THALES

AS350B3/EC130B4 VEMD Training

Preliminary Notes

This document must be used for training purposes only.
Under no circumstances should this document be used as a reference. It will not be updated.

In case of discrepancy between this document and any document issued by the Aircraft Manufacturer such as the AMM (Aircraft Maintenance Manual), the TSM (Trouble -Shooting Manual), the FIM (Fault Isolation Manual), FCOM (Flight Crew Operating Manual), Aircraft Flight Manual, or any official document issued by Thales Avionics Inc., the latter will take precedence over the present document.

This Document Was Created For An Instructor-led Computer Based Presentation.

Training Objectives

The objectives of the present training are :

- Introduction to VEMD
- VEMD System Interface
- VEMD Functionality
- On Board maintenance activities presentation

Note: References are made to the Aircraft Maintenance Documentation as applicable.

Note: While preparing this training manual, it may be necessary to adapt AMM references format according to actual AMM standard for the concerned system and products

List of Abbreviations

AFCS :	Automatic Flight Control System
AFCP :	Automatic Flight Control Panel
AHNG :	Avionique Hélicoptère Nouvelle Génération
AHRS :	Attitude and Heading Reference System
ALM :	AliMentation
ALT :	Altitude
AP :	Auto Pilot
APM :	Auto Pilot Module
APMS :	Automatic Pilot Module Selector
ARINC :	Aeronautical Radio INCorporation
A429 :	ARINC 429
ASG :	Arinc Symbol Generator module
ASIC :	Application Specific Integrated Circuit
ATC :	Air Traffic Control (Transponder)
ATP :	Acceptant Test Procedure
BAL :	Boite A Lumière (Lighting box)
BCD	Binary-Coded-Decimal (ARINC 429 label type)
BDSS :	Base de Données des Signaux Système
BITE :	Built In Test Equipment
BNR	Binary NumeRical (ARINC 429 label type)
CAD	Caution and Advisory Display
CAT :	Category
CBIT :	Continuous Buit In Test
COM :	Communication
CPDS :	Central Panel Display System
CPU :	Central Processing Unit
CRC :	Cyclic Redondant Code
CRM :	Centralized Radio Module
CRS :	CouRSe deviation
CSCI :	Computer Software Configuration Item
CVN :	Cooling Video NVG
CWP :	Cockpit Warning Panel
DH :	Decision Height
DIM :	Dimmming board
DME :	Distance Measuring Equipment
DMG :	Digital Map Generator
DMGCP :	Digital Map Generator Control Panel
DMUX :	Data MultipleXer
DPIFR :	Dual Pilot Instrument Flight Rules
DPVFR :	Dual Pilot Visual Flight Rules
DU :	Display Units

List of Abbreviations

FCDM :	Flight Control Display Module
FCDS :	Flight Control Display System
FIFO :	First In First Out
FLIR :	Forward Looking Infra-Red
FPROM :	Flash Programmable Read Only Memory
FT :	Flight Test
FW :	Failure Warning
GND :	Ground
GPS :	Global Positioning System
GS :	Ground Speed
H/C :	Helicopter
HDG :	Heading
HMG :	Homing
HSI :	Horizontal Situation Indicator
HUMM :	Health and Usage Monitoring Module
HUMS :	Health and Usage Monitoring System
HUMSM :	HUMS Module
H/W :	Hardware
HWCI:	Hardware Configuration Item
Hz :	Hertz
ICP :	Instrument Control Panel
ILS :	Instrument Landing System
I/O :	Input / Output
IT :	Interrupt
ITC	Inter Connection module
LCD	Liquid Crystal Display
LRM	Line Replaceable Module
LRU	Line Replaceable Unit
LSB	Less Signifiant Bit
MBD	Mother Board
MFD :	Multi Function Display
MTBF :	Mean Time Between Failure
NC :	Not Connected
NCD :	None Computed Data
ND :	Navigation Display
NM :	Nautical Mile
NMS :	Navigation Module System
NO :	Normal Operation
NR :	Rotor Speed
NVG :	Night Vision Goggles

List of Abbreviations

PELICAN : Packaging Equipment Line for Integrated Concept of Avionique Nouvelle
PFD : Primary Flight Display
P/N : Part Number
POST : Power On Self Test
PROM : Programmable Read Only Memory
PS : Static Pressure
PT : Total Pressure
PUMA : Peripheral Unit and Module Arinc 429

QFE : field elevation atmosphere pressure
QNH : sea level pressure

RAM : Random Access Memory
RCU : Reconfiguration Control Unit
RGB : Red Green Blue
RTC : Real Time Clock

SDI : Source / Destination Identifier
SMD : Smart Multi-function Display
SPIFR : Single Pilot Instrument Flight Rules
SPVFR : Single Pilot Visual Flight Rules
SSM : Sign / Status Matrix
STD : Standard
S/W : SoftWare

TTPU : Total Temperature Probe Unit
TOT: Turbine Output Temperature

UL : Upper Limit

VEMD : Vehicle and Engine Management Display
VMM : Vehicle Management Module
VOR : VHF Omnidirectional Range

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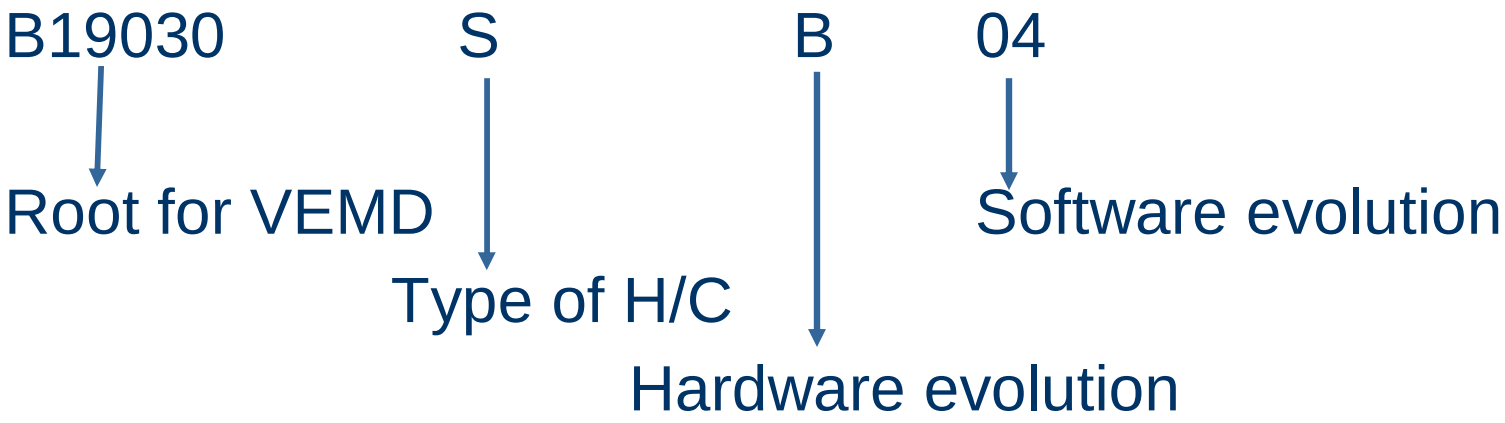
Section 1 – VEMD Part Numbers

VEMD P/N DEFINITION



SINGLE ENGINE FAMILY:

B19030**F**xxx	EC**120**, Non NVG
B19030**W**xxx	EC**120**, NVG
B19030S**A**xx	EC130, NVG, **Old LCD**
B19030S**B**xx	EC130, NVG, **New LCD**
B19030**MC**04	**AS350 B3**, Non NVG, **Old LCD**, soft 04
B19030**MD**04	**AS350 B3**, Non NVG, **New LCD**, soft 04

APPLICABILITY & MIXABILITY

APPLICABILITY		NVG		Non NVG	
P/N root		B19030S$_{xxx}$	B19030W$_{xxx}$	B19030M$_{xxx}$	B19030F$_{xxx}$
Current version		xxSB04	xxWB04	xxMD04	xxFC04
Applicability on H/C	EC120		**X**		**X**
	EC130 B4	**X**		**X**	
	AS350 B3	**X**		**X**	

MIXABILITY:

