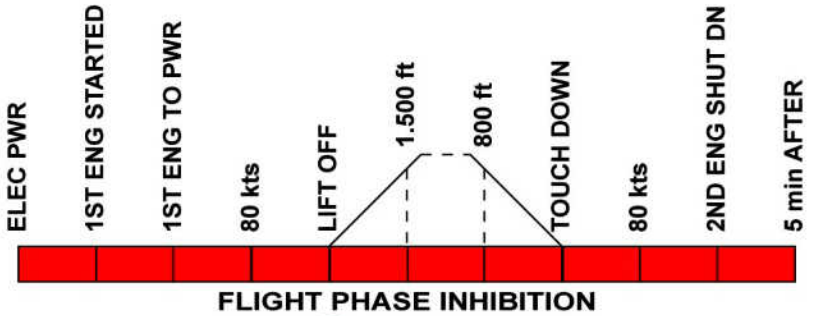
The list of actions to be done during the fire extinguishing procedure comes into view automatically on the ECAM display unit at the same time as the FIRE warnings.

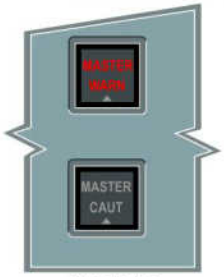
As soon as the required actions are done, the corresponding line is cancelled automatically on the ECAM display unit.

The following procedure must be applied: (Example Engine 1 Fire)

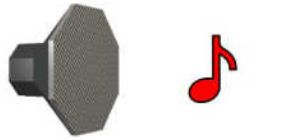
DISPLAY	ACTIONS
ENG 1 FIRE LAND ASAP	
THR LEVER 1.....IDLE	Throttle control lever in the Idle position
ENG MASTER 1.....OFF	ENG/MASTER switch in the OFF position, which: – closes the HP and LP fuel shut off valves and consequently shut down the engine.
ENG 1 FIRE P/B.....PUSH	Push the ENG/FIRE pushbutton switch, which: - closes the engine bleed air system - confirms the closure of the LP fuel shut off valve - de–energizes the IDG - closes the hydraulic shuts off valve - lights on the SQUIB legends associated to two fire extinguisher bottles (AGENT 1 and 2) - stops the Aural Warning: the CRC (**C**ontinuous **R**epetitive **C**hime)
AGENT 1 AFT 10 S...DISCH * Count down from 10 S to 0 S The line disappears at 0 S.	Wait 10 seconds: this is the time required for the engine to reach the windmilling rate in flight. At this rating the efficiency of the fire extinguishing procedure is optimum.
AGENT 1.....DISCH * This line appears at the end of the countdown	Squib the fire extinguisher bottle 1 by pushing the AGENT 1 pushbutton switch. The amber DISCH legend comes on when the engine fire extinguisher bottle is completely discharged.







(131VU)



CONTINUOUS
REPETITIVE CHIME

(20VU)

Figure 14 Operation of the Fire Extinguishing System (1)

Fire Extinguishing Procedure (continued)

Display	Actions
ATC.....NOTIFY	A distress signal is received by the air controllers through the ATC (**A**ir **T**raffic **C**ontrol) system. It provides identification and altitude of the aircraft. This enables quicker handling of the air traffic and improves safety.
IF FIRE AFTER 30 S: AGENT 2.....DISH * Count down from 30 S to 0 S. Line disappears when count down to 0 S.	If the FIRE legend is still on after 30 seconds, the second fire extinguisher bottle is fired. (Agent 2)

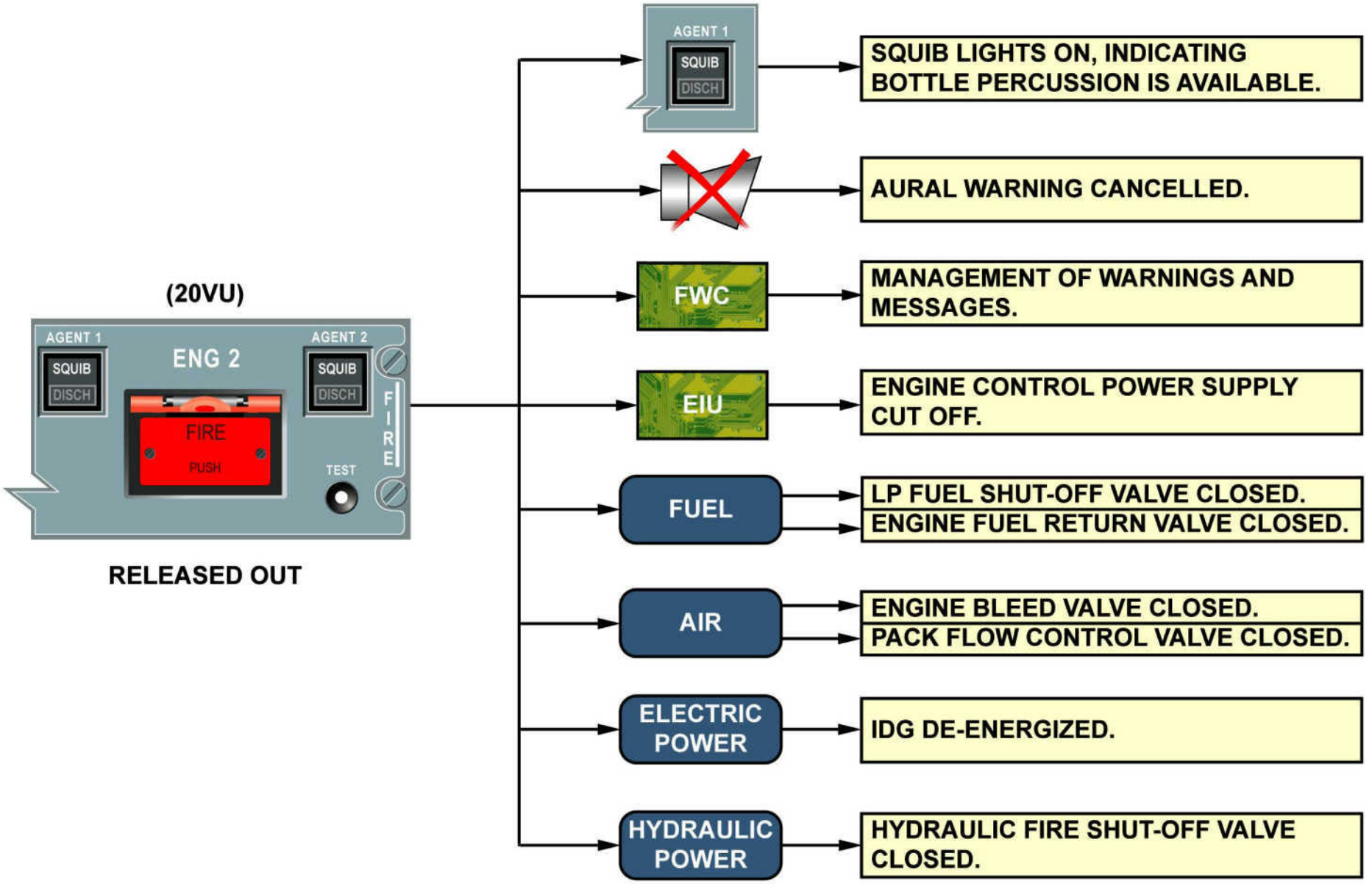


Figure 15 Operation of the Fire Extinguishing System (2)

OPERATIONAL TEST ADJUSTMENT/TEST

Operational Test (via PTT)

The operational test enables the pilot to monitor and activate the fire protection system. This test is part of the daily check–list and is available each time it is needed, on the ground or in flight.

You can do the operational test of the fire extinguishing system by pushing the TEST pushbutton switch (one per engine) located on the ENG/APU FIRE panel.

NOTE: The test pushbutton switch must be held during the whole test duration. The response time of the test is lower than 1 second.

The ENG/APU FIRE panel (1WD) provides the test logics and ensures the electrical continuity of:

- the firing circuitry of the fire extinguisher bottle
- the low pressure warning circuitry of the fire extinguisher bottle.

When you press the TEST pushbutton switch, the FIRE warning indications are triggered and you check the condition of the fire extinguishing system:

- on the AGENT 1 and AGENT 2 pushbutton switches:
  - lighting of the SQUIB legend
    (only if the two filaments are normally power supplied)
- lighting of the amber DISCH legend, (checking of the lamps only)
- electrical supply of the two filaments of each cartridge

NOTE: Although only one filament is sufficient to enable the firing of the cartridge, the test will be positive only if the two filaments are electrically supplied.

NOTE: The test current is limited to 80 mA by the test module whereas the firing current is 5A.

If the failure is detected during the test sequence, a fault message comes into view in the ECAM (For example ENG 1 (2) LOOP A(B) FAULT.

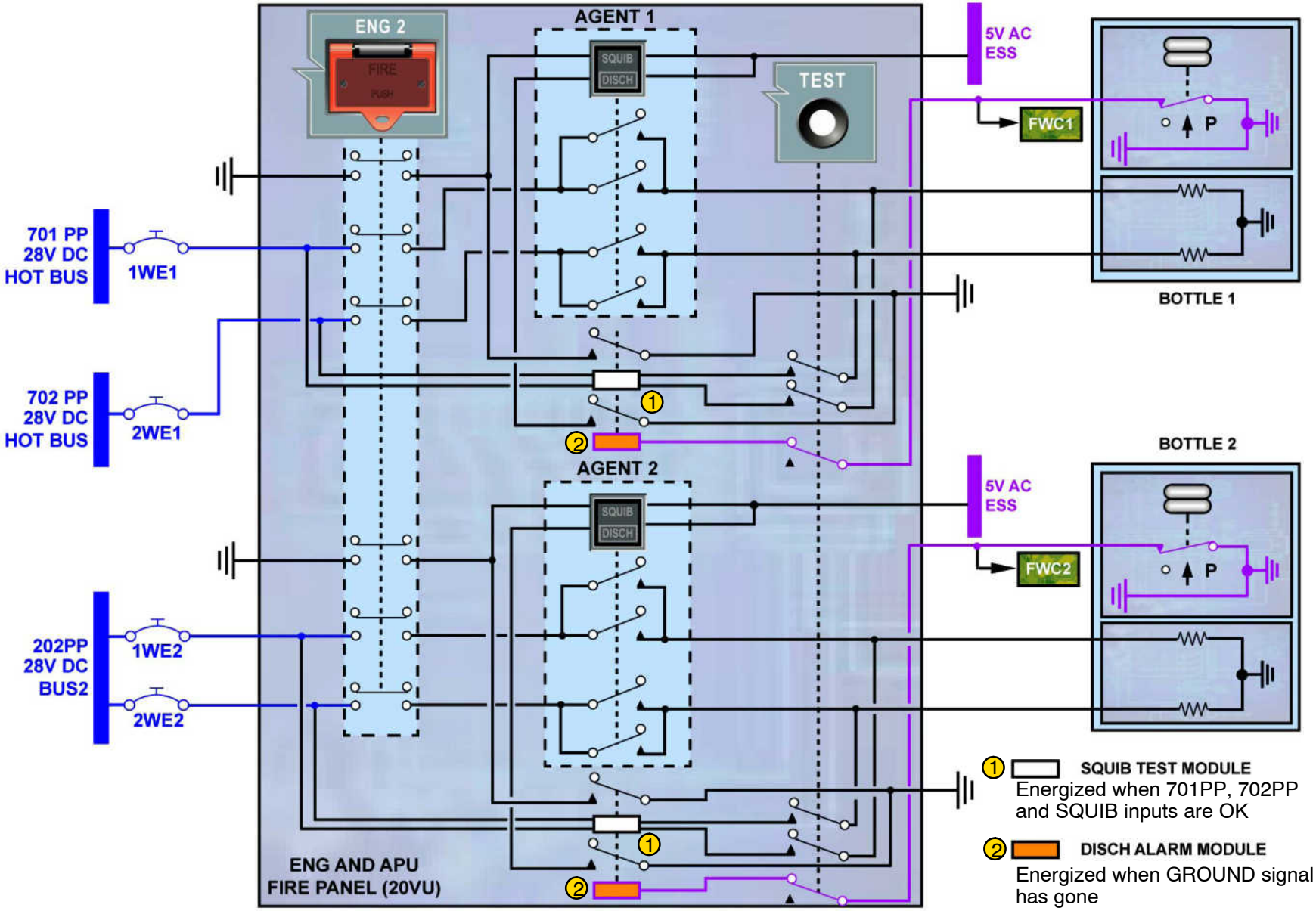


Figure 16 Operational Test using Press to Test Pushbutton

ENGINE/APU FIRE PANEL COMPONENT DESCRIPTION

Component Description

The fire extinguishing system comprises for each engine:

- on the ENG/APU FIRE panel (20VU):
  - one ENG 1(2) FIRE pushbutton switch
  - two SQUIB/DISCH (AGENT 1 and AGENT 2) pushbutton switches
  - one TEST Pushbutton switch
- two fire extinguisher bottles located in the engine pylon
- extinguishing lines routed in the pylon and leading to the nacelle.

ENG/APU Fire panel

The ENG/APU Fire panel consists of:

- ENG 1(2) FIRE Pushbutton Switch
- SQUIB/DISCH Pushbutton Switch

  Each SQUIB/DISCH (AGENT 1 and AGENT 2) pushbutton switch corresponds respectively to fire extinguisher bottle 1 and fire extinguisher bottle 2
- SQUIB legend

  The ENG 1(2) FIRE pushbutton switch arms the cartridge firing system.

  The SQUIB legend (white) comes on after this action.
- DISCH legend

  The DISCH legend (amber) comes on when the pressure switch installed on the fire extinguisher bottle transmits a low pressure signal, which indicates the discharge or a leakage of the fire extinguisher bottle
- TEST Pushbutton switch

  You can do the operational test of the fire extinguishing system by pushing the TEST pushbutton switch (one per engine) located on the ENG/APU FIRE panel

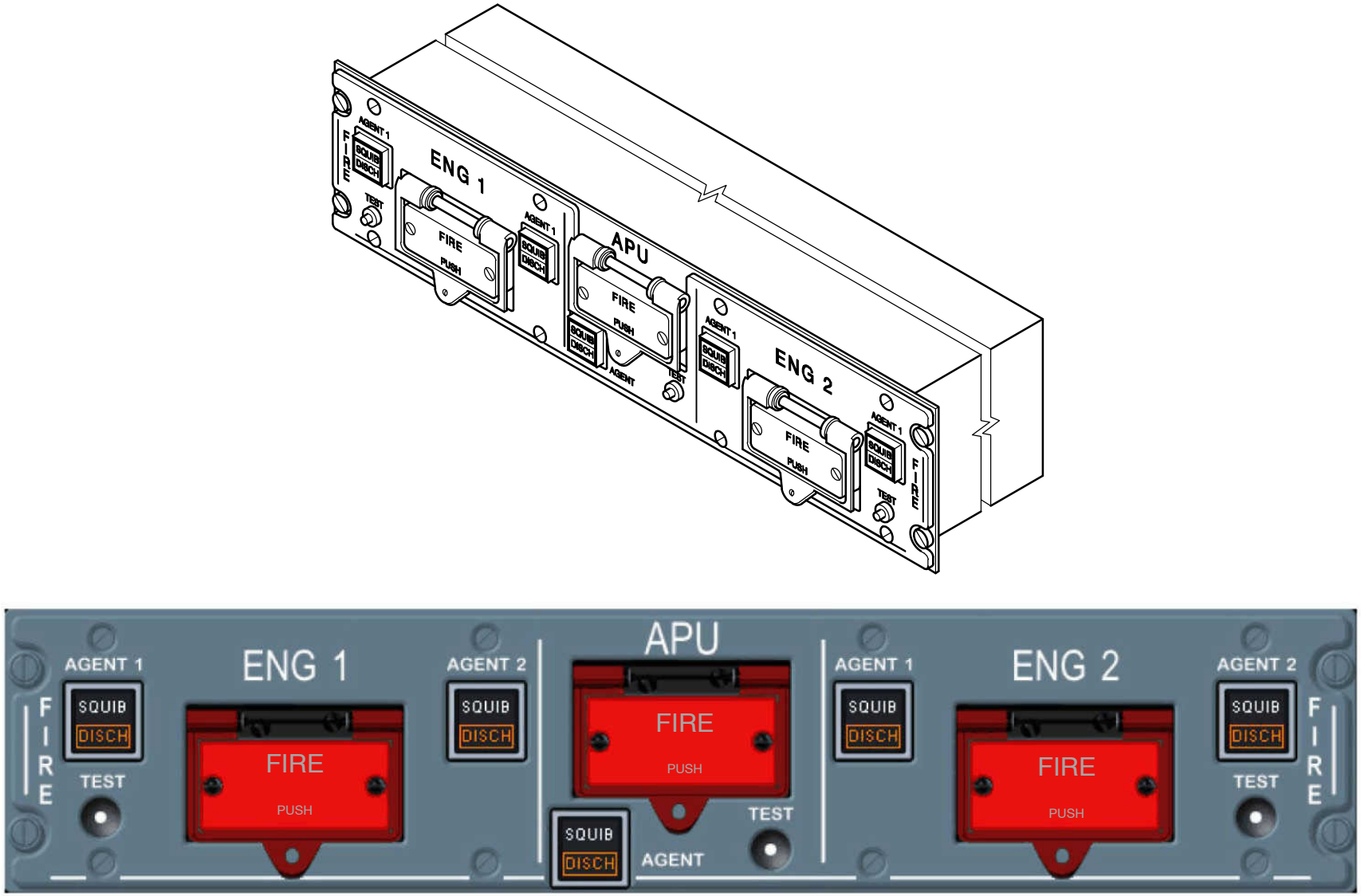


Figure 17 Engine/APU Fire Panel

FIRE EXTINGUISHING BOTTLE GENERAL DESCRIPTION

Fire Extinguishing Bottle

The fire extinguisher bottle is of the high–rate discharge type and is made up of:

- a spherical container/extinguishing agent
- a discharge head
- a cartridge.

Fire extinguishing agent

- type: Halon 1301 (bromotrifluoromethane, CF3 Br)
- quantity: 11 lb (5 kg)
- pressurized by nitrogen (N2), quantity 0.40 lb maximum (0.18 kg).

Spherical container

- material: NITRONIC 40 CRES
- number of outlet ports: 1
- volume: 378 cubic inches (6194 cubic centimeters)
- filling pressure: 600 psi (+0/+25 psi) at 70 deg.F
  (41.4 bars (+0/+1.8 bars) at 21 deg.C)
- Operating temperature: –54 deg.C to +96 deg.C (–65 deg.F to +205 deg.F).

On the spherical container there is:

- a pressure switch
- a filling fitting with a stainless steel disc
- an outlet port and frangible disc

The outlet port is located in the lower section of the container. The pressure switch and filling fitting are screwed and welded.

Pressure Switch (Spherical container)

The pressure switch senses a signal when the bottle is discharged or has a leakage.

It is calibrated to 275/450 psi (19/31 bars) increasing pressure (filling) and to 225/275 psi (15.6/19 bars) decreasing pressure (discharge or leakage).

The pressure switch is electrically connected to the ENG/APU FIRE panel which generates a discharge signal to the DISCH light (panel 255VU).

You can manually test the pressure switch fitted on the fire extinguisher bottle.

Filling Fitting (Spherical container)

You can fill the fire extinguisher bottle through the filling fitting assembly.

The filling fitting incorporates a stainless steel disc. It acts as a primary safety relief device in case of excessive pressure in the fire extinguisher bottle, i.e. between 1600 and 1800 psi. This corresponds to a temperature of 205 deg.F approximately (110 to 124 bars for 95 deg.C approximately).

Frangible Disc (spherical container)

Firing of the cartridge causes rupture of the frangible disc (calibrated metallic diaphragm) installed on the outlet port.

The fire extinguishing agent is then discharged via the discharge head in the fire–extinguishing distribution system.

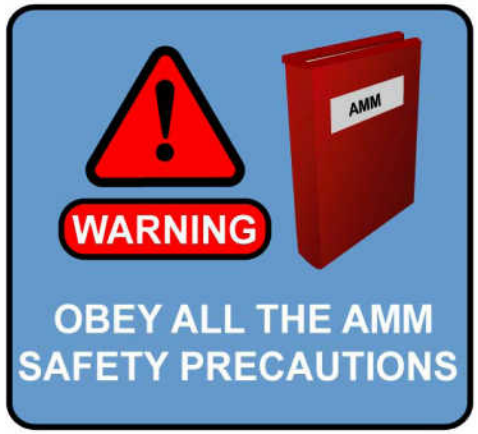
The frangible disc also functions as an overpressure device in case of excessive pressure in the fire extinguisher bottle, i.e. between 1600 and 1800 psi. This corresponds to a temperature of 205 deg.F approximately (110 to 124 bars for 95 deg.C approximately).

Discharge head

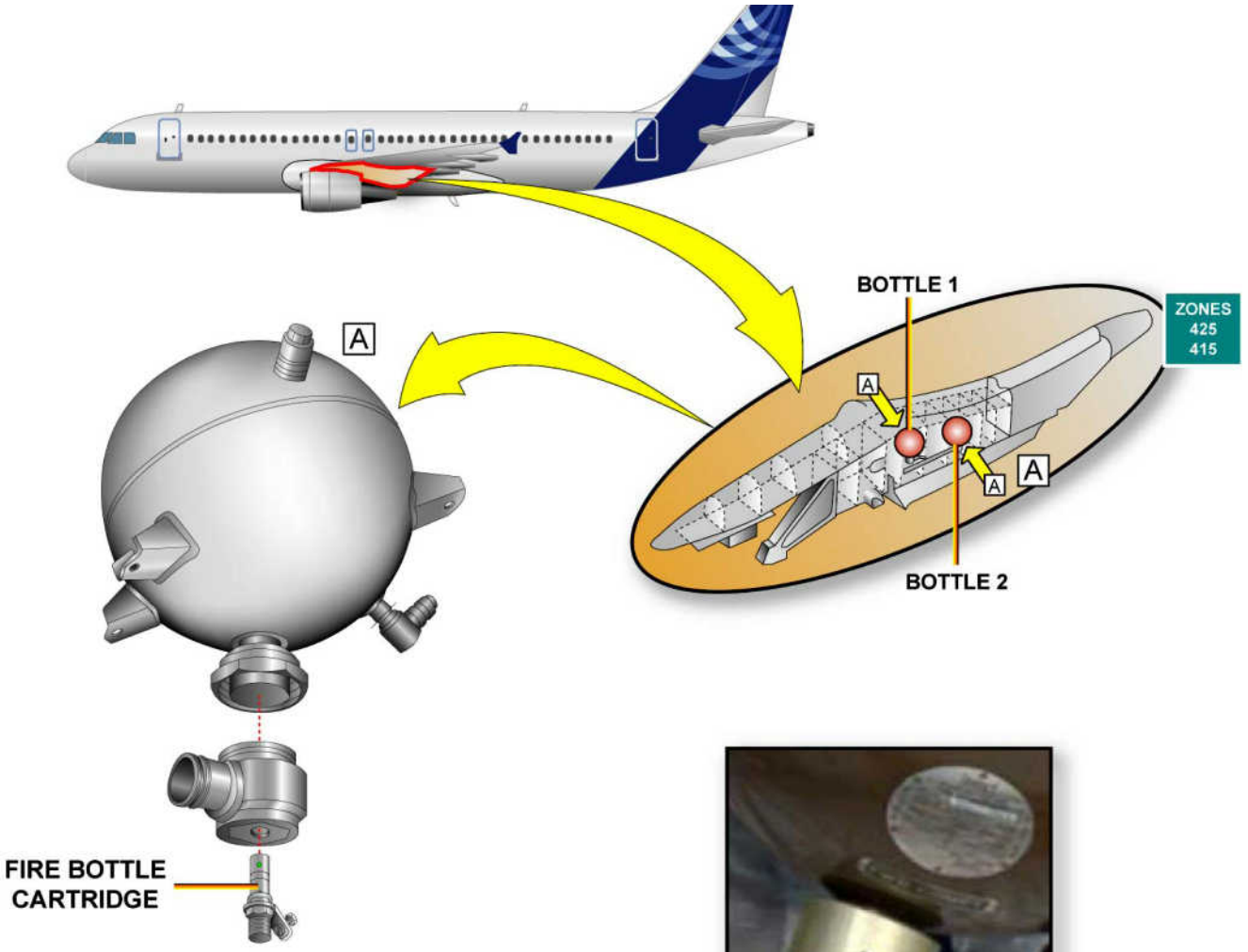
The discharge head can be oriented around its axis (rotatable through 360 deg.). Its position depends on whether it is installed on bottle 1 or 2.

The cartridge is installed on the discharge head. The percussion breaks up the frangible disc and all the fire extinguishing agent is thus free.

A strainer retains the fragments from the diaphragm.



AUTHORIZED PERSONNEL ONLY



PROTECTIVE CAP

Figure 18 Fire Extinguishing Bottle

FIRE EXTINGUISHING BOTTLE COMPONENT DESCRIPTION

CARTRIDGE

WARNING: THE CARTRIDGE IS AN EXPLOSIVE DEVICE. REMOVE IT BEFORE YOU DISASSEMBLE THE FIRE EXTINGUISHER BOTTLE.

TO PREVENT INJURY TO THE PERSONNEL BECAUSE OF THE EXPLOSION OF THE CARTRIDGE IF IT HAS NOT BEEN FIRED:

- INSTALL A SHUNT DEVICE.

  THIS WILL SHUNT THE PINS TOGETHER ON THE CARTRIDGE BEFORE ITS REMOVAL.

- DO NOT USE A FOIL SHUNT

WARNING: WARNING: MAKE SURE THAT THE MAXIMUM PERMITTED LIFE (MPL) OF THE CARTRIDGE IS LONGER THAN THE TIME TO THE NEXT SCHEDULED INSPECTION

WARNING: WARNING: DO NOT INSTALL THE CARTRIDGE ON THE DISCHARGE HEAD IF THE HEAD IS NOT INSTALLED ON THE FIRE EXTINGUISHER BOTTLE.

The electro–pyrotechnic cartridge contains 400 mg of explosive powder. The powder is fired by two filaments supplied with 28VDC.

Each filament is connected to a ground wire and can supply the electrical power necessary to the firing if the other filament fails.

This design ensures redundancy of the fire extinguisher bottle percussion system. The firing current is approximately 5A.

TEST OF THE PRESSURE SWITCH

The pressure switch on the fire extinguisher bottle has a manual test device. An hexagonal wrench is required to do the test.

The manual test checks the condition of the electrical contact. Rotation of the test screw opens the contact (continuity between pins 1 and 3): the DISCH legend on the AGENT 1(2) comes on.

In the rest position, the DISCH legend goes off.

NOTE: P > Minimum pressure = Continuity between pins 2 + 3.

P < Minimum Pressure = Continuity between pins 1 + 3.

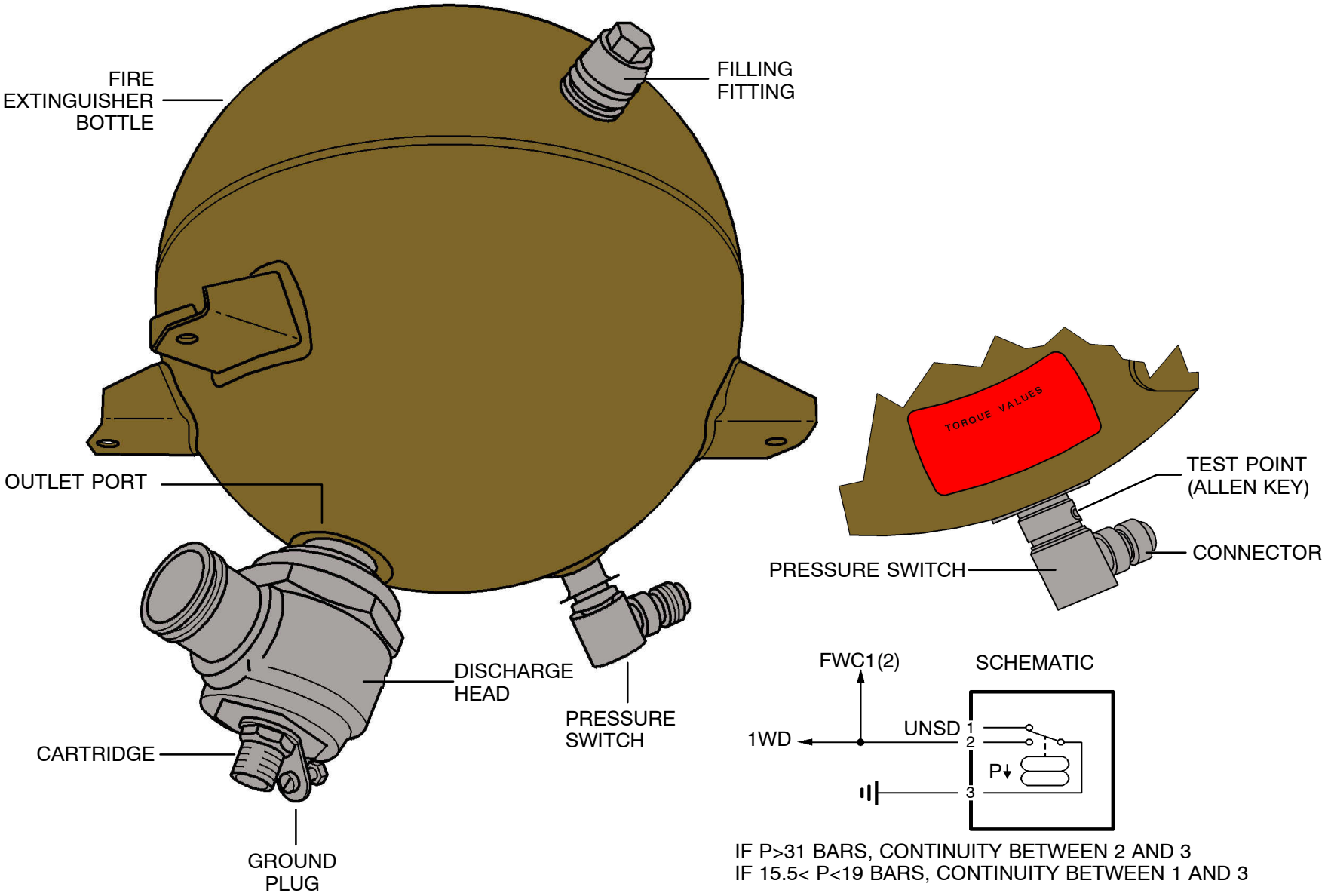


Figure 19 Fire Extinguishing Bottle

ENGINE FIRE PROTECTION CONTROLS

Component Location

The components of the fire detection system are for one engine:

- an ENG/APU FIRE panel on the overhead panel with:
  - one ENG FIRE pushbutton switch,
  - one TEST pushbutton switch
- one FDU per engine, which processes signals from the detectors
- two fire detection loops installed in parallel in the fire zones and connected to a FDU (**F**ire **D**etection **U**nit).

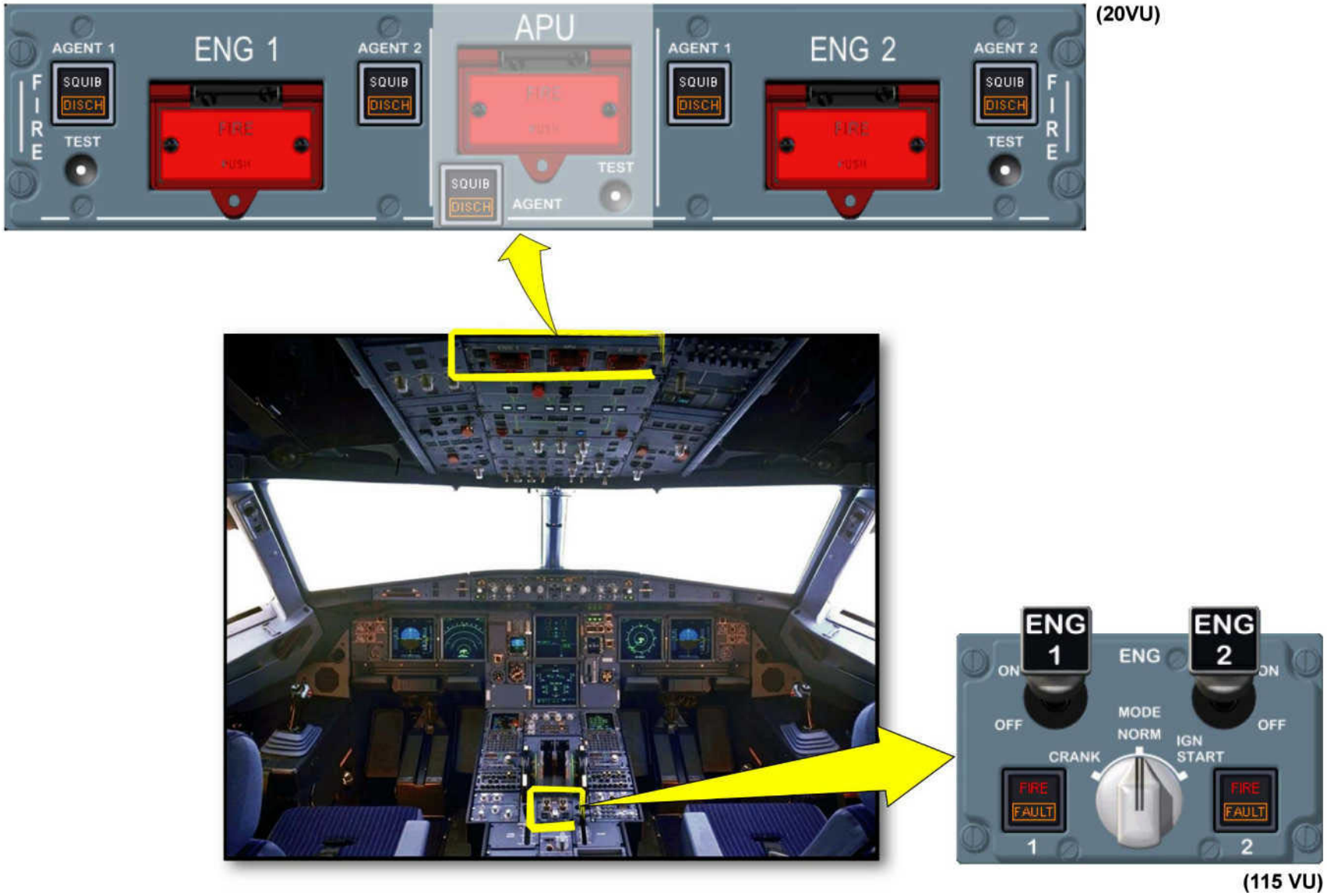


Figure 20 Engine Fire Component Location

26-13 APU FIRE AND OVERHEAT DETECTION

APU FIRE DETECTION-INTRODUCTION

General

The APU fire detection system operates on the pneumatic principle. It detects and indicates a fire or overheat condition in the APU compartment with two independent fire warning loops. The detection system is arranged with different discrimination levels for different combinations of fault and fire information

System Description

The detection system consists of two identical (electrically independent) loops (A and B). They are installed in the APU compartment adjacent to critical components, such as:

- fuel lines,
- starter generator,
- FCU,
- ignition box,
- turbine plenum

Sensor Element

The APU fire detector is a continuous length, thermal sensing, pneumatic detector. Each detector has a stainless steel housed responder assembly with a length of stainless steel sensor tube permanently attached. The full assembly is welded, brazed and hermetically sealed. In the sealed responder housing are a 5–pin electrical connector and two pressure sensitive switches (alarm and integrity) in ceramic insulators. The sensor is a braze–sealed tube that contains a special core material and pressurized inert gas. The detector operates pneumatically. The APU fire detector sensing elements go along the fire walls. Dual clamps hold the sensing elements at the fire walls. The responder housings of the elements are connected to the terminal plate.

Fire Detection Unit

The FDU (**F**ire **D**etection **U**nit) 13WG is installed in the avionics compartment. It includes two identical and independent circuits, one for each loop.

They are installed on three printed circuit boards:

- I/O (**I**nput/**O**utput) circuit board,
- Loop A and Loop B circuit board,
- Micro controller circuit board.

APU Fire Panel

The ENG/APU FIRE panel 1WD is on the cockpit overhead panel (20VU). The middle part is related to the APU fire detection and includes:

- an APU FIRE pushbutton with a red integral warning light. It is guarded red.
- a TEST pushbutton for a manual system test,
- an AGENT pushbutton with a white integral light SQUIB and an amber light DISCH.

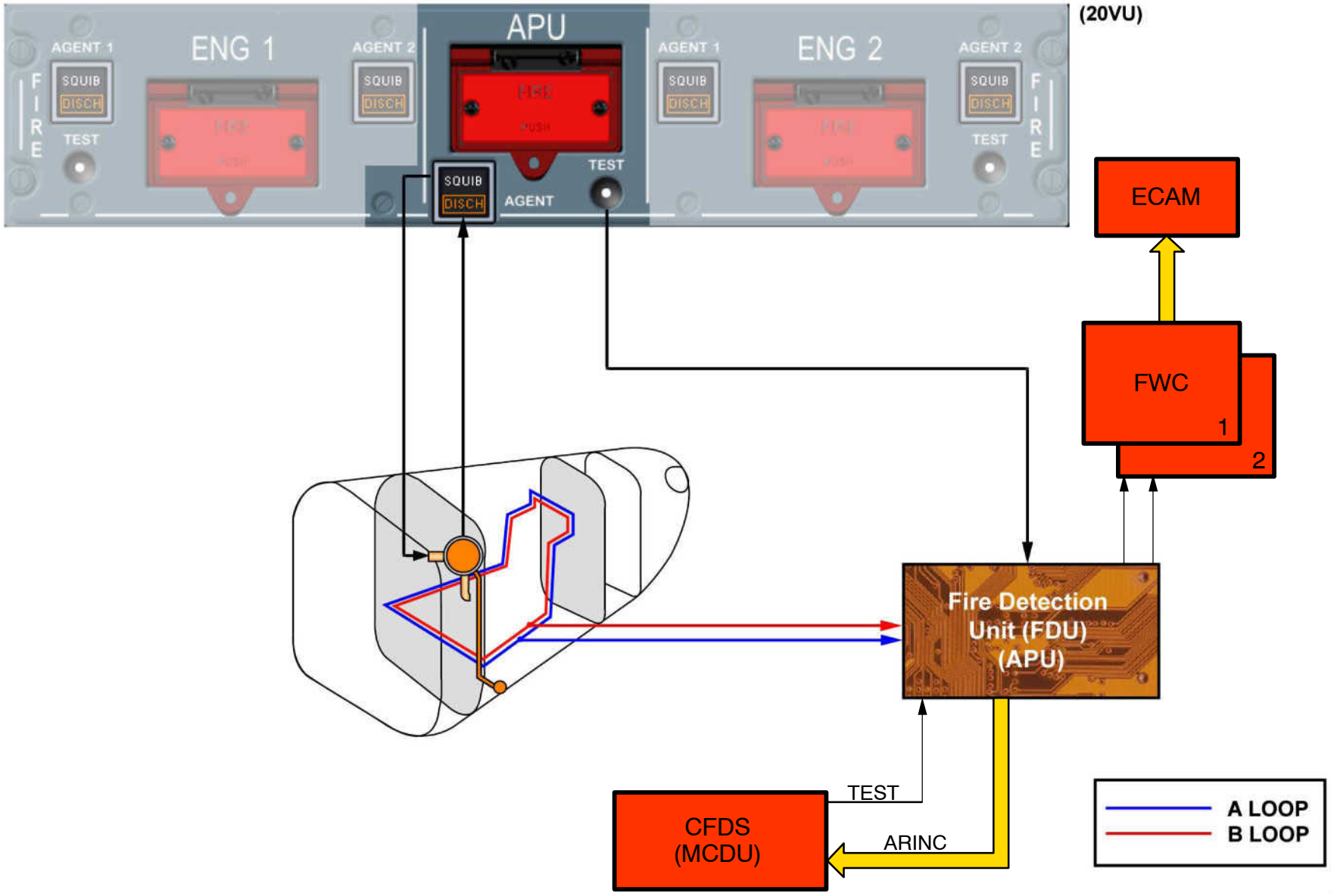


Figure 21 APU Fire Functional Schematic

FDU SYSTEM FUNCTION

Fire Sensor Elements

Increased overall or local temperature causes a fire signal in each sensor element.

Fire Detection Unit General

The Fire Detection Unit is installed in the avionics compartment. It includes two identical and independent circuits, one for each loop.

They are installed on three printed circuit boards:

- Input/Output (I/O) circuit board,
- Loop A and Loop B circuit board,
- Micro controller circuit board.
- Dual Loop Detection

During normal conditions (no fault, no fire, no tests) the input monitoring voltage is higher than the integrity fault threshold.

It is less than the contamination fault and fire thresholds. Any fault at the sensing element/responder level (integrity switch opens) or a loss of the electrical signals increases the resistance. The voltage decreases and makes a loop inop signal.

A responder fire detection closes the alarm switch. This causes a voltage higher than the threshold of contamination fault and fire comparators. When both inputs to the exclusive OR gate are high, its output is low and stops the fault output. Fire output is only energized, if the condition from the second loop are correct. The conditions are:

- fire
- fire within 5 s
- second loop inop

Input/Output circuit

The FDU creates a fire warning signal in channel A and B, if one of these conditions appear:

- Fire A and Fire B
- Fire A and Fault B
- Fault A and Fire B
- Fault A and Fault B within 5 s

The FDU creates discrete inop signals in the respective channel (A and B) if one of these conditions appear:

- electrical failure (loss of power, plug not connected)
- fault in a detector,
- failure in the detection circuit,
- detection of a single loop fire for greater than 15 s. while the other loop is normal.

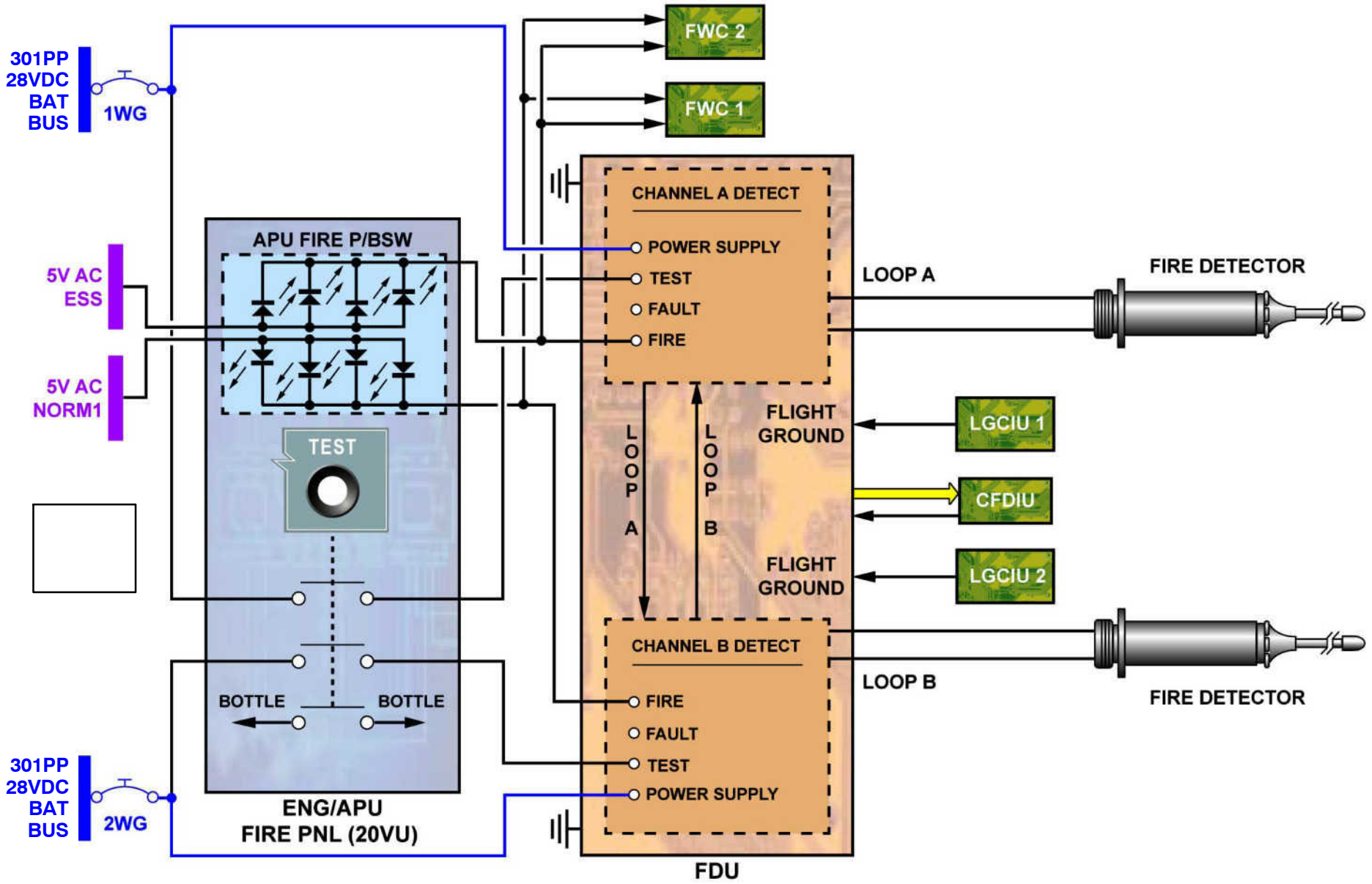


Figure 22 FDU Architecture

APU FIRE DETECTION SYSTEM DESCRIPTION

Fire Warnings

Fire warning conditions

Fire warnings are shown on the Fire Panel, ECAM and Master Warning Lights (also a repetitive chime).