B19030MC04 = B19030MD04

B19030MC02 = B19030MD03 Soft 03 = soft 02 + Driver new LCD

B19030SA01 = B19030SB02 Soft 02 = Soft 01 + Driver new LCD

B19030FB02 = B19030FC03 Soft 02 = Soft 01 + Driver new LCD

V2005 UPGRADE MATRIX– 04 VERSION

Initial P/N ↓	Upgrade into →					
B19030	**FB04**	**FC04**	**MC04**	**MD04**	**SA04**	**SB04**
FA	X					
FB01	X					
FB02	X					
FC03		X				
MA			X			
MB01			X			
MC02			X			
MD03				X		
SA01					X	
SA02					X	
SB02						X

Upgrade into 04 version can require application of several SBs for old P/N

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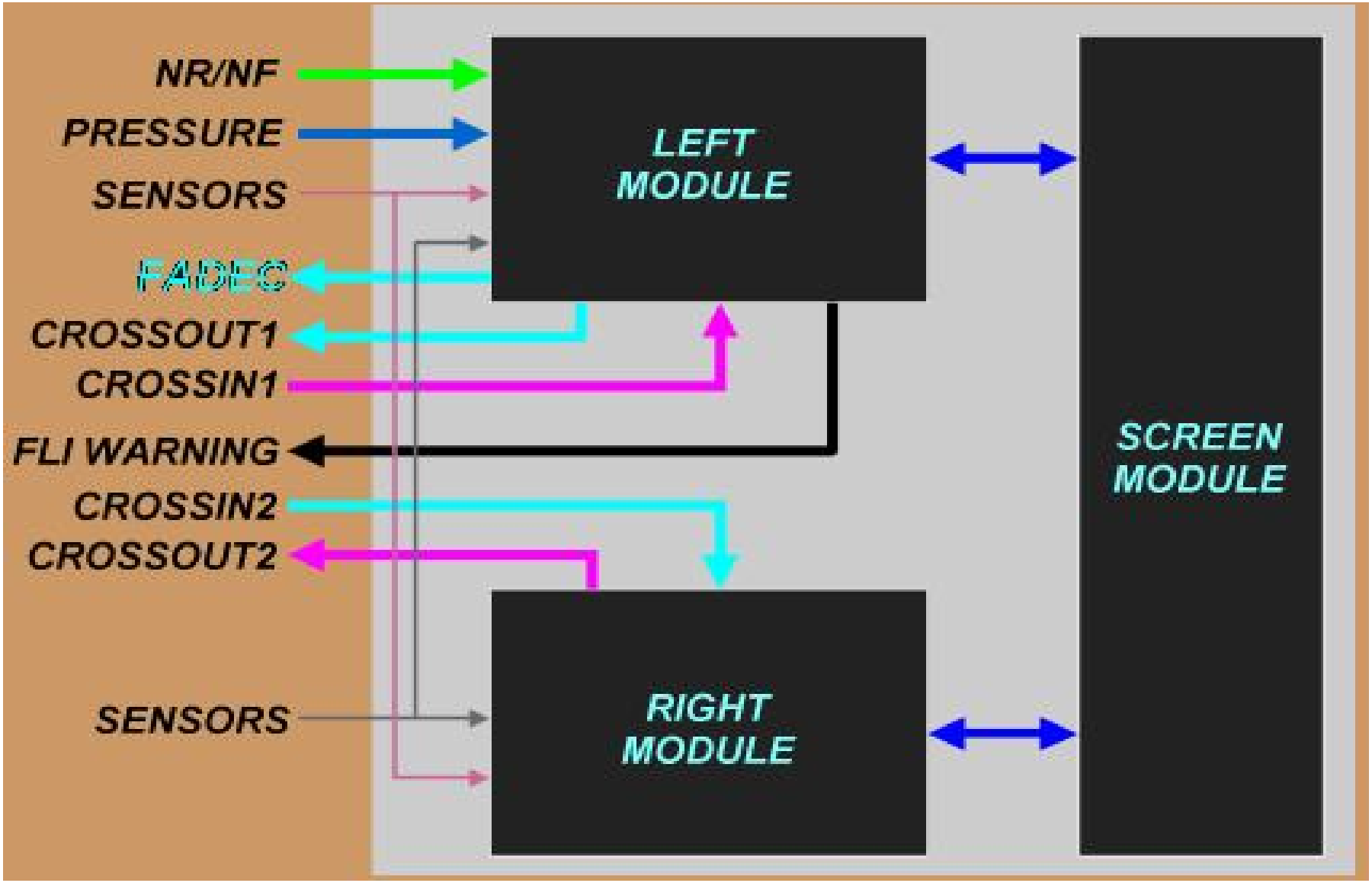
Section 2 – VEMD Interface Description

VEMD System Interface Description

The system VEMD has the following types of interfaces :

- ARINC crosstalk links between the two VEMD modules
- Inputs for outside sensors
-Internal sensors (P0 pressure and T4 cold junction temperature, called T4CJ) on Left Module Only
- Discrete Inputs for functions as (DAY/NIGHT Mode, Test Screen)
- Discrete Output for FLI Warning
- Ten buttons for controlling the VEMD, including two buttons for individual shut-off of the VEMD modules (reconfiguration)
- ARINC links for FADEC

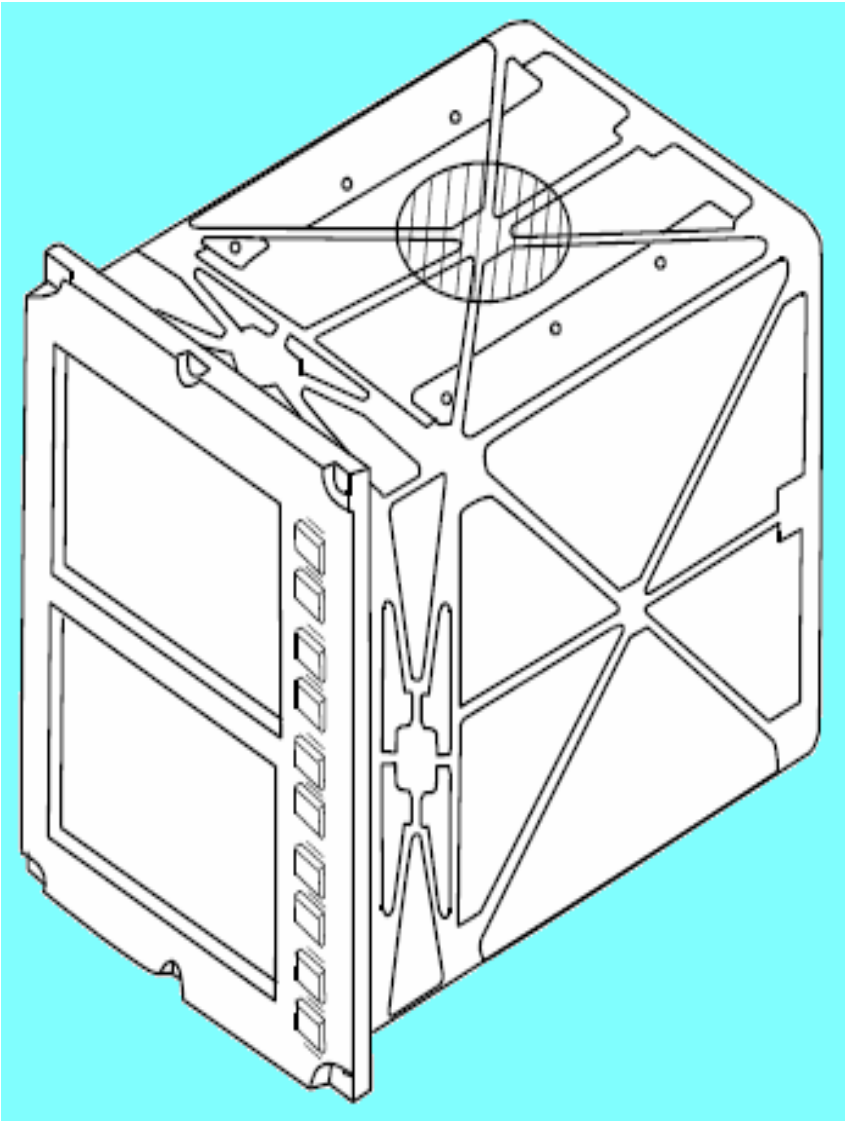
VEMD System Interface



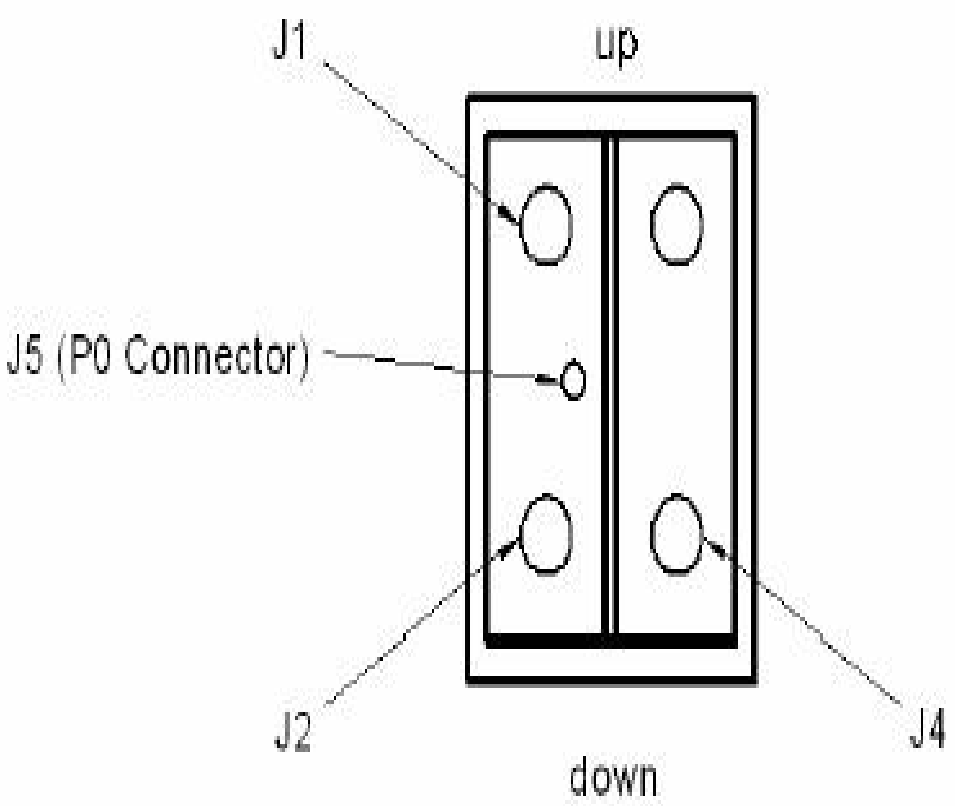
Physical Description - VEMD

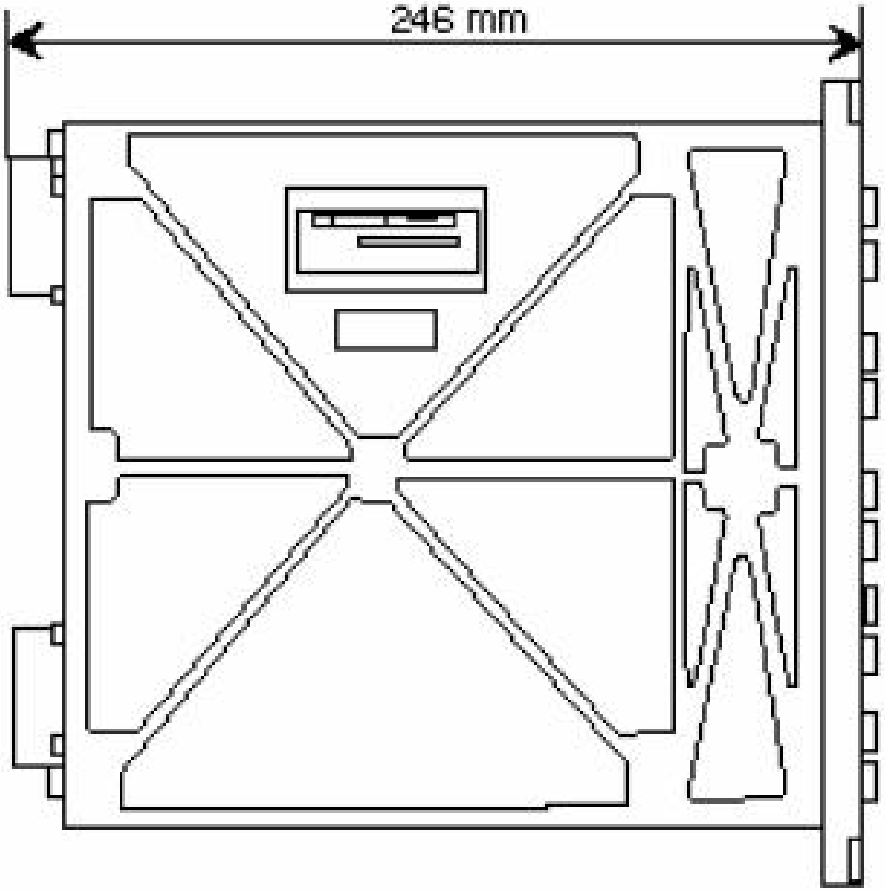
Characteristics

- Width (W): 156 mm.
- Height (H): 223 mm
- Depth (D): 246 mm.
- Weight: 3 kg max (non NVG)
  3.1 kg max (NVG)
- Power Supply: double +28 VDC.
- Power Consumption:
  1. 56 W during normal operation
  2. 78 W when heater is used
- Cooling: Internal fan (activated when internal temperature is higher than +50 degrees C.