The warnings appear at loop conditions:

- Fire A and Fire B
- Fire A and Fault B
- Fault A and Fire B
- Fault A and Fault B within 5 sec

Fire warnings on ground

On fire control panel 20VU:

- the red light in the APU FIRE pushbutton switch illuminates.

On glareshield panels 130VU and 131VU:

- the red light in the two MASTER WARNING pushbuttons flash
- a repetitive chime sounds

On panel 108VU:

- the red APU FIRE indication light comes on
- the external horn sounds

Fire warnings in flight

On fire control panel 20VU:

- the red light in the APU FIRE pushbutton switch illuminates.

On glareshield panel 130VU and 131VU

- the red light in the two MASTER WARNING pushbuttons flash
- a repetitive chime sounds

Messages

On ECAM engine and warning display appear:

- APU FIRE
- APU FIRE P/B PUSH
- AGENT AFT 10 S DISCH (automatic countdown)
- MASTER SW OFF

On ECAM system display: – .

- APU page is called up automatically

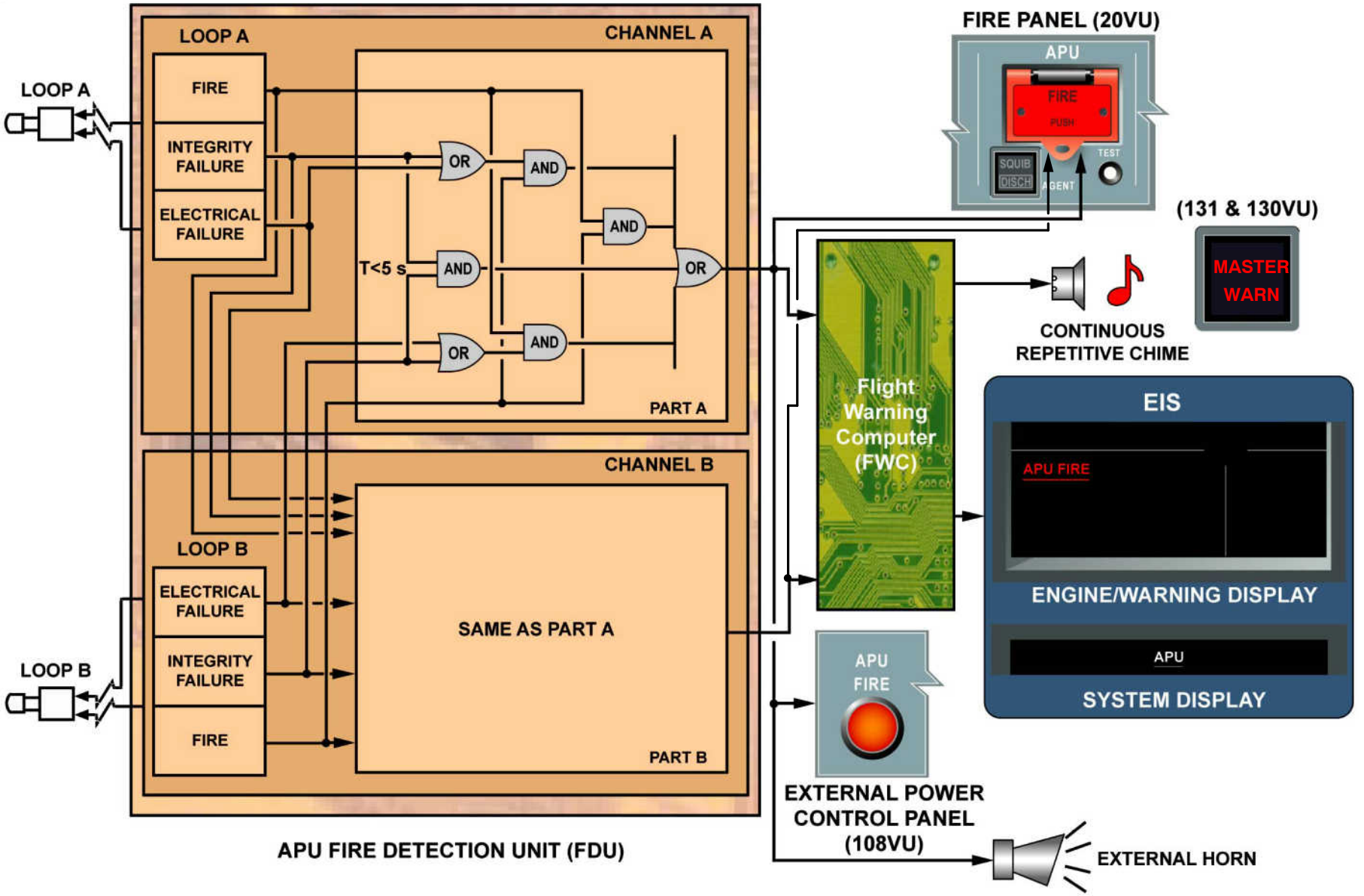


Figure 23 APU Fire Detection Logic-Fire

LOOP FAULT DETECTION SYSTEM OPERATION

Loop Fault Warnings

Loop fault warnings are provided, when one loop has:

- a fault in the detector or in the detection circuit
- an electrical power failure,
- a fire signal for more than 16 sec

Loop Fault message on ECAM engine and warning display:

- APU FIRE LOOP A or B FAULT

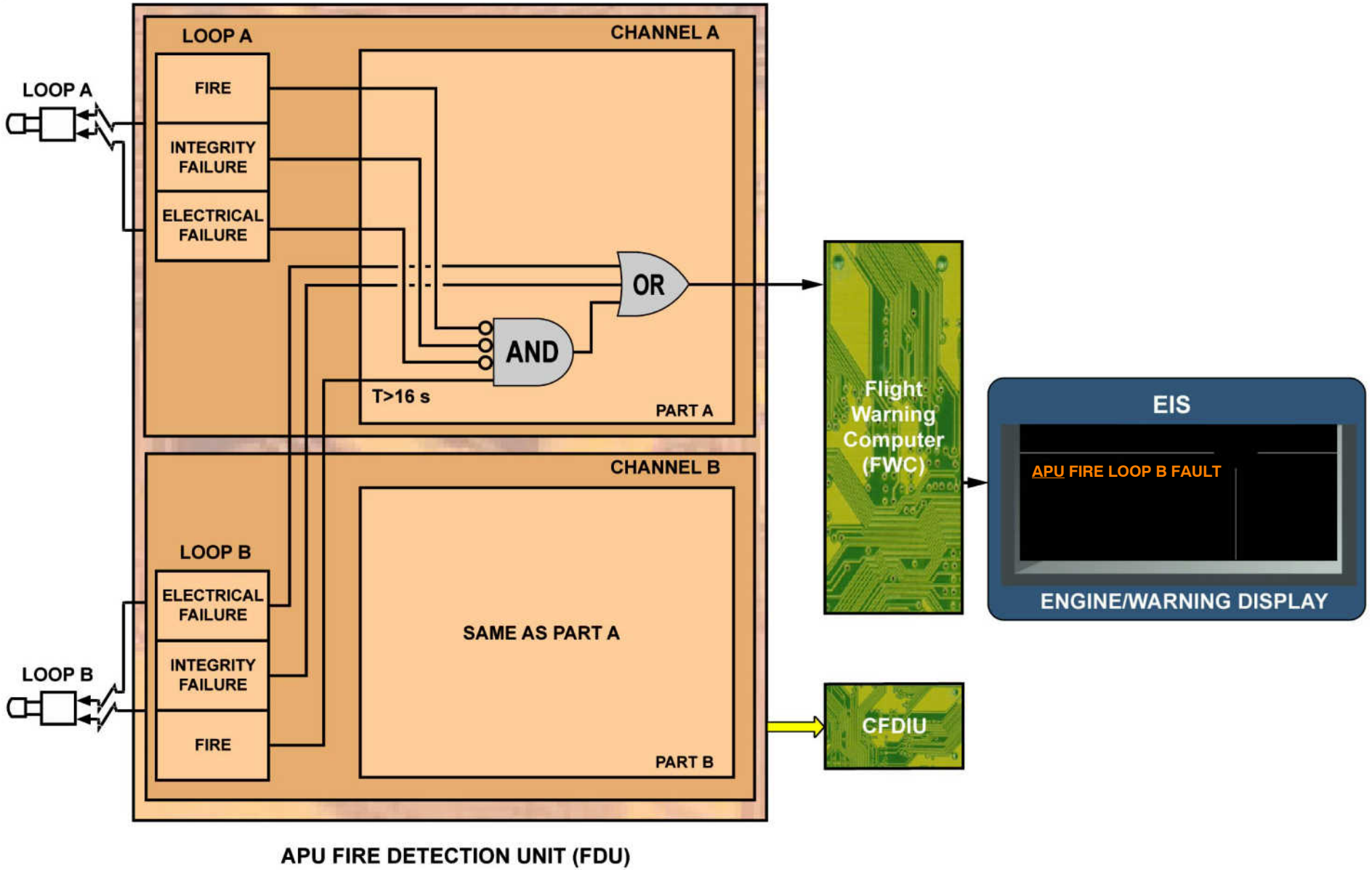


Figure 24 APU Fire Detection Logic-Loop Fault

APU FIRE DETECTION FAULT SYSTEM OPERATION

Detector Fault Warnings

APU detector fault warning is provided when both loops are faulty.

Detector fault warnings on glareshield 130VU and 131VU:

- the amber light in the two MASTER CAUTION pushbuttons illuminate,
- a single chime sounds.

Message on ECAM engine and warning display

- APU FIRE DET FAULT

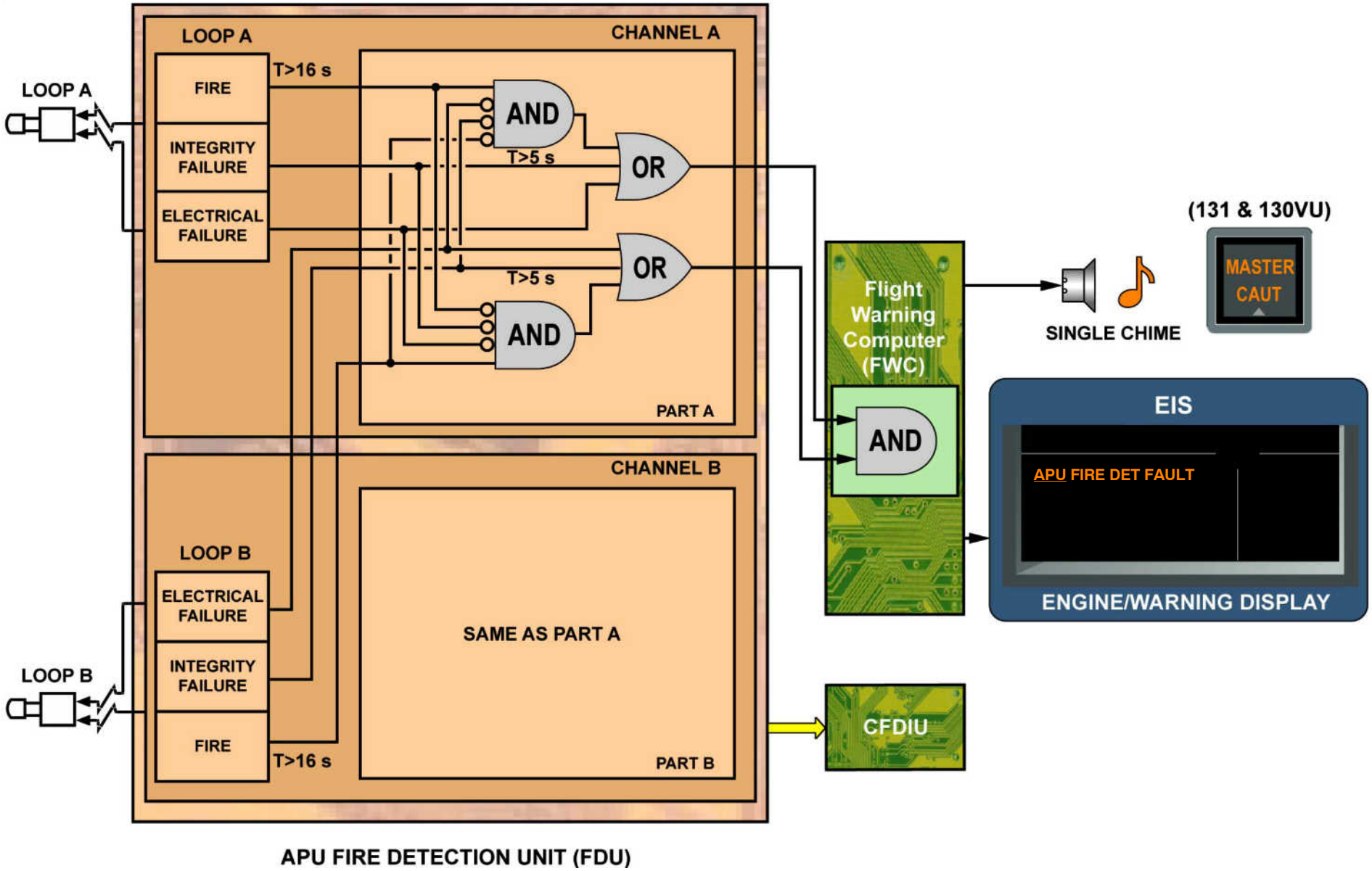


Figure 25 APU Fire Detection Logic-Detection Fault

26–22 APU FIRE EXTINGUISHING

INTRODUCTION

General

The APU fire extinguishing system extinguishes fires detected in the APU compartment. In flight, the crew must operate the system manually from the cockpit. On the ground, the fire and overheat detection system activates the extinguishing system automatically.

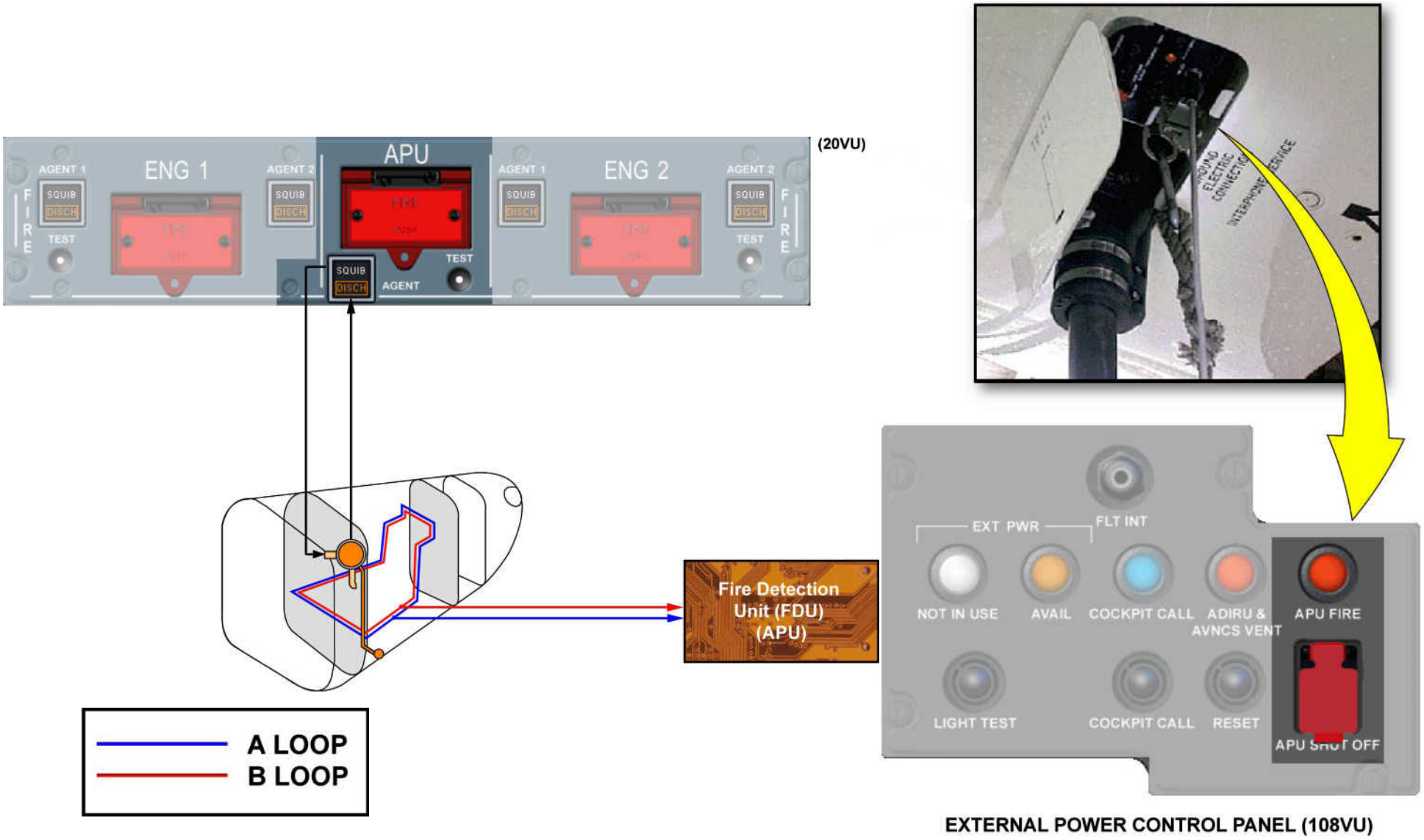


Figure 26 APU Extinguishing Overview

APU FIRE EXTINGUISHING GENERAL LAYOUT

System Description

The APU fire–extinguishing system has one fire extinguisher bottle. The bottle contains the extinguisher agent. It is hermetically sealed and pressurized with nitrogen. A pressure switch continuously monitors the pressure in the bottle. The bottle is installed in the fuselage, forward of the APU compartment between FR78 and FR79 (the FR79 is the FWD firewall of the APU compartment).

The bottle has one discharge outlet which is sealed with a metal diaphragm. A discharge head is installed on the discharge outlet.

A distribution pipe connects the discharge head to the outlet in the FWD firewall of the APU compartment.

An electrically–operated explosive cartridge is installed in the discharge head. The cartridge has two squibs (squib A and squib B).

When electrical power is supplied to the squibs the cartridge fires and ruptures the metal diaphragm in the bottle discharge outlet.

The extinguisher agent flows through the distribution pipe directly into the APU compartment.

If one squib has a failure the other squib makes sure that the cartridge fires correctly.

The bottle also has a pressure relief device which lets the extinguisher agent flow overboard if the pressure in the bottle increases to a given level.

If the pressure relief device operates the extinguisher agent flows through the overboard discharge pipe to the discharge indicator.

The extinguisher agent pushes the disc out of the discharge indicator housing and flows overboard. The ejected disc shows that the fire extinguisher is no longer serviceable.

When the agent is released (into the APU compartment or overboard) the pressure switch on the bottle sends a signal to the APU FIRE panel 1WD in the panel 20VU. The DISCH legend in the AGENT pushbutton switch comes on.

Interface

The APU fire–extinguishing system has an interface with:

- 23–42–00 Cockpit to ground crew call system
- 26–13–00 APU fire and overheat detection system
- 28–29–00 APU LP fuel shut off
- 31–52–00 FWC
- 32–62–00 Landing gear – position information
- 49–62–00 APU emergency shutdown

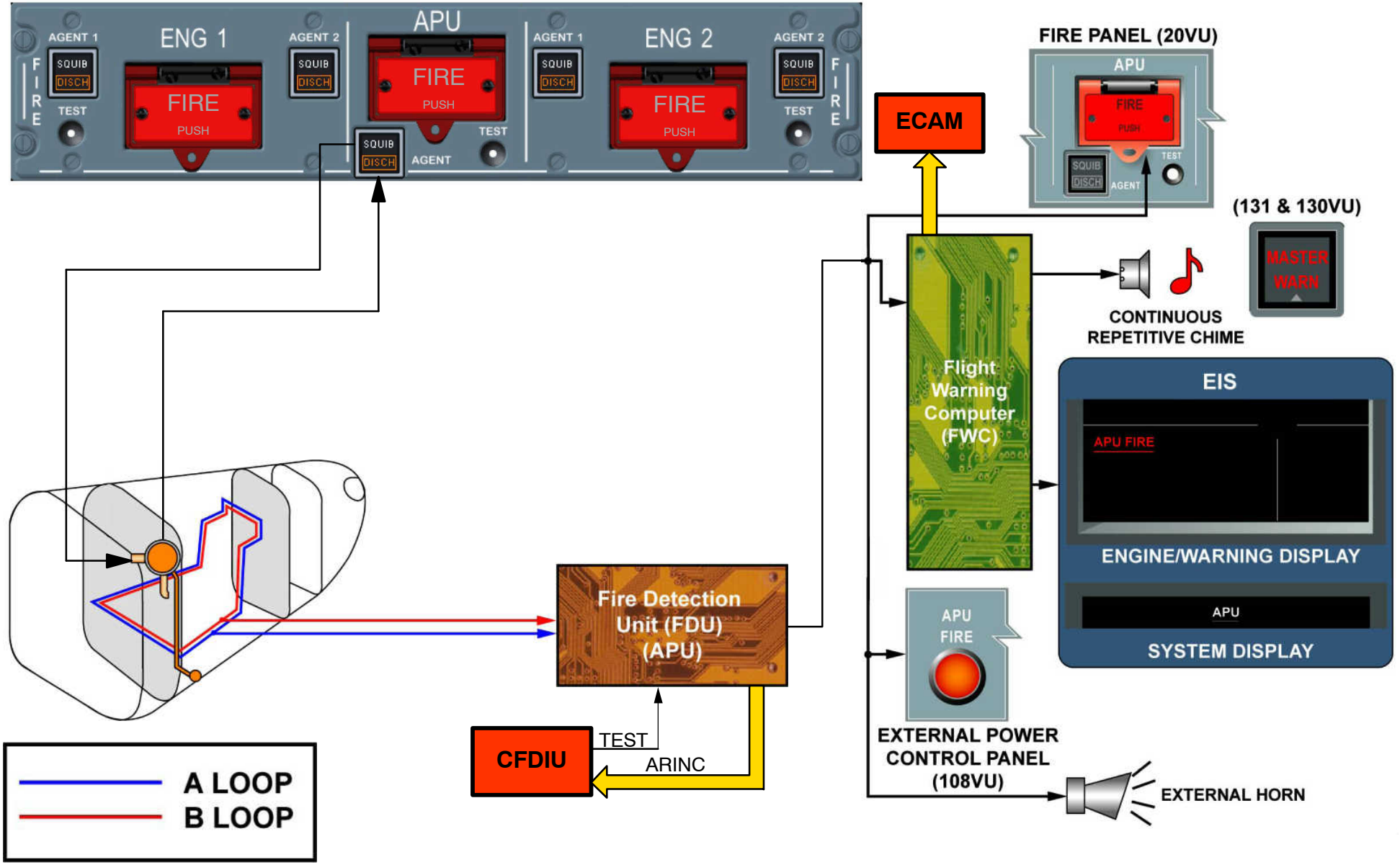


Figure 27 APU Fire Protection Overview

APU FIRE EXTINGUISHING CONTROLS AND INDICATION

APU FIRE EXTINGUISHING IN FLIGHT

General

The APU fire–extinguishing system extinguishes fires in the APU compartment. The system operates when the APU fire and overheat detection system detects an excessive temperature or a fire in the APU compartment. The system operates in the subsequent modes:

- APU fire extinguishing in flight
- APU fire extinguishing on the ground

The fire extinguisher bottle also has a pressure relief device which operates if the pressure in the bottle is too high. The pressure relief device can operate in flight or on the ground.

APU Fire Extinguishing in Flight

In flight the crew must operate the system manually from the APU FIRE panel in the cockpit. If the FDU detects an excessive temperature or a fire in the APU compartment it starts the subsequent cockpit warnings:

- On the APU FIRE panel 20VU the light in the APU FIRE pushbutton switch comes on.
- On the glareshield panels 130VU and 131VU the MASTER WARN lights flash.
- The CRC (**C**ontinuous **R**epetitive **C**hime) comes on.
- The ECAM upper display unit shows the message:
  - APU FIRE
  - APU FIRE P/B PUSH
  - MASTER SW OFF
  - LAND ASAP.
- On the ECAM lower display unit: the APU page comes on automatically

When you see the fire warning you must first push the APU FIRE pushbutton switch on the APU FIRE panel 20VU.

When you push the APU FIRE pushbutton switch:

- the APU starts the „APU Emergency shutdown procedure“,
- the APU fuel supply is closed,
- the Agent Pushbutton is armed (28V DC): –> Squib Light on,
- the ECAM upper display unit shows the message:
  - APU FIRE
  - AGENT AFT 10 S DISCH
  - MASTER SW OFF
  - LAND ASAP
- the automatic 10 second countdown starts. After 10 seconds the AFT 10 S indication goes off. (A 10 s delay allows the APU to slow down and increases the agent effect).
- After 10 seconds the ECAM upper display unit shows the message:
  - APU FIRE
  - AGENT DISCH
  - MASTER SW OFF
  - LAND ASAP

To fire the cartridge you must push the AGENT pushbutton switch.

When you push the AGENT pushbutton switch:

- the squib is activated
- the extinguisher agent is released and flows into the APU compartment
- the pressure in the bottle decreases, the pressure switch closes and sends a signal to the APU FIRE panel (the amber DISCH legend in the AGENT pushbutton switch comes on)
- the ECAM upper display unit shows the message:
  - APU FIRE
  - MASTER SW OFF
  - LAND ASAP

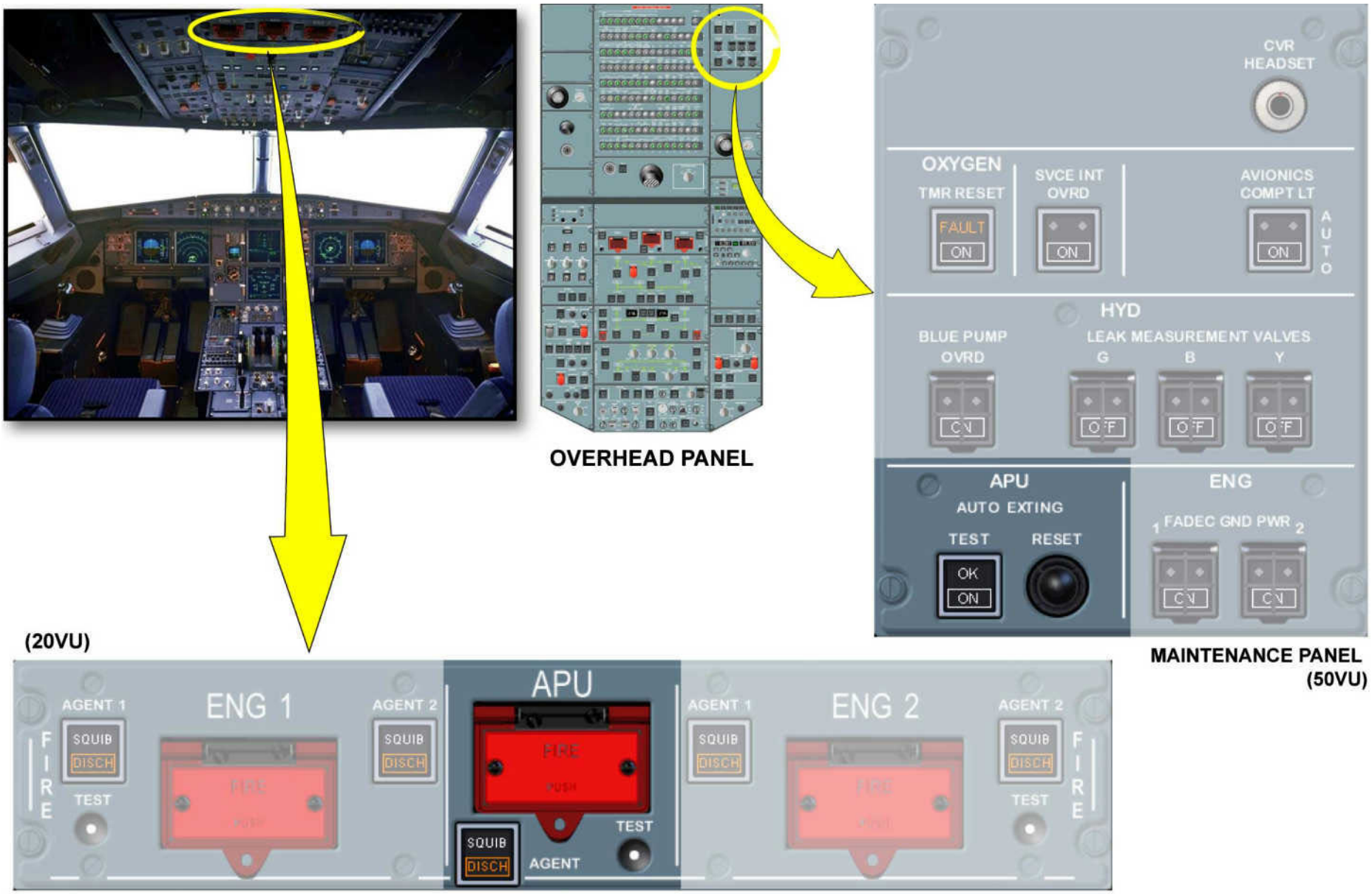


Figure 28 APU Fire Extinguishing Controls

APU FIRE EXTINGUISHING GENERAL DESCRIPTION

General

The APU fire–extinguishing system extinguishes fires in the APU compartment. The system operates when the APU fire and overheat detection system detects an excessive temperature or a fire in the APU compartment. The system operates in the subsequent modes:

- APU fire extinguishing in flight
- APU fire extinguishing on the ground

The fire extinguisher bottle also has a pressure relief device which operates if the pressure in the bottle is too high. The pressure relief device can operate in flight or on the ground.

APU Fire Panel

The ENG/APU FIRE panel 1WD is on the cockpit overhead panel (20VU). The middle part is related to the APU fire detection and includes:

- an APU FIRE pushbutton with a red integral warning light. It is guarded red.
- a TEST pushbutton for a manual system test,
- an AGENT pushbutton with a white integral light SQUIB and an amber light DISCH.

Interface

The APU Fire Detection System has interfaces with these systems (FIN):

- electrical power (Ref 24–00–00),
- APU fire extinguishing WF (Ref 26–22–00),
- Centralized Fault Display Interface (CFDUI) TW (Ref 31–32–00),
- FWS–Acquisition/Interface WW (Ref 31–52–00),
- Steering GB (Ref 32–50–00),
- Annunciator Light Test and Dimming LP (Ref 33–14–00).

Fire Warning Conditions

- Fire warnings are shown on the Fire Panel, ECAM and Master Warning Lights (also a repetetive chime). The warnings appear at loop conditions:
- Fire A and Fire B,
- Fire A and Fault B,
- Fault A and Fire B,
- Fault A and Fault B within 5 sec.

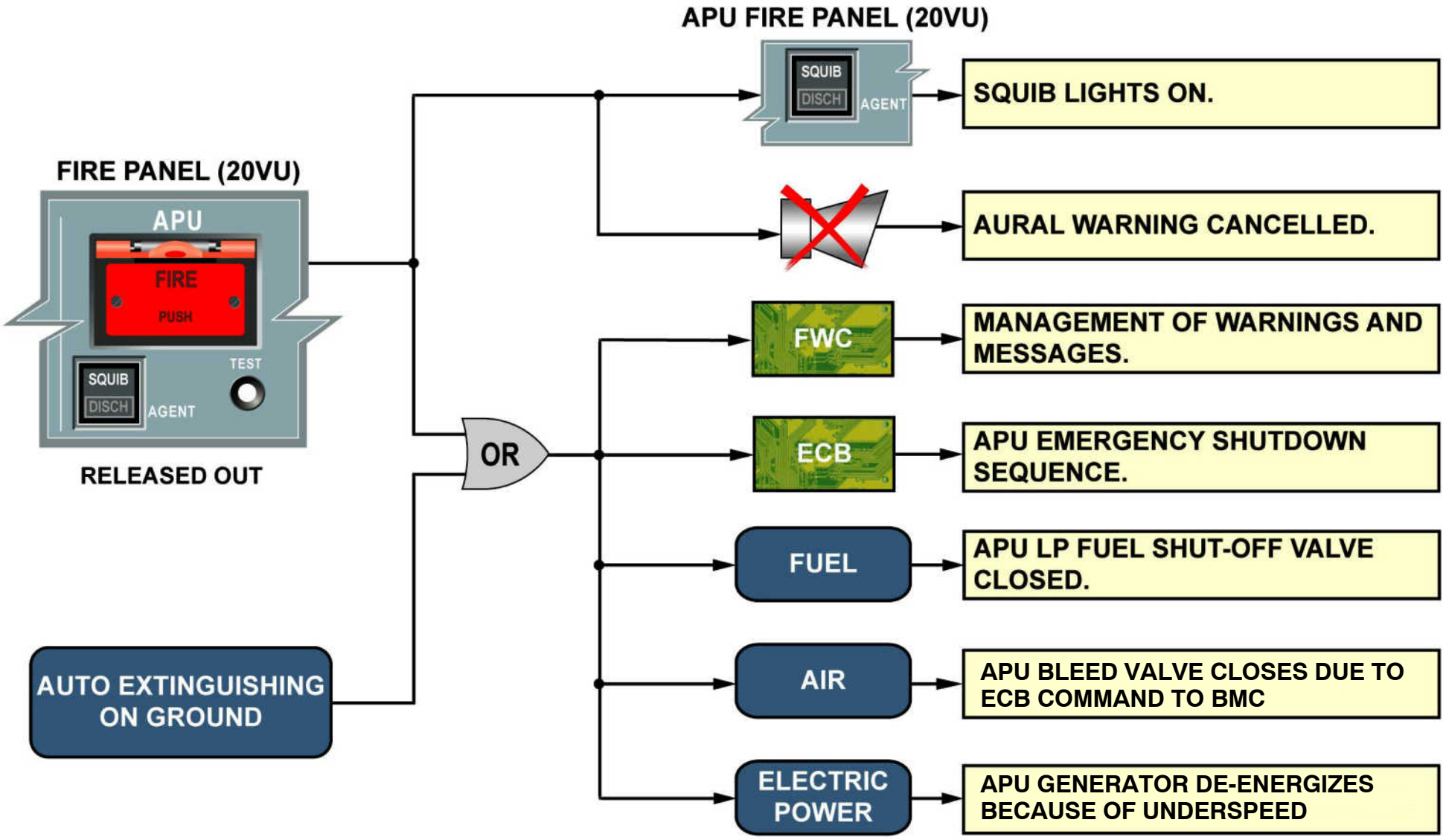


Figure 29 APU Fire Extinguishing (Flight Condition)

APU FIRE EXTINGUISHING IN FLIGHT PRESENTATION

General

The aircraft is in flight and the APU is running.

Fire Detection

When a fire is detected, the CRC (**C**ontinuous **R**epetitive **C**hime) sounds, the MASTER WARNing flashes and the APU FIRE PUSH button switch light on the APU FIRE panel comes on.

APU Isolation

To isolate the APU, the APU FIRE PUSH button switch must be released out. In this case, the CRC stops, the fuel low pressure shutoff valve and the fuel solenoid valve close and cause APU shutdown. The Single Chime (SC) sounds, the MASTER CAUTion and the FAULT light on the APU MASTER SWitch P/B come on. The SQUIB light comes on to indicate that the AGENT P/BSW can be used. The Electronic Control Box (ECB) controls the closure of the fuel valves.

Fire Extinguishing

A 10 s delay allows the airflow to reduce, this increases the agent effect. Then AGENT P/BSW must be pressed in. The fire bottle is discharged in the APU compartment and the DISCHarge light comes on.

When the fire is extinguished, the MASTER WARN and the APU FIRE PUSH button switch lights go off. The APU MASTER SW P/B has to be released out; when this is done the FAULT light and the MASTER CAUT go off.

This completes the procedure.

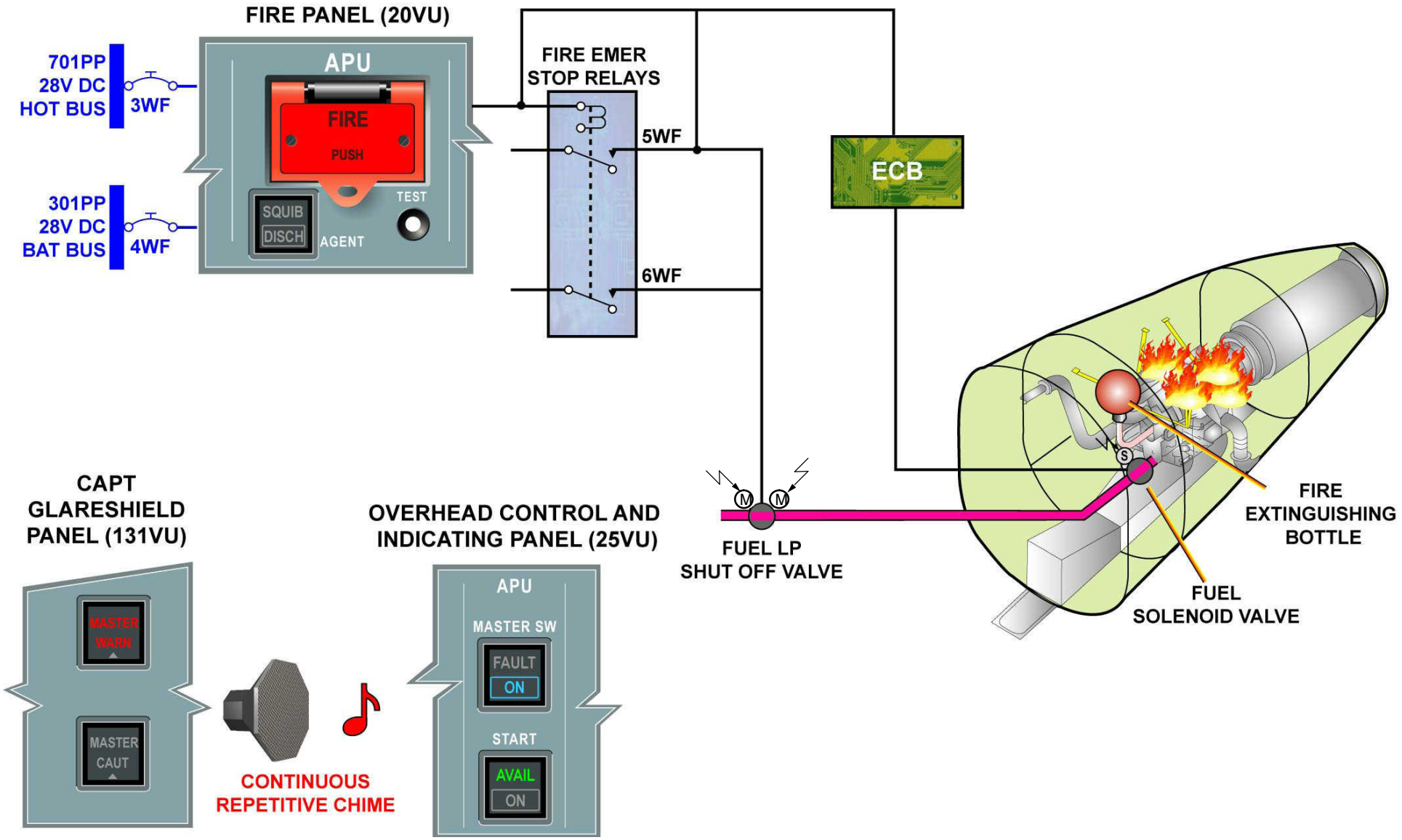


Figure 30 APU Fire Extinguishing (Flight Condition)

APU FIRE PANEL SYSTEM OPERATION

Fire Panel General Description

During the APU fire procedure, the APU FIRE PUSHbutton switch is manually released out. This triggers several automatic sequences simplifying further crew actions and system monitoring.

Monitoring Interfaces

Releasing the FIRE P/BSW out cancels the Continuous Repetitive Chime (CRC), signals the action to the Flight Warning Computer (FWC), for further management of other warnings and messages and the SQUIB light comes on, on the APU fire control panel.

Supply Interfaces

Quick isolation of all systems on the APU, which could be the origin of the fire or feed the fire, is achieved as soon as the FIRE P/BSW is released out.

These systems are:

- fuel
- air (via Electronic Control Box)

The APU generator stops because of underspeed.

The Electronic Control Box (ECB) of the APU is triggered to initiate an emergency APU shutdown.

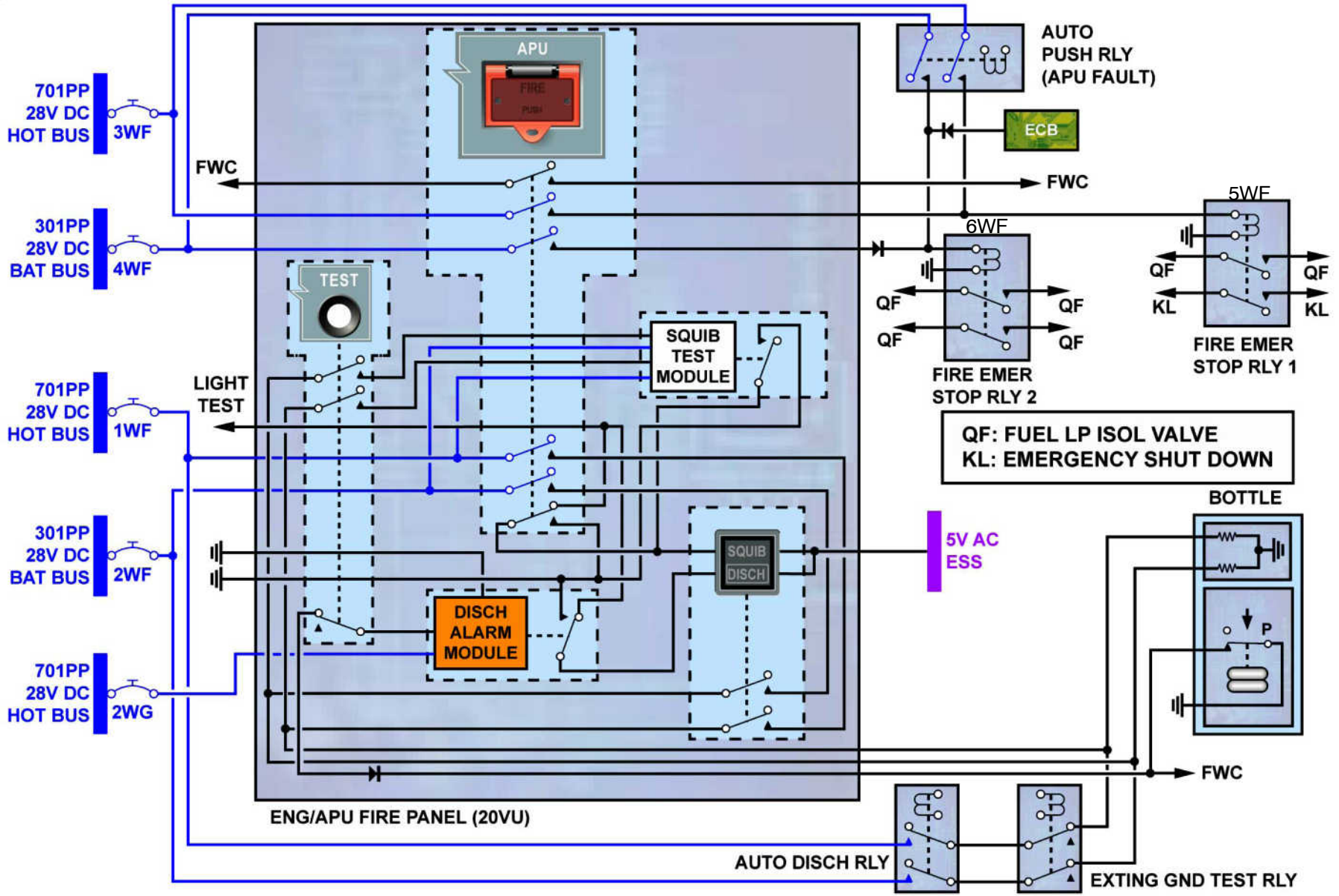


Figure 31 APU Fire Extinguishing (Flight Condition)

APU FIRE EXTINGUISHING ON GROUND PRESENTATION

APU Fire Extinguishing on ground

On the ground the automatic fire–extinguishing circuit controls the extinguishing sequence. The LGCIU (**L**anding **G**ear **C**ontrol and **I**nterface **U**nit) 5GA1 closes the FLIGHT/GROUND relay 43WF when the landing gear is compressed.

If the FDU detects an excessive temperature or a fire in the APU compartment it starts the subsequent cockpit warnings:

- on the APU FIRE panel 20VU the light in the APU FIRE pushbutton switch comes on
- on the glareshield panels 130VU and 131VU the MASTER WARN lights flash
- the continuous repetitive chime comes on
- the ECAM upper display unit shows the message:
  - APU FIRE
  - APU FIRE P/B PUSH
  - MASTER SW OFF
  - LAND ASAP
- on the ECAM lower display unit: the APU page comes on automatically.

The automatic fire–extinguishing circuit controls the extinguishing sequence:

- the ground crew Horn operates
- A signal to the APU ECB (**E**lectronic **C**ontrol **B**ox) which starts the APU emergency shutdown sequence.
- the APU fuel supply is closed
- 3 seconds later, the squib will be activated
- the extinguisher agent is released and flows into the APU compartment
- the pressure in the bottle decreases, the pressure switch closes and sends a signal to the APU FIRE panel 20VU

  The amber DISCH legend in the AGENT pushbutton switch comes on.
- the ECAM upper display unit shows the message:

  APU FIRE

  MASTER SW OFF

Reset

When you push the APU SHUT OFF pushbutton switch or you release the APU FIRE pushbutton the ground crew horn stops.

When the fire or overheat condition is no longer available the FDU de–energizes automatic fire extinguishing circuit, this de–energizes all operated relays in the automatic fire–extinguishing circuit.

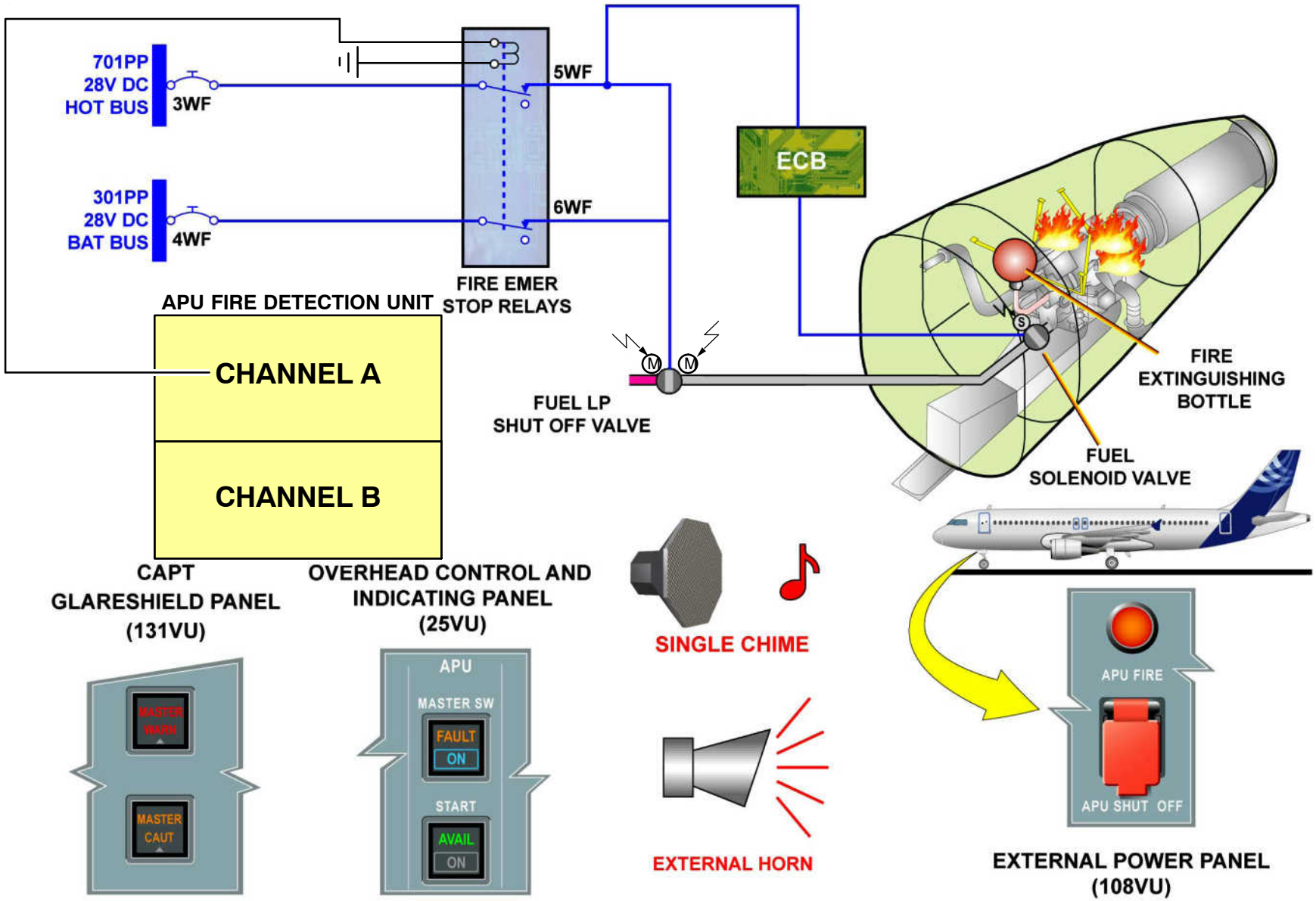


Figure 32 APU Fire Extinguishing on Ground

APU AUTO EXTINGUISHING CIRCUIT OPERATION

APU Fire Extinguishing on ground

On the ground the automatic fire–extinguishing circuit controls the extinguishing sequence. The LGCIU (**L**anding **G**ear **C**ontrol and **I**nterface **U**nit) 5GA1 closes the FLIGHT/GROUND relay 43WF when the landing gear is compressed.

If the FDU detects an excessive temperature or a fire in the APU compartment it starts the subsequent cockpit warnings:

- on the APU FIRE panel 20VU the light in the APU FIRE pushbutton switch comes on
- on the glareshield panels 130VU and 131VU the MASTER WARN lights flash
- the continuous repetitive chime comes on
- the ECAM upper display unit shows the message:
  - APU FIRE
  - APU FIRE P/B PUSH
  - MASTER SW OFF
  - LAND ASAP
- on the ECAM lower display unit: the APU page comes on automatically.

The automatic fire–extinguishing circuit controls the extinguishing sequence:

- the circuit breaker 30WF and the FDU energize the AUTO TIME DELAY PUSH relay (it operates three seconds after fire warning
- the relay energizes the HORN SUPPLY relay through the HORN OFF relay (the ground crew horn comes on)
- the relay also energizes the APU FIRE light on the external power panel (the red APU FIRE light comes on)
- the AUTO PUSH relay connects the 28VDC power supply from the circuit breakers and to the FIRE EMER STOP 1(2) relays 5WF and 6WF (this energizes the relays)
- the relays 5WF and 6WF connect the power supply from the circuit breakers to the APU low–pressure fuel–shutoff–valve actuator (the APU low–pressure fuel–shutoff–valve closes)
- the relay 5WF also sends a signal to the APU ECB (**E**lectronic **C**ontrol **B**ox) (Ref. 49–62–00) (the ECB starts the APU emergency shutdown sequence)
- the AUTO DISCH relay connects the 28VDC power supply from the circuit breakers 1WF and 2WF through the EXTING GND TEST relay to the squibs A and B in the cartridge (the cartridge fires and ruptures the diaphragm in the bottle discharge outlet)
- the extinguisher agent is released and flows into the APU compartment
- the pressure in the bottle decreases, the pressure switch closes and sends a signal to the APU FIRE panel (the amber DISCH legend in the AGENT pushbutton switch comes on)
- the FDU sends a signal to the FWC and the ECAM upper display unit shows the message
  - APU FIRE
  - MASTER SW OFF

Reset

When you push the APU SHUT OFF pushbutton switch or you release the APU FIRE pushbutton switch the 28VDC power supply from the circuit breaker 30WF is connected to the HORN OFF relay (this energizes the relay and the ground crew horn stops).

When the fire or overheat condition is no longer available the FDU de–energizes the AUTO TIME DELAY relay (this de–energizes all relays in the automatic fire–extinguishing circuit).

A3

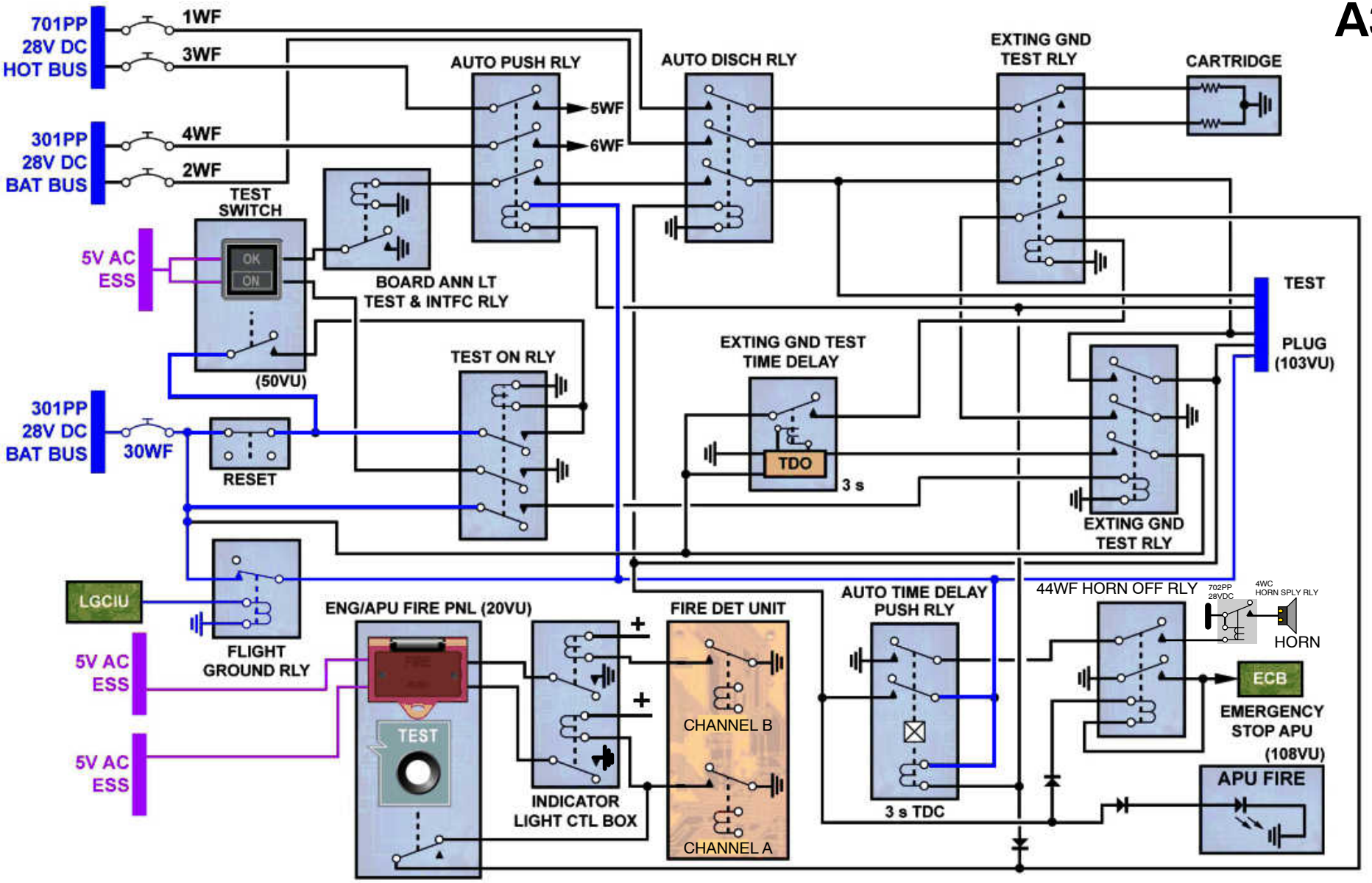


Figure 33 APU Fire Extinguishing on Ground

AUTOMATIC FIRE EXTINGUISHING ADJUSTMENT/TESTS

Automatic Fire Extinguishing - Ground Test

On the APU AUTO EXTING section of the overhead panel 50VU, the TEST pushbutton switch starts the test of the automatic fire–extinguishing system. This pushbutton switch operates the TEST ON relay :

- the ON indicator light in the TEST pushbutton switch comes on,
- the TEST ON relay connects the power supply from the circuit breaker to the EXTING GND TEST relay,

  (this energizes the EXTING GND TEST TIME DELAY relay and the AUTO TIME DELAY PUSH relay).
- the test on relay energizes the EXTING GND TEST relay which disconnects the automatic squib circuit of the fire extinguishing bottle, to prevent the fire bottle discharging
- the auto time delay relay energizes the HORN SUPPLY relay through the HORN OFF relay (the ground crew horn comes on)
- the Auto Time Delay relay also energizes the APU FIRE light on the external power panel (the red APU FIRE light comes on)
- the AUTO PUSH relay connects the 28VDC power supply from the circuit breakers 3WF and 4WF to the FIRE EMER STOP 1(2) relays 5WF and 6WF (this energizes the relays)
- the relays 5WF and 6WF connect the power supply from the circuit breakers 1QF and 2QF to the APU low–pressure fuel–shutoff–valve actuator (Ref. 28–29–00) (the APU low–pressure fuel–shutoff–valve closes)
- the relay 5WF also sends a signal to the APU ECB (**E**lectronic **C**ontrol **B**ox) (the ECB starts the APU emergency shutdown sequence
- on the APU AUTO/EXTING panel 50VU, the OK indicator light in the TEST pushbutton switch comes on (this indicates a successful test)

Reset

When you push the RESET switch:

- the the self–holding circuit of the relay TEST ON relay is de–energized
- all other relays are de–energized. (the fire extinguishing bottle is connected again to the automatic fire–extinguishing on ground circuit)
- the ground crew horn and the APU FIRE light go off
- the ON and OK indicator lights go off in the TEST pushbutton switch.

Squib and Discharge Test Operation

When you push the TEST pushbutton switch on the APU FIRE panel the squib and discharge test starts. The TEST switch connects each cartridge resistor in line with one relay which are installed in the APU FIRE panel. When both relays are energized the SQUIB legend of the AGENT pushbutton switch comes on. Both resistors of the cartridge function are operative.

The TEST pushbutton switch disconnects the normal pressure indication (DC GND signal) and simulates a pressure loss in the extinguisher bottle (bottle discharged). The disconnected GND signal triggers a relay via a transistor. The DISCH legend in the AGENT pushbutton switch comes on.

The test stops when the TEST pushbutton switch is released.

A3

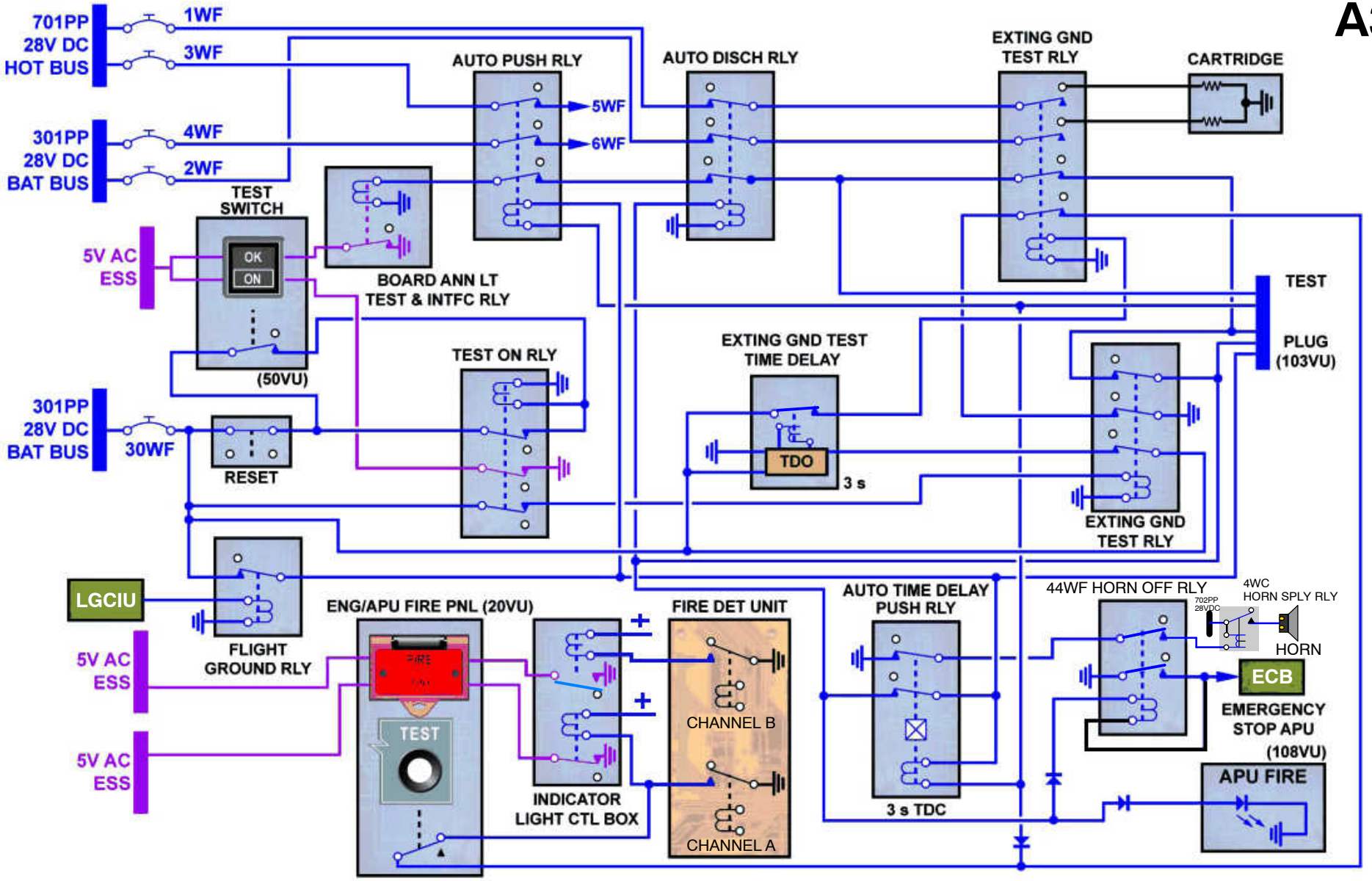


Figure 34 APU Automatic Fire Extinguishing-Test

APU FIRE EXTINGUISHER BOTTLE COMPONENT DESCRIPTION

Fire Extinguisher Bottle

The primary components of the fire extinguisher bottle are:

- the container,
- the discharge outlet with the metal diaphragm,
- the fill fitting assembly with the pressure relief device,
- the pressure switch with a guard,
- the identification plate.

Container (sperical Container)

The container is spherical, made of stainless steel and is hermetically sealed. The discharge outlet, the fill fitting assembly and the pressure switch are attached to the container.

The container is charged with the extinguisher agent and pressurized with nitrogen through the fill fitting assembly. The fill fitting assembly seals the container and has a stainless steel disc which functions as a pressure relief device. If the pressure in the container increases to 1680 psi +120 psi the disc ruptures and releases the extinguisher agent.

The container has a volume of 3670.71 cm3.

It is charged with 2.2679 kg of extinguisher agent and pressurized to 41.3685 bar.

It can operate between the ambient temperatures of –53.88 deg.C and +121.11 deg.C.

Pressure Switch

The pressure switch monitors the pressure in the container. It has a guard for protection. If the pressure in the container decreases to 200 psi the pressure switch opens and sends a discharge signal to the APU FIRE panel.

Discharge Outlet (Discharge Head)

The discharge head gives a directional flow path for the extinguisher agent. It is installed on the bottle discharge outlet with a coupling nut.

The discharge indicator is installed in the fuselage skin between FR78 and FR79. The overboard discharge pipe connects the discharge indicator to the pressure relief device on the fire extinguisher bottle. A red disc is installed in the discharge indicator housing. You can see the red disc if the pressure relief device on the fire extinguisher bottle is in the correct condition. If the pressure relief device operates, the extinguisher agent flows through the overboard discharge pipe to the discharge indicator. The extinguisher agent pressure pushes the red disc out of the discharge indicator housing. This shows that the pressure relief device has operated and that the bottle is no longer serviceable.

APU Fire Extinguisher Bottle Overpressure

If there is an overpressure (overtemperature) in the fire extinguisher bottle:

- the pressure relief device operates automatically
- the extinguisher agent is released and flows through the overboard discharge pipe to the discharge indicator
- the pressure of the extinguisher agent pushes the red indicator disc out of the discharge indicator housing (the ejected disc shows that the pressure relief device has operated)
- the pressure switch on the bottle transmits a signal to the AGENT pushbutton switch on the APU FIRE panel 20VU (the DISCH legend comes on)

Cartridge

The cartridge is installed in the discharge head. It is a high–reliability explosive device and has two squibs (squib A and squib B). When electrical power is supplied to the squibs the cartridge fires and ruptures the metal diaphragm in the bottle discharge outlet. This releases the extinguisher agent

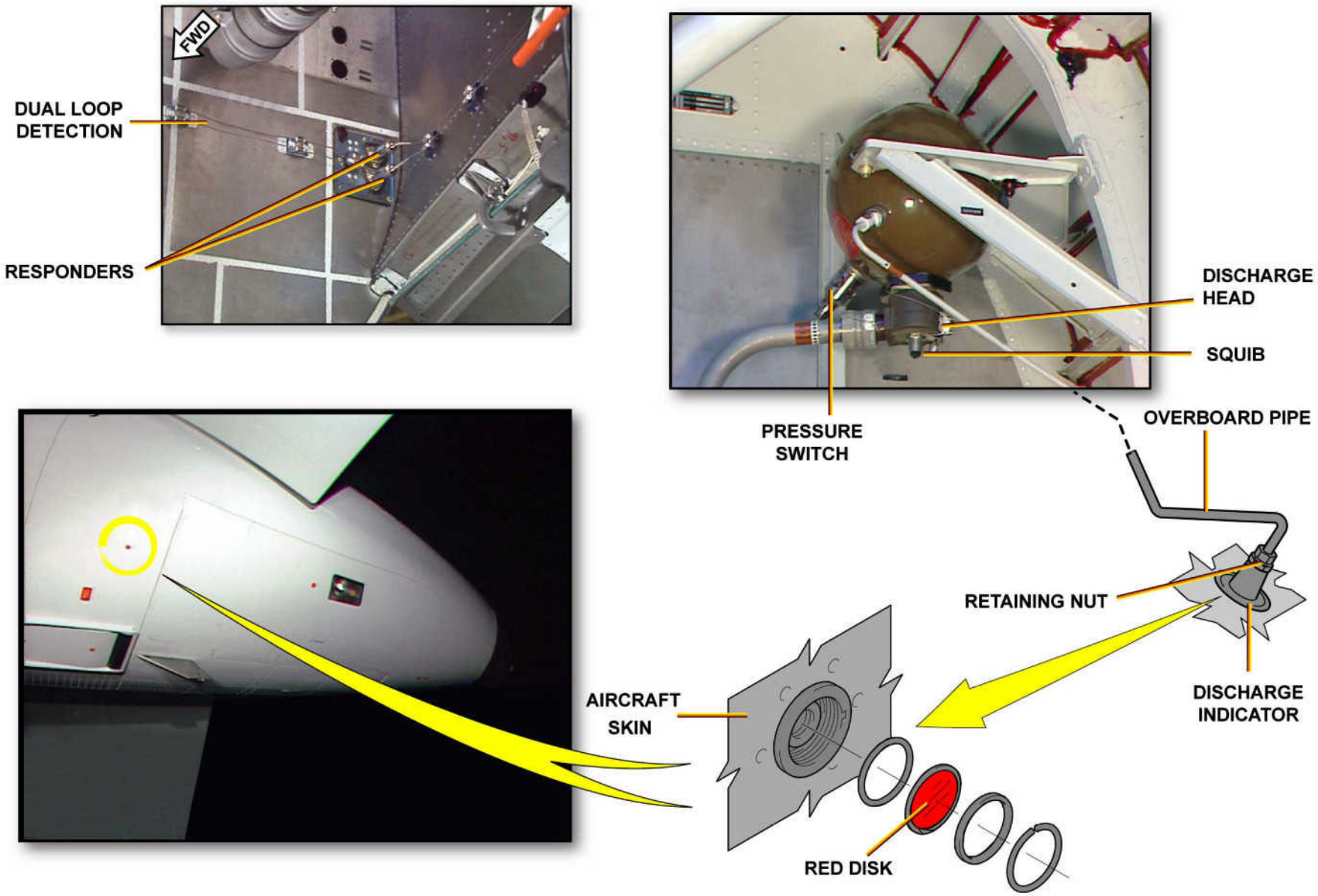
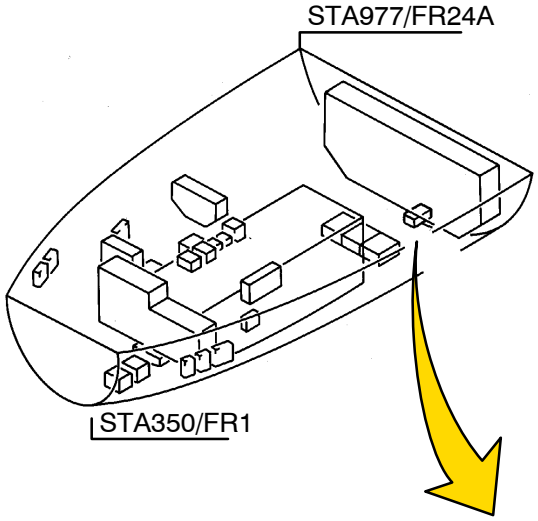
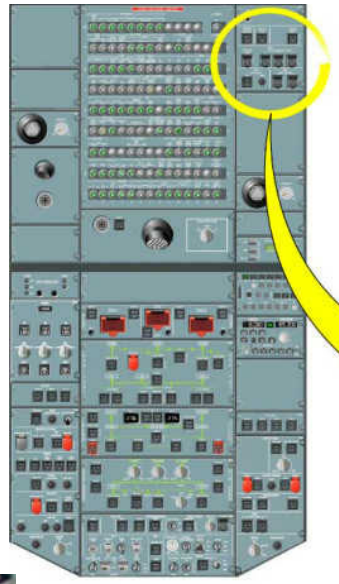


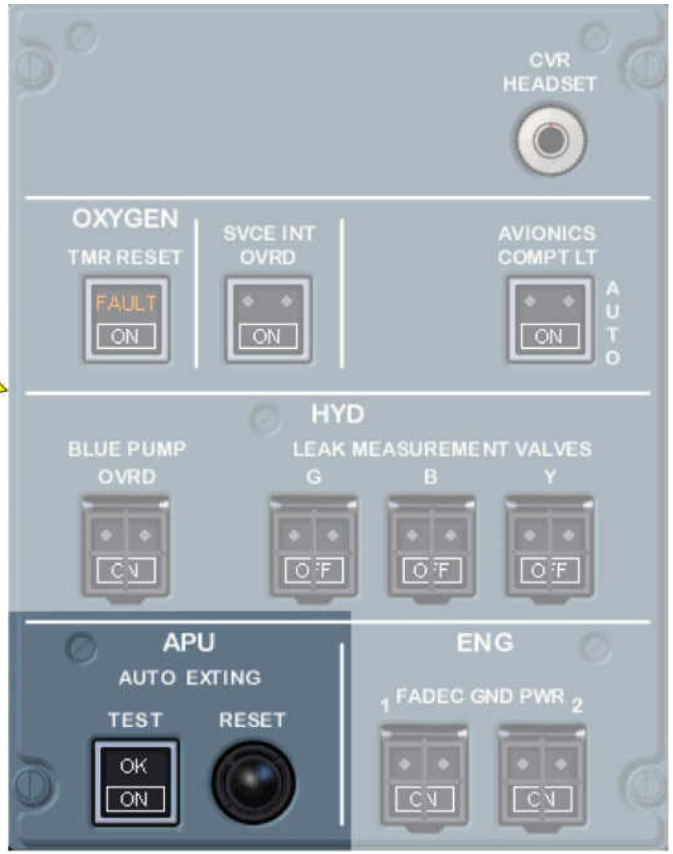
Figure 35 APU Fire Extinguishing Bottle Component Location

APU FIRE PROTECTION CONTROLS AND INDICATIONS





OVERHEAD PANEL



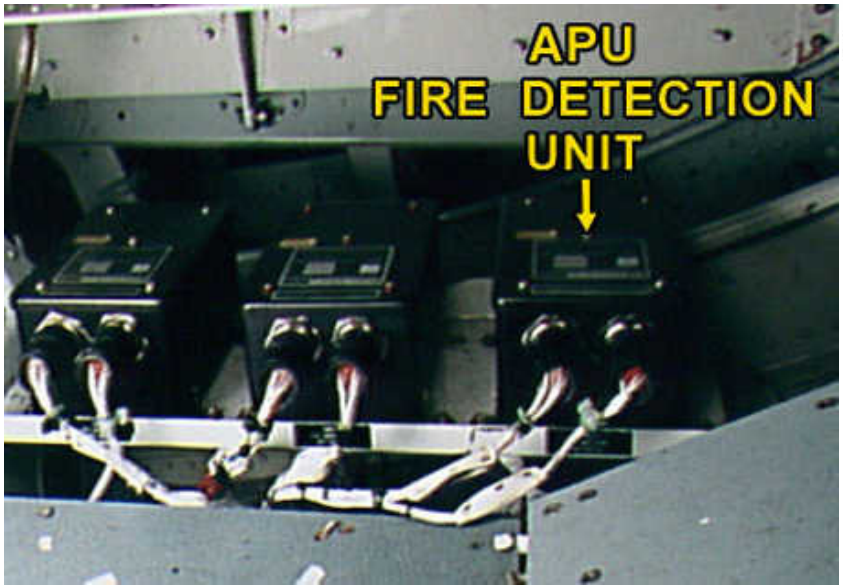


Figure 36 APU Fire Protection Component Location (1)

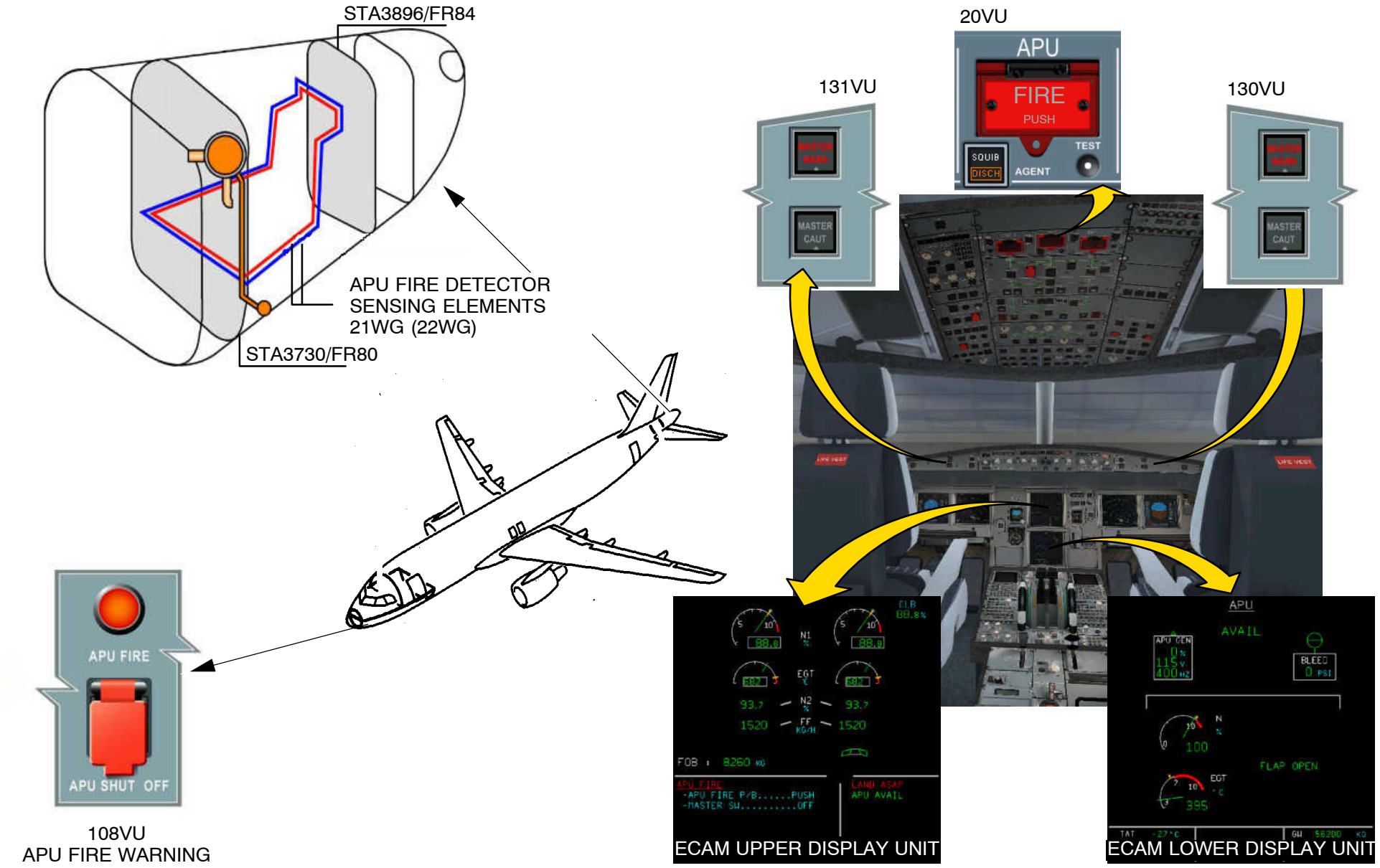


Figure 37 APU Fire Protection Component Location (2)

26–15 AVIONICS COMPARTMENT SMOKE DETECTION

GENERAL DESCRIPTION

Definition

There are two types of smoke detection:

- the direct detection by the crew
- the detection by a smoke detector

Functions

The avionics–compartment smoke–detection system confirms that there is smoke in the avionics compartment.

The smoke detection system includes one smoke detector installed on the air extraction duct.

The smoke detector triggers the smoke warnings to the cockpit when the alarm threshold is reached.

When there is smoke, pneumatic and electrical procedures are started.

System Description

When the smoke concentration is above the alarm threshold, the smoke detector triggers the smoke warnings in the cockpit:

- on the EMER ELEC PWR section of the panel 21VU
- on the VENTILATION section of the OVERHEAD CTL & IND panel 22VU
- the MASTER CAUT light comes on
- the warning message is shown on the lower ECAM display unit
- The aural warning sounds

When this happens, you must push the VENTILATION/BLOWER pushbutton switch and the VENTILATION/EXTRACT pushbutton switch: the OVRD legends come on.

This causes the blower fan to stop, closes the conditioned–air inlet valve and opens partially the skin air–outlet valve.

All other valves close and the air goes overboard through the skin air–outlet valve. The extract fan stays energized.

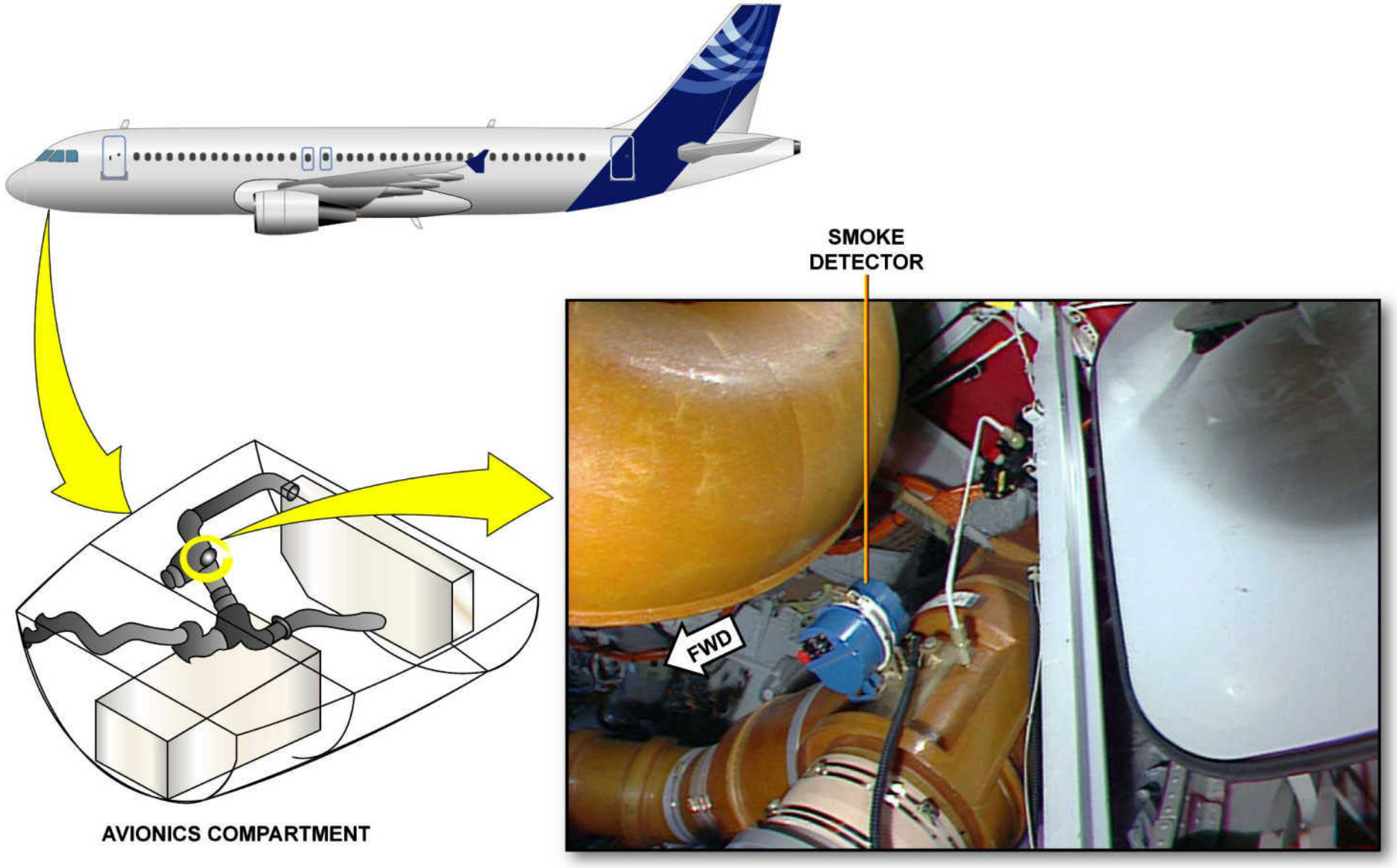


Figure 38 Avionic Equipment Smoke Detector

AVIONICS EQUIPMENT VENTILATION GENERAL DESCRIPTION

Normal operation

The avionics ventilation system operates in different configurations.

These configurations are dependent on, ambient temperature, whether the aircraft is on the ground, or in flight.

The avionics equipment is also cooled in different ways, these are not dependent on the ventilation system configurations.

Operation - Modes

The avionics equipment is cooled with air supplied in different ways depending on temperature conditions:

- open circuit
- closed circuit,
- partially open circuit
- cockpit supply air (in failure cases)

Open circuit

The avionics equipment is cooled with ambient air when the aircraft is on the ground and the skin temperature is above +12 deg.C (+53.60 deg.F).

In open circuit the following happens:

- the skin air inlet valve opens fully
- the skin air outlet valve opens fully
- the skin exchanger isolation valve closes

Closed Circuit

Normally the avionics equipment is cooled with air in a closed circuit when:

- the aircraft is on the ground and the skin temperature is below +9 deg.C (+48.20 deg.F)
- or when the aircraft is in flight and the skin temperature is below +31 deg.C (+87.80 deg.F)

In closed circuit configuration the following happens:

- the skin air inlet valve closes
- the skin air outlet valve closes
- the skin exchanger isolation valve opens

Partially open circuit

The avionics equipment is cooled with air in a partially open circuit when the skin temperature is above +35 deg.C (+95.00 deg.F) and:

- when the aircraft is on the ground (TLA above T/O)
- when the aircraft is in flight

In partially open circuit the following will happen:

- the skin air inlet valve closes
- the skin air outlet valve opens partially
- skin exchanger isolation valve opens

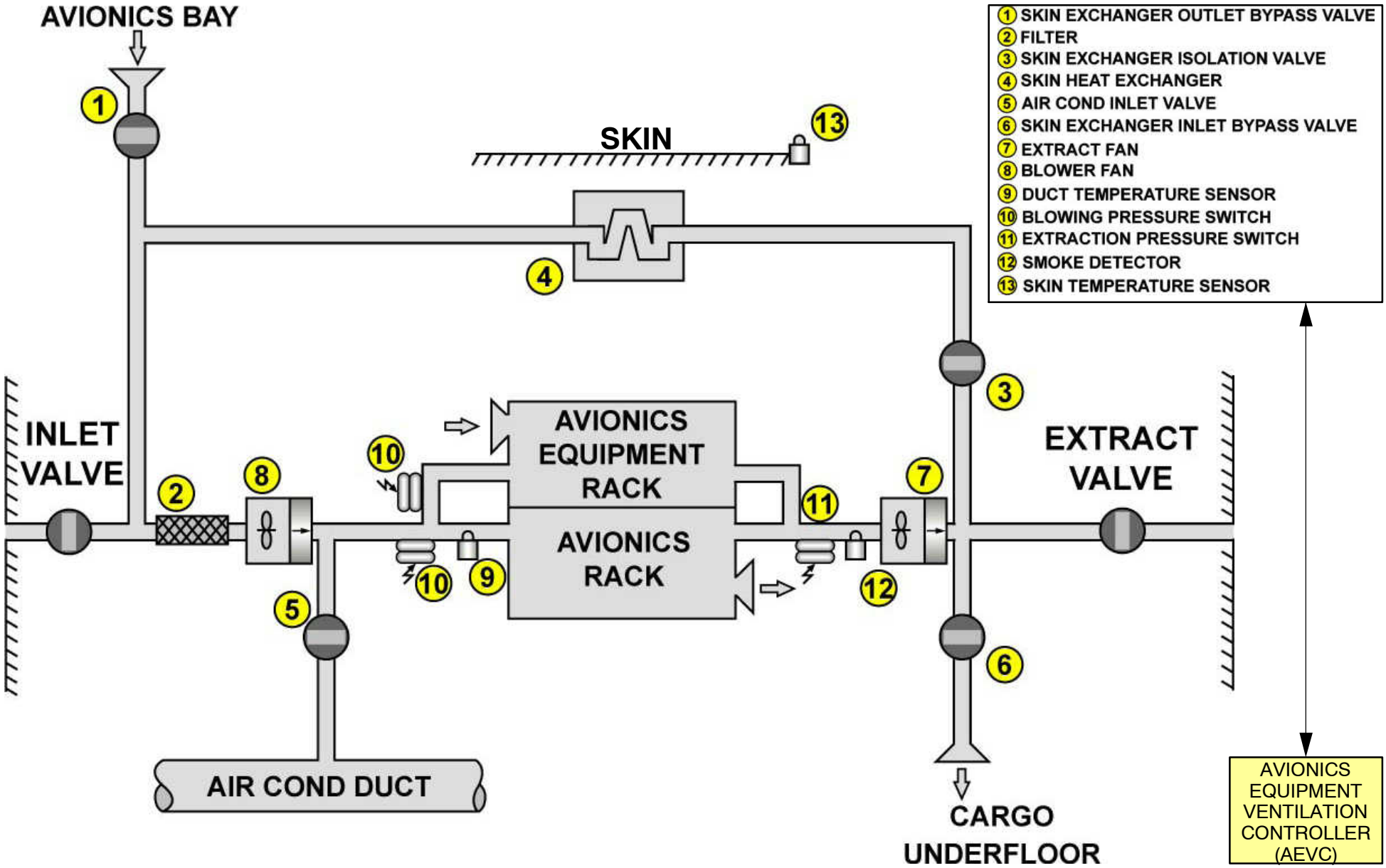


Figure 39 Avionics Equipment Ventilation Architecture

AVIONICS COMPARTMENT SMOKE DETECTION FUNCTION

Description

The aircraft has a cooling system for the avionics equipment. The cooling system is controlled and monitored by the AEVC (**A**vionics **E**quipment **V**entilation **C**ontroller). The air is circulated through the system by a blower fan (cool air supply) working together with an extraction fan (warm air removal).