VEMD Mechanical Interface

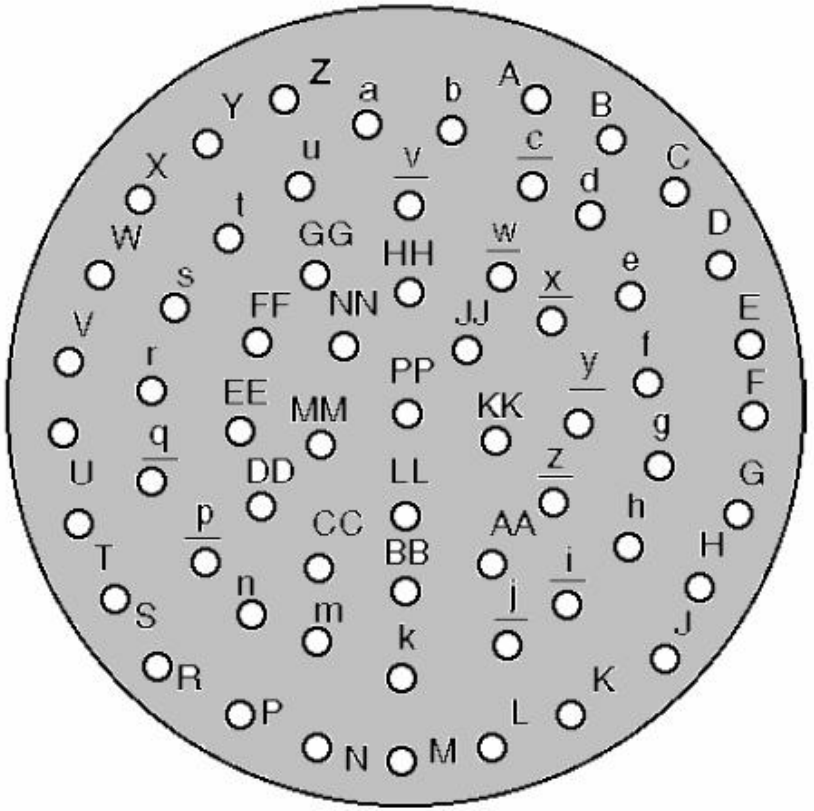




AS350B3/EC130B4 VE

VEMD Cannon Connector

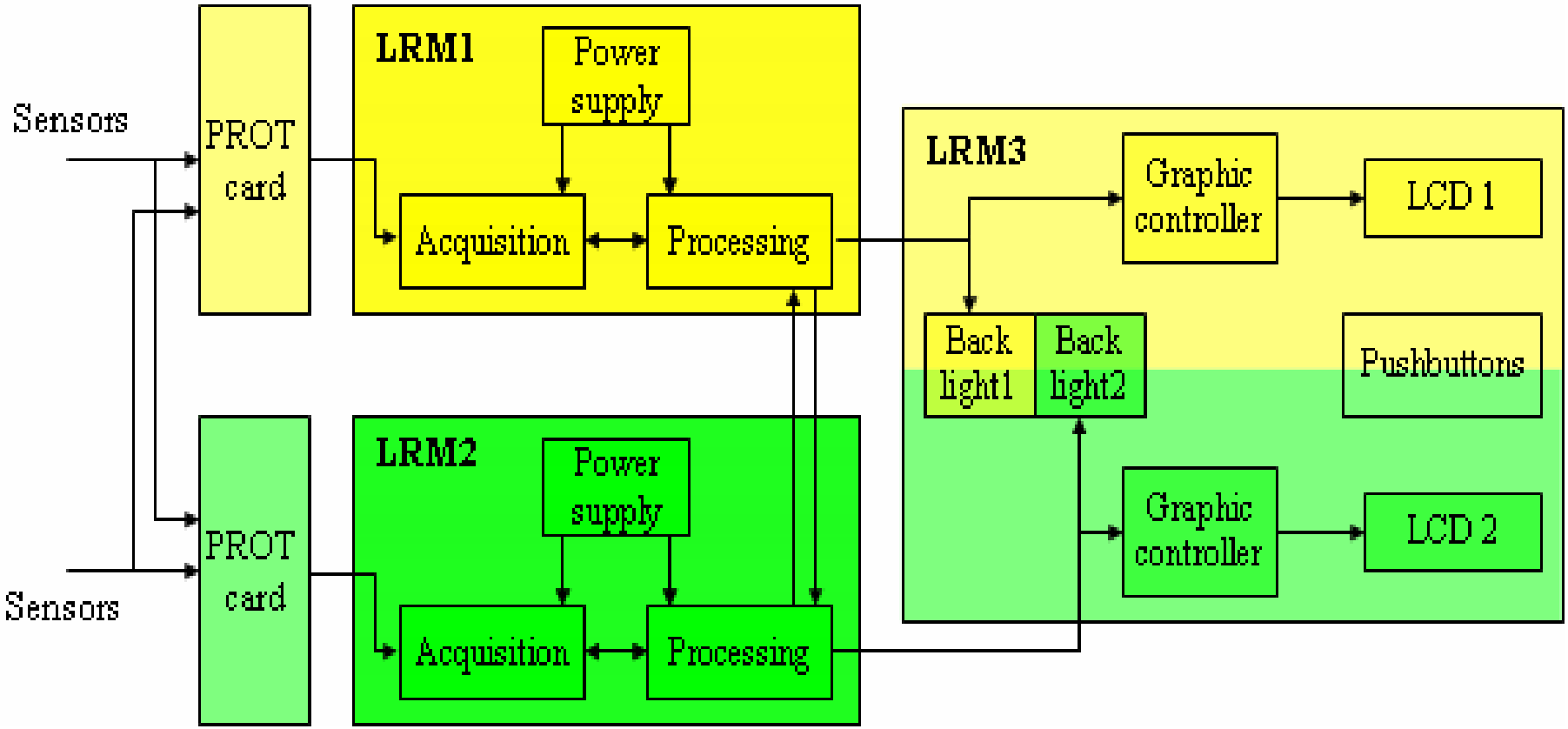
DRAWING CONNECTOR LABEL	FUNCTION	CONNECTOR STANDARD REFERENCE	CONNECTOR SPECIFIC REFERENCE
J1	I/O signals	MBL00R24C61P	-
J2	I/O signals	MBL00R24C61PW	-
J4	I/O signals	MBL00R24C61PX	-
J5	PO sensor	-	MS-33649-5 type



VEMD Block Diagram

HARDWARE BLOCK DIAGRAM :

The VEMD is composed of 3 modules : LRM1, LRM2 & LRM3.



Functional Description Continued - VEMD

VEMD controls

■ The VEMD front panel includes the following buttons:

- buttons OFF1 and OFF2: to turn on or to turn off the display screen of channel 1 and channel 2,
- buttons SCROLL and RESET: to display the screen pages of the current mode page,
- buttons SELECT, +, - and ENTER : to select, to modify and to validate a data field,
- buttons BRT: to modify the brightness of the screen.

Functional Description - VEMD

The VEMD (Vehicle & Engine Management Display) is installed on the instrument panel of the B3 or EC130 helicopter and designed to manage in function of the selected helicopter essential and unessential vehicle and engine data. - the display of vehicle parameters,

- - the display of engine parameters,
- - the computation and display of engine first limitation
- - the computation and display of weight related to performance data,
- - the display of engine performance checks,
- - the display of FADEC data,
- - the computation and display of the number of engine cycles.
- - includes built-in tests that help check its own operation and that of related avionic systems.

Displayed engine and airframe parameters:

– A rectangular cross-hatched flag : bleed valve open.
– "NG and DNG" :Ng and DNg (gas generator rating, deviation with respect to Ng at Max Take-Off Power in)
– "T4" : "T4" (free turbine input temperature).
– "TQ" : "TQ" (engine torque).
– "FLI" : First Limitation Indicator.
– "OAT" : Outside Air Temperature.
– "P2" : P2 air bleeding.
– "FUEL QTY" : Fuel quantity.
– "ENG OIL PRESS" : Engine oil pressure.
– "ENG OIL TEMP" : Engine oil temperature.
– "BUS" : Bus bar voltage.
– "GEN" : Generator current.
– "START" : Starter current.
– "FUEL F" : Fuel delivery and endurance. If optional fuel flow sensor is installed.
– "SLING" : Sling load (optional)

VEMD Sensor Data Acquisition

The CPDS will acquire numerical inputs and analog, discretes or frequential types sensor signals.
The following are the different types of inputs on the CPDS for Sensor Data.

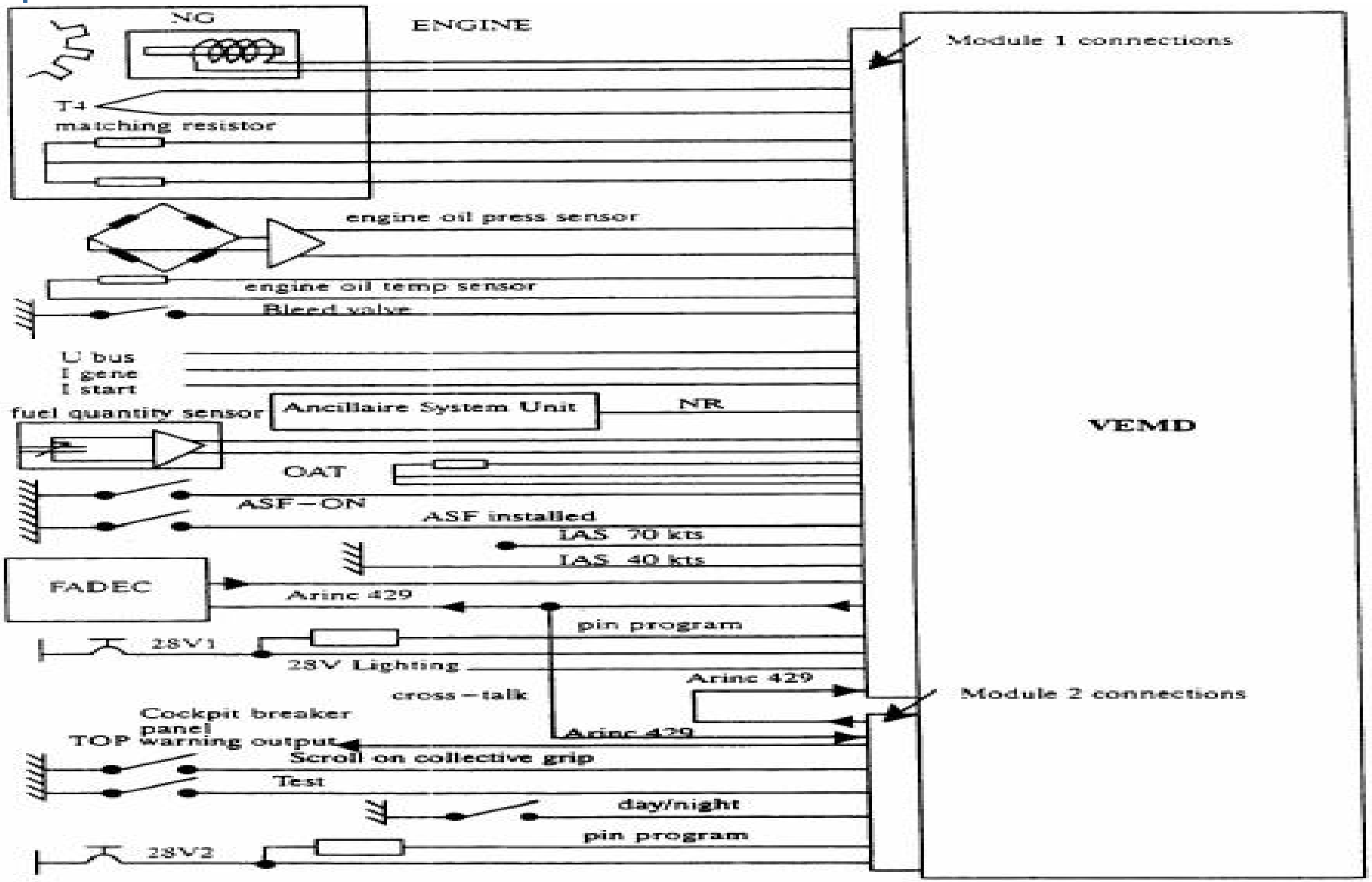
- 275 mV, 11.5 V, and 32 V for Analog
- Resistance (.5 or 1 mA)
- Frequential (Low Frequency or High Frequency -> 1 Hz to 30 KHz)
- Pressure
- Pulse Counting

The processing of analog, pulse counting, frequential parameters includes the following features:

- Software Filtering: Average of the 16 last values sampled
- Domain check: Values are checked for specified Range (Upper/Lower Limit)

- VEMD acquires reference voltages and calculates gains and offsets to be used for analog conversion correction.
- The analog parameters to be acquired are corrected of the temperature effects by using their corresponding gain and offset computed each 4 CPU cycles.
- Resistance inputs includes a rational fraction of resistance computation, and an interpolation regarding a standard table for parameter evaluation (IE Temperature).
- Frequential and Pulse Counting Data requires linear conversion to a physical unit.

VEMD System Interface



VEMD External Input Summary

The VEMD is able to acquire numerical inputs and analog, discretes or frequential types sensor signals. The following table gives the list of sensors and other external input signals handled by the VEMD. (SEE APPENDIX A for VEMD Interface Pin Tables)

Naming	SSS Ref [3]	Symbo Ref [4]	Algo Ref [5]	ICD Ref [11]	Type	Use
STARTC (*)	Start C	Start C			275 mV	Starter Current
GENC (*)	Gen C	Gen C	INTENS/I		275 mV	Generator Current
MARKLEVEL	Marking level			LIGHT-ING	32 V	Marking light control
BUSV (*)	Bus V	BUS VLT	U		32 V	Bus voltage
FQ	FQ	FQ		FQ	11.5 V	Fuel Quantity
EOP	EOP	EOP		EOP	11.5 V	Engine Oil Pressure
SLING	Sling load	SLING			11.5 V	Sling Load
NR	NR	NR	NR	NR	11.5 V	Rotor speed
EC130/B3	-			EC130/B3	11.5 V	Selection B3 or EC130
EOT	EOT	EOT		EOT	P10.5	Engine Oil Temperature
OAT	OAT	OAT	T0	OAT	P11	Outside Air Temperature
T4	T4	T4	T4	T4	Al/Cr	Temperature of Turbine
FFT	FFT			FF-RT	Resistor	Fuel Temperature
T4R1	R1			T4-R1	Resistor	T4 resistor 1
T4R2	R2			T4-R2	Resistor	T4 resistor 2
FF	Fuel Flow	FF		FF	LF	Fuel Flow
NG	NG	NG	NG	NG	HF	Engine Speed
HSPEED	High speed		BVIS40	HIGH SPEED	Discrete	High Speed
BACFAS	P2_ASF_P				Discrete	Sand filter operating
BLDVAL	Bld Val	BLD Val	BVADF		Discrete	Bleed valve
BACHT	P2-H				Discrete	Heating system operating
BPRFAS	ASF-M			ASF-M	Discrete	Anti Sand Filter Mounted
BIAS	IAS	IAS	BVIS70		Discrete	Indicated Air Speed
BACDM	P2_D				Discrete	Demisting system operating
DAY	-			DAY/ NIGHT	Discrete	Day or Night mode
NVG	-			NVG	Discrete	NVG mode
TEST	-			TEST	Discrete	Test external command
SCROLL	SCROLL	SCROLL		SCROLL	Discrete	Scroll external command

VEMD Internal Sensors

Naming	SSS Ref [3]	Symbo Ref [4]	Algo Ref [5]	ICD Ref [11]	Type	Use
P0	P0		P0		32 V	External Pressure
P0-T					32 V	Pressure Sensor Temperature
T4CJ					Temp	T4 Cold Junction Temperature

Internal sensors exist on the Left Module for:
P0 pressure
T4 cold junction temperature

Note: To make accurate measurements for T4, a technique known as cold junction compensation is used.
The signal produced by a thermocouple is a function of the *difference* in temperature between the probe tip (hot junction) and the other end of the thermocouple wire (cold junction).

ASU PCB No. 2 VEMD Related Functions

Acquisition and processing of the NR signal for the VEMD.

An electronic circuit transforms the A.C. signal transmitted by the NR sensor into a D.C. voltage, which is equal to the Main Rotor RPM, which can be used by the VEMD.

Characteristics of the output signal:

- 1 V D.C. from 0 to 40 rpm
- 10 V D.C. at 450 rpm

Accuracy: +/- 1.5 rpm from 300 to 450 rpm.

Filtering and matching of the optional sling load signal for the VEMD

The sling strain gage supplies an electrical signal, which is proportional to the sling load. This signal is filtered and matched by the electronic circuits of ASU 2 in order to be processed and displayed.

Power comes from the electrical master box to ASU2. A circuit on ASU2 adjusts the voltage by dividing the voltage by 6. Where 30 volts is equal to 5 volts going to the VEMD.

Note: (WDM 31-41-00-001)

The voltage read on the VEMD and the Electrical master box may be not the same. Adjust the generator voltage by measuring the voltage at the electrical master box.

VEMD INTERNAL OUTPUT SIGNALS

The software managed VEMD outputs comprise of ARINC429 crosstalk links, and the FLI warning discrete which is designated to trigger (ground=active) an audio system to signal an overlimitation of one of the main engine parameters.

VEMD Discrete Definition

- The VEMD will have various discrete inputs which will in most cases tell the VEMD the state of some component in the airframe (IE P2 Heater) or to activate a function of the VEMD (IE VEMD Test Screen.

- The VEMD should sense the voltage on each Discrete input to determine the state (open or closed) of each associated switch.

- When the circuit senses a low resistance or a specified low voltage , the current flow from the input should signify a "ground" state.

- When a higher voltage level is present or a greater resistance is presented at the input, little or no current should flow which should signify an “open” state.

- The "true" condition may be represented by either of the two states (ground or open) depending on the VEMD operational software.

- The logic sources for the Discrete Inputs to the VEMD often take the form of electrical switches/relays in the airframe.

- These relays/switches can either connect to the specific VEMD Discrete Input pins on the VEMD connector to airframe ground or leave them open circuit as necessary.