The extraction airflow is downstream of the avionics equipment, so the avionics SMOKE detector is installed in the extraction duct and will detect smoke coming from the computers and control boxes. The detector is monitored by the AEVC. The smoke detector sends an alarm signal the FWC to show the AVIONICS SMOKE warning in the cockpit.

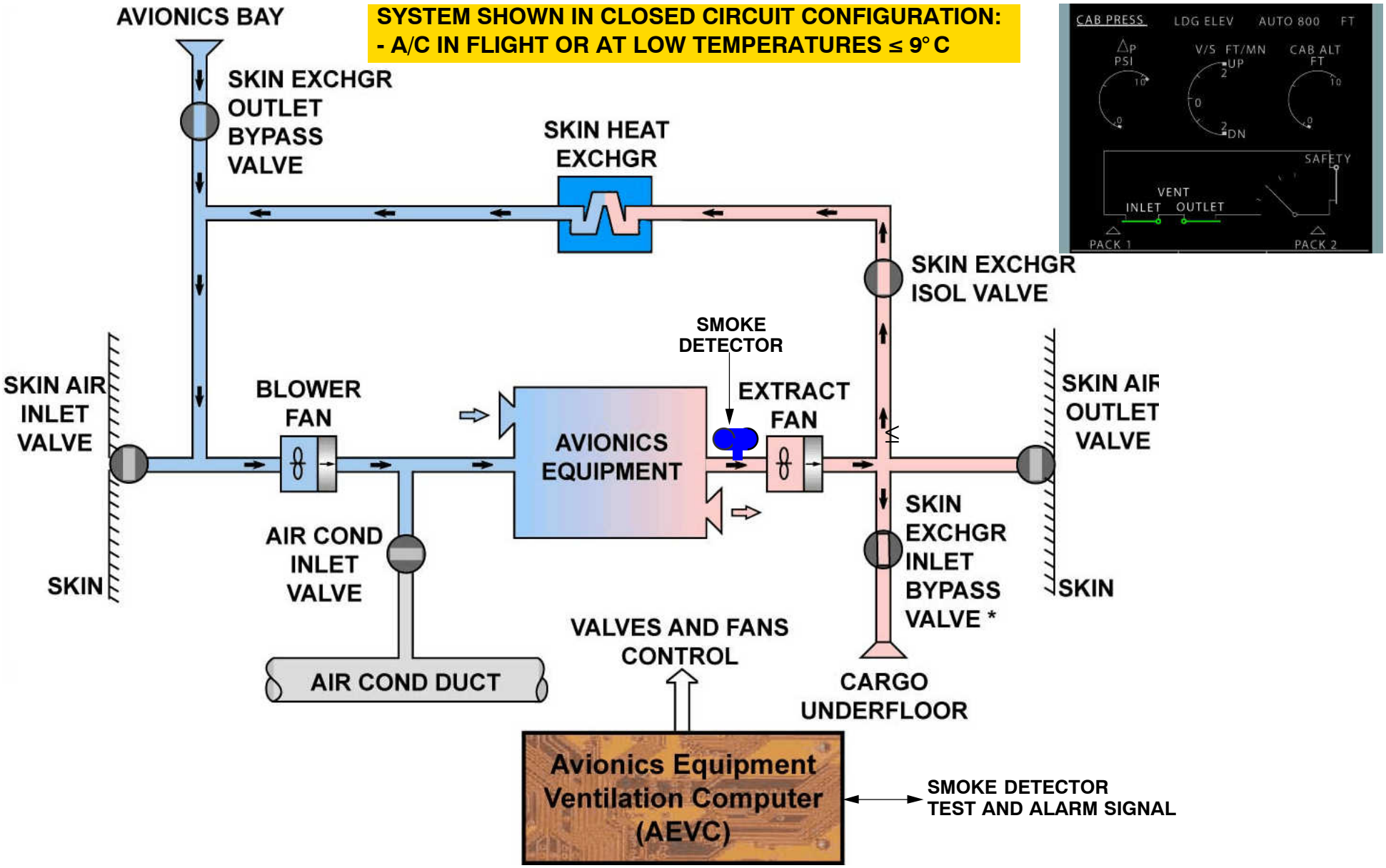


Figure 40 Closed Circuit Configuration)

SMOKE DRILL PROCEDURE GENERAL DESCRIPTION

Operation in Warning Configuration

The alarm output (discrete signal) is activated when the alarm threshold is reached.

As the smoke detector operates in autonomous mode, the corresponding warnings are directly triggered by means of relays to the cockpit.

Indicating

When the alarm threshold is reached, the smoke detector triggers the following warnings:

- on the EMER ELEC PWR section of the overhead panel 21VU
  - the SMOKE legend of the GEN 1 LINE pushbutton switch comes on
- on the VENTILATION section of the overhead panel 22VU
  - the FAULT legends of the BLOWER and EXTRACT pushbutton switches come on,
- the MASTER CAUT light comes on
- a warning message is shown on the lower ECAM display unit
- The SC (**S**ingle **C**hime) sounds.

NOTE: When smoke concentration decreases below the alarm threshold, the smoke detector returns to the initial state.

A3

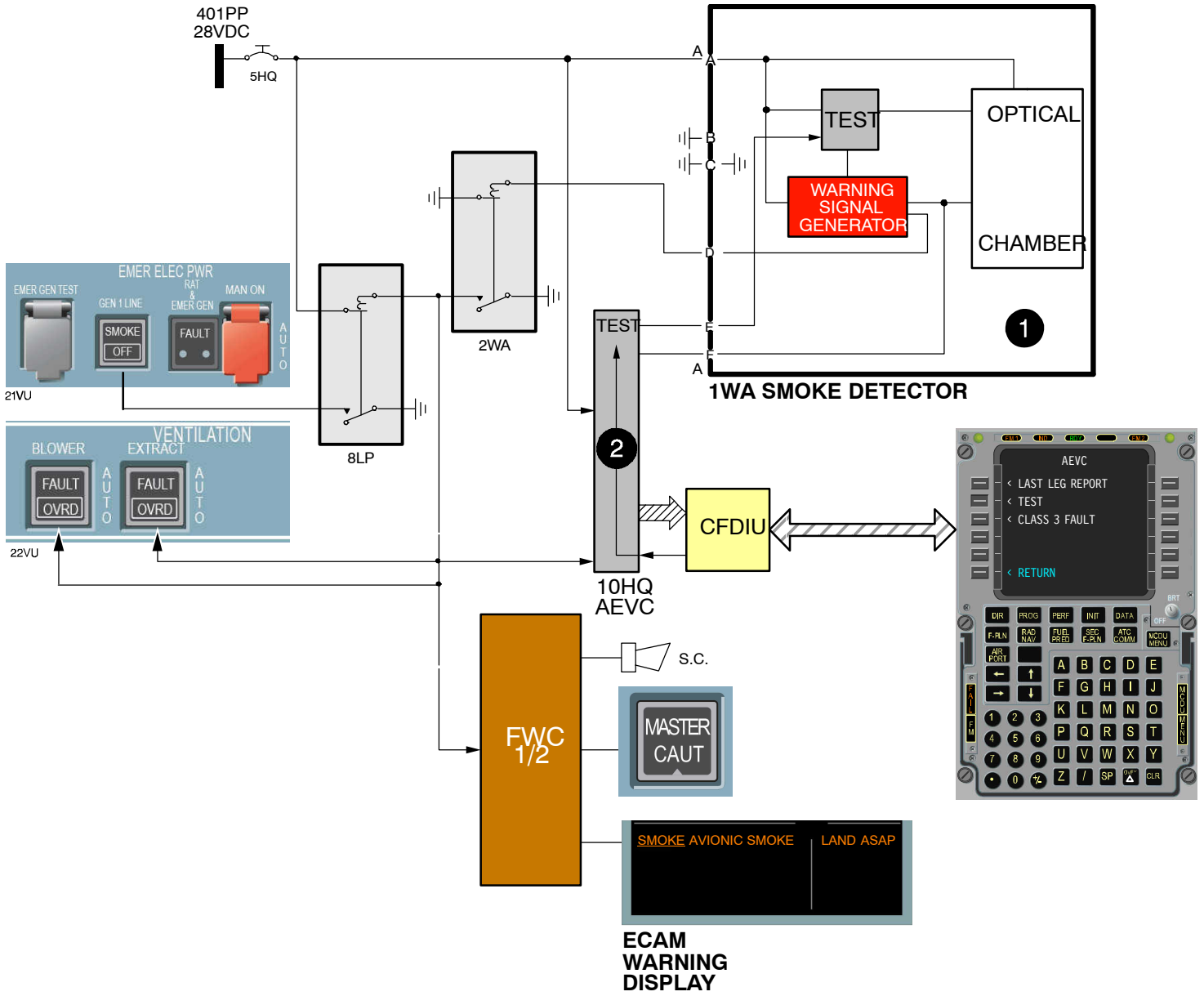


Figure 41 Avionic Smoke Detection Interface

SMOKE DRILL PROCEDURE PRESENTATION

SMOKE DRILL PROCEDURE (AIR CONDITION)

Smoke Procedure

The list of the necessary actions during the smoke procedure comes into view automatically on the lower ECAM display unit while the SMOKE warnings are triggered.

When these actions are completed, the related lines are cancelled automatically on the lower ECAM display unit

The procedure below must be applied:

DISPLAY		ACTIONS
AVIONICS SMOKE		LAND ASAP
IF PERCEPTIBLE SMOKE:		Smoke from avionics compartment is detected directly by the crew
OXY MASK/GOGGLES	ON	Make sure crew members can speak to control tower each other. Do not use the interphone position to keep the interference of the Oxygen–mask breathing noise to a minimum.
CAB . FANS	OFF	To keep smoke off the cockpit and the cabin.
BLOWER	OVRD	
EXTRACT	OVRD	Avionics ventilation is provided by air conditioning system and extracted overboard: VALVE COND AIR opening, VALVE SKIN AIR OUTLET partial opening, all other valves of the system closing. Blower fan (A) stopping, extract fan (B) remains energized.

A3

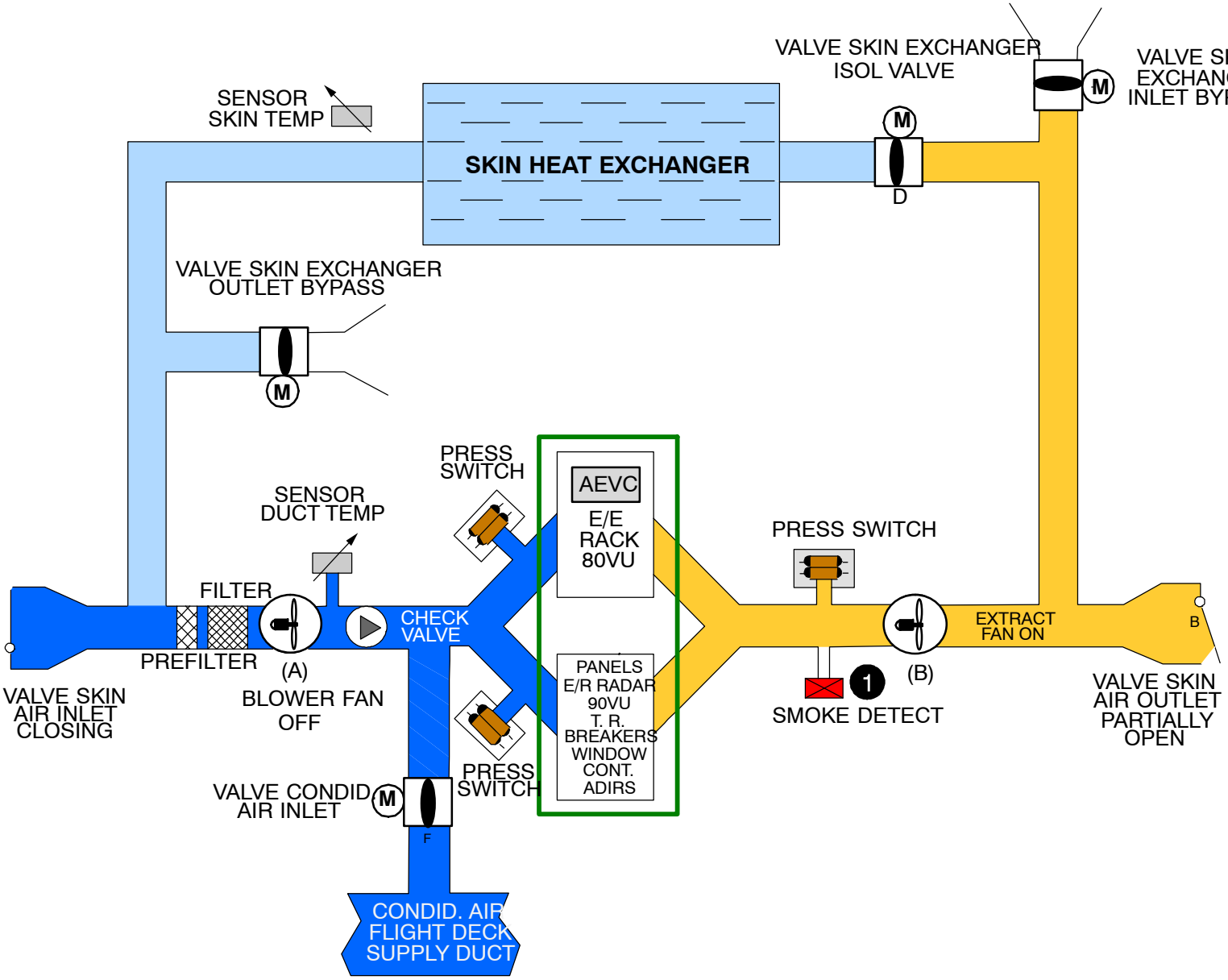


Figure 42 Smoke Drill Procedure (Air Condition)

SMOKE DRILL PROCEDURE (ELECTRICAL)

DISPLAY		ACTIONS
IF SMOKE AFTER 5MN 00S:		An electrical procedure is applied to eliminate the cause of the smoke if the smoke emission persists more than 5 min
EMERG ELEC GEN 1 LINE	OFF	GEN 1 LINE contactor opens. GEN 1 remains in operation and supplies one fuel pump in each wing tank. AC BUS 1 is supplied by GEN 2 through bus tie contactor
EMER ELEC PWR	MAN ON	The RAT (**R**am **A**ir **T**urbine) is extended and the emergency generator is connected to the aircraft network
GEN 2	OFF	The Aircraft operates under Electrical Emergency Configuration. Only AC ESS (incl. Shed) Bus and DC ESS (incl. Shed) Bus supplied

NOTE: if smoke disappears within 5 minutes, restore normal ventilation.

NOTE: before landing (landing gear down) restore electrical system.

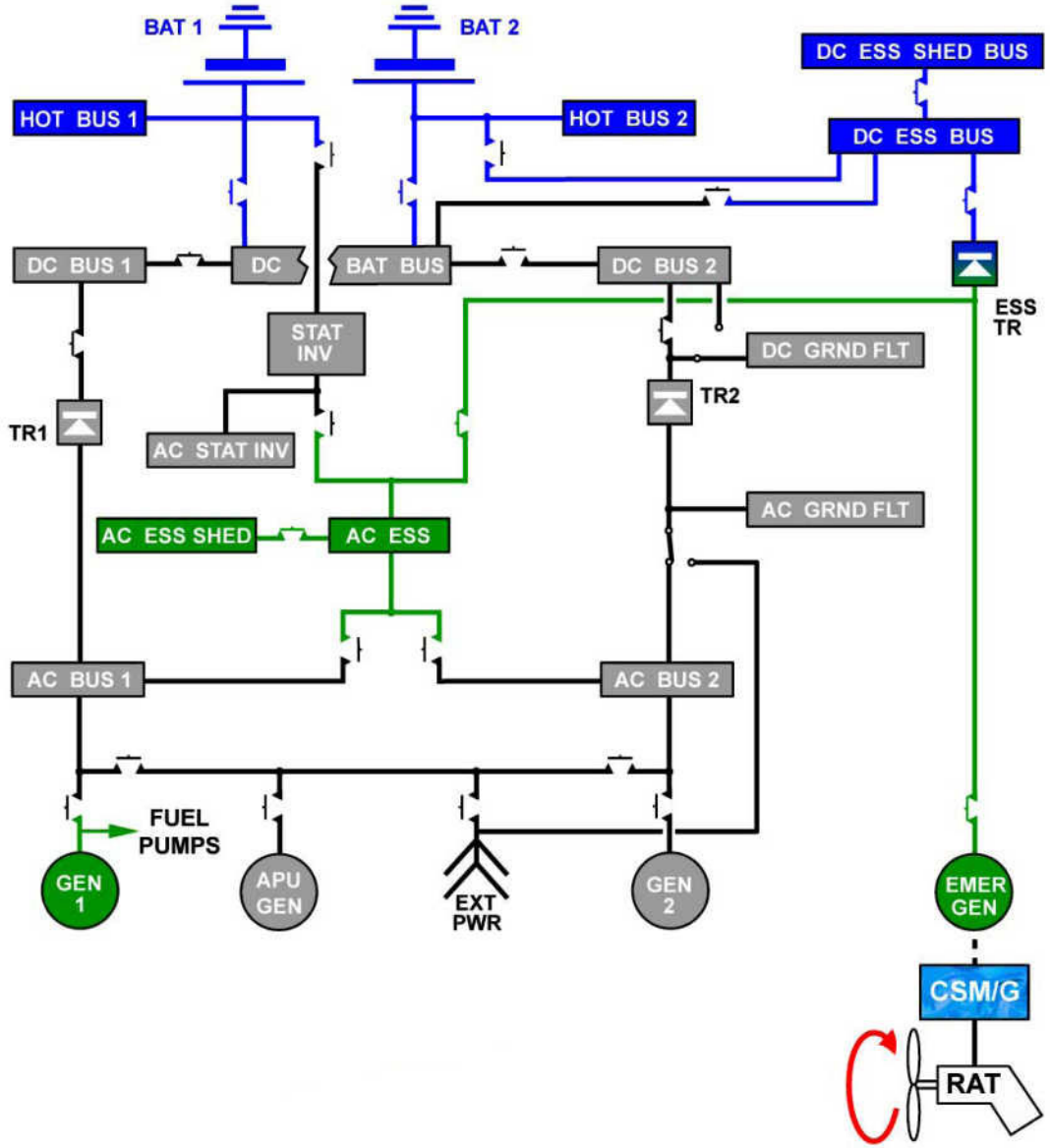


Figure 43 Smoke Drill Procedure (Electrical)

FUEL PUMP SUPPLY IN SMOKE CONFIG FUNCTIONAL OPERATION

FUEL PUMPS ELEC PWR SUPPLY IN SMOKE CONFIG

Smoke Warning

If an avionics smoke warning occurs and smoke is confirmed, GENerator 1 LINE SMOKE P/BSW light comes on amber on the EMERgency ELECtrical PoWeR panel.

In this case, several actions have to be taken by the cockpit crew concerning mainly the ventilation and communication systems. If the smoke warning remains 5 min after actions on the ventilation and communication systems, the avionics smoke procedure displayed on ECAM/EWD has to be applied.

EMER ELEC GEN 1 LINE Off

In this case, Generator Line Contactor (GLC) 1 opens. Generator 1 remains energized and supplies one fuel pump in each wing tank. AC BUS 1 is supplied by generator 2 through Bus Tie Contactors (BTCs).

EMER ELEC PWR MAN On

In this case, the Ram Air Turbine (RAT) is extended and the emergency generator is connected to the aircraft network by its control unit, when the parameters are correct. The emergency generator then supplies the AC ESSential BUS and DC ESS BUS through ESS Transformer Rectifier (TR).

GEN 2 Off

When the emergency generator is available, the generator 2 P/BSW must be set to OFF.

NOTE: Before L/G extension, GEN 2 and EMER ELEC GEN 1 LINE P/BSW must be set to ON.

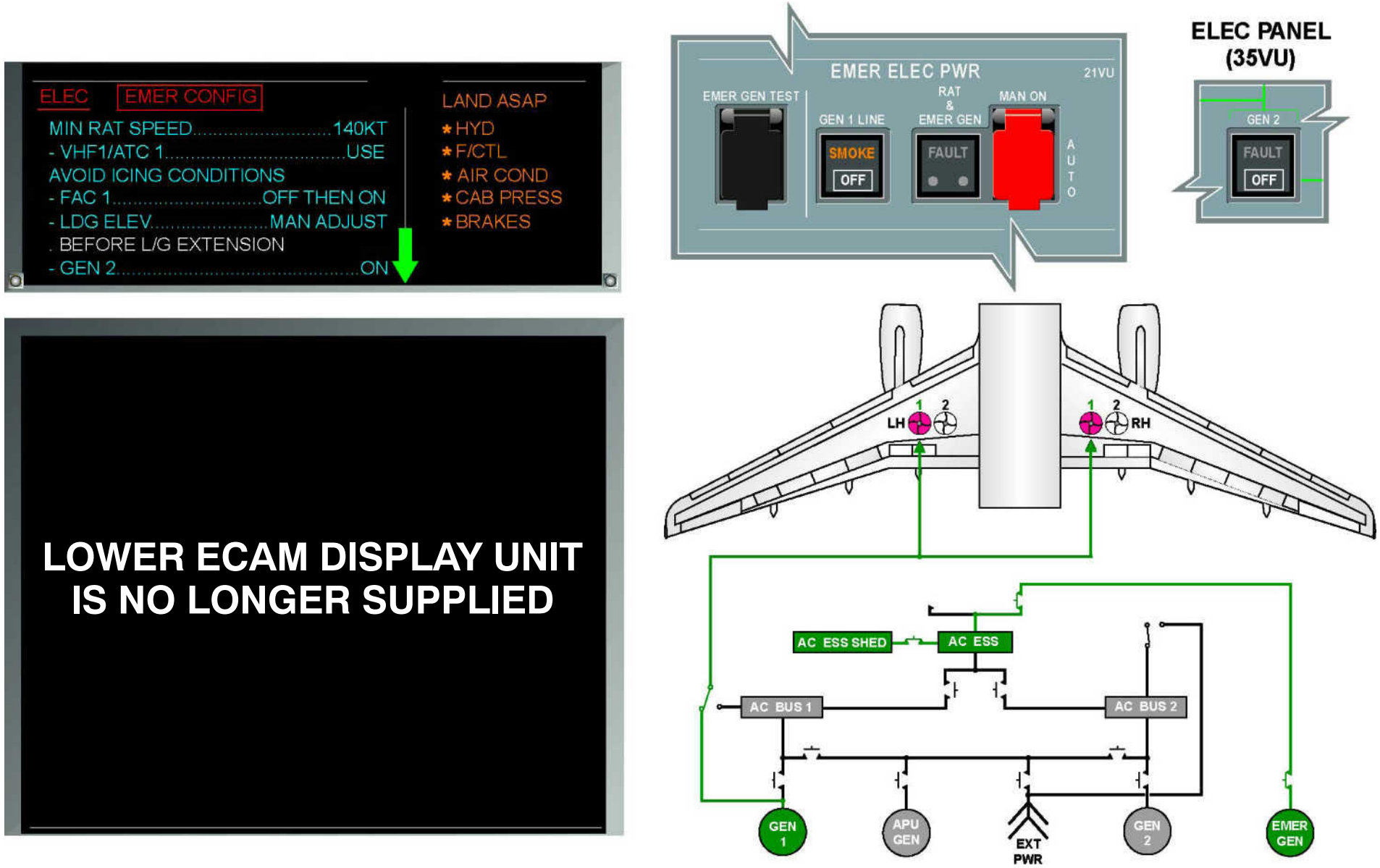


Figure 44 Fuel Pumps Power Supply After Smoke Drill Procedure

AVIONIC SMOKE DETECTION SYSTEM LOCATIONS

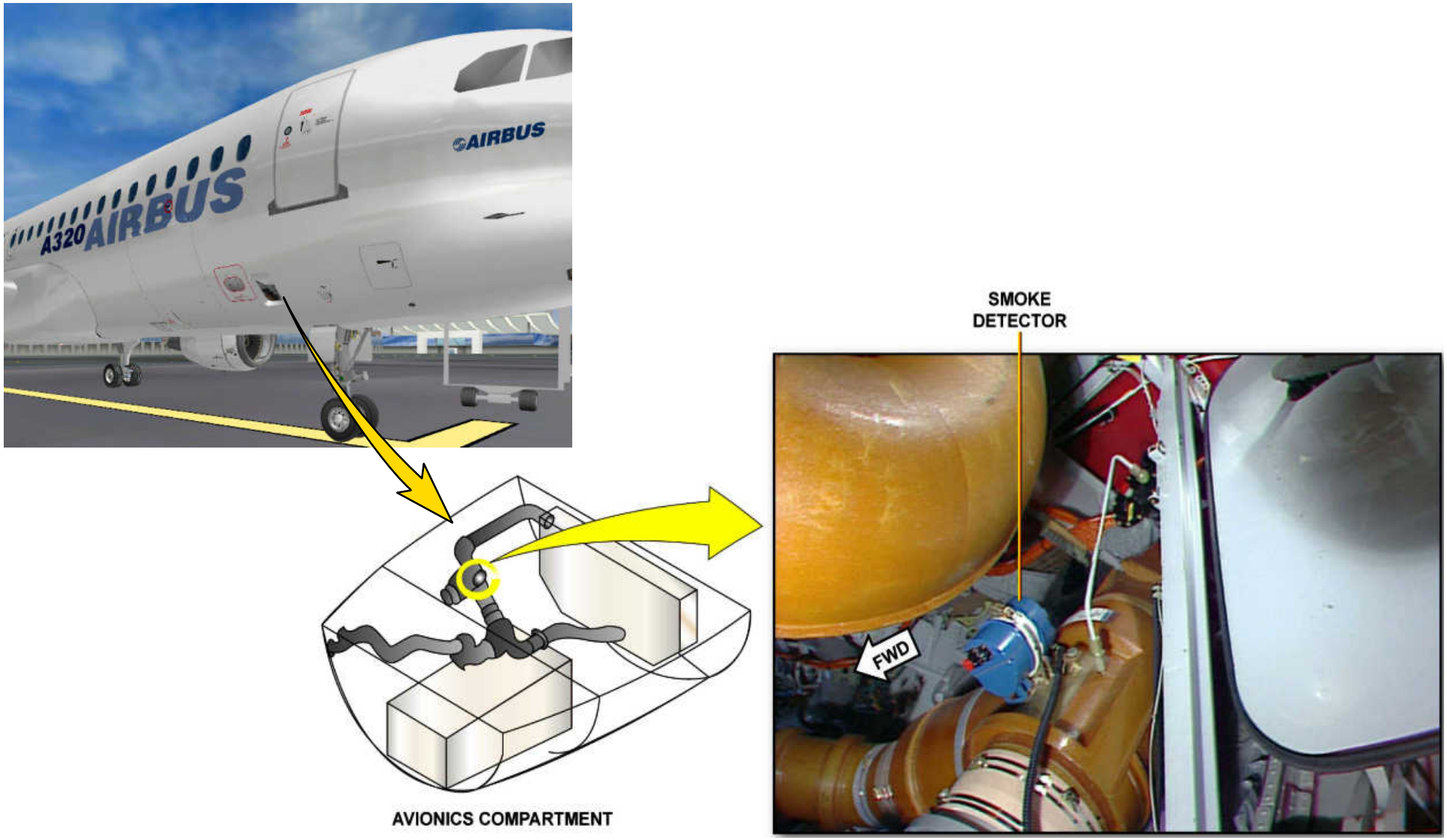


Figure 45 Avionics Smoke Detector Location

Figure 46 Avionic Smoke Detection System Components

26–16 CARGO COMPARTMENT SMOKE DETECTION

GENERAL DESCRIPTION

General

The cargo–compartment smoke–detection system is installed in the cargo compartment. It gives a visual and aural warning in the cockpit, if smoke or fire is in the compartment. It is a dual loop system to prevent incorrect warnings. Two smoke detectors are installed in the FWD compartment and four smoke detectors in the AFT, with an AND–logic.

The system Includes:

- the smoke detectors (Fwd: 2/Aft: 4)
- the smoke annunciator lights and a TEST pushbutton switch
- SDCU (**S**moke **D**etection **C**ontrol **U**nit)

Indications are shown on the ECAM (**E**lectronic **C**entralized **A**ircraft **M**onitoring) upper display unit.

Smoke Detectors

Two different types of smoke detectors may be installed:

- the ionization type smoke detectors,
- the optical smoke detectors.

Smoke Annunciator Lights

A FWD SMOKE annunciator light 11WH and an AFT SMOKE annunciator light 12WH are installed on the cargo smoke panel 22VU. When any set of smoke detectors operate, they transmit a warning signal to the SDCU 10WQ. The SDCU through two ARINC 429 buses independently control the warning outputs to the FWC (**F**light **W**arning **C**omputers). The related SMOKE annunciator light comes on.

PTT (Press-to-Test) pushbutton switch

The (PTT) pushbutton switch together with the SDCU, permits a functional test of the cargo smoke detection system. The (PTT) pushbutton switch is installed between the smoke annunciator lights on the cargo smoke panel 22VU.

SDCU (Smoke Detection Control Unit)

The SDCU controls the lavatory and cargo–compartment smoke–detection system. The SDCU BITE (**B**uilt–**I**n **T**est **E**quipment) controls and monitors the systems and interfaces with the CFDS (**C**entralized **F**ault **D**isplay **S**ystem).

It records the unsatisfactory components and system malfunctions (Ref.26–17–00).

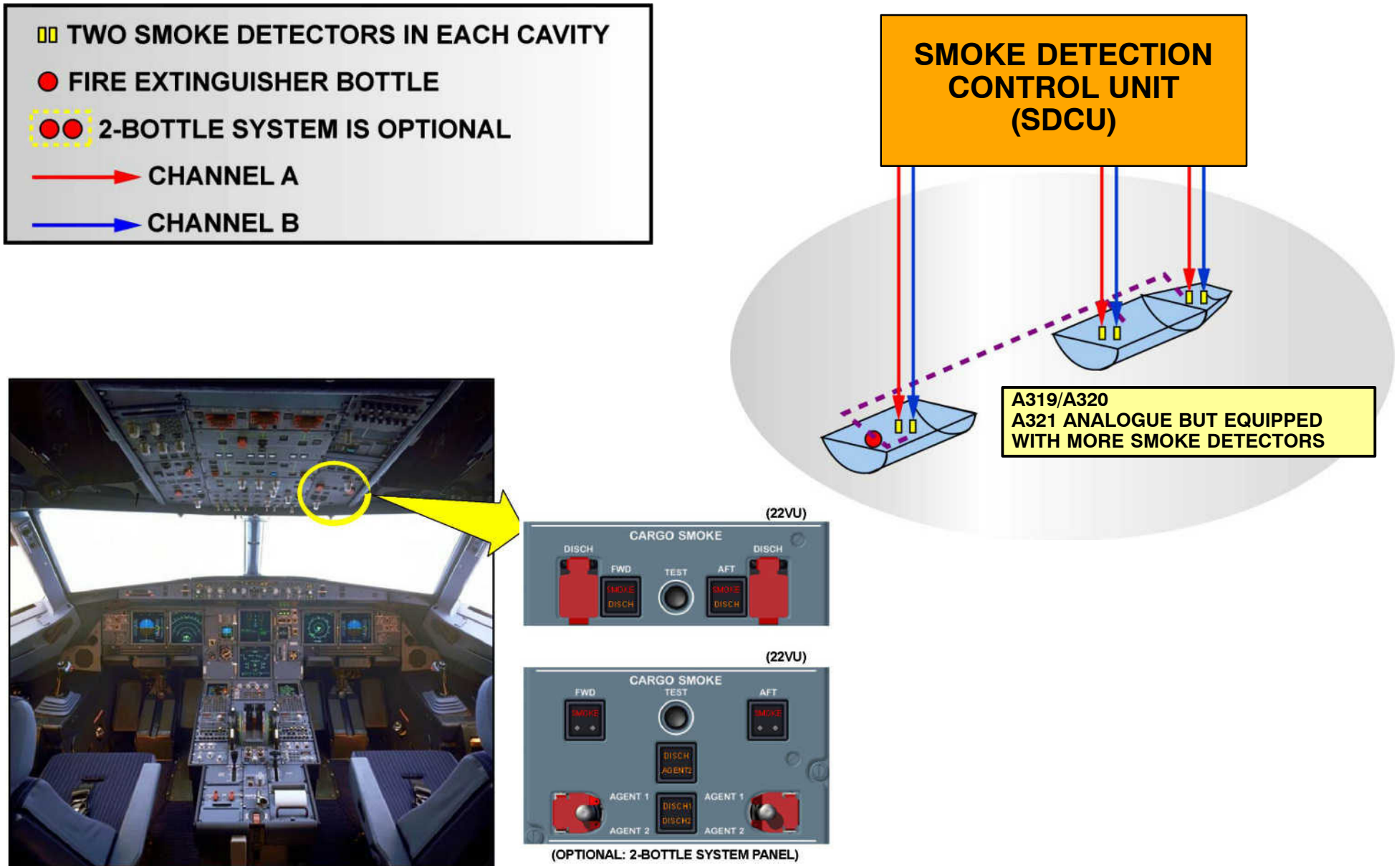


Figure 47 Description and Operation (A319/A320/A321)

CARGO FIRE PROTECTION SYSTEM LAYOUT

GENERAL

The cargo fire protection is supplied by two systems:

- the cargo smoke detection (separate FWD & AFT systems),
- the cargo fire extinguishing (separate FWD & AFT systems).

Smoke Detectors

The cargo smoke detection system is installed in the FWD and in the AFT/BULK cargo compartments. Four smoke detectors are located in two cavities in the ceiling of the AFT/BULK cargo compartment and two others detectors in the FWD cargo compartment.

The cargo smoke detectors are interconnected to each other. They are part of a loop which is connected to the SDCU (**S**moke **D**etection **C**ontrol **U**nit). The loop contains also the lavatory smoke detectors.

SDCU

For each compartment, the SDCU activates the warnings with an AND logic gate to prevent false warnings. The SDCU also monitors the smoke detectors in case of a single detection. When only one cargo smoke detector detects smoke, the SDCU checks the second detector automatically.

- If this test shows a normal operation of the second detector, the first detector is declared faulty. The result is no SMOKE warning in the cockpit.
- If this test shows an abnormal operation of the second detector, the SMOKE warnings are activated. The second detector is declared faulty.

Warnings

The SDCU sends signals for cockpit local warnings, ECAM system and cargo ventilation controller. It also supplies the fault messages to the CFDS (**C**entralized **F**ault **D**isplay **S**ystem).

In case of FWD or AFT/BULK smoke detection; the respective SMOKE light comes on on the CARGO SMOKE panel. At the same time the cargo ventilation controller closes the isolation valves of the affected compartment (if ventilation installed).

In case of a smoke detector failure, the SDCU sends signals to the ECAM and CFDS systems.

DISCH Pushbutton

When smoke is detected, the related DISCHcharge P/B has to be pressed, in order to fire the relative squib of the extinguishing bottle. Action on one of the FWD or AFT guarded DISCH P/Bs discharges the bottle in the respective cargo compartment. Both DISCH lights come on when the fire extinguishing bottle is discharged.

Bottle

One extinguisher bottle is installed in the FWD cargo compartment and supplies fire extinguishing for the FWD or for the AFT/BULK cargo compartments. The bottle has a pressure switch to monitor agent pressure and two electrically firing cartridges or squibs for agent discharges.

The bottle pressure and the two squibs circuit conditions are continuously monitored by the SDCU. In case of bottle pressure drop or loss of electrical squib continuity, the SDCU sends signals to the ECAM and CFDS.

Test Pushbutton

When the TEST P/B is pressed and held, the SDCU carries out an automatic test.

- Smoke and a bottle pressure drop conditions are simulated.
- The smoke detectors are tested.
- The SMOKE and DISCH lights on the CARGO SMOKE panel come on, and the ECAM warnings are activated.

When the TEST P/B is released, the DISCH lights go off, with a time delay of 2 seconds, and the SMOKE lights go off, with a time delay of 10 seconds. The ECAM message disappears and will be automatically repeated with the warning indications for approximately 6 seconds.

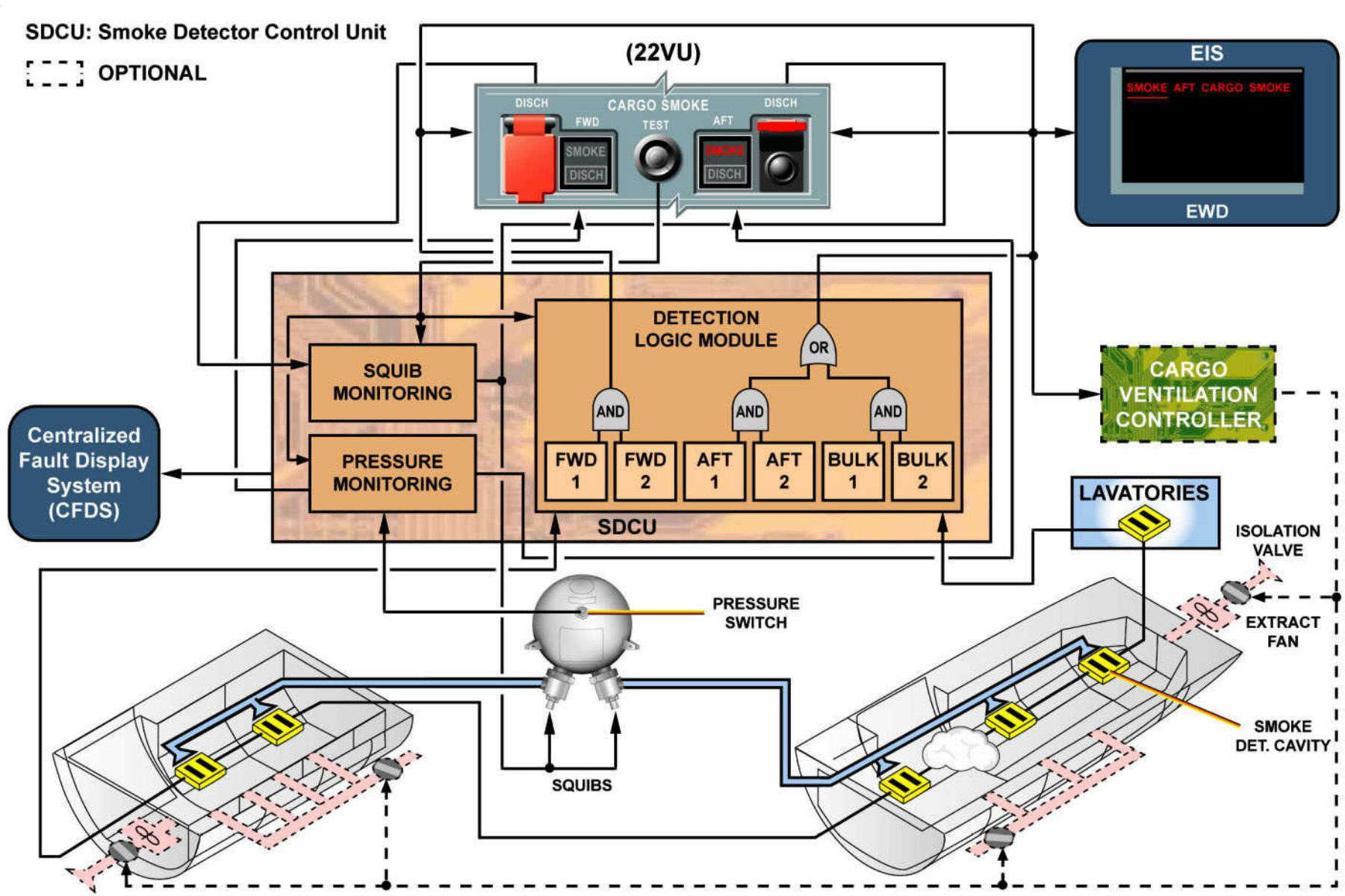


Figure 48 Cargo Fire Protection Schematic (A321)

CC SMOKE DETECTION SYSTEM DESCRIPTION

NORMAL OPERATION

Smoke detected in the cargo compartment will cause:

- the related SMOKE warning light to come on,
- the red light in the MASTER WARNING pushbutton switch to flash
- the aural repetitive chime to sound
- the ECAM upper display unit to show the messages
  - SMOKE FWD/AFT CARGO SMOKE
  - ISOL VALVE (of affected compartment) ... OFF (if not automatically closed)
  - AGENT ... DISCH .

NOTE: In the case of a smoke warning the isolation valves of the cargo compartment ventilation system close automatically.

They remain closed, independent of the smoke warning signals.

OPERATION WITH ONE FAULTY SMOKE DETECTOR

When only one detector sends an alarm, the SDCU checks the second detector automatically. If this test shows a normal function of the second detector, the result is no indication in the cockpit. The alarm of the detector is a false warning. If this test shows an abnormal function of the second detector, the warning signals come on. The alarm of the first detector is the correct warning.

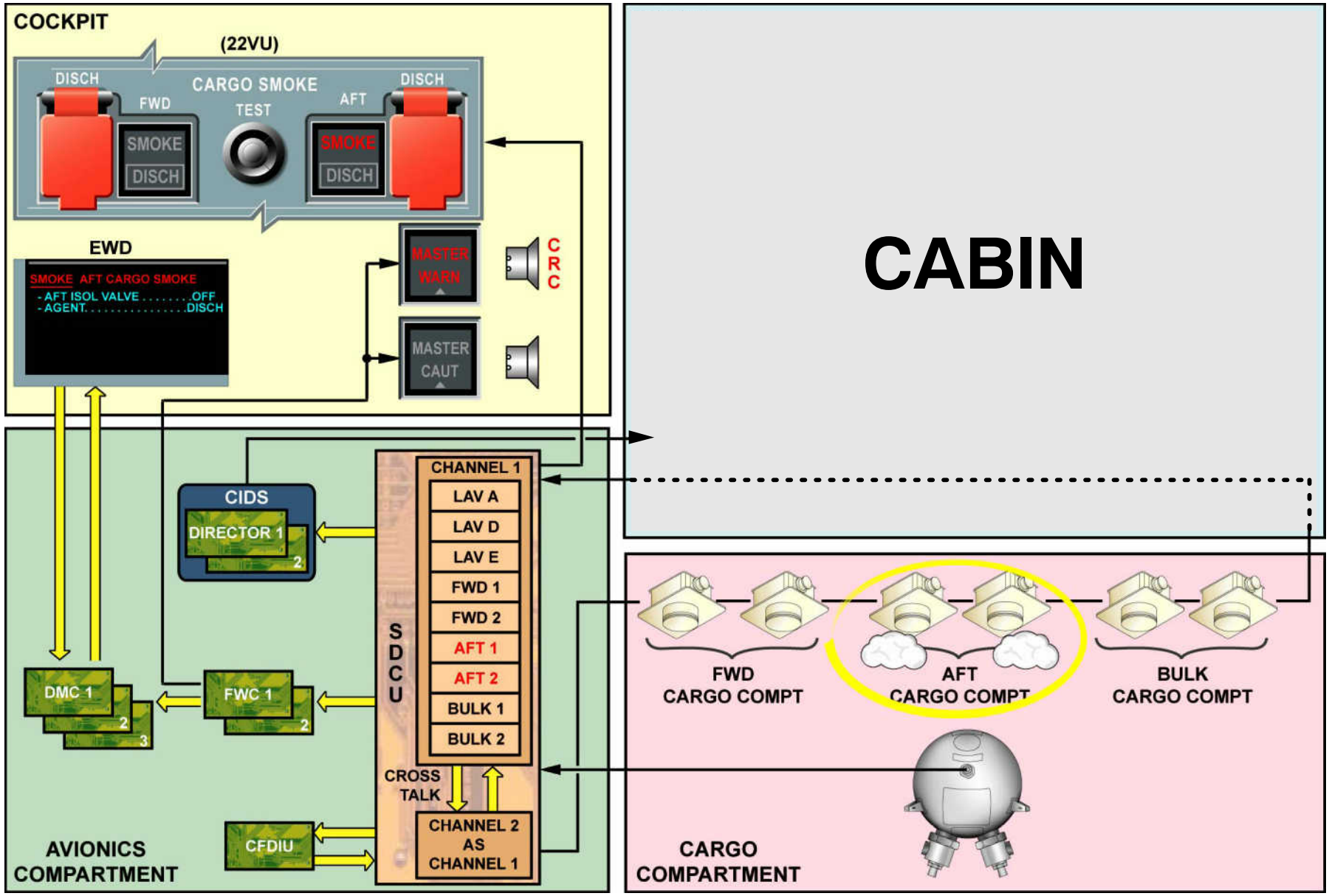


Figure 49 Normal Operation

CARGO FIRE PROTECTION FAULTS OPERATION

Cargo Smoke Detector Fault

When a cargo smoke detector is detected faulty by the SDCU, it is automatically isolated from the loop.

When the two detectors of the same cavity are detected faulty, a cargo smoke detection fault message is displayed on the ECAM. The inoperative detectors (bulk shown as example) are also indicated to the CFDIU.

Cargo Extinguishing Bottle Fault

In case of a fire bottle pressure drop or a loss of electrical squib continuity, the SDCU sends signals to the ECAM and to the CFDS (**C**entralized **F**ault **D**isplay **S**ystem). When a discontinuity occurs on the squib circuit, the following warning is activated by the FWCs:

- the SC (**S**ingle **C**hime),
- the MASTER CAUT light,
- the ECAM message.

The inoperative squib is also indicated to the CFDIU.

SDCU Fault

When an internal failure of the SDCU is detected, a SDCU fault warning signal is sent to the cockpit.

In case of failure of one channel, the smoke detection is still done by the remaining channel.

In case of failure of both channels (as shown in the example), the fault is displayed on the ECAM, the SC is triggered and MASTER CAUT light comes on. The failure is also indicated to the CFDIU.

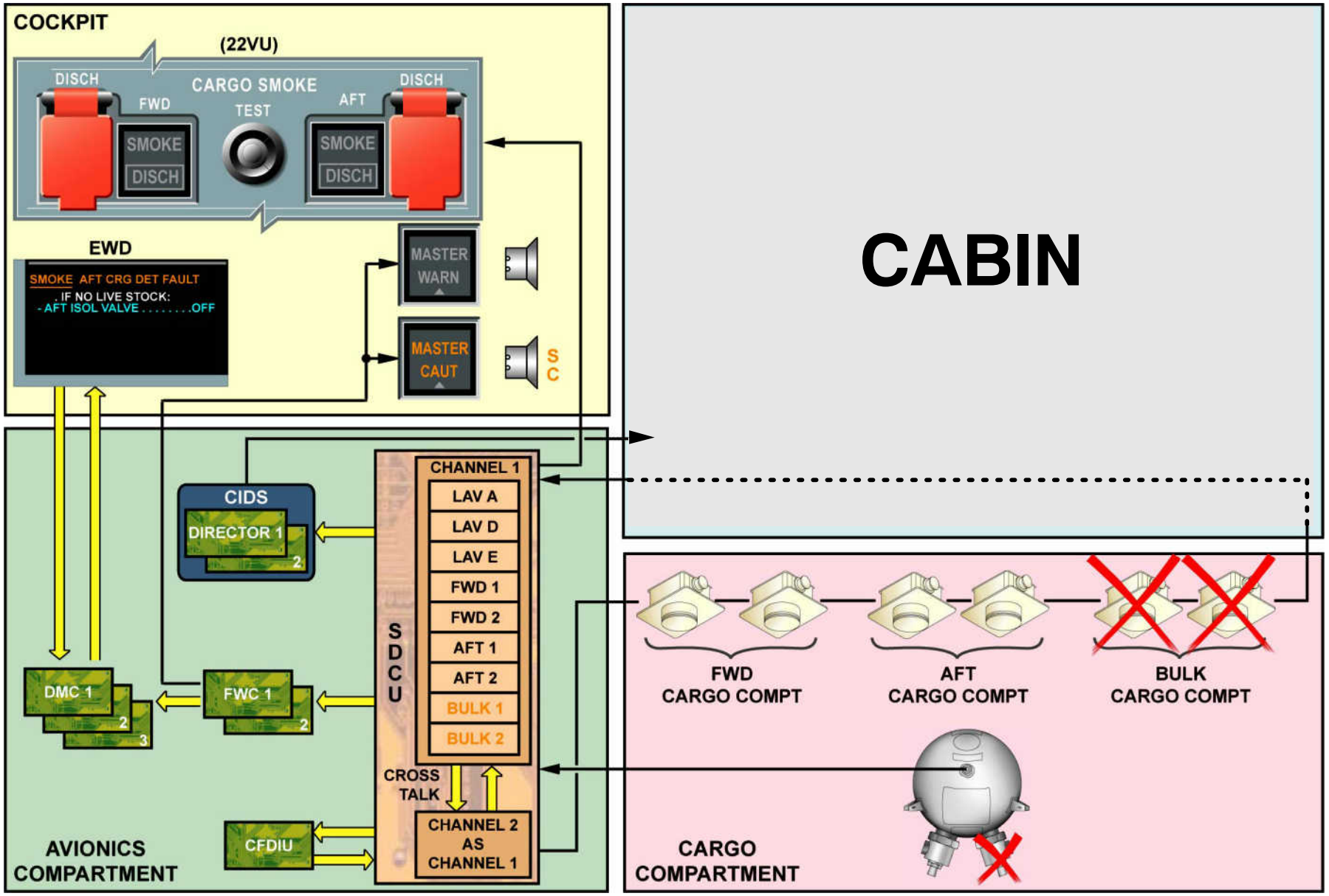


Figure 50 Cargo Compartment Smoke Detection Operation

26–23 CARGO COMPARTMENT FIRE EXTINGUISHING

CONTROLS AND COMPONENTS

The cargo–compartment fire–extinguishing system is installed to extinguish a fire in the FWD or AFT cargo–compartments. It is a single–shot fire–extinguishing system.

The system includes:

- a bottle with the extinguishing agent
- the pipes from the bottle to the compartments
- two pushbutton switches and to activate the system
- two SMOKE/DISCH indication lights
- a control unit for transmission of the signals, for test indication on the ECAM and for maintenance purposes

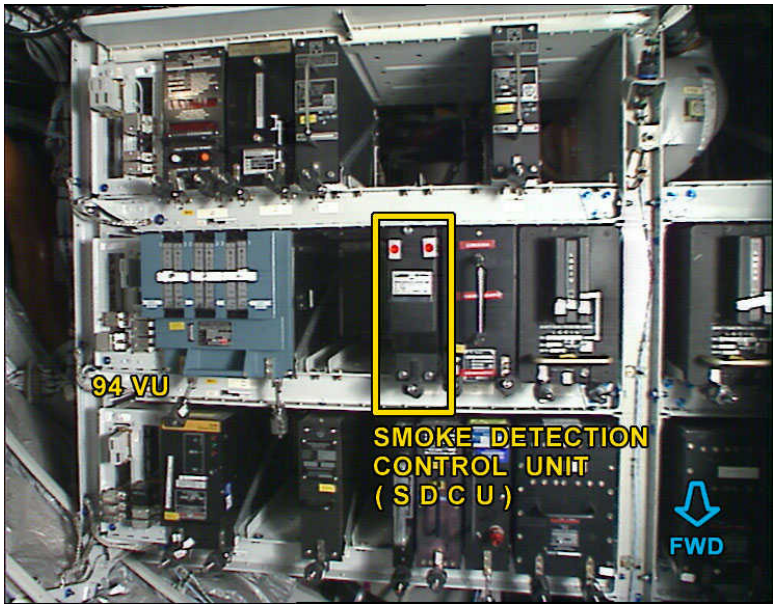


Figure 51 SDCU Location

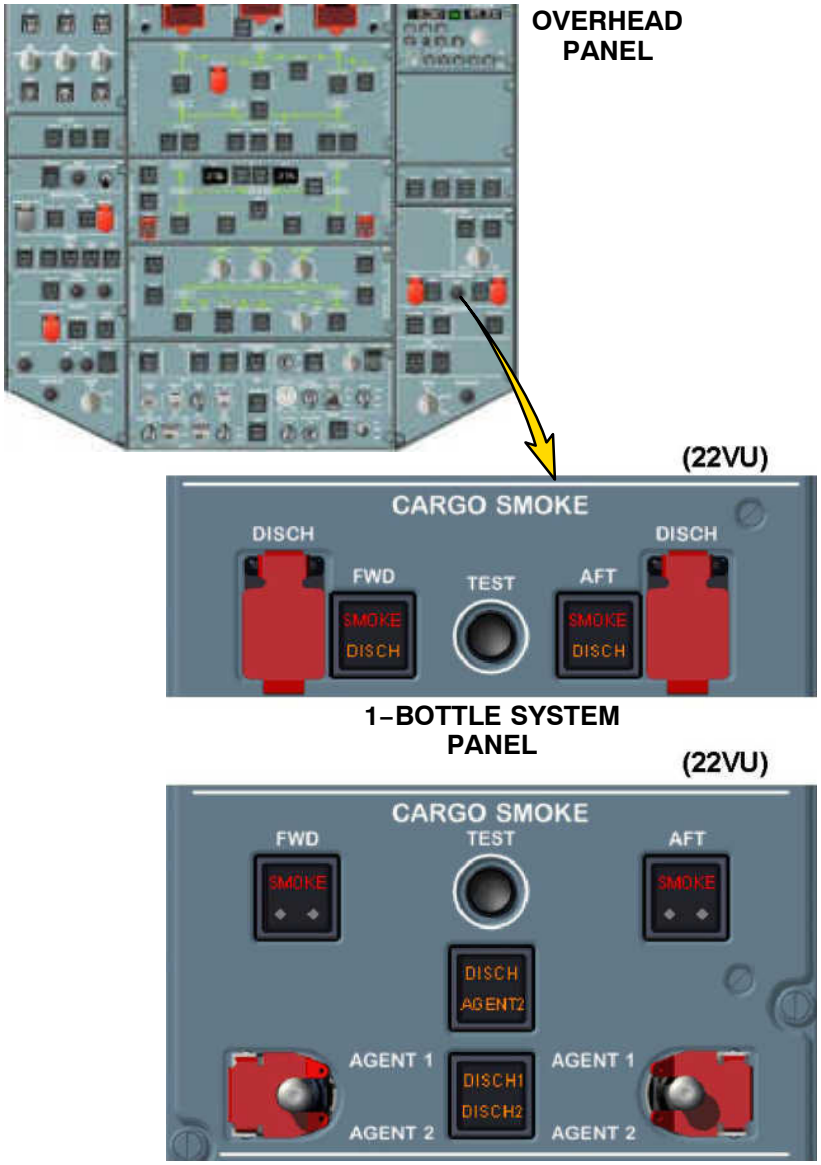


Figure 52 Cockpit Controls

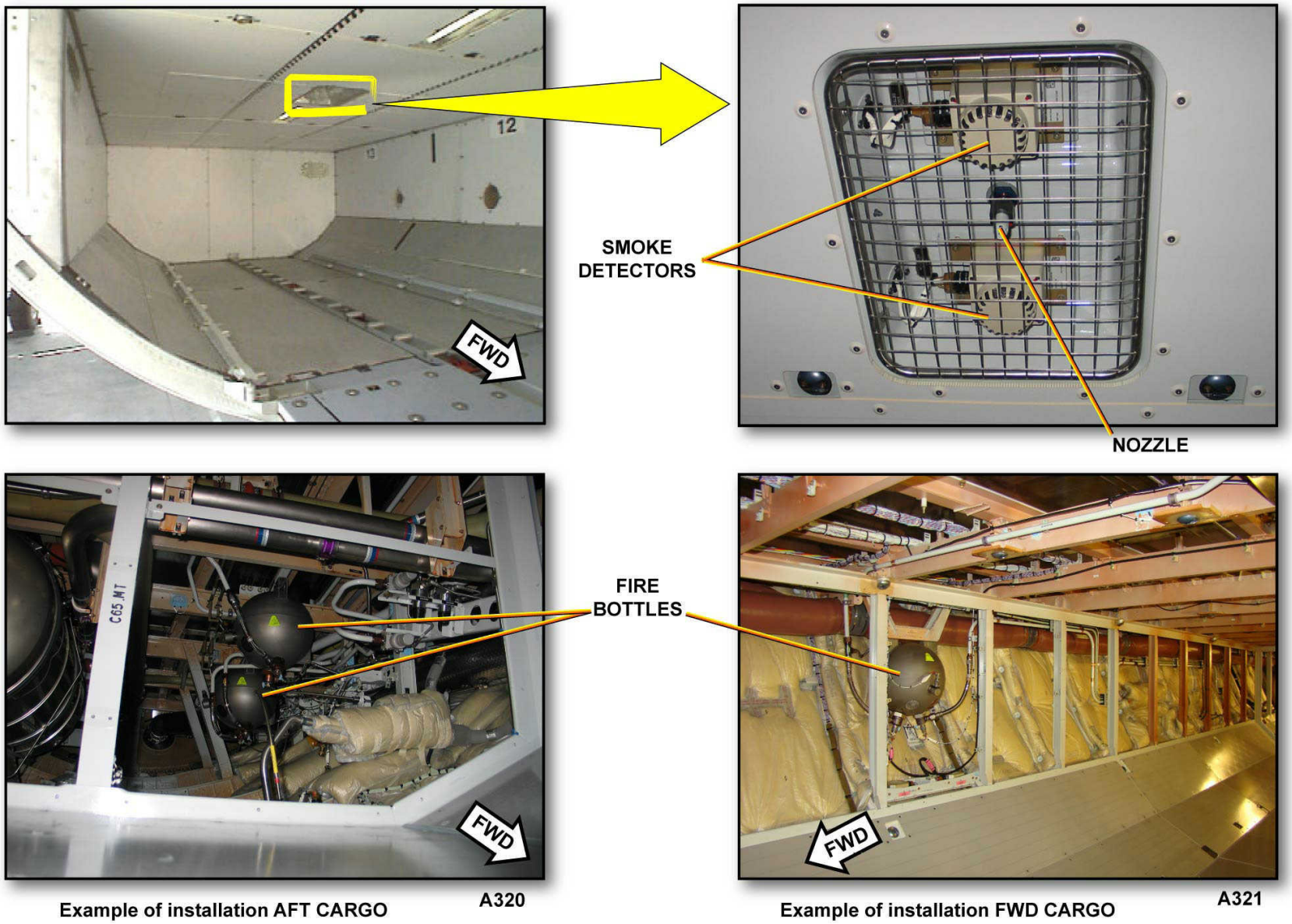


Figure 53 Cargos Fire Protection Components

CC FIRE EXTINGUISHING SYSTEM FUNCTION

Fire Extinguishing System

The cargo–compartment fire–extinguishing system has a fire extinguisher bottle for the FWD and AFT cargo–compartments.

One fire extinguisher pipe connects the bottle with the FWD discharge nozzle and one pipe with the two nozzles in the AFT cargo–compartment. The nozzles are installed in the cargo–compartment smoke–detector cavities.

Electrically–detonated cartridges fire the extinguisher bottle.

One cartridge is installed for the FWD cargo–compartment and one for the AFT cargo–compartment. A safety relief device is attached to the bottle to prevent a pressure increase. Outside temperatures can cause a pressure increase.

A pressure switch is also attached to the bottle. It monitors the discharge of the bottle.

Controls and Indications

The controls and indications are on the cargo smoke overhead–panel 22VU and the ECAM upper display unit.

The overhead panel 22VU has:

- two guarded DISCH pushbutton switches
  (one for the FWD and one for the AFT cargo–compartment)
- two SMOKE/DISCH indication lights
  (both DISCH lamps come on when the contacts of the bottle pressure switch open)
- a TEST pushbutton switch

The SDCU (**S**moke **D**etection **C**ontrol **U**nit) continuously monitors the bottle pressure condition, the two cartridges and the wiring. If faults occur they will appear on the ECAM upper display unit.

The faults are also transmitted to the CFDS (**C**entralized **F**ault **D**isplay **S**ystem)

SDCU COUNTING

The SDCU channels are counting the smoke detectors in reversed order.

In case of a smoke detector failure the SDCU channels will display the related channel numbers on the MCDU-CFDS menu. For example the indication is 04/11 (A321). Then the smoke detector 5WQ in LAV E is defective.

The following tables show the counting logic of the SDCU.

SDCU Counting (A321)

Cannel 1 / Channel 2	FIN	Position
01 / 14	1WQ	LAV A
02 / 13	8 WQ	LAV H
03 / 12	4WQ	LAV D
04 / 11	5WQ	LAV E
05 / 10	10WH	AFT CC 1. from behind
06 / 09	9WH	AFT CC 2. from behind
07 / 08	8WH	AFT CC 3. from behind
08 / 07	7WH	AFT CC 4. from behind
09 / 06	6WH	AFT CC 5. from behind
10 / 05	5WH	AFT CC 6. from behind
11 / 04	4WH	FWD CC 1. from behind
12 / 03	3WH	FWD CC 2. from behind
13 / 02	2WH	FWD CC 3. from behind
14 / 01	1WH	FWD CC 4. from behind

SDCU Counting (A319/A320)

Cannel 1 / Channel 2	FIN (A320)	FIN (A319)	Position
01 / 09	8WQ	1WQ	LAV A
02 / 08	4WQ	4WQ	LAV D
03 / 07	5WQ	5WQ	LAV E
04 / 06	6WH	6WH	AFT CC 1. from behind
05 / 05	5WH	5WH	AFT CC 2. from behind
06 / 04	4WH	4WH	AFT CC 3. from behind
07 / 03	3WH	3WH	AFT CC 4. from behind
08 / 02	2WH	2WH	FWD CC 1. from behind
09 / 01	1WH	1WH	FWD CC 2. from behind

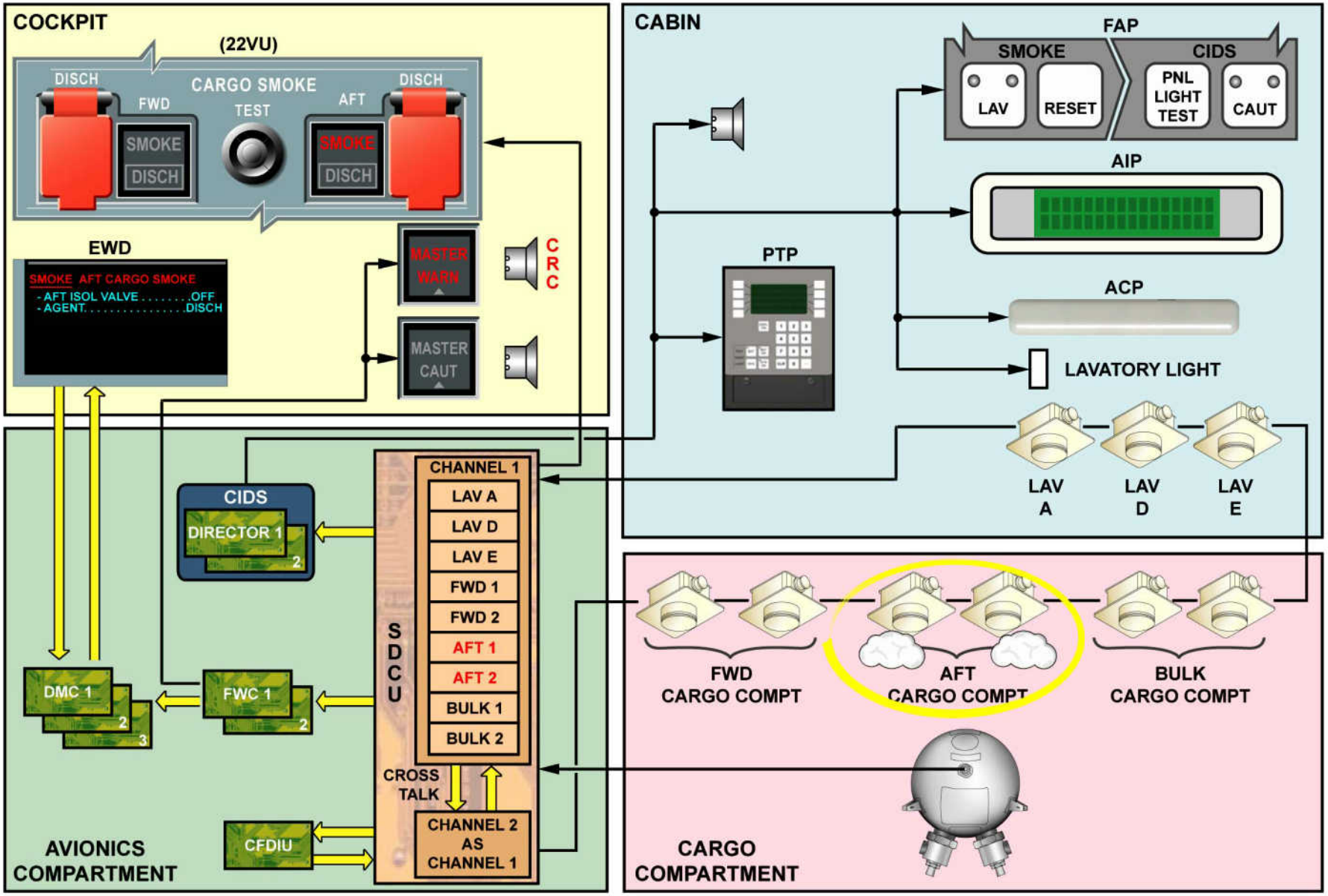


Figure 54 Cargo Smoke Detection Schematic

CC SMOKE DETECTION/EXTINGUISHING CONTROL AND INDICATION

OPERATION & CONTROL

Smoke Detectors (Ionization Type)

The smoke detectors ionize the air particles that pass between their electrodes. As smoke has a higher specific gravity than air, it causes the electrical resistance of the circuit to increase.

The current decreases and the voltage in the measurement chamber increases to a higher level than the reference chamber. At a set difference level the detector sends a signal. The reference chamber makes allowances for differential pressure. It makes sure that the detector operates on the ground and in flight within the same level of sensitivity.

Smoke Detectors (Lighting Type)

The smoke detector operates on the principle of scattered light. The light source, the labyrinth and the photocell are set out in a horizontal plane so that the photocell cannot receive light. But when there is smoke, the smoke particles reflect and scatter a part of the light beam. The photocell receives this light and gives an analog signal and sets off the alarm.

Smoke Annunciotor Lights

A FWD SMOKE annunciator light 11WH and an AFT SMOKE annunciator light 12WH are installed on the cargo smoke panel 22VU. When any set of smoke detectors operate, they transmit a warning signal to the SDCU 10WQ.

The SDCU through two ARINC 429 buses independently control the warning outputs to the Flight Warning Computers (FWC). The related SMOKE annunciator light comes on.

Press–to–Test (PTT) pushbutton switch

The (PTT) pushbutton switch together with the SDCU, permits a functional test of the cargo smoke detection system. The (PTT) pushbutton switch is installed between the smoke annunciator lights on the cargo smoke panel 22VU.

Smoke Detection Control Unit (SDCU)

The SDCU controls the lavatory and cargo–compartment smoke–detection system. The SDCU Built–In Test Equipment (BITE) controls and monitors the systems and interfaces with the Centralized Fault Display System (CFDS).

It records the unsatisfactory components and system malfunctions.

Normal Operation

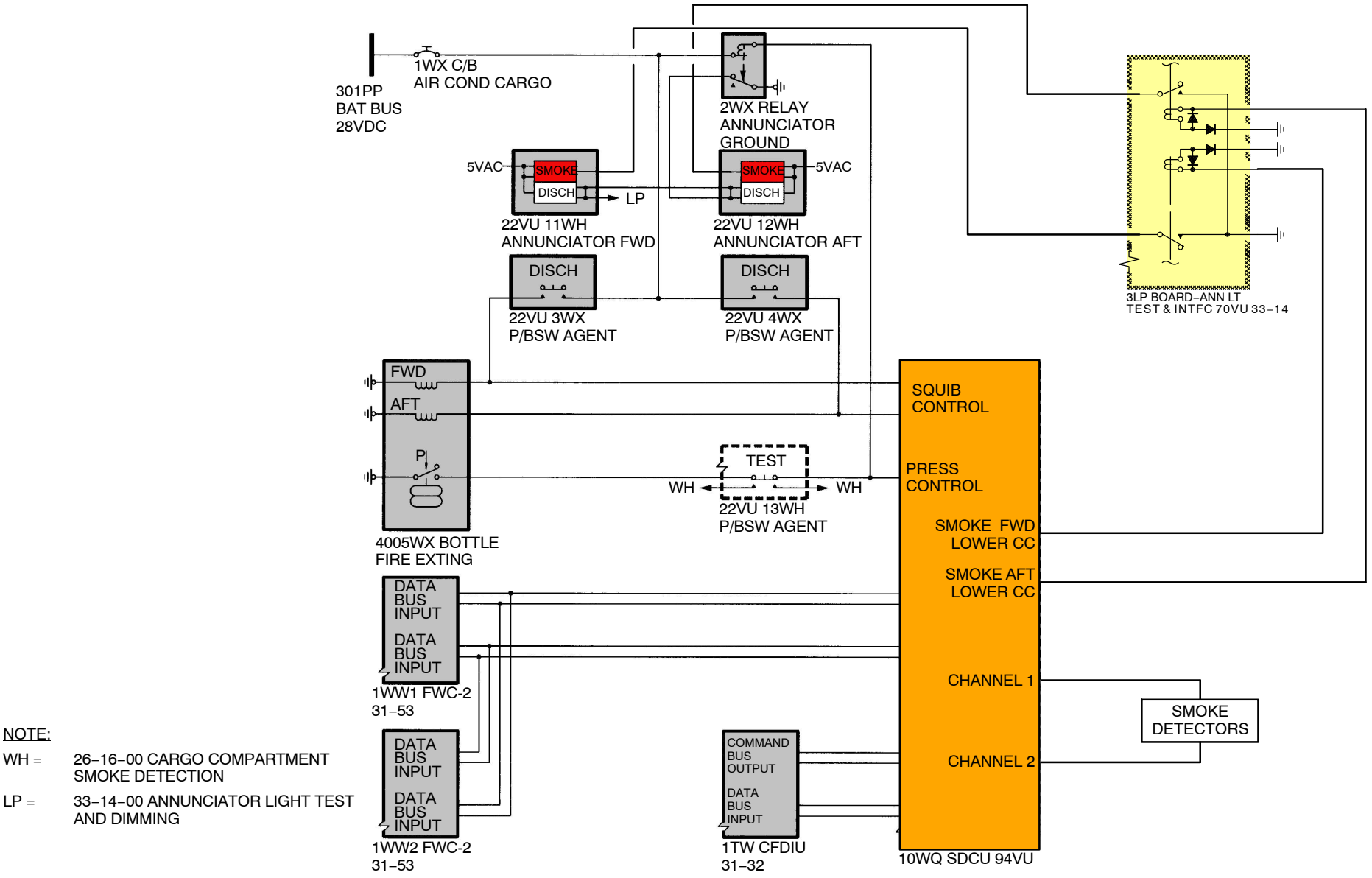
Smoke detected in the cargo compartment will cause:

- the related SMOKE warning light to come on,
- the red light in the MASTER WARNING pushbutton switch to flash,
- the aural repetitive chime to sound,
- the ECAM upper display unit to show the messages:
  - SMOKE FWD/AFT CARGO SMOKE
    - ISOL VALVE *(of affected compartment)* ... OFF *(if not automatically closed)*
    - AGENT ... DISCH .

Operation with one Faulty Smoke Detector

When only one detector sends an alarm, the SDCU checks the second detector automatically. If this test shows a normal function of the second detector, the result is no indication in the cockpit.

The alarm of the detector is a false warning. If this test shows an abnormal function of the second detector, the warning signals come on. The alarm of the first detector is the correct warning.



NOTE:

WH = 26–16–00 CARGO COMPARTMENT SMOKE DETECTION

LP = 33–14–00 ANNUNCIATOR LIGHT TEST AND DIMMING

Figure 55 Operation/Control & Indication

CC SMOKE DETECTION/EXTINGUISHING SYSTEM OPERATION

Smoke Warning

If smoke occurs

- the related red SMOKE/DISCH indication light comes on
- the continuous repetitive chime is heard MASTER WARNING lights flash
- On the ECAM upper display unit the related message is shown:
  - SMOKE FWD CARGO SMOKE
  - AGENT.....DISCH
- or
  - SMOKE AFT CARGO SMOKE
  - AGENT.....DISCH

If a smoke warning occurs, you have to lift the guard and to push the related DISCH pushbutton switch.

The cartridge at the bottle outlet detonates and the agent discharges into the applicable cargo– compartment.

The related DISCH indicator light comes on.

The SDCU also gives a signal to the Flight Warning Computer (FWC) and CFDS. The FWC changes the ECAM upper display to AGENT DISCH.

The CFDS stores the low–pressure data.

Fault Condition

The SDCU continuously monitors the bottle pressure condition, the two cartridges and the wiring. A low pressure fault causes:

- On the overhead panel 22VU:
  the DISCH indication lights to come on.
- On the ECAM upper display unit:
  the AGENT DISCH message to come on
- On the glareshield panels
  the MASTER CAUTION lights to come on
- In the cockpit:
  a single chime to sound

A cartridge fault causes a message to show on the ECAM upper display unit as follows:

- FWD BTL SQUIB FAULT

or

- AFT BTL SQUIB FAULT

The faults are also transmitted to the CFDS.

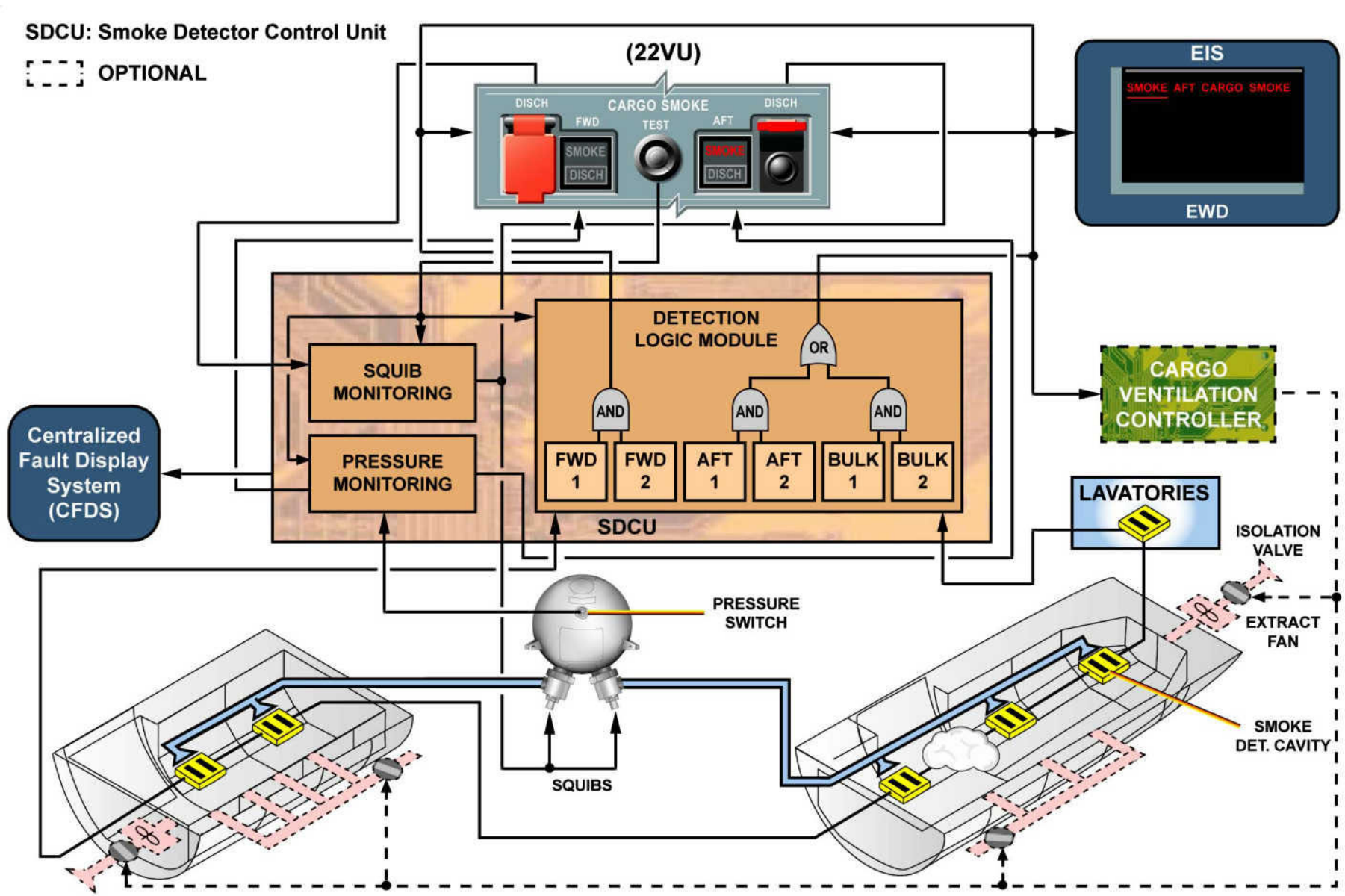


Figure 56 System Architecture

MAINTENANCE PRACTICES

Operational Test General

When you push the TEST pushbutton switch 13WH on the overhead panel 22VU, the SDCU does an automatic test. Smoke and bottle pressure drop conditions are simulated. Indications appear as follows:

- On the CARGO SMOKE panel 22VU:
  - the FWD and AFT SMOKE indication lights come on.
  - the FWD and AFT DISCH indication lights come on.
- On the glareshield panel 130VU:
  - the MASTER WARNING lights come on.
- In the cockpit:
  - the continuous repetitive chime is heard.
- On the ECAM upper display unit, the messages:
  - SMOKE FWD CARGO SMOKE
  - AGENT.....DISCH
  - SMOKE .....AFT CARGO SMOKE
  - AGENT.....DISCH

come on.

When you release the TEST pushbutton switch , the DISCH indication light goes off with a time delay of approx. 2 s, and the SMOKE indication light goes off with a delay time of approx. 10 s. The ECAM messages go off and will be automatically repeated with the warning indications, for approximately 6 s.

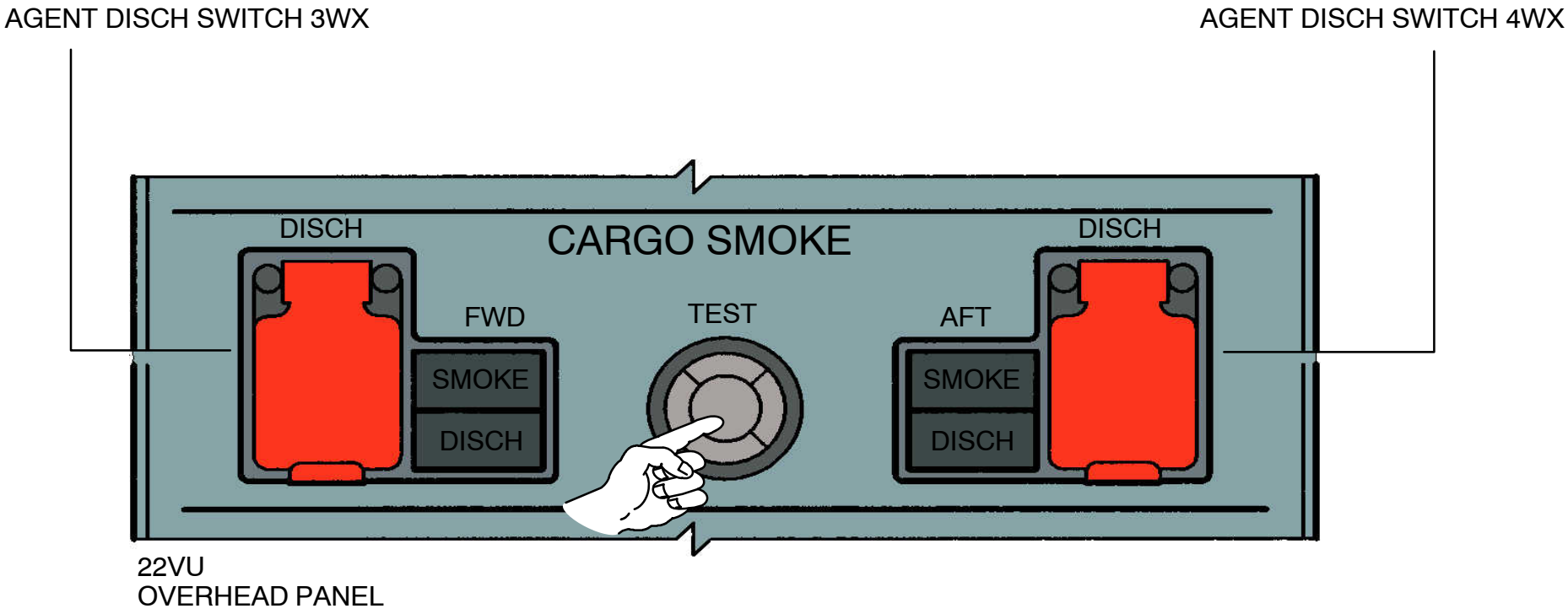


Figure 57 Operational Test Pushbutton

SYSTEM TEST USING THE PRESS TO TEST PUSHBUTTON

When you press the (PTT) pushbutton switch for more than 2 s a test of the smoke detectors is initiated. The SDCU tests the smoke detectors automatically.

The indications are:

- the FWD SMOKE and AFT SMOKE warning lights come on, twice for approx. 2 s, with a delay of approx. 5 s. in a normal condition.

The system also passes the test, when the lamps come on once in the case of:

- a wiring failure on the detector's bus system
- a failure of one SDCU channel
- the respective SMOKE warning light does not come on, if both smoke detectors, installed in one cavity, do not operate

The test stops approx. 10 s after the PTT pushbutton switch is released.

After the PTT pushbutton is pressed, the isolation valves of the cargo compartment ventilation system close and the extraction fan stops (Ref. 21–28–00). When the test stops, the isolation valves open and the extraction fan starts. The information is stored in the CFDS (**C**entralized **F**ault **D**isplay **S**ystem).

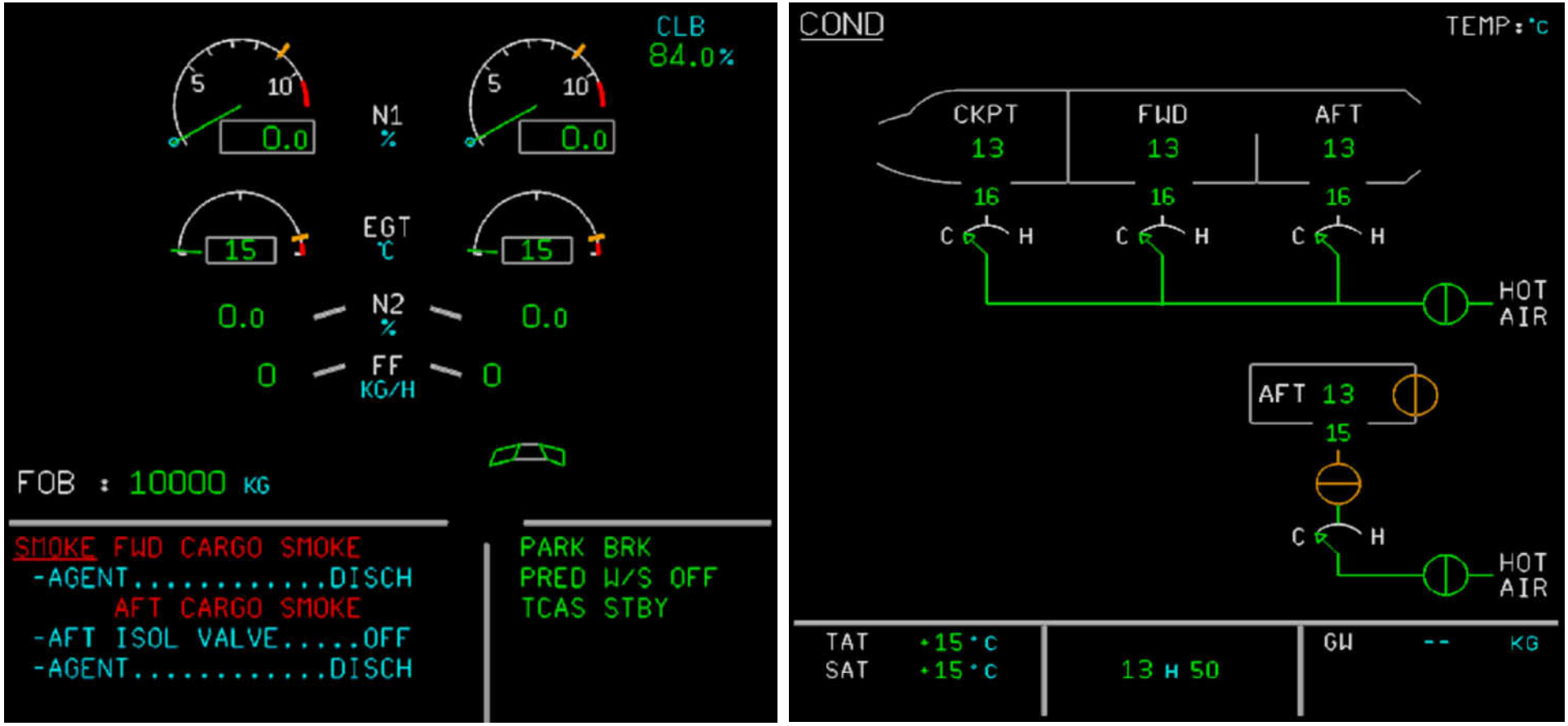


Figure 58 System Test Indication

ETOPS CONFIGURATION SYSTEM PRESENTATION

ETOPS REQUIREMENTS FOR CARGO HOLD PROTECTION

The ETOPS (**E**xtended range with **T**win engine aircraft **OP**eration**S**) rules require the A/C to be protected against cargo fire, for the duration of the diversion (120 min, 180 min) with added 15 min supplemental, in the scenario of a go–around requiring a second approach to the alternate airport.

Additional features are installed in order to guarantee sufficient agent concentration for the time of the diversion plus 15 minutes.

Such features with the single shot system configuration, requires:

- a large bottle.

Such features with the dual shot system configuration, requires:

- an additional bottle (two bottles),
- a flow metering system on the second bottle.