VEMD Discrete Input/Output

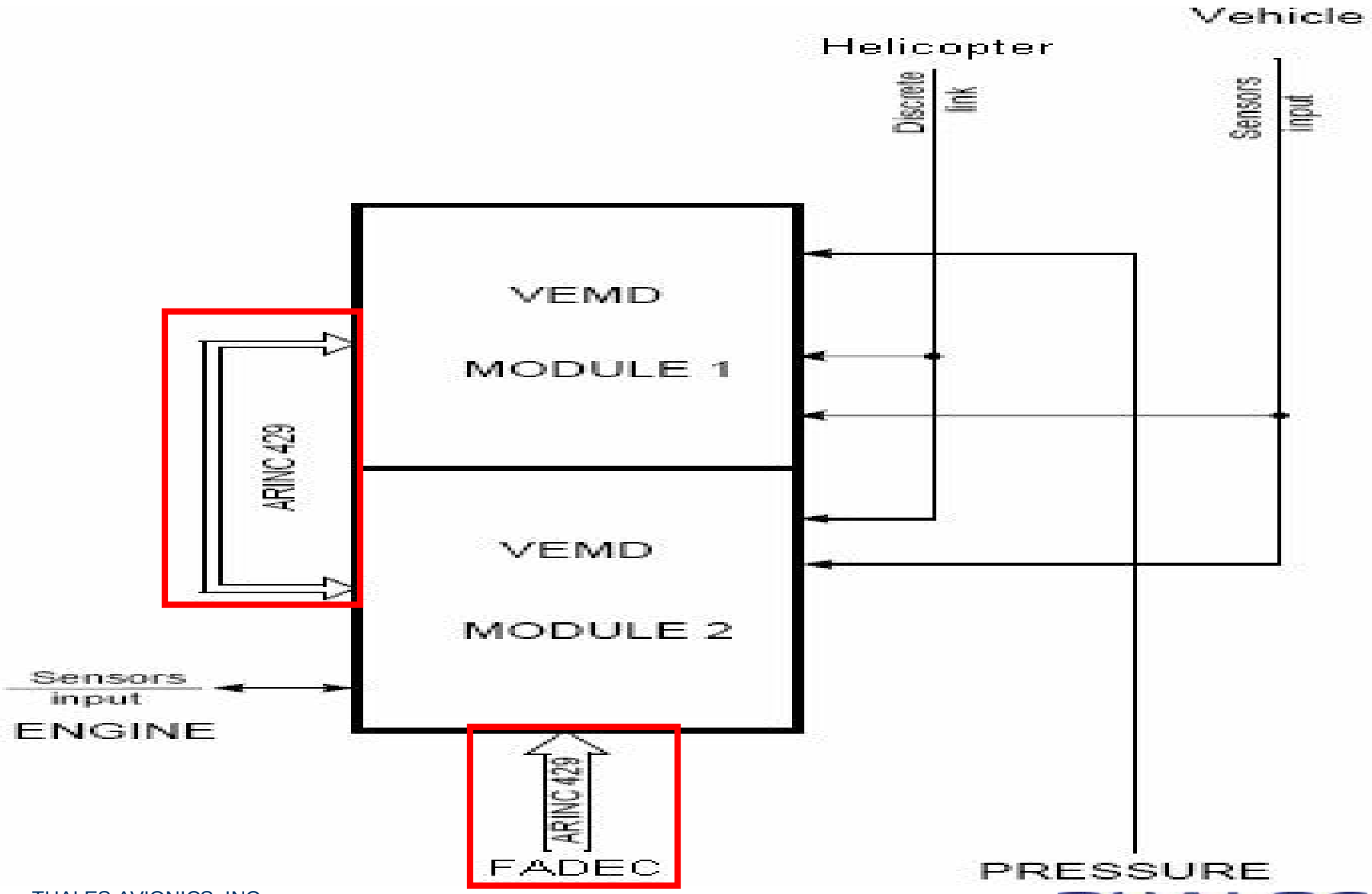
The VEMD has 16 discretes inputs, and 11 are used for the B3/B4 system.

The acquisition of the discretes are done without interruption and the results are stored in VEMD memory. (1 = True or On)

Naming	SSS Ref [3]	Symbo Ref [4]	Algo Ref [5]	ICD Ref [11]	Type	Use
HSPEED	High speed		BVIS40	HIGH SPEED	Discrete	High Speed
BACFAS	P2_ASF_P				Discrete	Sand filter operating
BLDVAL	Bld Val	BLD Val	BVADF		Discrete	Bleed valve
BACHT	P2-H				Discrete	Heating system operating
BPRFAS	ASF-M			ASF-M	Discrete	Anti Sand Filter Mounted
BIAS	IAS	IAS	BVIS70		Discrete	Indicated Air Speed
BACDM	P2_D				Discrete	Demisting system operating
DAY	-			DAY/ NIGHT	Discrete	Day or Night mode
NVG	-			NVG	Discrete	NVG mode
TEST	-			TEST	Discrete	Test external command
SCROLL	SCROLL	SCROLL		SCROLL	Discrete	Scroll external command

DISCRETE INPUT USE			
number	Use	number	Use
DISIN0	HSPEED =1 if discrete input HIGH-SPEED at level 0V	DISIN8	DAY = 1 if discrete input DAY/NIGHT in high impedance state
DISIN1	BACFAS = 1 if discrete input P2-ASF-P at level 0V	DISIN9	-
DISIN2	BLDVAL = 1 if discrete input Bleed valve at level 0V	DISIN10	TEST =1 if discrete input TEST at level 0V
DISIN3	BACHT = 1 if discrete input P2-H at level 0V	DISIN11	SCROLL= 1 if discrete input SCROLL at level 0V
DISIN4	BPRFAS = 1 if discrete input ASF-M at level 0V	DISIN12	-
DISIN5	BIAS = 1 if discrete input IAS at level 0V	DISIN13	-
DISIN6	BACDM = 1 if discrete input P2-D at level 0V	DISIN14	-
DISIN7	NVG =1 if discrete input NVG at level 0V	DISIN15	-

VEMD ARINC 429 Interface



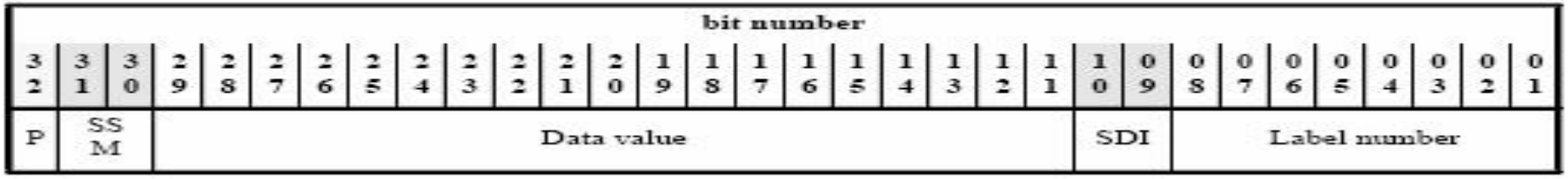
Technical Description

- ARINC 429 is a two-wire data bus that is application-specific for commercial and transport aircraft.
- The connection wires are twisted pairs.
- Words are 32 bits in length and most messages consist of a single data word.
- Standard ARINC 429 specification defines the electrical and data characteristics and protocols.
- ARINC 429 uses a unidirectional data bus standard (Tx and Rx are on separate ports) known as the Mark 33 Digital Information Transfer System (DITS).
- Messages are transmitted at either 12.5 or 100 kbit/s to other system elements that are monitoring the bus messages. The transmitter is always transmitting either 32-bit data words or a NULL state.

ARINC 429 Word Format

ARINC 429 Word Format
Each ARINC word is a 32-bit value that contains five fields:
Bit 32 is the parity bit, and is used to verify that the word was not damaged or garbled during transmission.

- **Bits 30 to 31 is the Sign/Status Matrix, or SSM, and often indicates whether the data in the word is valid.**
  - **OP (Operational) - Indicates the data in this word is considered to be correct data.**
  - **TEST - Indicates that the data is being provided by a test source.**
  - **FAIL - Indicates a hardware failure which causes the data to be missing.**
  - **NCD (No Computed Data) Indicates that the data is missing or inaccurate for some reason other than hardware failure. For example, autopilot commands will show as NCD when the autopilot is not turned on.**
  - **The SSM can also indicates the Sign (+/-) of the data or some information related to it like an orientation (North/South/East/West).**
- **Bits 11 to 29 contain the data. Bit-field, Binary Coded Decimal (BCD), and binary encoding (BNR) are common ARINC 429 data formats. Data formats can also be mixed.**
- **Bits 9 and 10 are Source/Destination Identifiers (SDI) and indicate for which receiver the data is intended or more frequently which subsystem transmitted the data.**
- **Bits 1 to 8 contain a label (label words), expressed in octal, indentifying the data type.**



FADEC ARINC Labels

The VEMD is able to acquire data via ARINC labels from the FADEC.