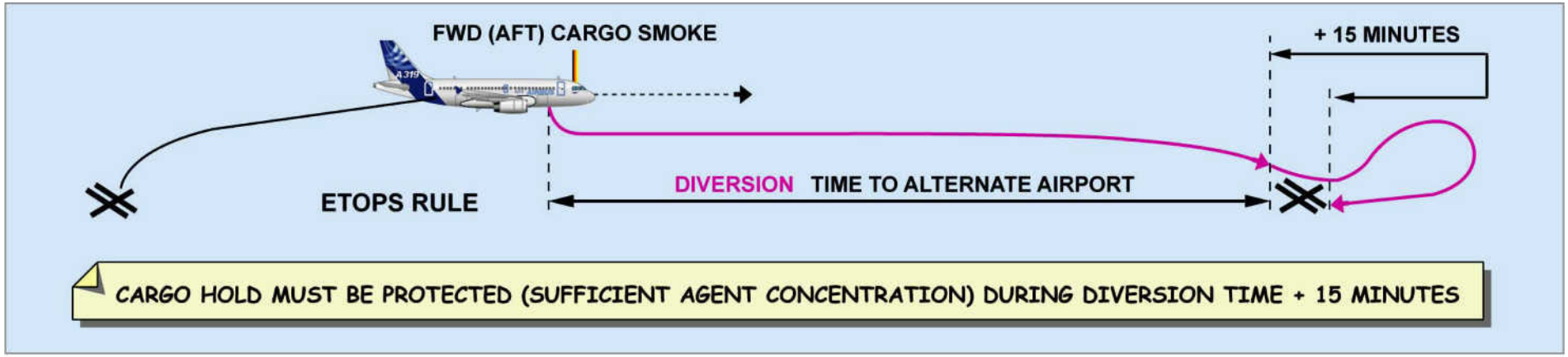


Figure 59 ETOPS Requirements for Cargo Hold Protection

BOTTLE CONFIGURATION TO SATISFY ETOPS 120 OR 180 MIN

Depending on the volume of the cargo holds on the SA family models (A318, A319, A320 and A321) the A/C has:

- for the A318, A319 and the A320, two 630 cu. in. bottles to protect up to 180 min ETOPS,
- for the A319, a single 800 cu. in. bottle, gives/protects a protection up to 120 min ETOPS
- for the A321, two bottles gives/protects a protection up to 135 min ETOPS, extended up to 180 min ETOPS.

Because of the maintenance access constraints in the FWD and AFT cargo holds, particularly with the installation of the ACT on the A319CJ and also on other models, such bottles, squib and flow metering system are installed on the side or AFT of the bulk cargo hold.

The A321 bottles, squib and flow metering system are installed on the side of the FWD cargo hold.

NOTE: The installation of the flow metering system is on the discharge circuit of the second bottle.

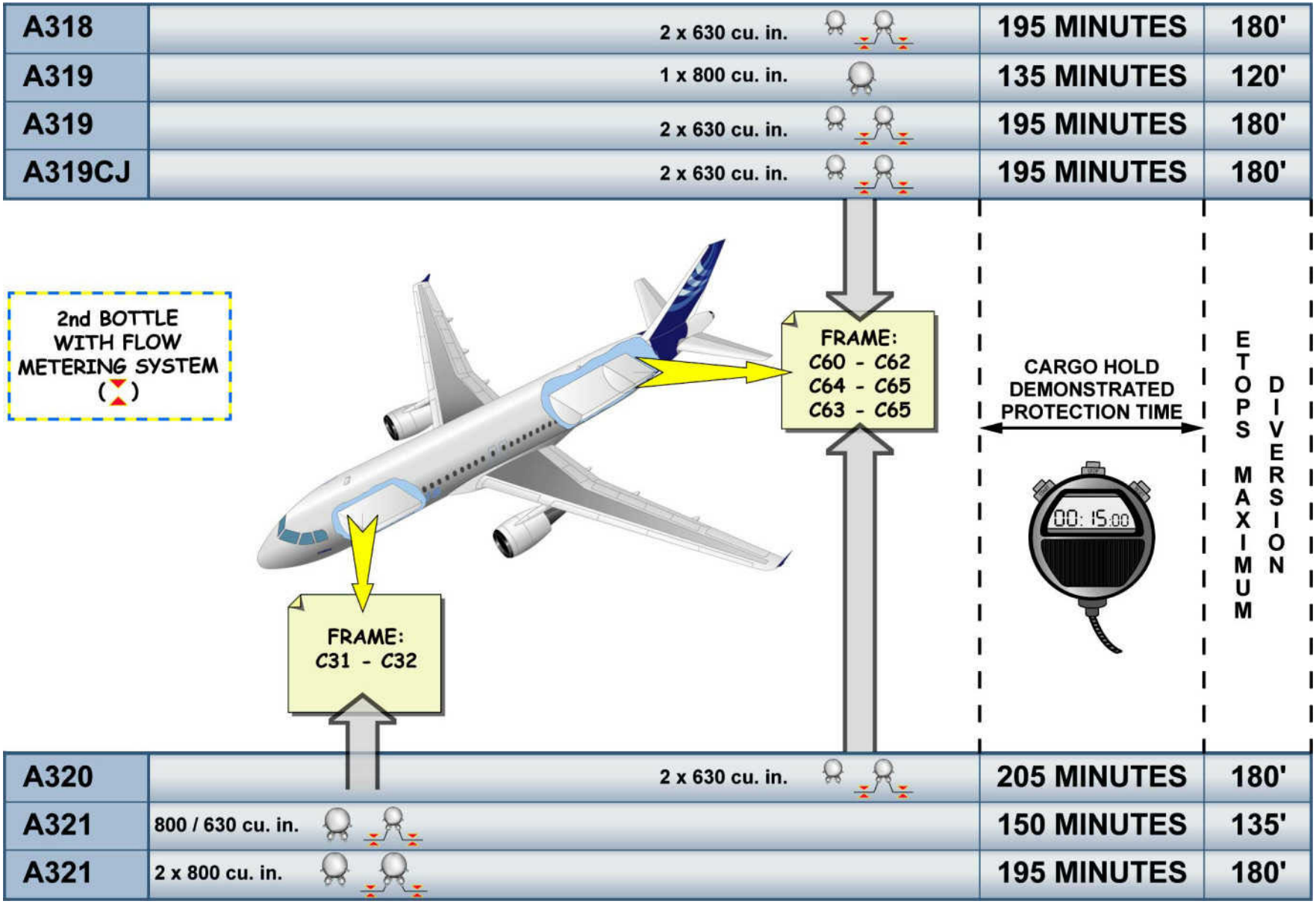


Figure 60 Bottle Configuration to Satisfy ETOPS 120 or 180 MIN

System Description

This panel 22VU has an additional optional ETOPS (**E**xtended range **T**win engined aircraft **OP**eration**S**) system. On the A319 only, combination of ETOPS and ventilation and therefore heating options is not possible.

The ETOPS panel 22VU has a two–shot extinguishing system, which, is composed of two bottles, and their squib system.

The second bottle supplies the FWD and AFT cargo compartment discharge nozzles through an ETOPS flow metering system. This system is installed in both fire extinguisher delivery tubes between bottle 2 and the FWD and AFT cargo compartments.

Each duct is composed of:

- a water absorbing filter,
- a solid particle filter,
- a pressure reducer,
- a diaphragm and non–return valve.

When the FWD (AFT) SMOKE light comes on, the flight crew selects AGENT 1 with the corresponding toggle switch.

This action ignites the corresponding squib on the fire bottle, which then discharges extinguishing agent into that compartment.

60 minutes after the discharge of the first bottle, the DISCH AGENT 2 light appears. This is to indicate that the flight crew has to discharge AGENT 2 to maintain the required extinguishing concentration.

Bottle 1 is discharged in approximately 60 seconds, whereas Bottle 2 discharges within approximately 90 minutes controlled by a flow metering system.

This ensures sufficient agent concentration for 205 minutes.

A321 Configuration

This panel 22VU also comprises and has an additional and optional ETOPS system. The layout of the cargo smoke detectors and extinguishing nozzles is different. There are 4 smoke detectors and 2 extinguishing nozzles in the FWD cargo compartment.

In the AFT cargo compartment there are 6 smoke detectors and 3 extinguishing nozzles. When the AGENT 2 position is selected on the CARGO SMOKE panel, bottle 2 is discharged through this system.

The system ensures that there is a sufficient agent concentration in the cargo compartment for ETOPS flight duration.

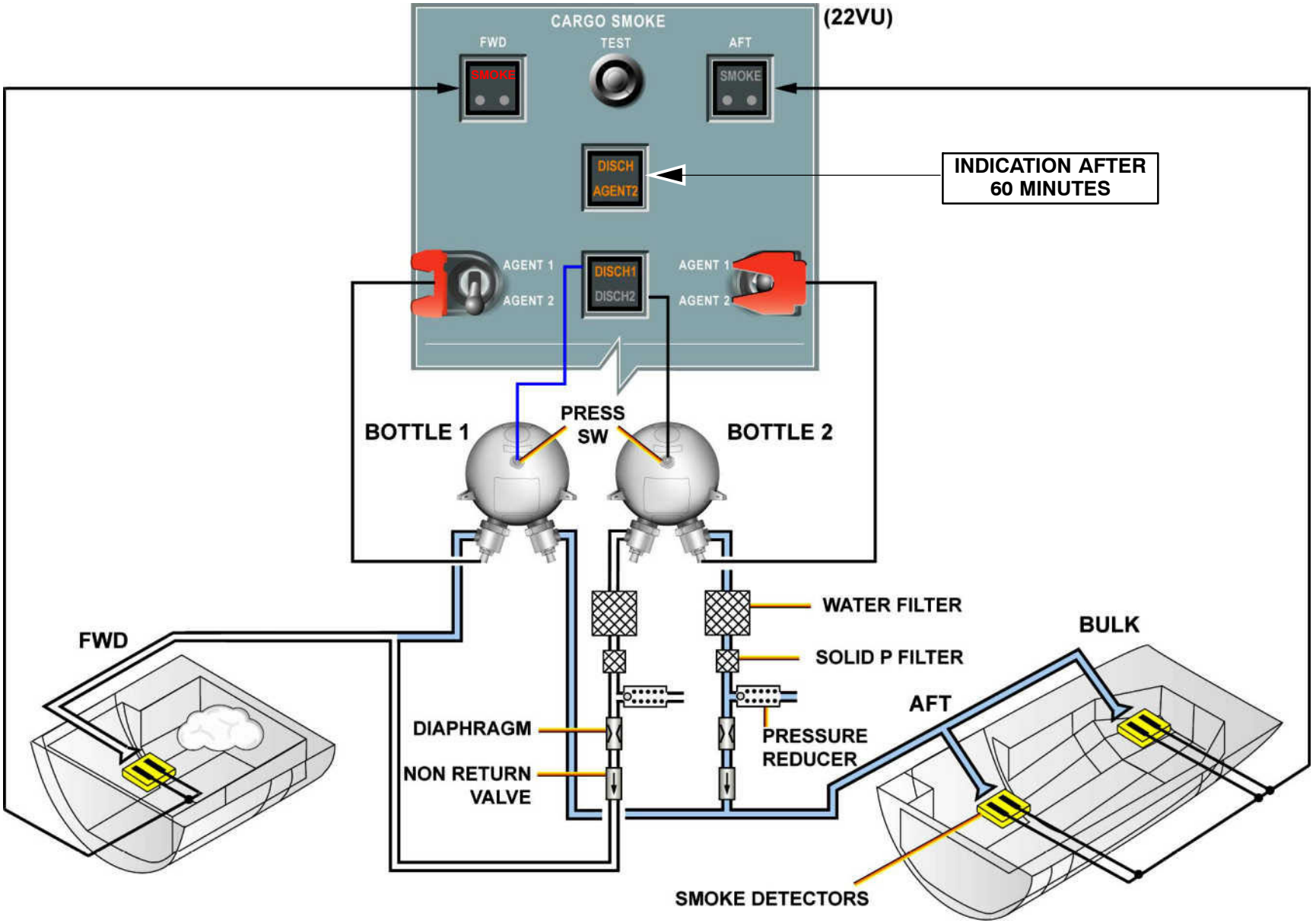


Figure 61 Cargo Fire Protection System in ETOPS Configuration

26–17 LAVATORY SMOKE DETECTION

GENERAL DESCRIPTION

General

A smoke detection system is installed to detect smoke and/or fire in the lavatories. The lavatory smoke detectors are installed in a loop system, together with the cargo–compartment smoke detectors. If smoke is detected, the system gives a visual and aural warning to the flight crew. This system is made–up of

- one smoke detector for each lavatory
- the SDCU (**S**moke **D**etection **C**ontrol **U**nit)

Smoke or fire in one of the lavatories causes a detector to signal the SDCU. The SDCU sends signals to the CIDS (**C**entralized **I**ntercommunication **D**ata **S**ystem) and the FWC (**F**light **W**arning **C**omputer).

The FWC gives indications on

- the ECAM upper display unit

The CIDS gives indications on

- the FWD attendant panel
- the area call panel

SDCU (Smoke Detection Control Unit)

The SDCU has two channels, which make it a fail–safe unit. The system will operate normally if one channel fails. The BITE (**B**uilt **I**n **T**est **E**quipment) detects and isolates failures in the SDCU. It also makes sure that the smoke detectors function correctly. Most of the system functions are monitored continuously. The line key switch (on the CFDS (**C**entralized **F**ault **D**isplay **S**ystem) and the MCDU (**M**ultifunction **C**ontrol and **D**isplay **U**nit)) simulates a smoke condition when pressed. Information of faulty equipment is signaled to the CFDS.

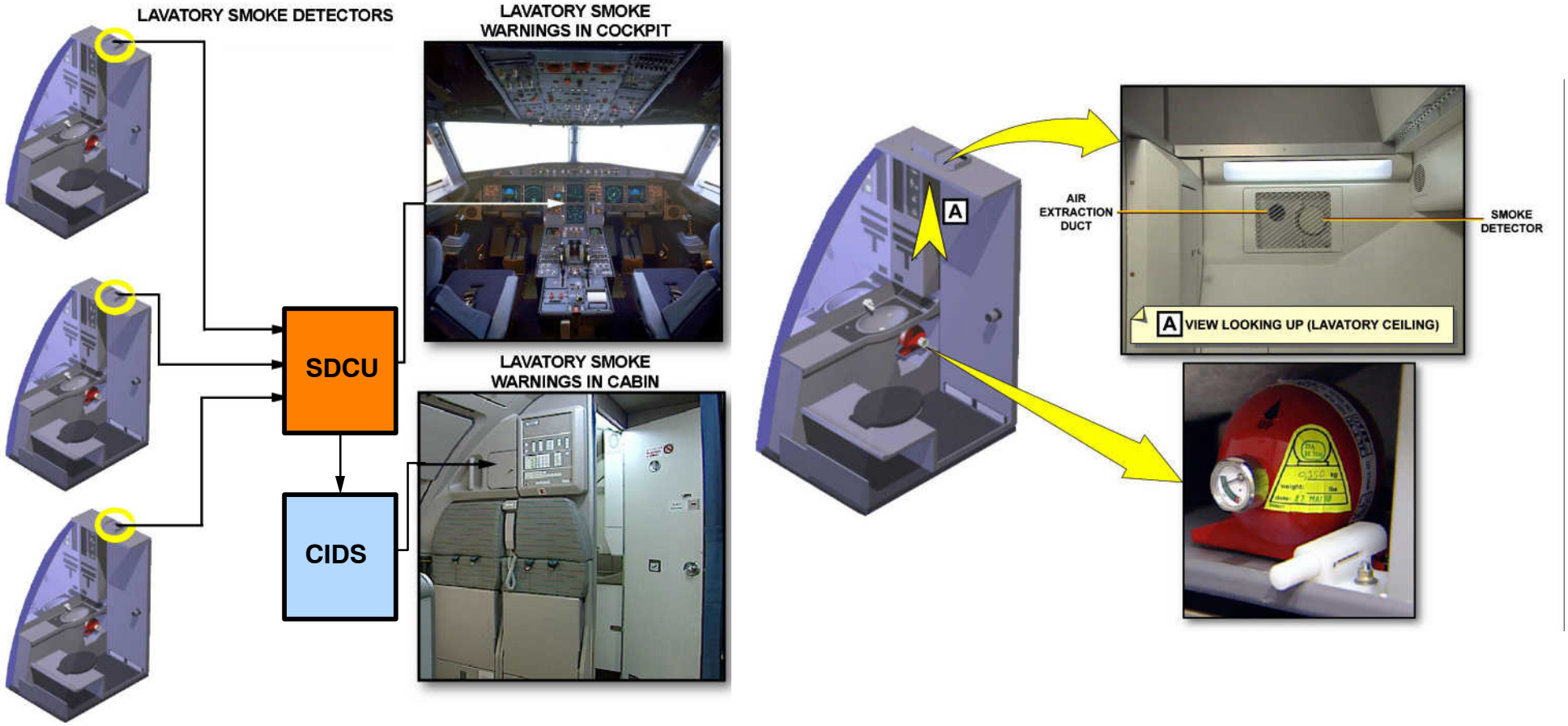
Smoke Warning Facilities

Smoke warnings are given in the cockpit and the cabin. The cockpit warnings are:

- a repetitive chime,
- a red master warning light,
- a smoke warning indication on the ECAM upper display unit.

The cabin warnings are:

- a triple chime of approx. 392 Hz from all cabin loudspeakers with a repetitive time of approx. 30 s,
- an amber flashing light on the respective ACP (**A**rea **C**all **P**anel),
- a common red lavatory smoke indicator on the FWD attendant panel,
- an amber flashing light on the door frame of the respective lavatory,
- a “SMOKE LAV X“ indication and a red flashing light on the AIP (**A**ttendant **I**ndication **P**anel).



SDCU: SMOKE DETECTION CONTROL UNIT
CIDS: CABIN INTERCOMMUNICATION DATAT SYSTEM

Figure 62 Lavatory Fire Protection General

LAVATORY SMOKE DETECTION SYSTEM DESCRIPTION

Smoke Condition

Smoke that enters the measurement chamber of the smoke detector, gives a warning signal to the SDCU. The SDCU transmits the signal to the CIDS and FWC via data buses. The CIDS directors send the signal to the FAP (**F**orward **A**ttendant **P**anel) , AIP (**A**ttendant **I**ndication **P**anel) and ACP (**A**rea **C**all **P**anel). The aural and visual warning reset switch on the FAP stops the warning indications on the ACP and AIP. You cannot switch off the smoke indication on the FAP. This indication goes off, when the density of the smoke drops below the threshold of the respective smoke detector.

Failure Condition

The SDCU continuously monitors all components of the system. When the SDCU detects a failure on any smoke detector, the faulty detector is automatically isolated in the bus system. The failure is signalled to the CIDS, FWC and CFDS. The CIDS director signals the fault message to the PTP (**P**rogramming and **T**est **P**anel) in the cabin. The FWC initiates a fault indication on the ECAM upper display unit. If one of the two SDCU channels fail, an automatic fault–indication is displayed on the ECAM upper display unit

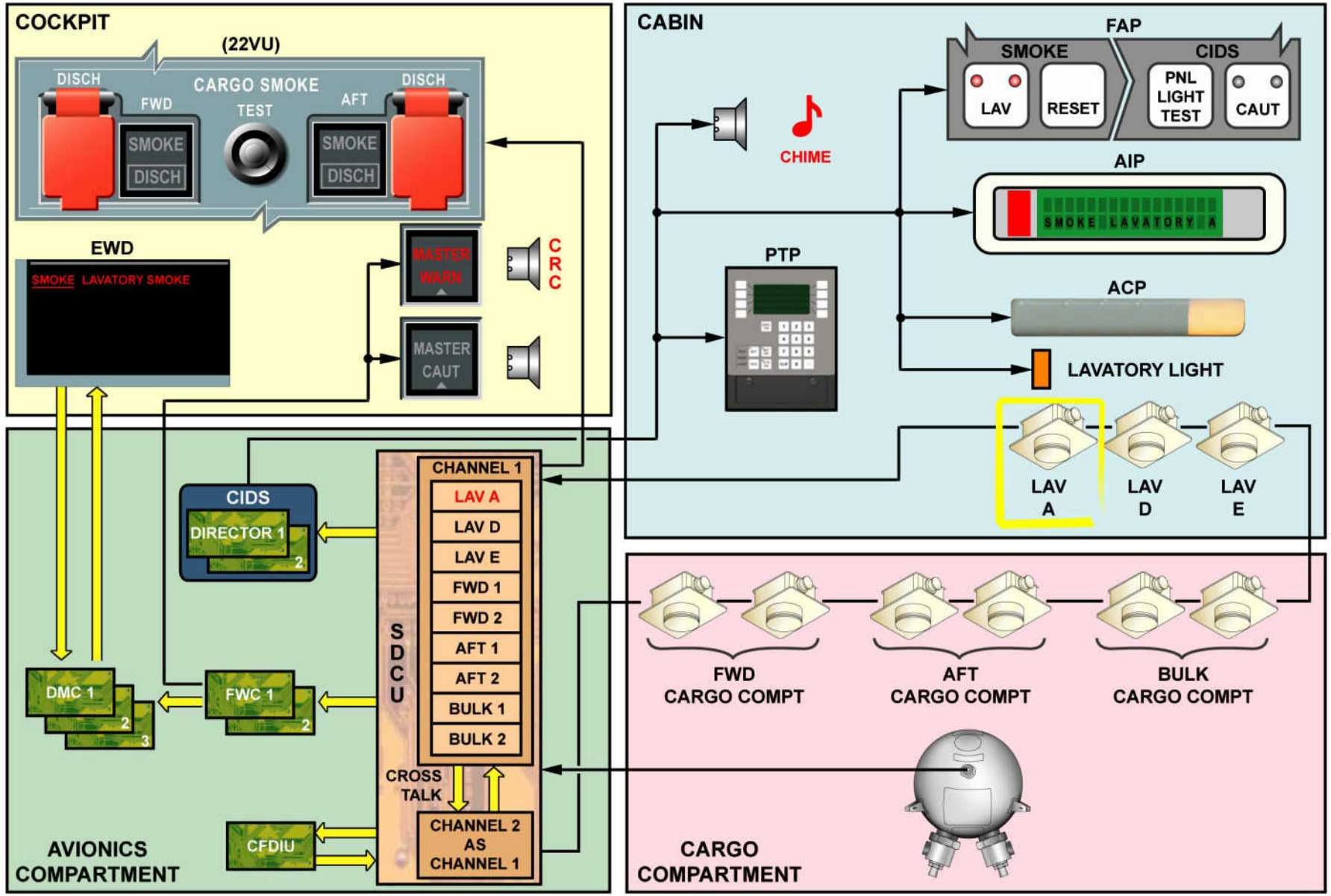


Figure 63 LAV Detection General Overview

LAVATORY SMOKE FAULTS DETECTION OPERATION

Lavatory Smoke Detector Fault

When a lavatory smoke detector failure is detected by the SDCU, the faulty detector is automatically isolated from the loop. The lavatory detection fault is indicated in the cockpit and the cabin. The inoperative lavatory smoke detector is indicated to:

- the CFDIU (**C**entralized **F**ault **D**isplay **I**nterface **U**nit), for maintenance purposes,
- the FWC, for ECAM indication,
- the CIDS directors, for the FAP amber CIDS CAUTion light and the PTP (**P**rogramming and **T**est **P**anel) indication.

NOTE: With CIDS CAUT light on, the CIDS SYSTEM STATUS page on the PTP must be interrogated to find the affected lavatory.

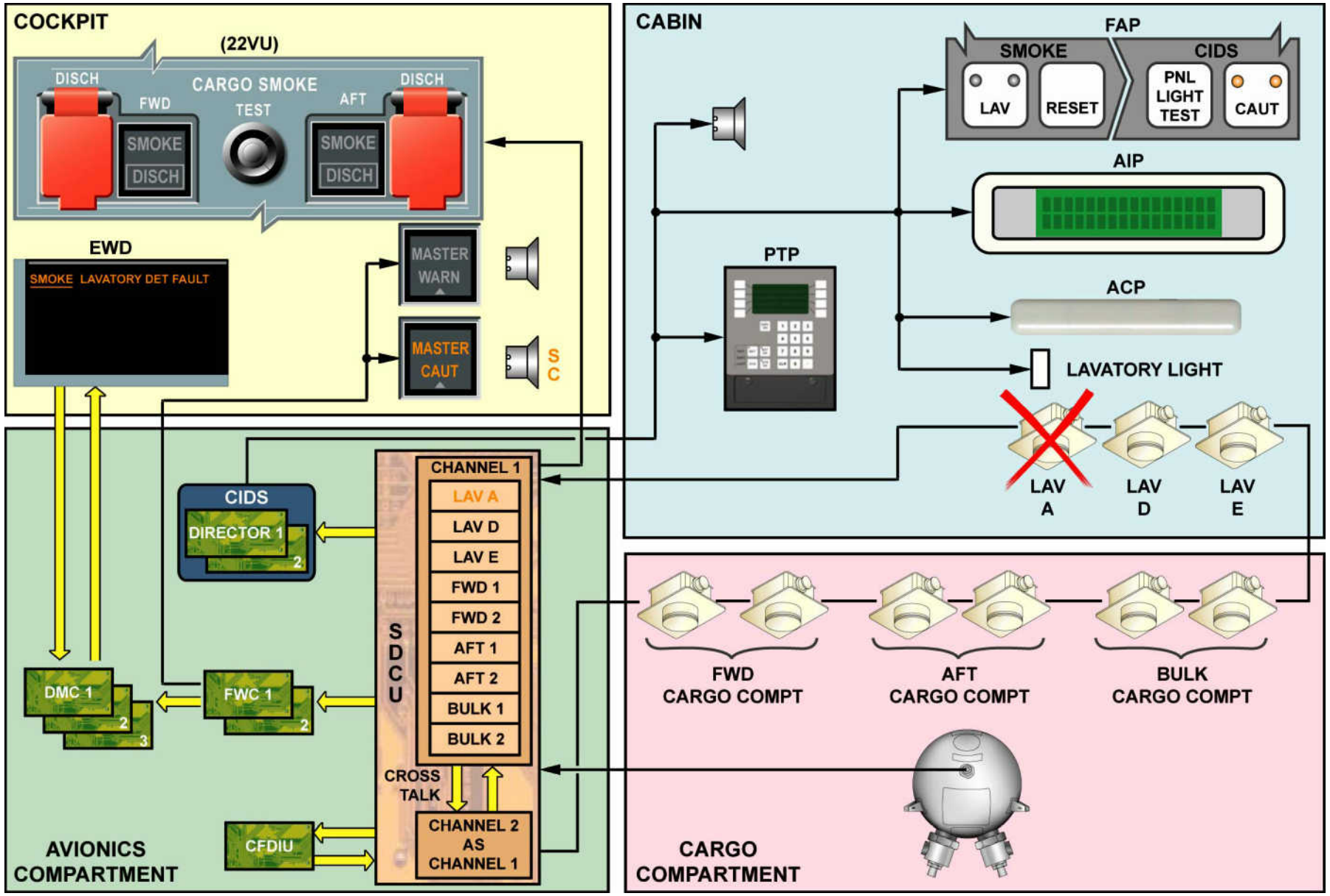


Figure 64 Lavatory Smoke Detector Fault

SDCU FAULT OPERATION

SDCU Fault

When an internal failure of the SDCU is detected, a SDCU fault warning signal is sent to the cockpit.

In case of failure of one channel, the smoke detection is still done by the remaining channel.

In case of failure of both channels (as shown in the example), the fault is displayed on the ECAM, the SC is triggered and MASTER CAUT light comes on. The failure is also indicated to the CFDIU.

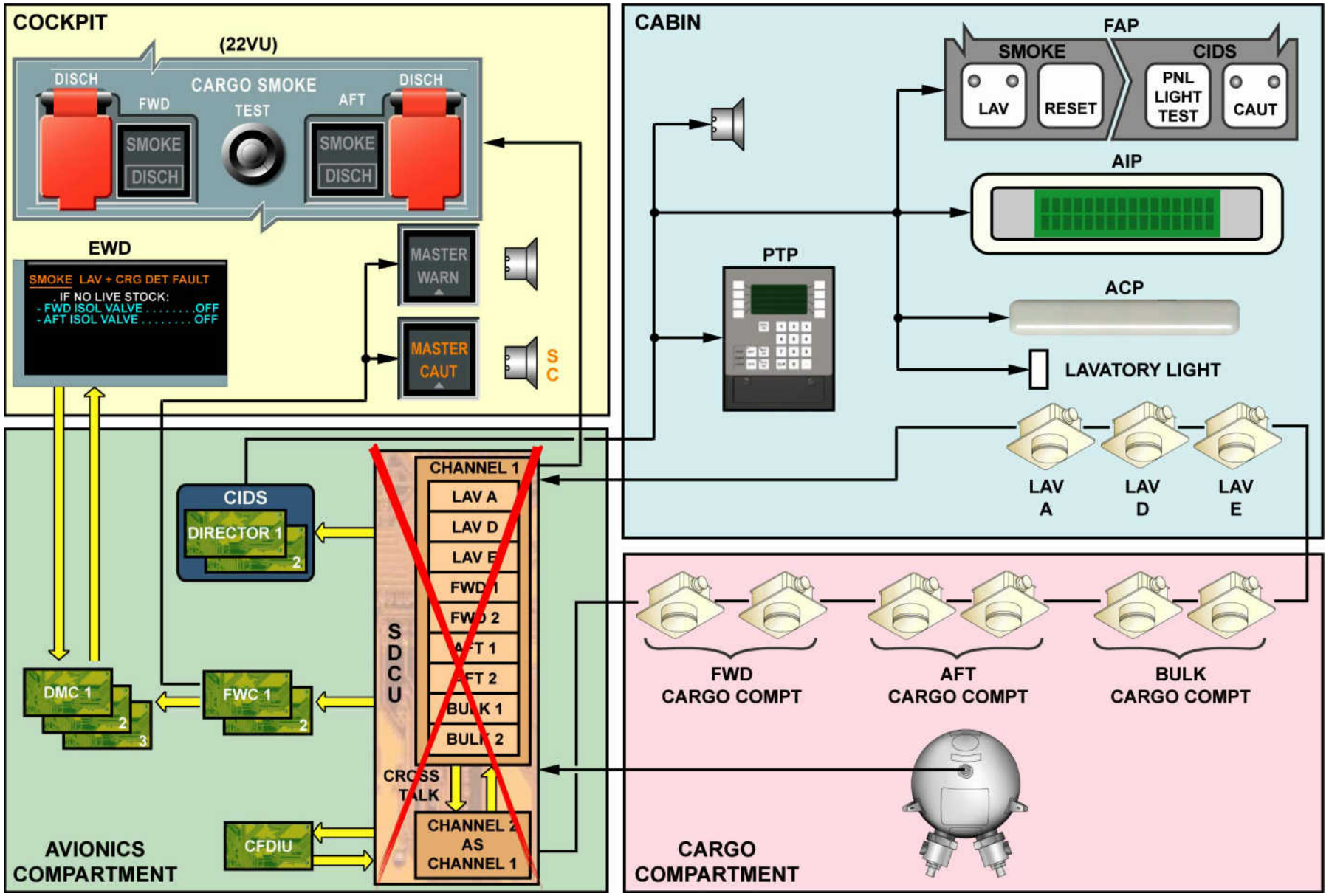


Figure 65 SDCU FAULT

SYSTEM MONITORING VIA PTP INDICATION

MONITORING VIA THE PTP CONTROLS

System Status Menu

To switch on and display the main menu the DiSPLay ON P/B has to be selected on the PTP (Programming and Test Panel).
The SYSTEM STATUS page presents the current status of the CIDS (**C**abin **I**ntercommunication **D**ata **S**ystem) and for maintenance, additional information about the status of the systems also monitored by the CIDS.

In this example, a failure has been detected in the lavatory smoke detection system. In order to get access to the related page the LAV SMOKE SYS FAIL line key is selected.

LAV SMOKE SYS FAIL

This page indicates that the SMOKE DET of the LAV A is faulty.

System Status Menu (2nd Page)

To get additional information on maintenance the CONT line key is selected. This is the next page of the SYSTEM STATUS.

Maintenance Menu

To get this information the MAINTENANCE line key is selected.

This page shows further information to obtain from:

- LAST LEG REPORT,
- PREV LEGS REPORT,
- LRU IDENTIFICATION,
- FAULT DATA,
- CLASS 3 FAULTS line keys.

To get the rest of the menu the CONT line key is selected.

NOTE: Selection of FAULT DATA gives coded trouble shooting data for internal director and DEU (**D**ecoder **E**ncoder **U**nit) failures.

Figure 66 PTP Location

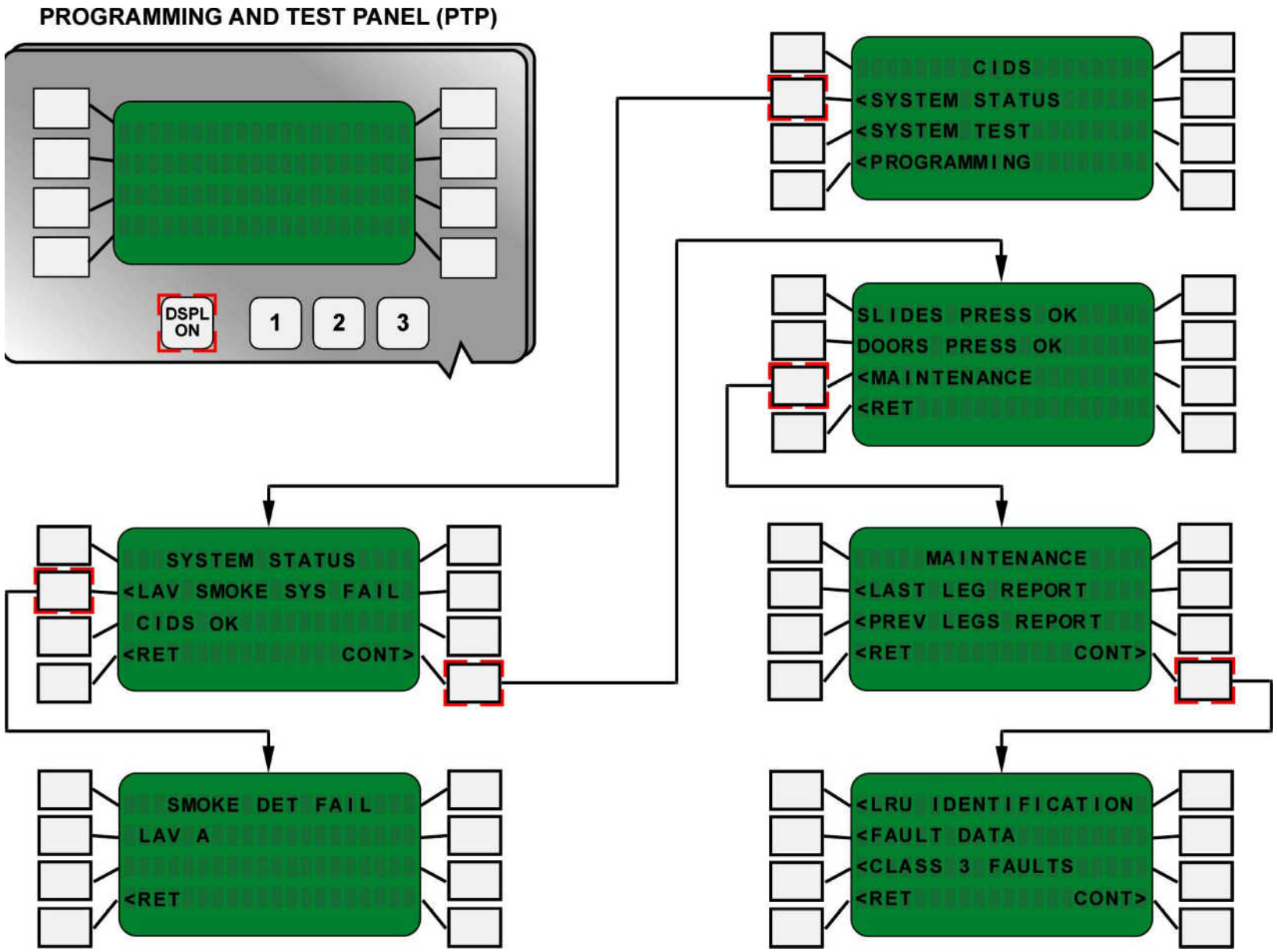


Figure 67 Monitoring of Lavatory Smoke detection System (PTP)

LAVATORY SMOKE DETECTION SYSTEM COTROLS & INDICATION

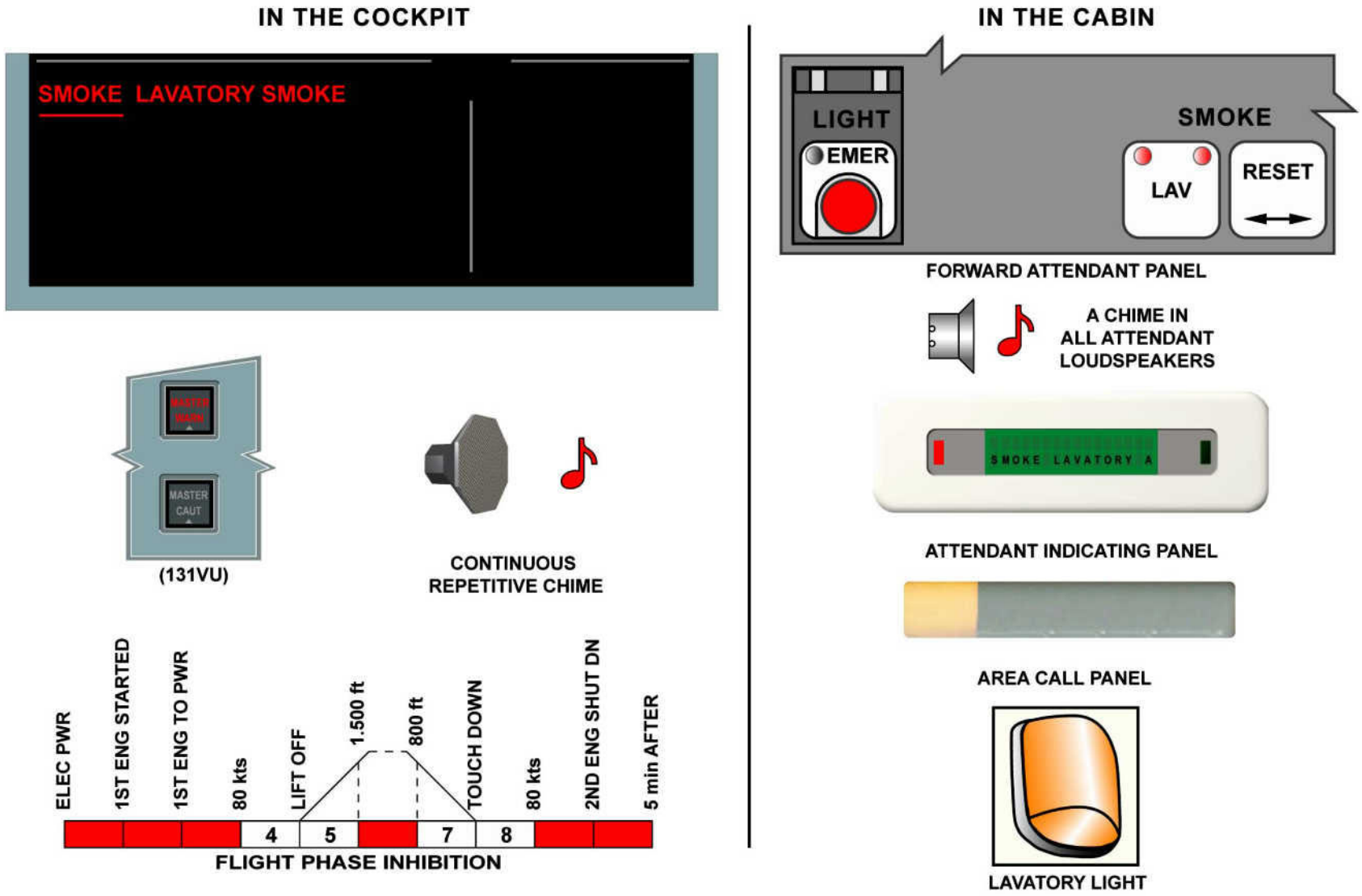


Figure 68 Lavatory Smoke Detection System Components (1)

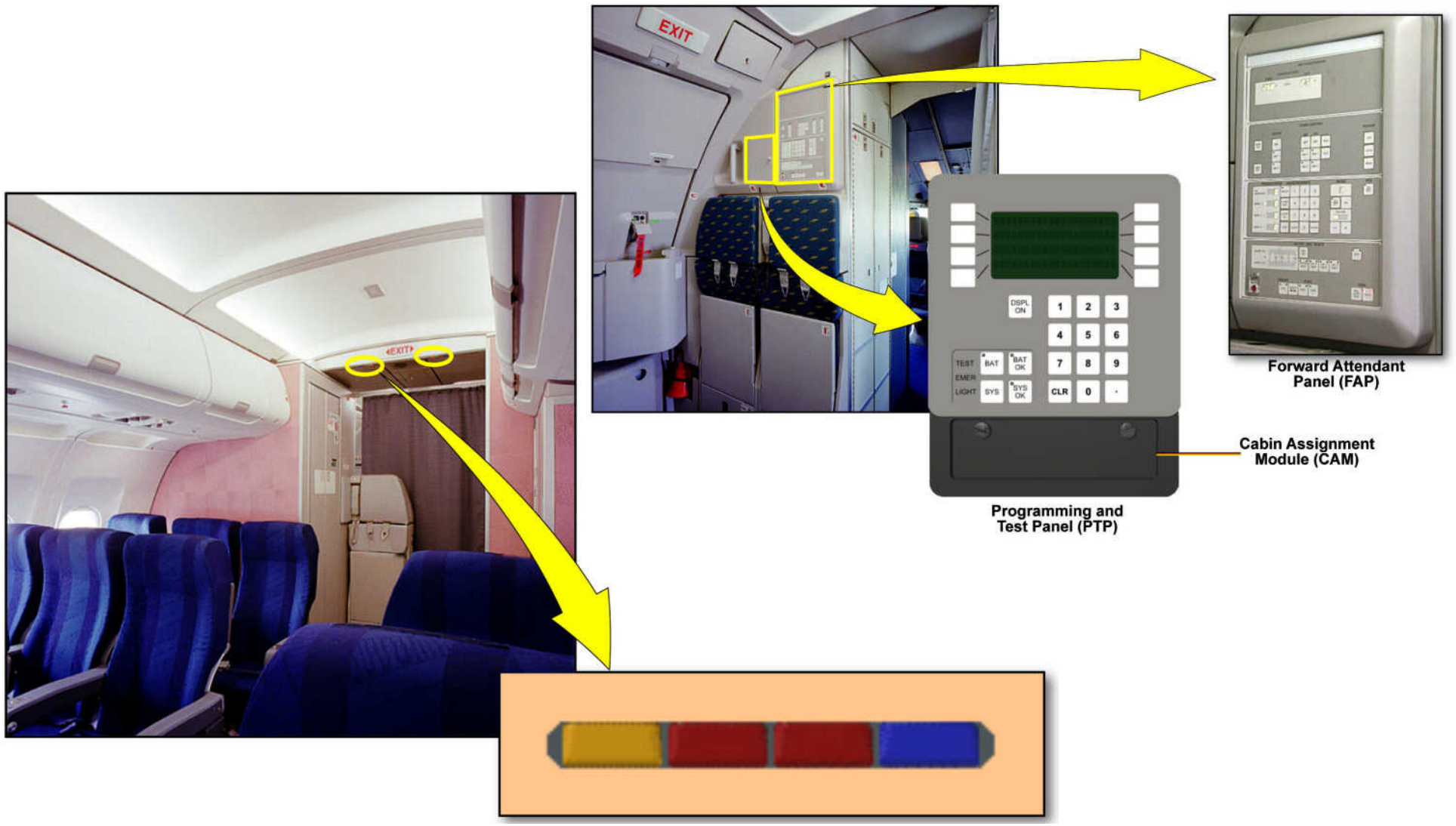


Figure 69 Lavatory Smoke Detection System Components (2)

26–25 LAVATORY FIRE EXTINGUISHING

GENERAL DESCRIPTION

General

The lavatory fire–extinguishing system is installed in each lavatory service cabinet. The lavatory fire–extinguishing system discharges its agent automatically when heat activates it.

Any fire in the waste is kept within the confines of the metal waste–paper bin. An inert gas floods the lavatory service cabinet and extinguishes the fire.

Each lavatory fire–extinguishing system has an extinguisher bottle which is self–actuated.

Operation

The lavatory fire–extinguishing system is completely automatic and self–contained. A fire or overheat condition opens the release mechanism.

When the temperature in the waste paper–bin area is approx. 79 DEG.C (174.20 DEG.F) the fusible material in the tip of the discharge tube melts. The lavatory fire extinguisher then discharges completely within 3 to 15 s.

There are two different agents available:

- Extinguisher filled with 100 to 130g Halon 1301. Bottle weight 454g.
- Extinguisher filled with 120g FE36 which has comparable performance and efficiency to Halon 1211. Bottle weight 360g.

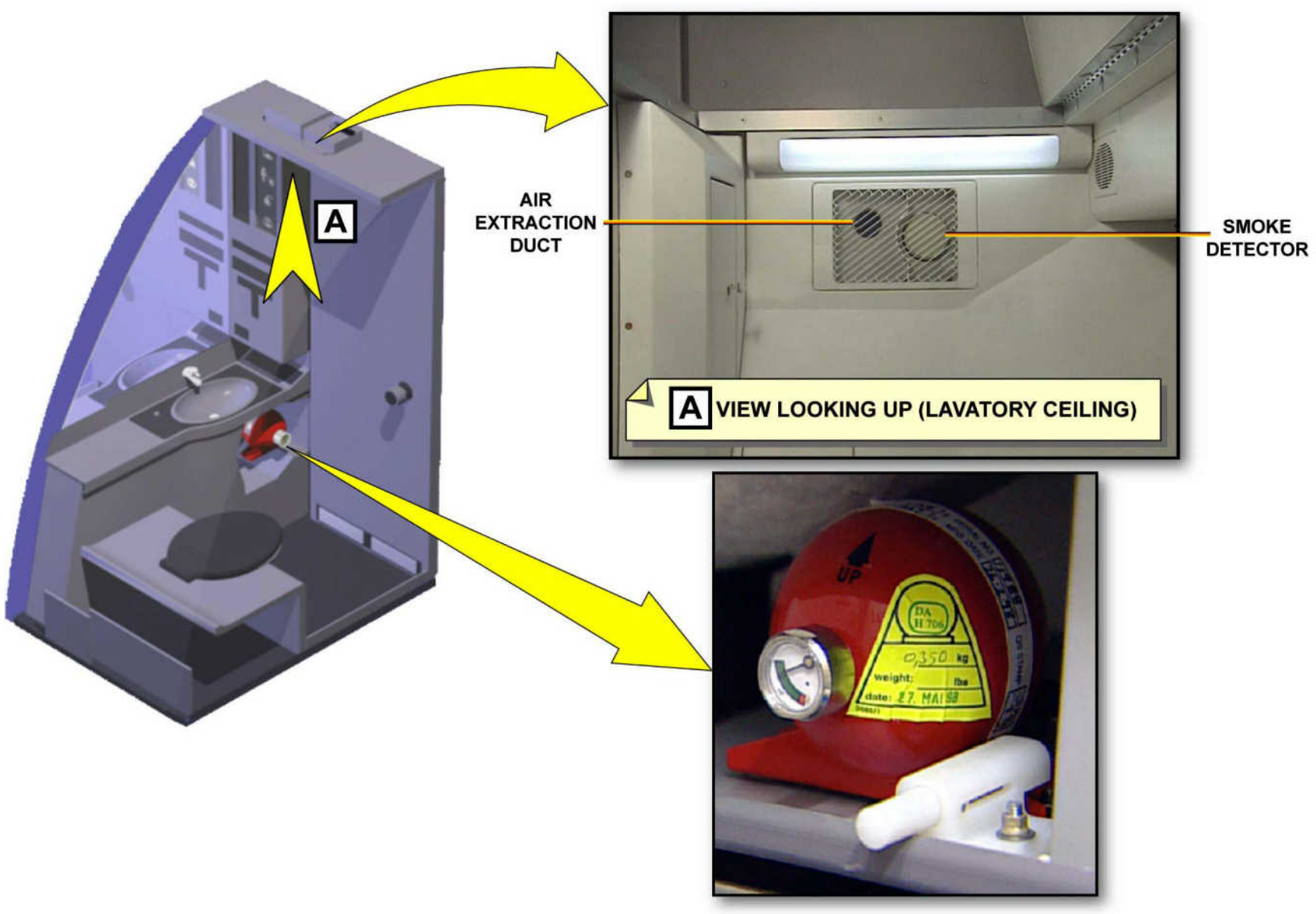


Figure 70 Lavatory Fire Extinguishing-General

EXTINGUISHER BOTTLE COMPONENT DESCRIPTION

Fire Extinguisher

Each fire extinguisher has:

- a spherical container
- a fill port with a fill valve
- a mounting bracket
- a discharge tube with a fusible plug
- an identification label
- a pressure gage (optional)

Spherical Container

The spherical container is made of brass and has a diameter of approximately 60 mm (2.3622 in.). The mounting bracket, the discharge tube and the fill port are attached to the container. The fusible plug installed in the end of the discharge tube seals the tube and keeps the extinguisher agent in the container.

The container is charged with the extinguisher agent through the fill valve in the fill port. The extinguisher agent also pressurizes the container.

The pressure gage is installed on the fill port after the container is charged.

The identification label bonded to the container shows:

- the part number
- the serial number
- the date of manufacture
- the extinguisher agent type
- the total weight of the extinguisher

NOTE: There are also fire extinguishers available without a pressure gage.

They have self–adhesive temperature indicator which is on each waste chute. It gives an indication if there is an excessive temperature in the waste paper bin area. The temperature indicator has a grey disc. At a temperature of approx. 71 DEG.C (159.80 DEG.F) the color changes to black.

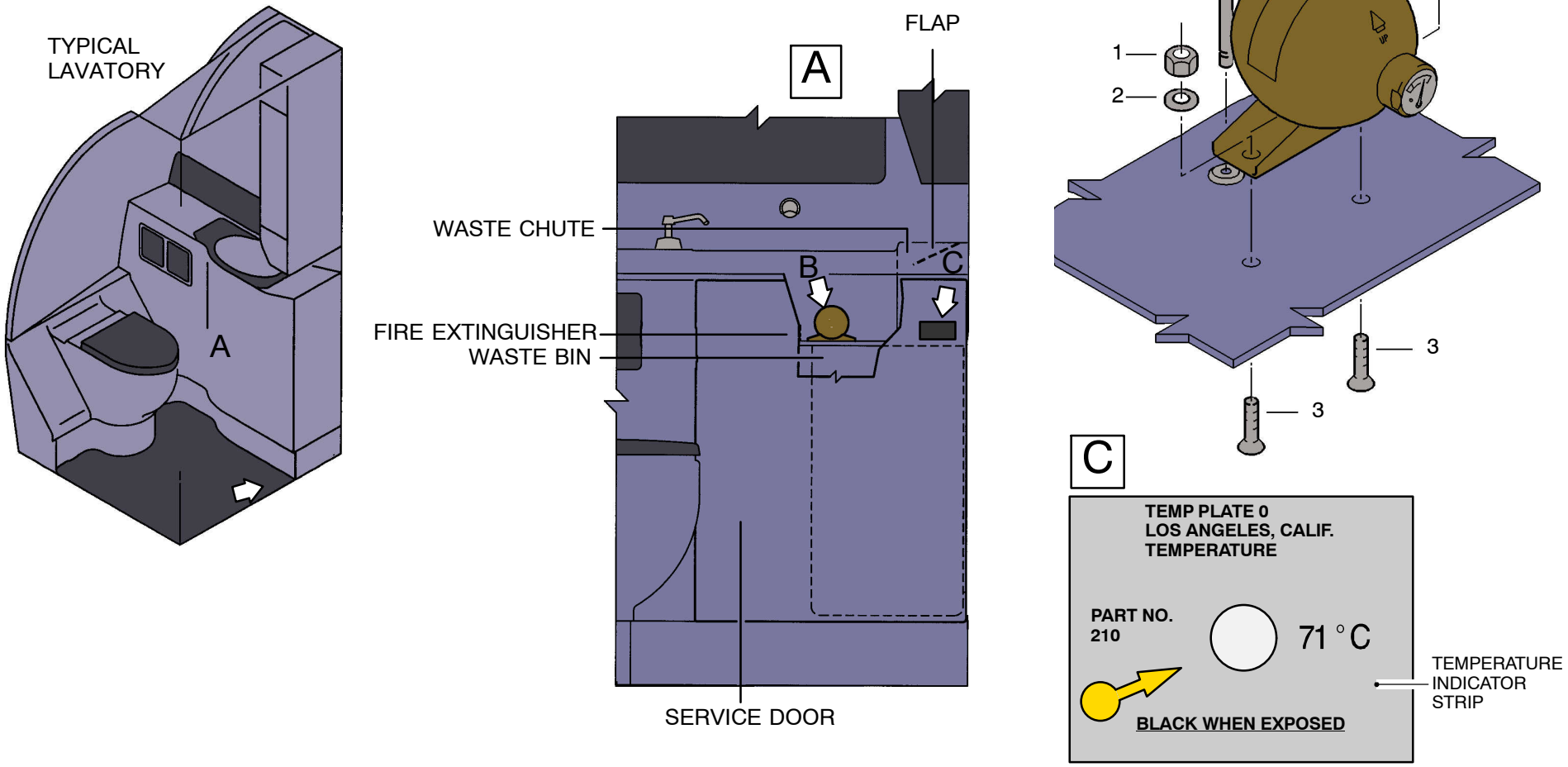


Figure 71 Component Description

26–00 FIRE PROTECTION GENERAL

MAINTENANCE PRACTICES

OPERATIONAL TEST

The operational test can be performed on the ground or in flight. The test of the detection and extinguishing circuits is done with the related TEST pushbutton switch on the respective overhead panels.

Each engine detection and extinguishing system is monitored by the Fire Detection Unit (FDU) (one per engine). The APU detection and extinguishing system is monitored by its own FDU. APU auto–extinguishing circuit can be tested in the cockpit on the maintenance panel (50VU).

Cargo–compartment detection and extinguishing circuits are tested with the related TEST pushbutton switch on the overhead panel (22VU). The cargo–compartment detection and extinguishing system is monitored by the Smoke Detection Control Unit (SDCU).

BUILT–IN TEST EQUIPMENT (BITE)

The BITE test for each computer is done at power up or when the maintenance test signal is sent from the MCDU. This test can be done only on the ground.

- Engine and APU detection and extinguishing circuits can be tested from the MCDU.
- Smoke detection in lavatory can be tested from the MCDU. The system is monitored by the SDCU.
- Smoke detection in avionics compartment can be tested via the AEVC from the MCDU.

NOTE: To test the avionics smoke detector “AIRCOND“ has to be selected in the SYSTEM REPORT/TEST menu.

- Cargo compartment detection and extinguishing circuits can be tested from the MCDU.

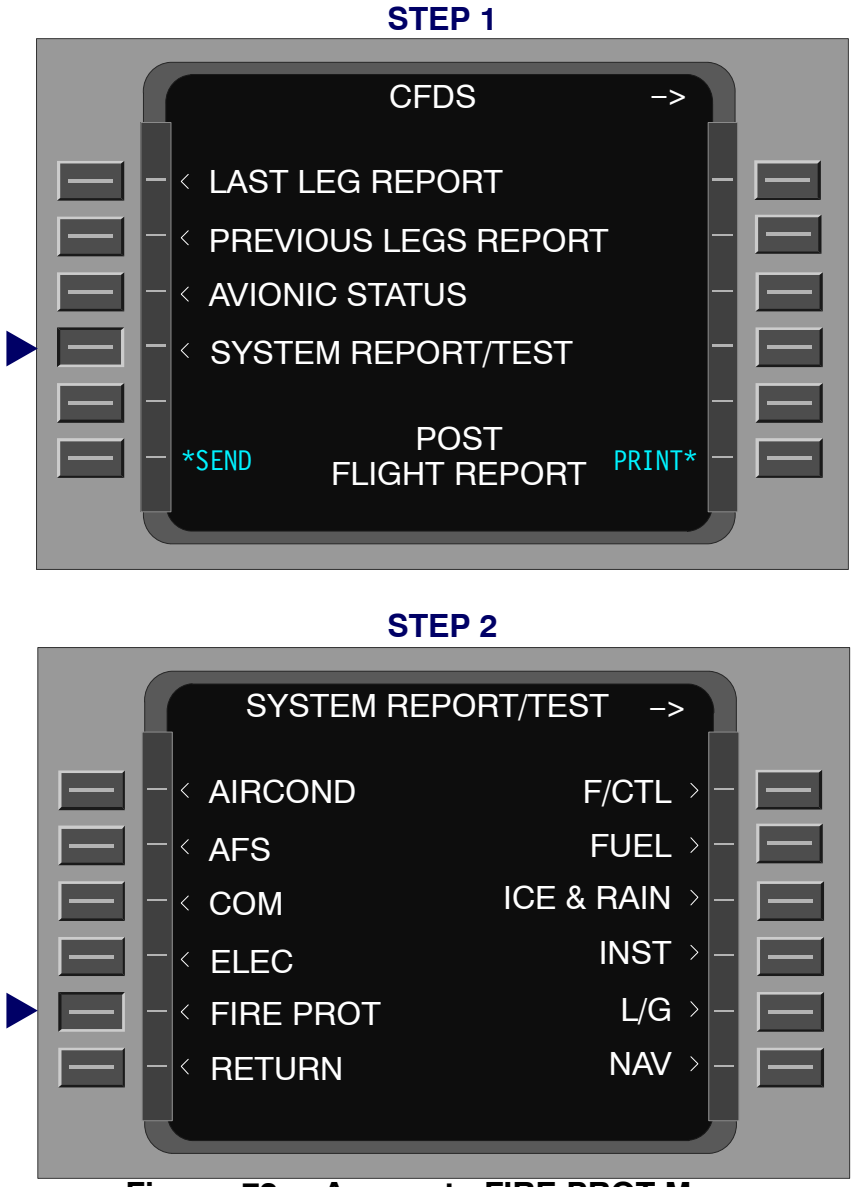


Figure 72 Access to FIRE PROT Menu

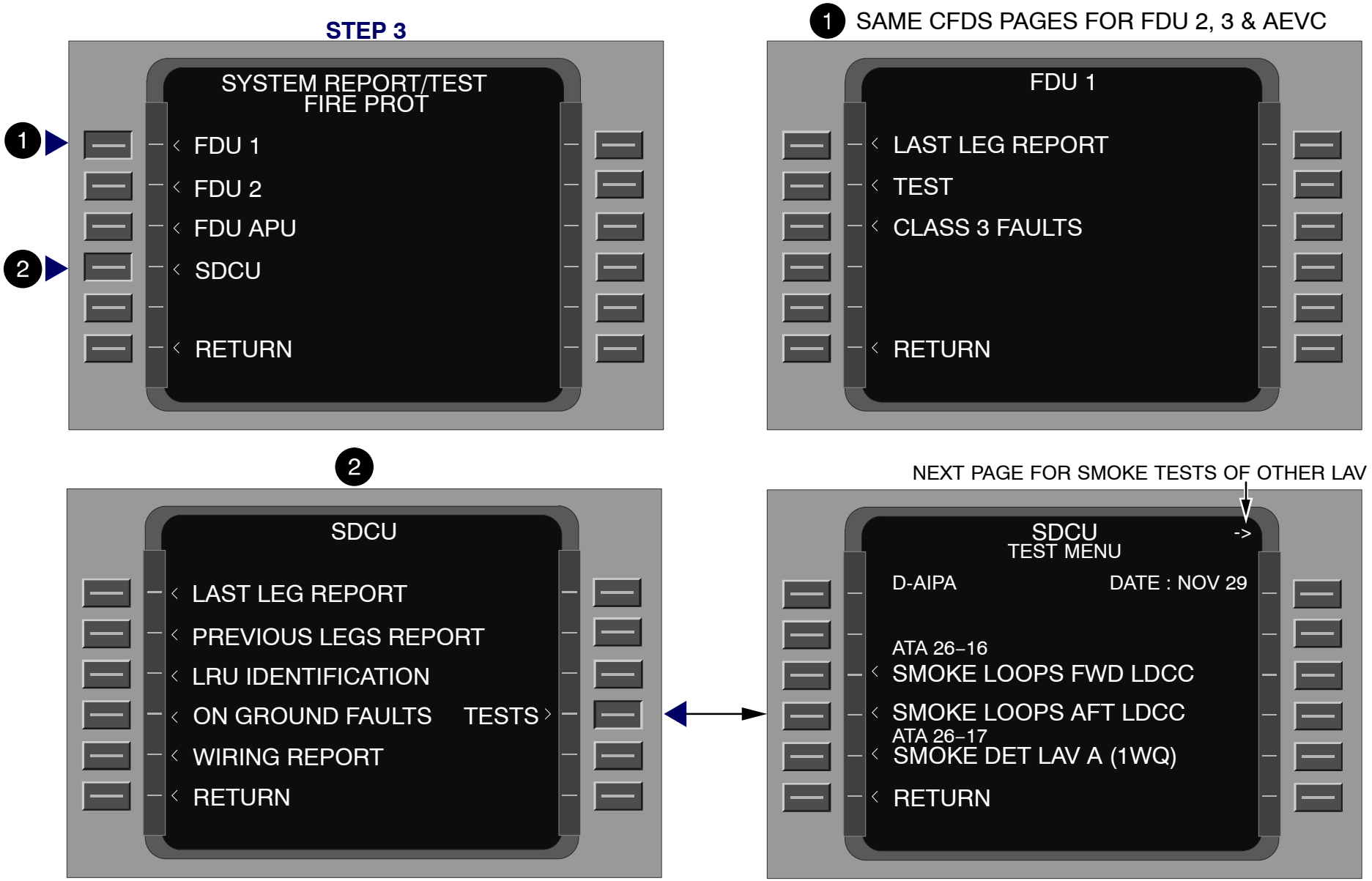


Figure 73 SYSTEM REPORT/TEST - FIRE PROT Menu on MCDU

POWER SUPPLY DESCRIPTION

Maintenance Advise

If the APU is being used to power the aircraft for maintenance operations, the APU auto extinguishing test should be performed prior to APU start in addition to the fire test. During maintenance operations the APU will most likely be running unattended. This test will insure that the APU will be protected in case of a fire on the ground. When a fire is detected the APU will shut down and the fire bottle will be discharged automatically.

In addition, the ground warning horn will sound. The Auto extinguishing test pushbutton is found on the overhead MAINT panel. The test must be done with the APU shut down but with the master switch selected ON. During the test the APU auto shutdown is simulated and the APU fuel supply valve is closed.

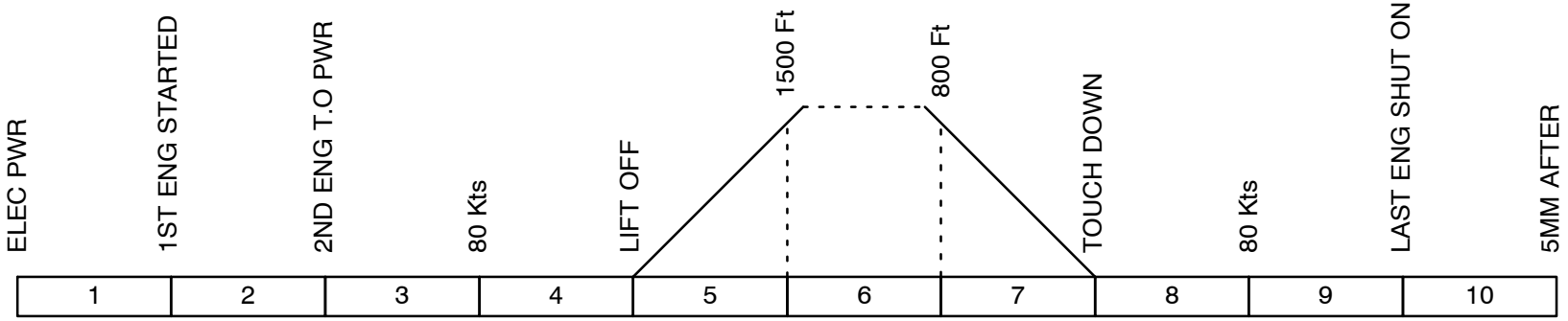
Both squibs of each engine fire bottle No. 1 and one squib of the APU fire bottle are supplied by 28V DC from the HOT bus. When performing maintenance with the FIRE pushbutton released out, make sure to pull both squib C/Bs to protect against bottle discharge. If the C/Bs are not pulled, the bottle may be discharged even without power on the aircraft.

BUS EQUIPMENT LIST

			NORM		EMER ELEC		
			AC	DC	AC ESS	DC ESS	HOT
ENG/APU	FIRE DETECTION	ENG 1 LOOP A				X	
		ENG 1 LOOP B		DC2			
		ENG 2 LOOP A		DC2			
		ENG 2 LOOP B				X	
		APU LOOP A		DC BAT			
		APU LOOP B		DC BAT			
	FIRE EXTINGUISHING	ENG 1/2					
		BTL 1 SQUIB A					HOT 1
		BTL 1 SQUIB B					HOT 2
		BTL 2 SQUIB A		DC 2			
		BTL 2 SQUIB B		DC 2			
		APU					
		BTL SQUIB A					HOT 1
		BTL SQUIB B		DC BAT			
		AUTO EXT		DC BAT			
CARGO LAVATORIES		SDCUCH1				SHED	
		SDCUCH2		DC2			
		FWD/AFT CARGO EXTING BOTTLES		DC BAT			

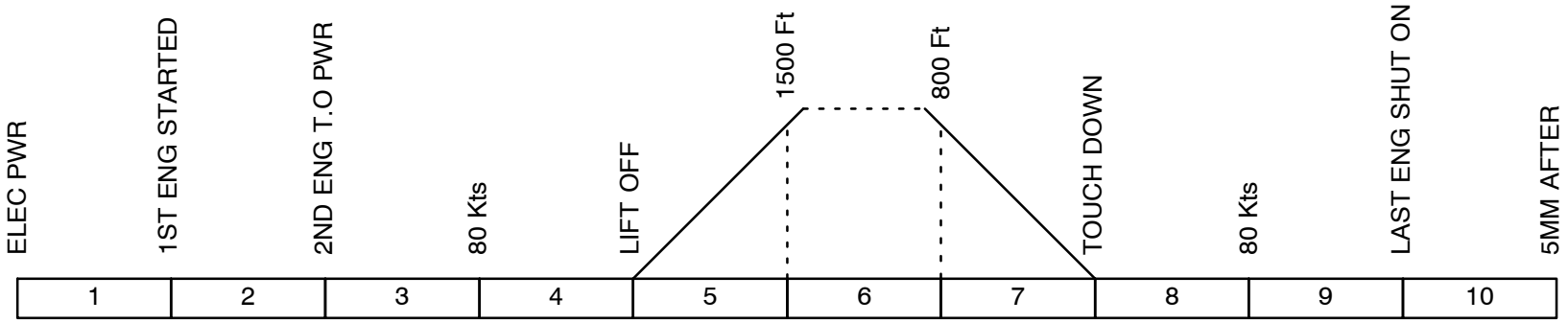
Figure 74 ATA 26 Bus Equipment List

SYSTEM WARNINGS AND CAUTIONS PRESENTATION



E/WD FAILURE MESAGE	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLIGHT PHASE INHIBIT
ENG 1 (2) FIRE	CRC	MASTER WARN	ENGINE	RED FIRE P/B, FIRE ON ENG MASTER PNL	NIL
APU FIRE			APU	RED FIRE P/B,	
ENG 1 (2) / APU FIRE DET FAULT	SC	MASTER CAUT	NIL	NIL	3,4,5,7,8
ENG 1 (2) / APU FIRE LOOP A (B) FAULT	NIL	NIL	NIL	NIL	
AVIONICS SMOKE	SC	MASTER CAUT	ELEC	GEN 1 LINE SMOKE FAULT LT ON BLOWER & EXTRACT P/B	4,5,7,8
SMOKE LAVATORY SMOKE	CRC	MASTER WARN	NIL	CABIN	4,5,7,8

Figure 75 Fire Detection System ECAM Messages (1)



E/WD FAILURE MESAGE	AURAL WARNING	MASTER LIGHT	SD PAGE CALLED	LOCAL WARNINGS	FLIGHT PHASE INHIBIT
SMOKE LAVATORY DET FAULT	NIL	NIL	NIL	NIL	3,4,5,7,8
SMOKE FWD (AFT) CARGO SMOKE	CRC	MASTER WARN	COND	RED LT ON FWD (AFT) CARGO SMOKE IND	4,5,7,8
SMOKE LAV+CRG DET FAULT (SDCU CHAN A&B FAULT)	SC	MASTER CAUT	NIL	NIL	3,4,5,7,8
SMOKE FWD (AFT) CRG DET FAULT	NIL	NIL	NIL	NIL	3,4,5,7,8
CARGO SMOKE FWD (AFT) BTL SQUIB FAULT	SC	MASTER CAUT	NIL	NIL	3,4,5,7,8
SMOKE DISCH AGENT 2 1 HOUR AFTER CARGO SMOKE ONLY IF 2 BOTTLE ETOPS SYSTEM IS INSTALLED	SC	MASTER CAUT	NIL	AMBER LT ON DISCH AGENT 2 IN-DICATOR	3,4,5

Figure 76 Fire Detection System ECAM Messages (2)

MAINTENANCE PRACTICES

SAFETY ADVISE

When you work on aircraft, make sure that you obey all the AMM (**A**ircraft **M**aintenance **M**anual) safety procedures. This will prevent injury to personnel and/or damage to the aircraft. Here is an overview of main safety precautions related to the fire protection system.

Do not try to open or repair the smoke detectors. Only workshops authorized by the manufacturer can do work on the smoke detectors.

The cartridge is an explosive device. To prevent explosion of the cartridge, install the applicable protective device. This will protect the electrical connector of the cartridge. Do not use a foil shunt.

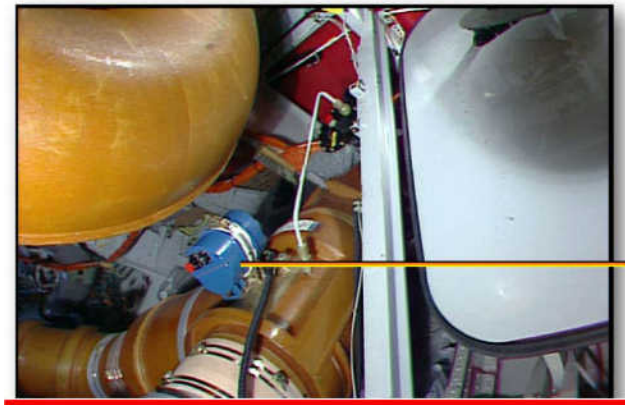
When installing engine or APU fire detection elements, be careful not to bend or damage the element.

The engine and APU fire extinguishing bottles are connected to a HOT BUS. Make sure to pull all applicable C/Bs when doing maintenance on these systems, even without electrical power supplied to the aircraft.

ENGINE AND APU FIRE PANEL (20VU)

WARNING

THE ENGINE AND APU FIRE EXTINGUISHING BOTTLES ARE CONNECTED TO A HOT BUS. MAKE SURE TO PULL ALL APPLICABLE C/BS.



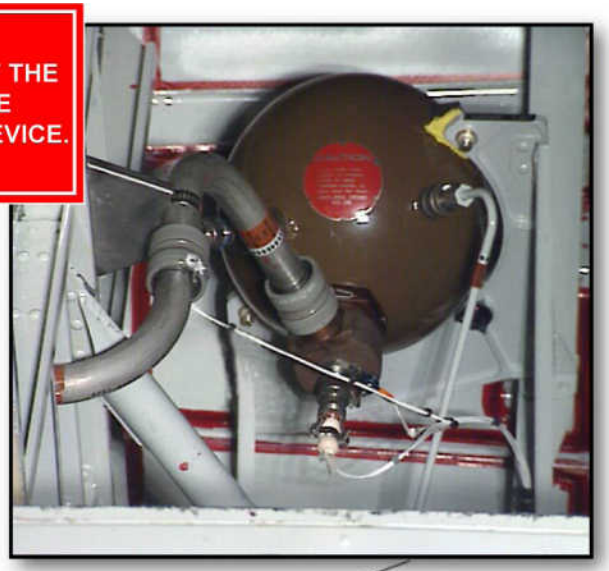
SMOKE DETECTOR

WARNING

DO NOT TRY TO OPEN OR REPAIR THE SMOKE DETECTORS. ONLY AUTHORIZED WORKSHOPS CAN WORK ON THE SMOKE DETECTORS.

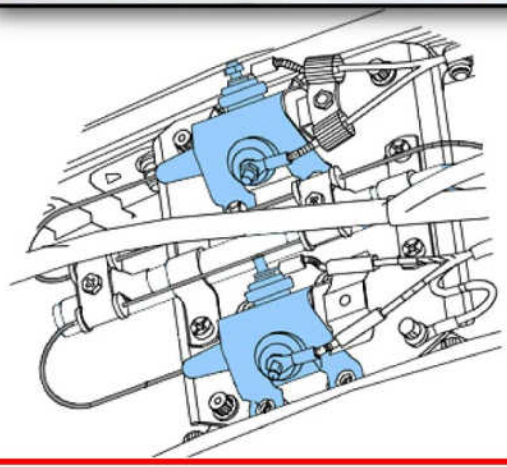
WARNING

TO PREVENT EXPLOSION OF THE CARTRIDGE INSTALL THE APPLICABLE PROTECTIVE DEVICE.



WARNING

OBEY ALL THE AMM SAFETY PROCEDURES.



WARNING

WHEN INSTALLING ENGINE OR APU FIRE DETECTION ELEMENTS, BE CAREFUL NOT TO BEND OR DAMAGE THE ELEMENT.

Figure 77 Safety Precautions

26–00 FIRE PROTECTION-GENERAL

DIFFERENCES BETWEEN CLASSIC & ENHANCED SYSTEM GENERAL DESCRIPTION

LAVATORY AND CARGO FIRE PROTECTION CLASSIC

Lavatory Smoke Detection

The lavatory smoke–detection system detects smoke in the lavatories and sends a signal to the SDCU (**S**moke–**D**etection **C**ontrol **U**nit). The cargo smoke-detection system detects smoke in the fwd and aft cargo compartment. The detectors are of the ionization type. A safety bus system connects the detectors to the SDCU.

When the SDCU receives the smoke signal from one detector in a lavatory it supplies a smoke warning signal to:

- the FWC (**F**light **W**arning **C**omputer), it displays on the EWD (**E**ngine/**W**arning **D**isplay) the applicable warning message (possible to disable by PIN-programming)
- the CIDS (**C**abin **I**ntercommunication **D**ata **S**ystem), it shows on several panels in the cabin in which lavatory the smoke is detected.

Cargo Smoke Detection

The SDCU controls the cargo–compartment smoke–detection system. The SDCU BITE (**B**uilt–**I**n **T**est **E**quipment) controls and monitors the systems and interfaces with the CFDS (**C**entralized **F**ault **D**isplay **S**ystem). It records the unsatisfactory components and system malfunctions.

In case of smoke warning the isolation valves of the cargo–compartment ventilation system close automatically. They remain closed independently of the smoke warning signals.

LAVATORY AND CARGO FIRE PROTECTION ENHANCED

Lavatory Smoke Detection

A smoke detection system is installed to detect smoke and/or fire in the lavatories. The lavatory smoke detectors are connected to the related DEU B via a CAN (**C**ontroller **A**rea **N**etwork) bus. The DEU B transmits the information to both CIDS channels. If smoke is detected, the system gives a visual and aural warning to the flight crew.

This system is made–up of:

- one smoke detector for each lavatory,
- a DEU B
- the CIDS (**C**abin **I**ntercommunication **D**ata **S**ystem) director, containing also the CIDS–SDF (**S**moke **D**etection **F**unction)

Smoke or fire in one of the lavatories causes a detector to signal this alarm condition to the CIDS director. This alarm condition is then forwarded to the CIDS–SDF which provides the information to the Flight Warning computer.

The FWC gives indications on:

- the ECAM upper display unit

The CIDS gives indications on:

- the flight attendant panel
- the area call panel
- the attendant indication panel

Cargo Smoke Detection

The cargo–compartment smoke–detection system is installed in the cargo compartment. It gives visual and aural warnings in the cockpit, if smoke or fire is in the cargo compartment. The system includes:

- the smoke detectors,
- the smoke annunciator lights and a TEST pushbutton switch,
- the CIDS–SDF (**S**moke **D**etection **F**unction of the **C**abin **I**ntercommunication **D**ata **S**ystem)

If smoke in the cargo compartment is detected by the system, indications will be given on the ECAM upper display unit and via smoke warning lights on the overhead panel.

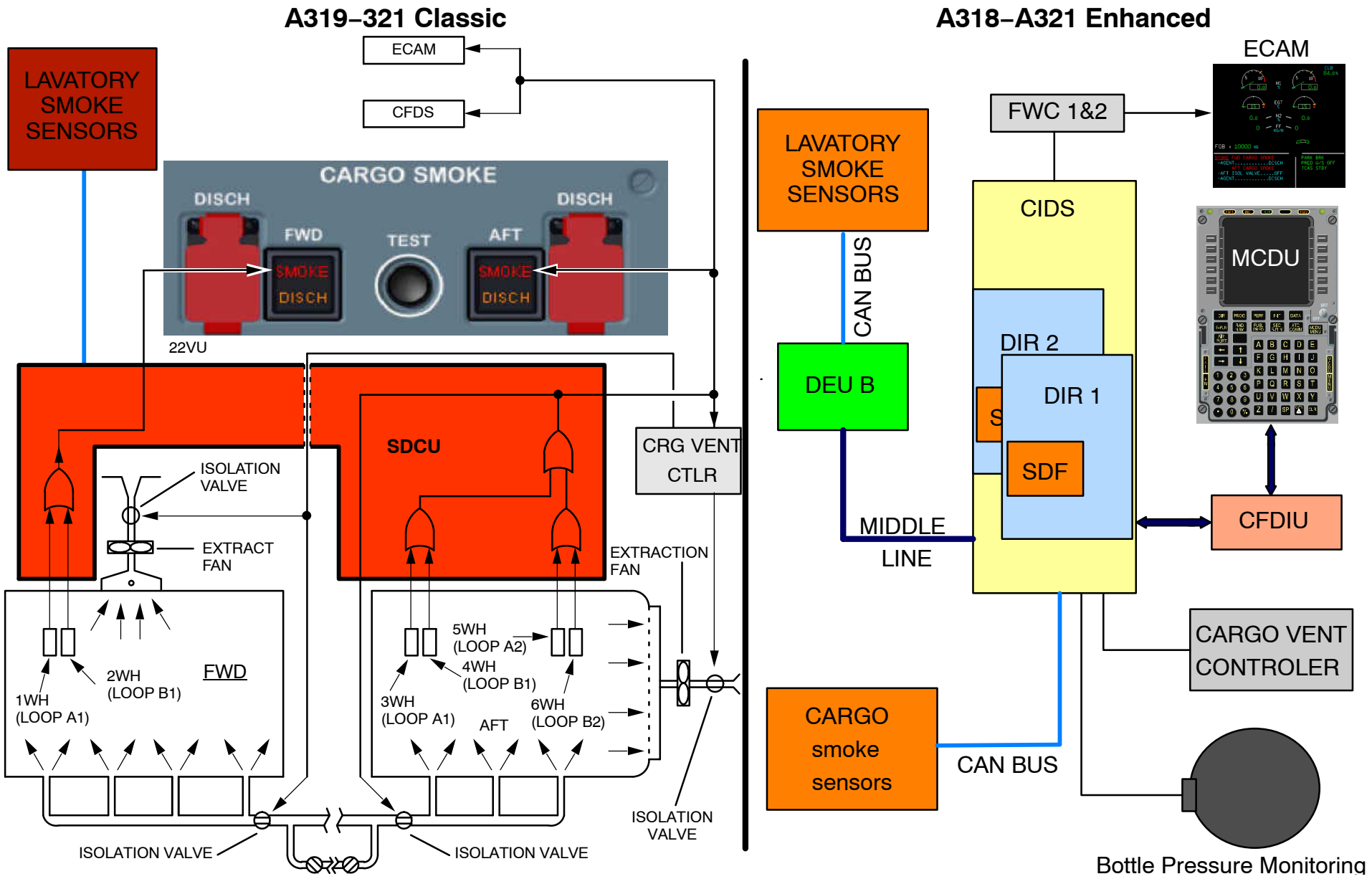


Figure 78 Smoke Detection General

LAVATORY SMOKE DETECTION INDICATION

FAP smoke detection page

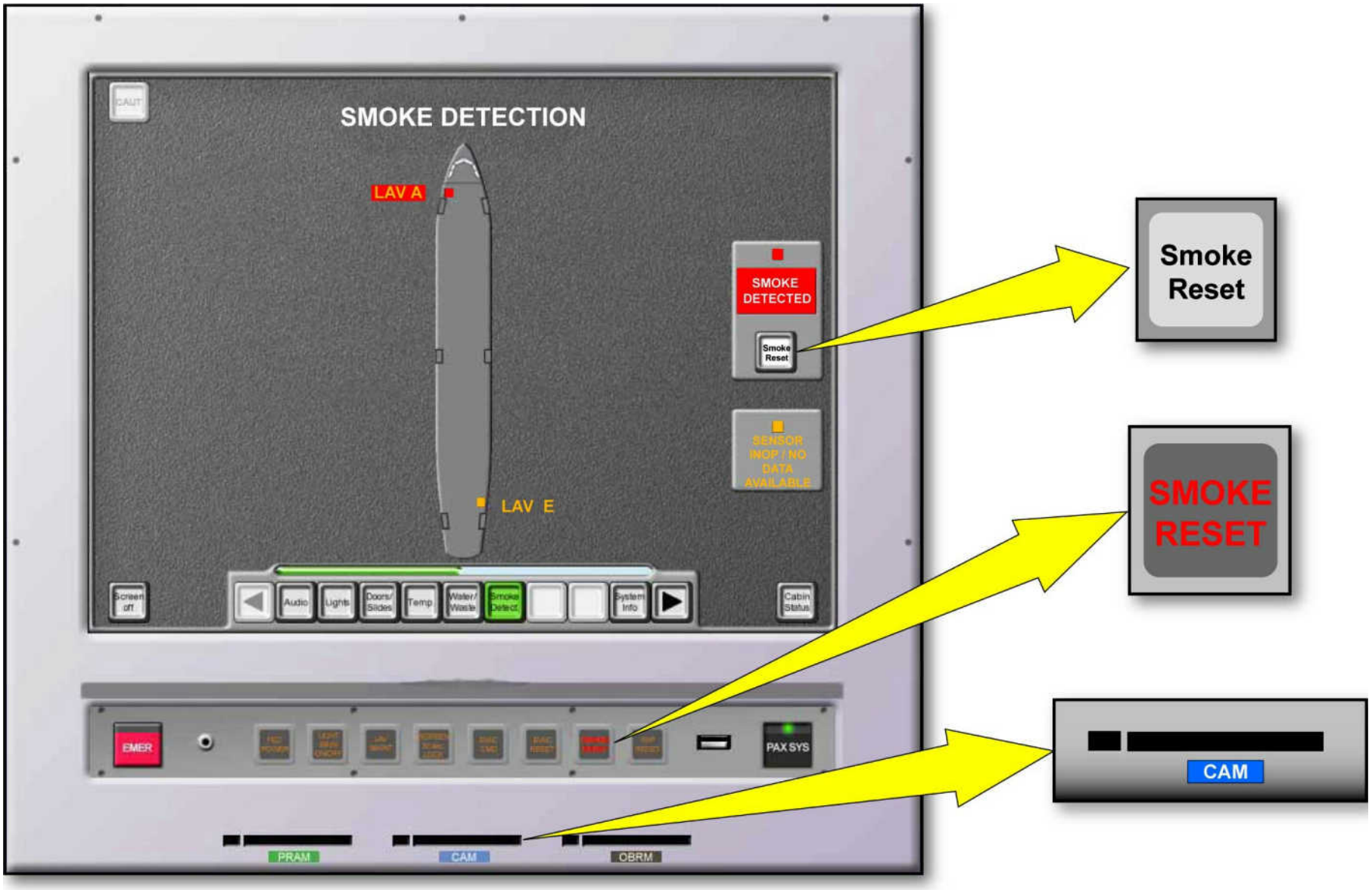
The FAP smoke detection page indicates cabin related smoke alerts and smoke sensor faults. In the case of smoke alert the page will come up automatically regardless of any other previous selected page or FAP function.

The following messages shall be indicated:

- Smoke alerts with location,
- Sensor faults with location,
- Smoke signal reset.

A system configuration by plug–in memory cassette, the CAM (**C**abin **A**ssignment **M**odule), is installed in the front of the FAP. It defines the smoke detection properties:

- Definition of chime distribution,
- Definition of AIP indications,
- Assignments of call lights,
- Assignments of ACP indications,
- Assignments of smoke zone reset commands,
- Assignments of flashing modes for smoke indications.



FLIGHT ATTENDANT PANEL

Figure 79 Smoke detection FAP

SMOKE DETECTON SYSTEM DESCRIPTION

GENERAL

The cargo and lavatory smoke detectors are connected to both SDFs (**S**moke **D**etection **F**unctions) integrated in the CIDS (**C**abin **I**ntercommunication **D**ata **S**ystem) directors via CAN (**C**ontroller **A**rea **N**etwork) buses.

The SDF Boards have an independent ESS power supply and are still active when the DIR board in the Director is defective. The SDF Board powers also the cargo smoke detectors.

Lavatory Smoke Detection

The lavatory smoke detectors are connected to type B DEUs (**D**ecoder/**E**ncoder **U**nits) via CAN buses and the DEUs B are linked to the CIDS directors via the CIDS middle line bus. The DIR board inside the CIDS Director sends the information to the SDF Board.

The lavatory smoke detection is done by the CPU (**C**entral **P**rocessing **U**nit) and the CIDS–SDF. When smoke is detected in a lavatory, the DIR CPU 1 or 2 sends the following cabin warnings:

- a triple chime is broadcast in all cabin or attendant station loudspeakers,
- a flashing amber light on the related ACP (**A**rea **C**all **P**anel),
- ”SMOKE LAV X” message is displayed and a red indicator flashes on all the AIPs (**A**ttendant **I**ndication **P**anels),
- SMOKE DETECTION page appears automatically on the Flight Attendant Panel (FAP) on which ”SMOKE DETECTED” red message is displayed and a red icon is displayed at the affected location,
- the affected amber lavatory call light flashes.

Simultaneously, the SDF 1 or 2 sends a smoke alert to the FWCs (**F**light **W**arning **C**omputers), which generates the following cockpit warnings:

- a CRC (**C**ontinuous **R**epetitive **C**hime),
- the red MASTER WARNing light,
- the LAVATORY SMOKE warning message on the EWD.
- If smoke is no longer detected, the directors automatically reset all visual and aural indications.

NOTE: An option disables lavatory warnings in the cockpit.

Cargo Smoke Detection

When cargo smoke is detected, the CIDS–SDF function sends the SMOKE warning signal to the cockpit through the FWCs. When smoke is detected in one compartment, (aft shown as example), the following activated warnings are:

- the CRC,
- the MASTER WARN light,
- the ECAM message,
- the SMOKE light on the CARGO SMOKE panel.

If a cargo ventilation and/or heating system is installed the SDF sends a signal to the related system controllers. Then the isolation valves of the related cargo compartment will close.