Naming	SSS Ref [3]	Symbo Ref [4]	Algo Ref [5]	ICD Ref [11]	Type	Use
FFFAD	FF Fadec		-		ARINC	Fuel Flow from FADEC
NFCYCTFAD	CT4		-		ARINC	Total NF cycles from FADEC
NGCYCTFAD	CT3		-		ARINC	Total NG cycles from FADEC
NFFAD	NF	NF	NF NFFAD		ARINC	NF from FADEC
NGFAD	NG		NGFAD		ARINC	NG from FADEC
NGMCFAD	NG PMC		NGMC-FAD		ARINC	NG PMC from FADEC
NGMDFAD	NG PMD		NGMD-FAD		ARINC	NG PMD from FADEC
T4FAD	T4		T4FAD		ARINC	T4 from FADEC
TRQFAD	TRQ	TRQ	CPFAD		ARINC	Torque from FADEC

FADEC Parameters

Delta NG

- FADEC calculates the NG limits and transmits them to Lane 1 and 2 which checks their validity.
- Each VEMD calculation lane then calculates the actual limits. (According to the Electrical power drain and PO)
- Each VEMD models calculates Delta NG from the NG and NG limits.
- If both VEMD lanes do not agree, then Delta NG is displayed with a fail symbol.
- The NG will be displayed with fixed limits.
- If lane 1 Fails or switch off these parameters are displayed with a fail symbol.

Fuel Flow

- FADEC transmits these parameters to Lane 1 only and checks their validity (if A/C is not equipped Fuel Flow equipped, and Fuel Flow is set to N/I in configuration options).
- Fuel Endurance is calculated from Fuel Flow.
- It the parameters are not valid or Lane 1 fails or switch off these parameters will be displayed with a fail symbol

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Section 3 - VEMD Aircraft Configuration

CPDS Phases of Operation

- There are 3 phases corresponding to 3 modes ...

GROUND PHASE

Ground Status:
VEMD detects Engine Stop

● **CONFIGURATION mode**

FLIGHT PHASE

Start status:
Ng is between 10 % and 60 %.
FLIGHT status:
Ng is higher than 60 %

● **FLIGHT mode**

SHUTDOWN PHASE

GROUND status:
Ng is lower than 10 % and NR lower than 70 RPM

● **MAINTENANCE mode**

VEMD Mode Logic

On the VEMD, the distinction between FLIGHT and End of Flight status are determined by the following parameters:

- Engine start (rpm rise): Ng is between 10 % and 60 %.
- FLIGHT Status: Ng is higher than 60%.
- Restart: After Flight Status has occurred, Ng is between 10 % and 60 %.
- End of Flight: NG drops below 10 % and NR is lower than 70

These statuses either authorize or do not authorize some operating modes of the VEMD; they also allow some pages to be displayed automatically:

– In the "FLIGHT" mode, the "FLI" page will appear automatically and will be displayed only if the VEMD detects the "flight" status.
– In the "FLIGHT" mode, the "FLIGHT REPORT" page will be displayed as soon as the VEMD detects an engine stop after a "flight" status phase.
– The "MAINT" and "CONFIG" modes will only be accessible when the VEMD detects the "engine stop" status.

rpm.

Initiating Configuration Mode - VEMD

The CONFIGURATION mode can only be activated when the engine is detected in the « ground » state.

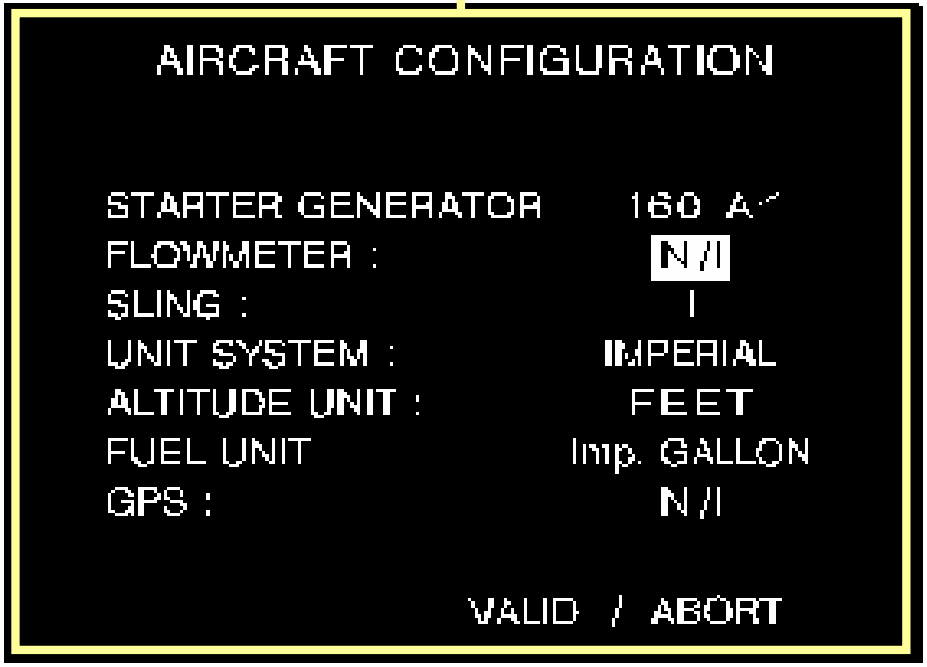
To access to this mode:

1. turn off the VEMD,
2. turn on the VEMD,
3. depress SELECT and ENTER keys simultaneously (keep depressed),
4. keep the SELECT and ENTER keys depressed until the message

   “RELEASE KEYS” appears.

To switch from the CONFIGURATION mode to the FLIGHT mode the VEMD must first be switched off then switched on.

Aircraft Configuration



AIRCRAFT CONFIG

This page lists the optional equipment items that have an influence on the VEMD applications; it also allows selecting the units displayed.

The options provided for are:

- **160A or 200A Starter Generator**
- **FUEL FLOWMETER**
- **"SLING"**
- **"GPS" (Post -04 VEMD Version: GPS enables all the data unloaded from the VEMD in "MAINT" mode to be dated).**

- possibility to change unit of measure system (a)

- possibility to change altitude unit

If the options are declared to be installed when they are not fitted on the helicopter, the VEMD detects a fault on the installation (IE FLOWMETER).

(a) Note: see on next page the SI and IMPERIAL systems of measure units.

N/I = Not Installed

Parameter Metrics - VEMD

Unit of measure system: SI (International System) or IMPERIAL

	SI	IMPERIAL
Altitude:	m	Ft
TOT, EOT:	°C	°C
NG, TRQ:	%	%
Temperature:	°C	°F
Fuel quantity:	Kg	lb
Weights:	Kg	lb
Hour:	h	h
Minute:	mn	mn
Second	s	s
Electrical resistance:	W	W
Flowrate:	Kg/h	lb/h
Electrical current:	A	A
Electrical voltage:	V	V
Rotation:	tr/mn (RPM)	tr/mn (RPM)
Pressure (EOP):	bar	Psi
Speeds:	Kts	Kts

Section 4 - VEMD Power-Up Sequence

Functional Description – VEMD Power-Up

- The VEMD is energized by the presence of the 28V across the equipment terminals
- When the VEMD is switched on the switch-on self test (PBIT - Power-up Built-in Test) is activated - regardless of whether the VEMD is in GROUND or FLIGHT status .
- The internal self test functionally tests the VEMD hardware and software.

During the initialization phase:

-the message <TEST IN PROGRESS> is displayed, in white, on the screens.

- if the BIT (Built-In Test) is OK, the equipment are automatically switched in operational mode.

CPDS Power Up Procedure Continued

If the BIT is not OK, two cases must be considered:

• **Lane 1 unavailable**:

- the lane 1 displays the <LANE FAILED> red message.
- the lane 2 displays the <LANE 1 FAILED> <PRESS OFF1> yellow message.

The equipment shall remain in this state until the crew members depress the OFF1 button. Pressing OFF1 shall validate the built-in tests and switch lane 2 to operational mode, and shut down lane 1.

• **Lane 2 unavailable**:

- the lane 2 displays the <LANE FAILED> red message.
- the lane 1 displays the <LANE 2 FAILED> <PRESS OFF2> yellow message.