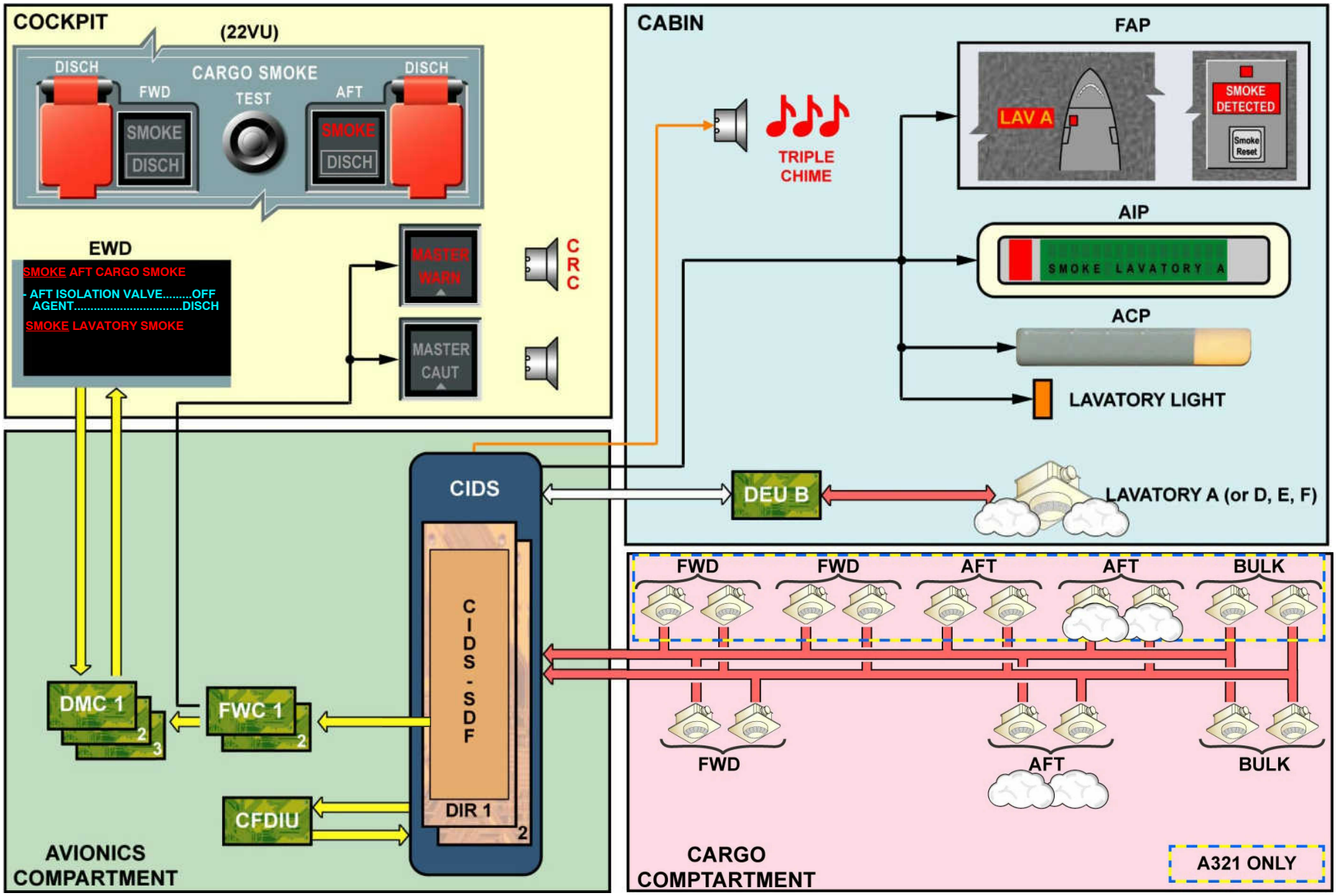


Figure 80 Smoke detection schematic

CARGO FIRE PROTECTION SYSTEM OPERATION

General

The cargo fire protection is supplied by two systems:

- the cargo smoke detection (separate FWD & AFT systems),
- the cargo fire extinguishing (separate FWD & AFT systems).

Smoke Detectors

The cargo smoke detection system is installed in the FWD and in the aft/bulk cargo compartments.

On the A318/319/320 four optical smoke detectors are located in two cavities in the ceiling of the aft/bulk cargo compartment and two others optical detectors in the FWD cargo compartment.

On the A321 six optical smoke detectors are located in three cavities in the ceiling of the aft/bulk cargo compartment and four others optical detectors are located in two cavities in the ceiling of the FWD cargo compartment.

The cargo smoke detectors are electrically connected to the CIDS (**C**abin **I**ntercommunication **D**ata **S**ystem) directors via CAN (**C**ontroller **A**rea **N**etwork) buses.

Warnings

The CIDS–SDF sends signals for cockpit local warnings, ECAM system and cargo ventilation controller. It also supplies the fault messages to the CFDS (**C**entralized **F**ault **D**isplay **S**ystem).

In case of FWD or aft/bulk smoke detection; the respective SMOKE light comes on, on the CARGO SMOKE panel. At the same time the cargo ventilation controller closes the isolation valves of the affected compartment (If ventilation installed).

In case of a smoke detector failure, the CIDS–SDF sends signals to the ECAM and CFDS systems.

Bottle

On A320 and A321, one extinguisher bottle is installed in the **FWD** cargo compartment, on A318 and A319 the bottle is installed in the **AFT** cargo compartment.

The bottle supplies fire extinguishing for the FWD and for the aft/bulk cargo compartments. The bottle has a pressure switch to monitor agent pressure and two electrically firing cartridges or squibs for agent discharges.

The bottle pressure and the two squibs circuit conditions are continuously monitored by the CIDS–SDF. In case of bottle pressure drop or loss of electrical squib continuity, the CIDS–SDF sends signals to the ECAM and CFDS.

Test Pushbutton

When the TEST P/B is pressed and held, the CIDS–SDF carries out an automatic test. Smoke and a bottle pressure drop conditions are simulated. The smoke detectors are tested.

When the TEST P/B is pressed and held, the SMOKE and DISCH lights on the CARGO SMOKE panel come on twice, and the ECAM warnings are activated. The isolation valves of the cargo compartment ventilation system close and the extraction fan stops.

The CIDS also passes the test and in case of a failure of one CIDS–SDF channel the lamps come on only once.

When the TEST P/B is released, the DISCH lights and the SMOKE lights go off.

The isolation valves of the cargo compartment ventilation system open and the extraction fan starts. The information is stored in the CFDS.

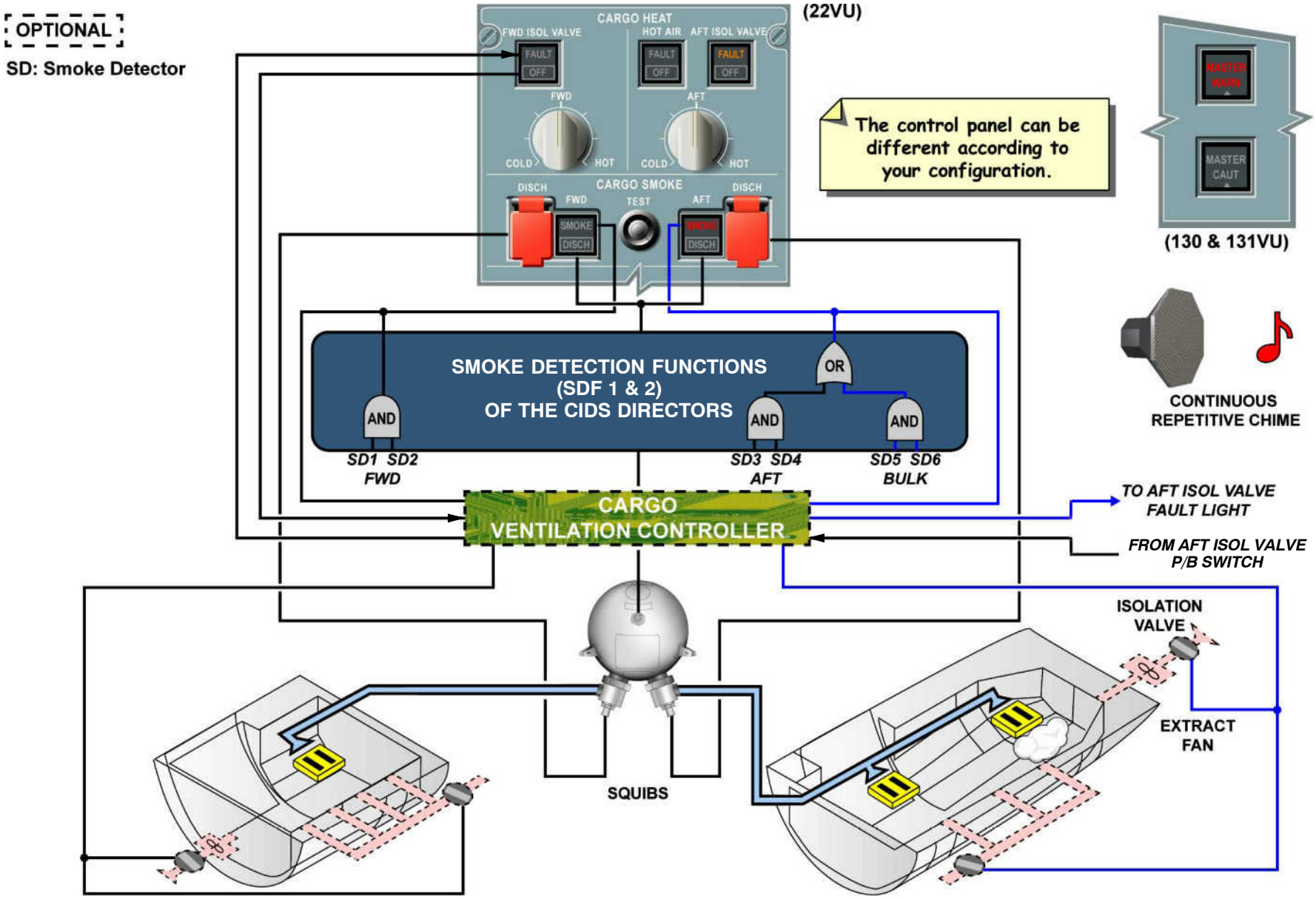


Figure 81 Cargo Smoke Protection Enhanced

SMOKE DETECTION FUNCTION DESCRIPTION/OPERATION

GENERAL

The Directors have a DIR CPU board and a SDF (**S**moke **D**etection **F**unction) board. They have an independent power supply and BITE. Also they can operate independently. The power supply for the SDF board also powers the cargo smoke detectors.

The lavatory smoke detectors are connected to the DEU B (**D**ecoder **E**ncoder **U**nits Type **B**), while the cargo smoke detectors are directly connected to the SDF boards inside the Directors. The connection type of the smoke detectors is a CAN bus (**C**ontroller **A**rea **N**etwork).

The CAN bus is a vehicle bus standard designed to allow microcontrollers and devices to communicate with each other within an environment without a host computer. It was designed 1983 at Robert Bosch GmbH specifically for automotive applications but is now also used in other items.

The active DIR part is responsible to alert the SDF part in case of a lavatory smoke. The position and name of the lavatory is received by the software on the CAM (**C**abin **A**ssignment **M**odule) inside the FAP. The SDF will alert the cockpit crew via the FWS (**F**light **W**arning **S**ystem). The DIR will alert the cabin crew via the FAP, chimes and warning indications and lights in the cabin.

When smoke is detected in the cargo compartment the active SDF will alert the cockpit crew via the FWS. There will be no cabin warning in case of cargo smoke only.

Under normal conditions the DIR 1 and SDF 1 board are active. The DIR 2 board becomes active, when DIR 1 sends a FAULT information.

The SDF 2 becomes active when SDF 1 sends a FAULT information. The take over function of the DIR and SDF boards is independently from each other.

When the Active DIR and SDF are **not** in the same Director, then in case of a lavatory smoke the active DIR will inform the active SDF via the passive DIR. The active DIR will trigger the cabin warnings and the active SDF the cockpit warnings.

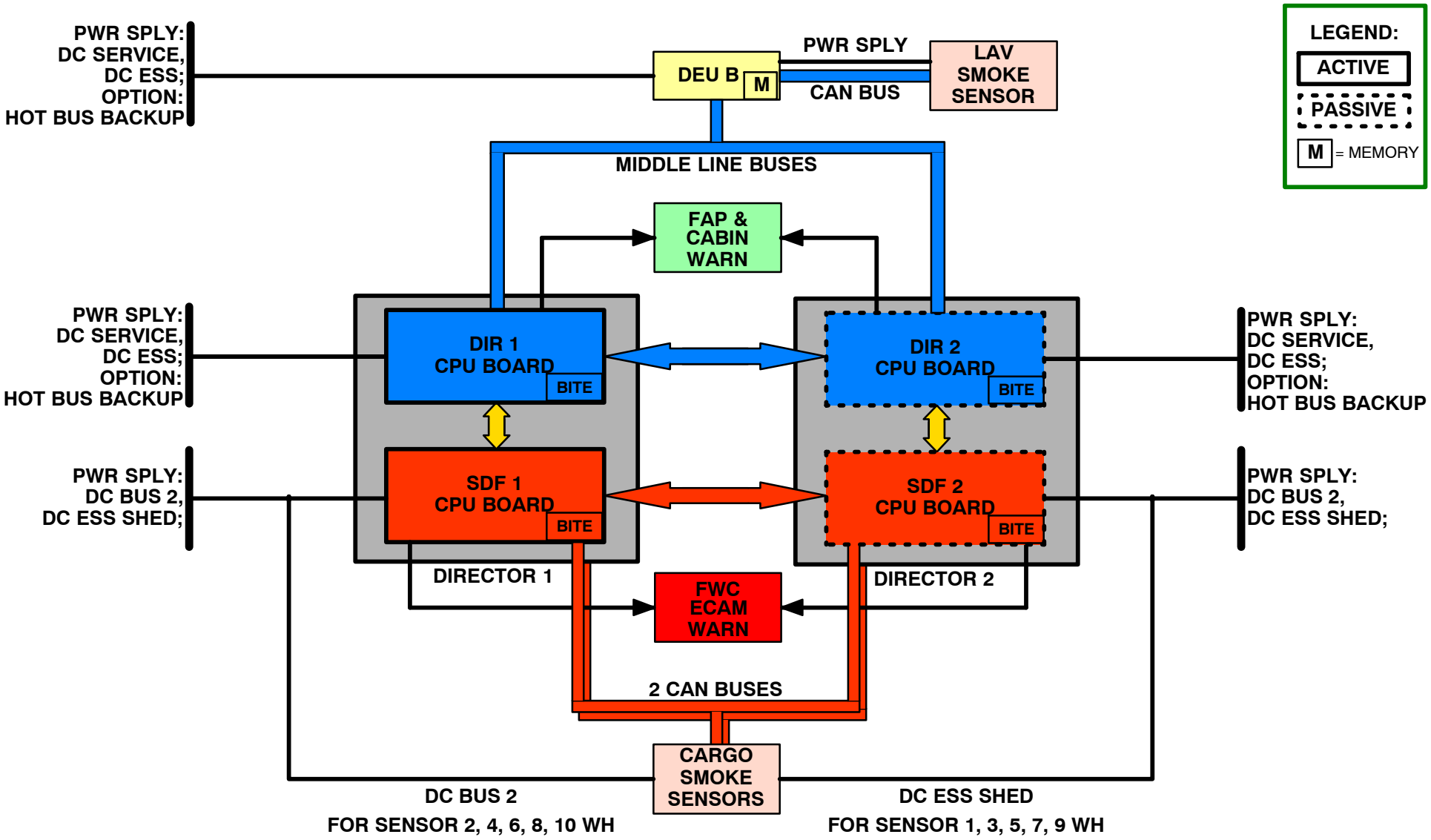
Also the DIR and SDF board have their own BITE connected to the CFDIU (**C**entralized **F**ault **I**nterface **D**isplay **U**nit). Therefore there are different BITE menus of the DIR on the “SYSTEM REPORT/TEST/COM“ page while the BITE menu of the SDF is found in the “SYSTEM REPORT/TEST/FIRE PROT“ page on the MCDU (refer to MCDU pages).

NOTE: The DEU B have a **M**emory for failures.

For example when a lavatory smoke detector is declared defective by the related DEU B, the DEU B will store this failure and send the failure message to the DIR, so that the SDF is informed and that the defective sensor is displayed on the FAP.

When the smoke detector is replaced without regarding the AMM procedure to pull the CB of the related DEU B, the DEU B will still send the failure information from its memory to the DIR, even when an operative smoke detector is installed.

The fault memory of the DEU B erases only during power interruption.



Source of information: A321 MSN: 3625

Figure 82 Smoke detection schematic

TAKE OVER LOGIC FUNCTIONAL OPERATION

The Take Over function in case of failure of the DIR or SDF boards is independetly of each other. The schematics describe which consequences appear in case of single or multiple failures of the boards.

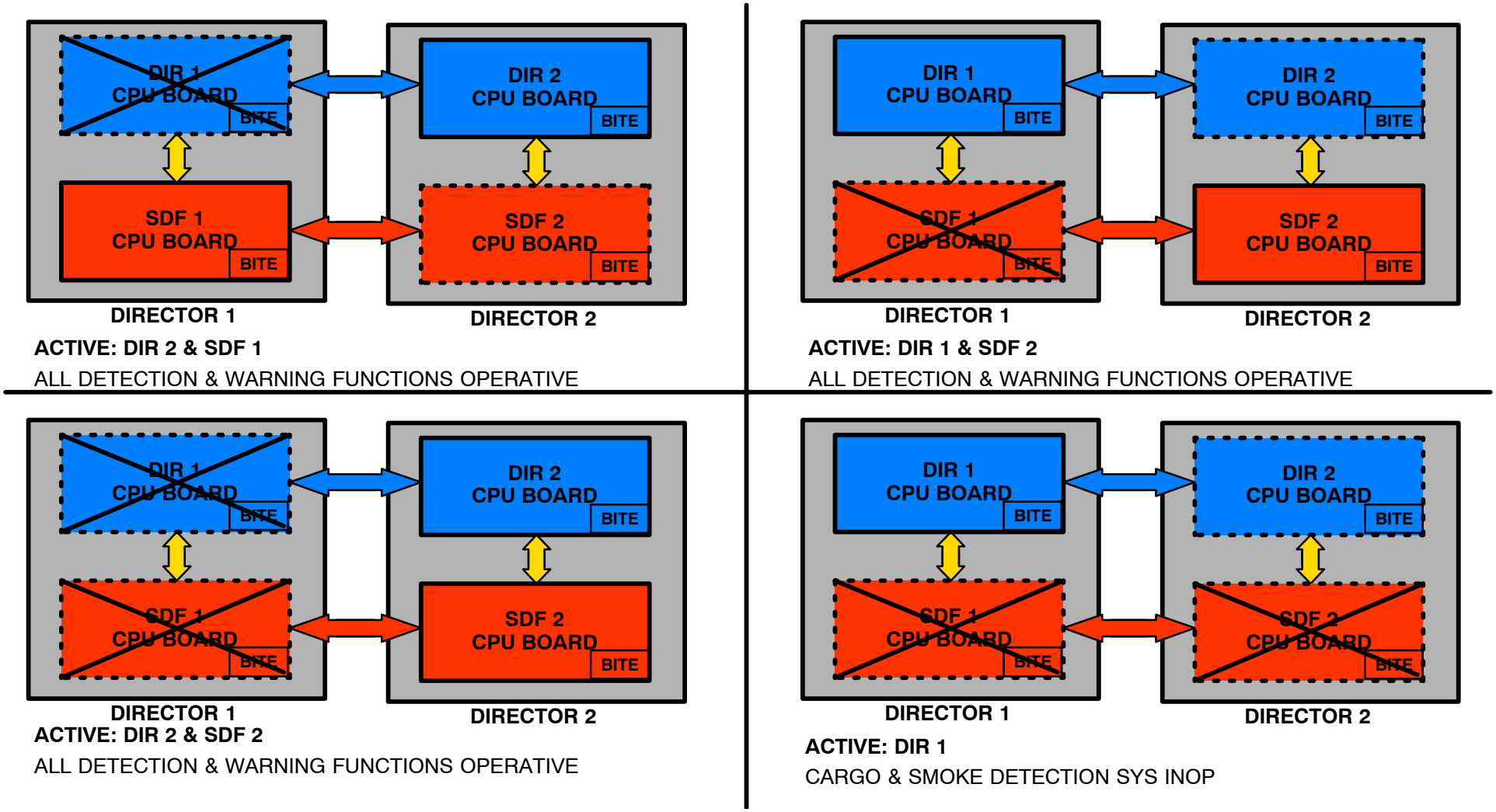
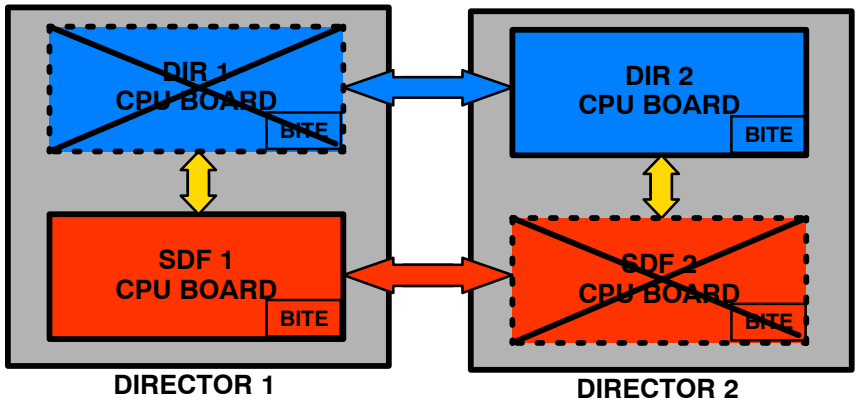


Figure 83 Take Over Logic of the DIR and SDF boards (1)

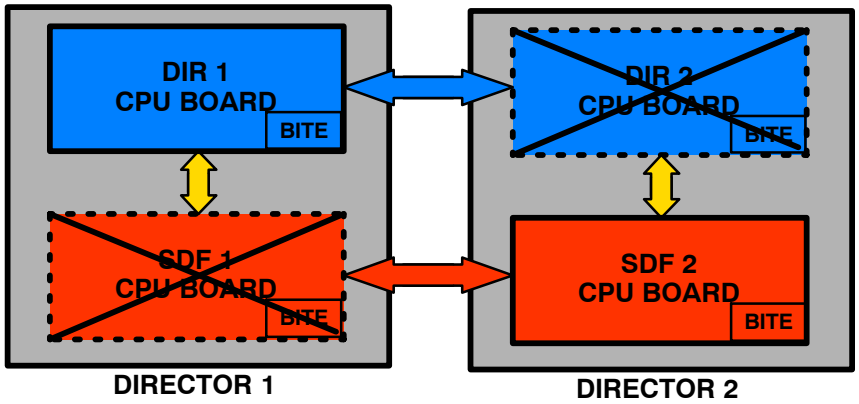
TAKE OVER LOGIC IN CASE OF FAILURE (PART 2)

The DIR board in one Director and the SDF board in the other DIR are not able to exachange lavatory smoke system data directly. They need either a functional passive DIR or SDF board to exchange data.



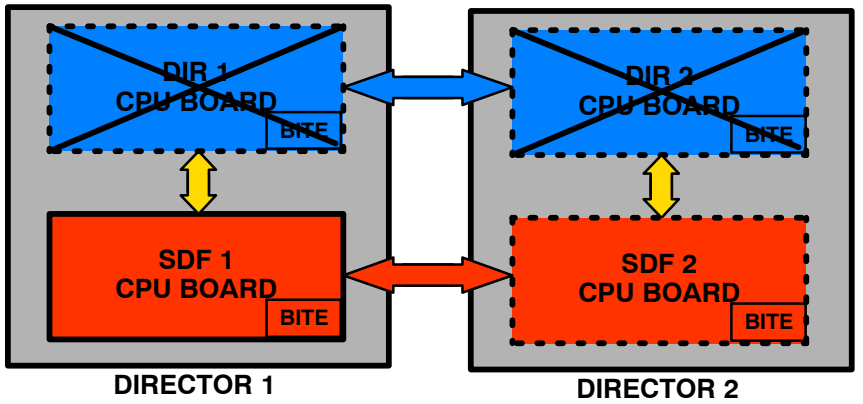
ACTIVE: DIR 2 & SDF 1

LAVATORY SMOKE WARNING IN THE CABIN ONLY. NO CROSSTALK POSSIBLE BETWEEN DIR 2 AND SDF 1 IN CASE OF LAV SMOKE.
CARGO SMOKE DETECTION OPERATIVE



ACTIVE: DIR 1 & SDF 2

LAVATORY SMOKE WARNING IN THE CABIN ONLY. NO XTALK POSSIBLE BETWEEN DIR 1 AND SDF 2 IN CASE OF LAV SMOKE
CARGO SMOKE DETECTION OPERATIVE



ACTIVE: SDF 1

LAVATORY SMOKE DETECTION INOP
(AND ALL CIDS FUNCTIONS)
CARGO SMOKE DETECTION OPERATIVE

Figure 84 Take Over Logic of the DIR and SDF boards (2)

SYSTEM BITES GENERAL DESCRIPTION

BITE Test Facilities

The FDU processes signals issued from the sensing element responder and continuously transmits messages to the CFDIU (**C**entralized **F**ault **D**isplay **I**nterface **U**nit).

The AEVC tests the smoke detector of the avionics compartment.

The SDCU monitors the smoke detectors installed in the cargo compartment and in the lavatories.

FAULT information is sent to the CFDIU.

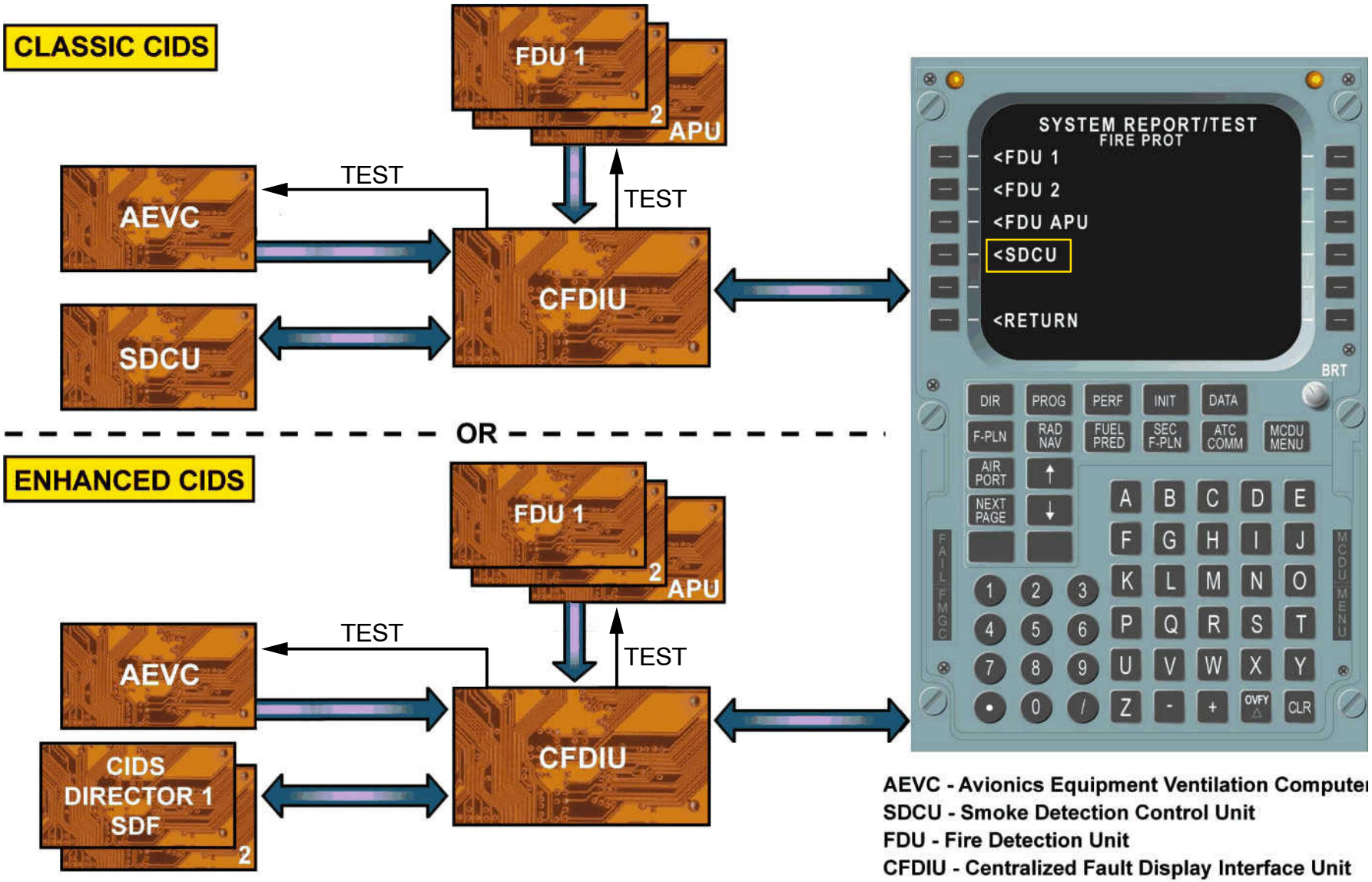
On the enhanced cabin systems, the two CIDS directors (SDF) monitor the smoke detectors installed in the cargo compartment and in the lavatories.

NOTE: In order to do a BITE test of the enhanced CIDS - SDF you have to select “SDCU“ in the “SYSTEM REPORT/TEST - FIRE PROT“ menu!

BITE Types

The system BITE types are:

- TYPE 1
  - SDCU
  - SDF 1
  - SDF 2
- TYPE 2
  - FDU 1
  - FDU 2
  - APU FDU
  - AEVC



AEVC - Avionics Equipment Ventilation Computer
SDCU - Smoke Detection Control Unit
FDU - Fire Detection Unit
CFDIU - Centralized Fault Display Interface Unit
CIDS - Cabin Intercommunication Data System
SDF - Smoke Detection Function

Figure 85 FDU - Bite Test

MAINTENANCE PRACTICES

CFDS MCDU PAGES

Bite test

Because the SDCU is replaced by the CIDS–SDFs, the SDCU menu page has been modified:

- SDCU title becomes CIDS–SDF1 or 2,
- ON GROUND FAULT has been replaced by a GND SCANNING line key,
- WIRING REPORT line key has been replaced by TROUBLE SHOOT DATA line key,
- PRINT line key has been replaced by SMOKE WARN TEST line key,
- A CLASS 3 FAULT line key is added,
- A SYSTEM TEST line key is added,
- A GROUND REPORT line key is added,
- SPECIFIC DATA line key is added.

Fire Protection CFDS Menu

On ground, SMOKE WARN TESTS can be selected on the SDCU menu of the MCDU.

If submenu SMK WARN TEST is selected, a submenu with all smoke detectors installed is displayed. A test for each smoke detector can be selected by the line key.

During the test of the lavatory smoke detectors the active CIDS channel sends a test request to the relative lavatory smoke detector via the DEU B and the CAN bus.

If the smoke detector is operative it transmits a test–alarm information to the DEU B. The DEU B transmits the information to the CIDS–SDF via the CIDS internal bus.

The CIDS starts the cabin indications (chime, FAP, AIP, ACP) and the CIDS–SDF sets the ARINC 429 outputs to the FWC.

The lavatory smoke warning is displayed on ECAM together with a repetitive chime and master warning. The test finishes when all indications are confirmed or when the MCDU line key RETURN is selected.

NOTE: the ”SMK DET AVIONICS TEST” is a pin–programmed option.

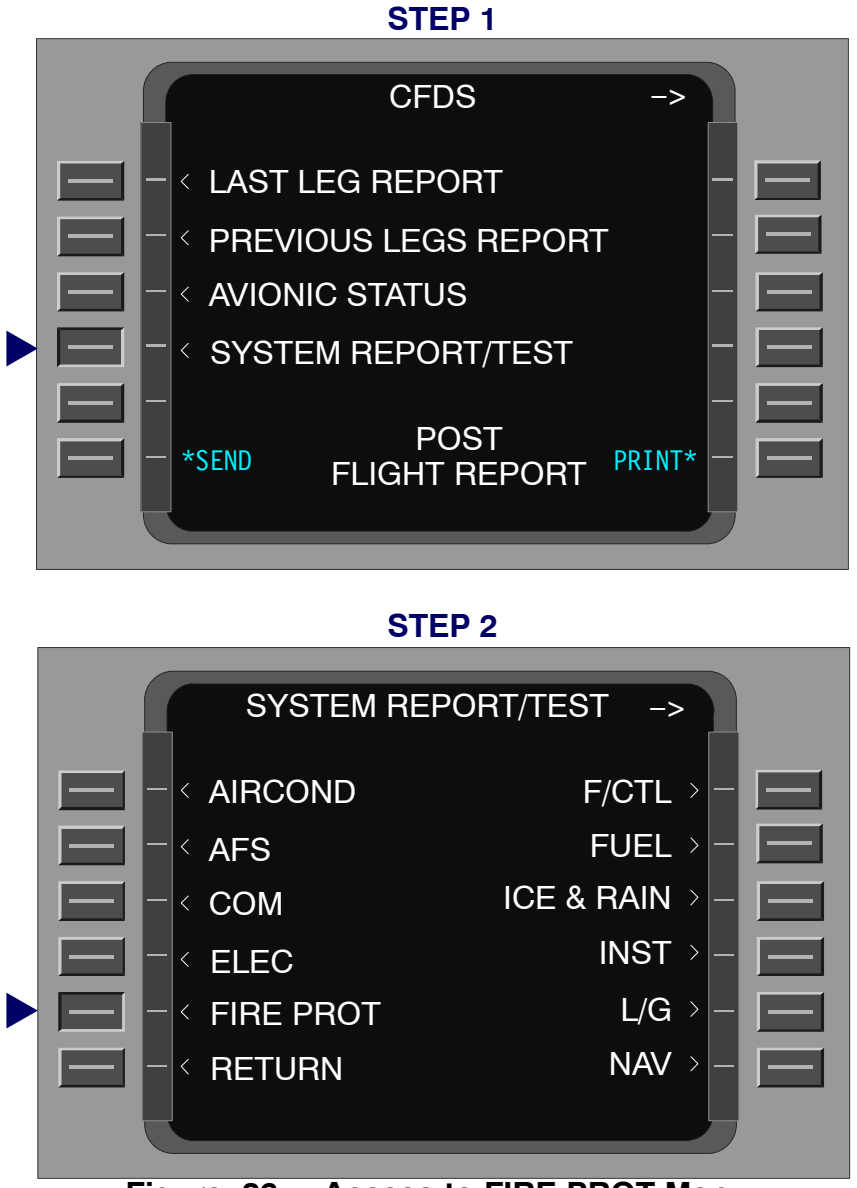


Figure 86 Access to FIRE PROT Menu

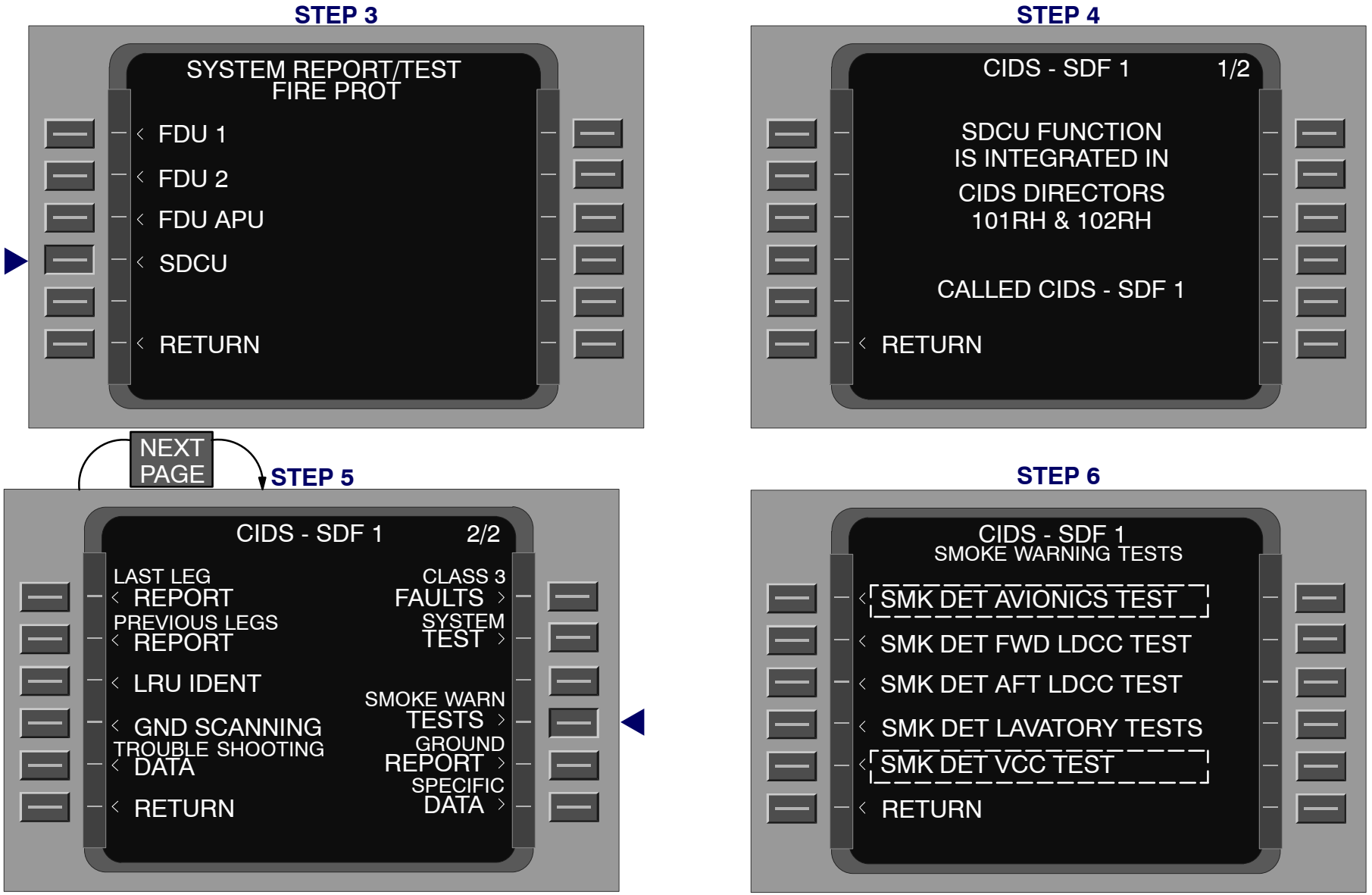


Figure 87 SDF MCDU Menu

26–24 PORTABLE FIRE EXTINGUISHER

GENERAL DESCRIPTION

General

The portable fire extinguishers are installed in the aircraft for use if an on–board fire occurs.

The portable fire extinguishers are installed in positions which have easy access and are kept fully prepared for immediate use.

Description

The portable fire extinguishers are used to extinguish a fire in the cabin, in the cockpit or in the avionics compartment.

There are two different types of portable fire extinguishers.

Each type is filled with a different agent, halon or liquid (water). If a fire occurs, the crew can manually operate the portable fire extinguisher to extinguish the fire.

NOTE: The portable fire extinguishers are installed in different locations in the cabin and in the cockpit.
Each location will be shown by a placard.

Operation

During normal conditions the portable fire extinguisher is installed in its holder. The crew can remove the portable fire extinguisher from its holder, remove the safety device and operate it manually.

The valve assembly controls the release of the extinguishing agent.

When the operating lever is operated, the valve in the valve assembly opens. The pressure in the container then pushes the halon agent up the syphon tube to the nozzle.

When the extinguishing agent is released through the nozzle, the pressure in the container decreases. The decreased pressure is shown on the pressure gauge. This is an indication that the extinguisher has been used.

TYPICAL COCKPIT INSTALLATION

TYPICAL CABIN INSTALLATION
(FLIGHT ATTENDANT SEAT)

Figure 88 Portable Fire Extinguisher-General Description

PORTABLE FIRE EXTINGUISHER COMPONENT DESCRIPTION

Portable Fire Extinguisher - Halon Agent

The portable fire extinguisher is filled with halon agent and is pressurized with Nitrogen. It can be used to extinguish A, B and C classes of fire. The portable fire extinguisher has two primary components:

- A cylindrical container assembly
- A valve assembly

Cylindrical Container Assembly

The cylindrical container assembly contains the extinguishing agent. The container is metal and is painted red. It has a flat base to let it stand vertically. The container has bonded labels which show identification and information.

Valve Assembly

The valve assembly is installed on the cylindrical container and controls the release of the extinguishing agent from the container assembly. The operating head has:

- A carrying handle
- An operating lever
- A nozzle
- A safety device
- An indicator disk or a pressure gauge.

NOTE: For detailed information about the use and the data of the portable fire extinguisher refer also to the label. The label on the extinguisher contains the instructions for use, approval number, details of its weight and the date of the last check.

Operation

During normal conditions the portable fire extinguisher is installed in its holder. The crew can remove the portable fire extinguisher from its holder, remove the safety device and operate it manually.

The valve assembly controls the release of the extinguishing agent. When the operating lever is operated, the valve in the valve assembly opens.

The pressure in the container then pushes the halon agent up the syphon tube to the nozzle. When the extinguishing agent is released through the nozzle, the pressure in the container decreases.

The decreased pressure is shown on the pressure gauge. This is an indication that the extinguisher has been used.

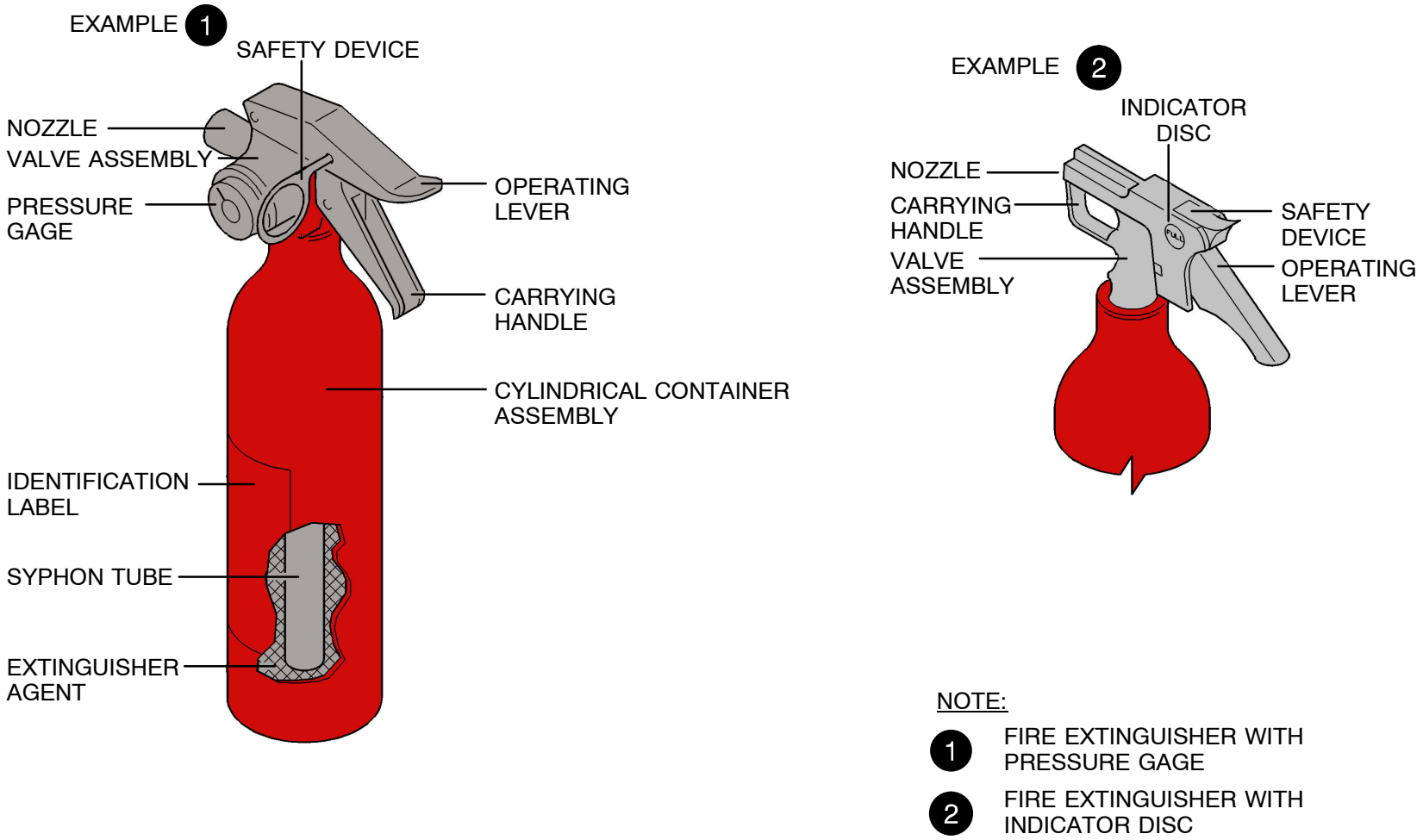


Figure 89 Component Description

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