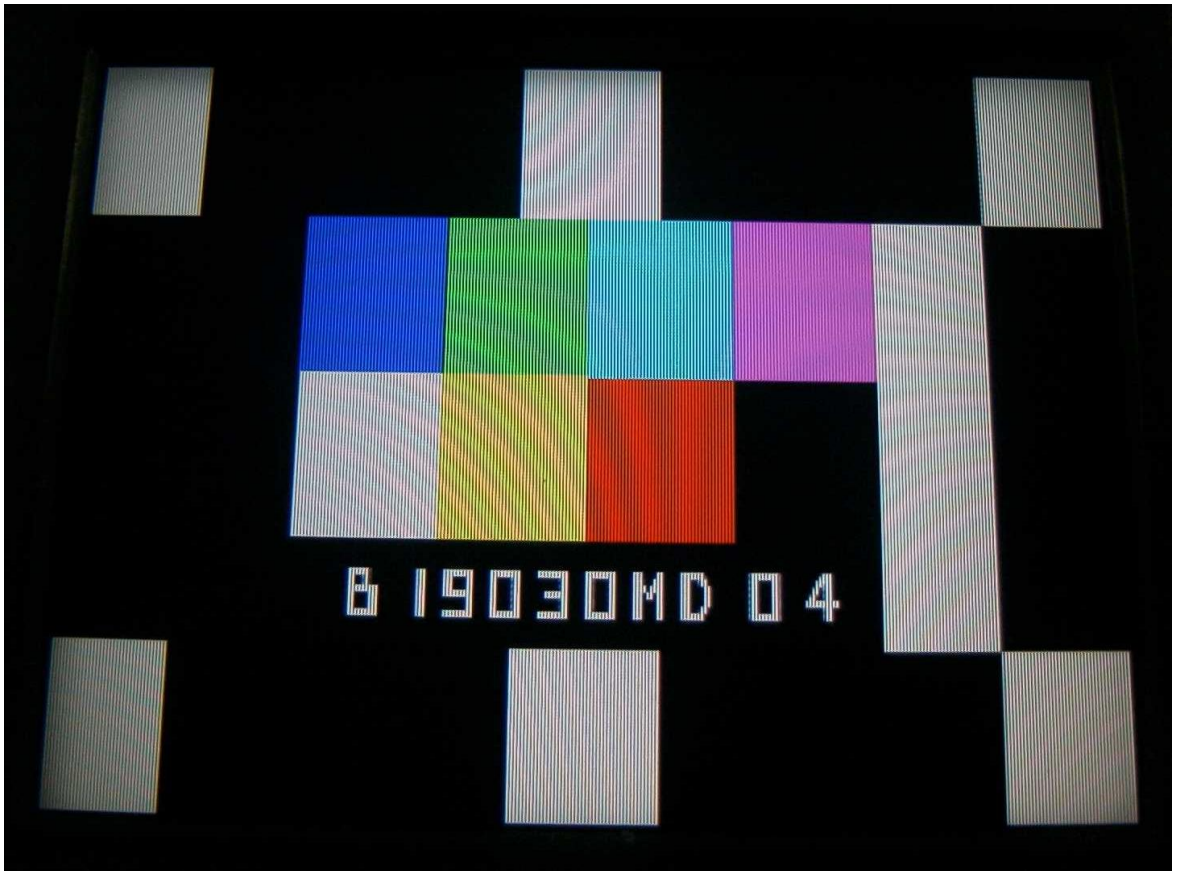
The equipment shall remain in this state until the crew members depress the OFF2 button. Pressing OFF2 shall validate the built-in tests and switch lane 1 to operational mode, and shut down lane 2.

At power up, a screen is detected as failed if it is black.

VEMD Test Pattern

The crew may activate the VEMD Test Pattern to check the VEMD screens.
This pattern can only be activated on ground.
The page is displayed on both screens and includes :

- Rectangles of different colours.
- A "version equipment" message zone.



CONFIG DIFFERS MESSAGE

After start-up of the VEMD, if the message "Config Differs ---> Maintenance" is shown:

- Differences between the external configuration data of each of the VEMD calculation modules may exist. (aircraft configuration).

- The data can be harmonized at the **TRANS RESET** submenu.

- Access "MAINT mode", "TRANS RESET" function to transfer the external configuration data contents from one of the modules to the other module.

SELECTION INPUT DEFAULT Message

A specific pin program made with two analog inputs (one for lane 1 and one for lane 2) allows selection of aircraft type (B3 or B4).

In case of discrepancy between both analog input signals, the lane which have detected the default displays a black page with message: "LANE X FAIL -- > PRESS OFF X" followed by message: "SELECTION INPUT DEFAULT".

If the 2 values are <= 1V or unconnected: B3 AIRCRAFT is selected

If the 2 values are > 1V EC130 AIRCRAFT is selected

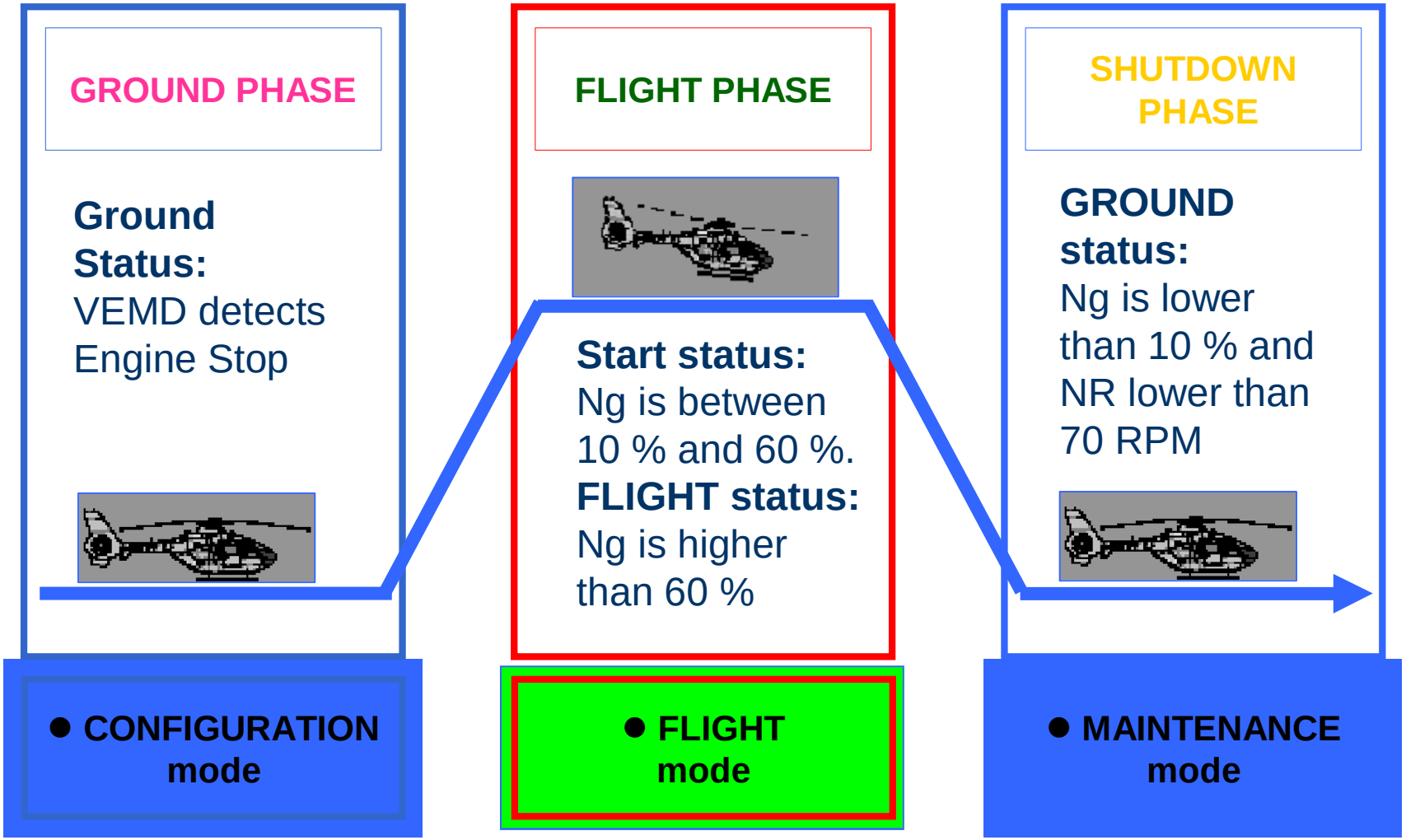
If the 2 values differ > 1V and the other <= 1V or invalid ”SELECTION INPUT DEFAULT“ is displayed.

If the VEMD displays « SELECTION INPUT DEFAULT » on both screens, a functional check of the wiring should be made (see WDM 31-61-00-001).

Section 5 – VEMD Flight Mode

CPDS Phases of Operation

- There are 3 phases corresponding to 3 modes ...



Flight Mode –> VEMD

The "FLIGHT" mode monitors and manages the helicopter's performances; it is activated once the initialization tests have been completed.
Should both lanes be operational, the following pages are accessible automatically:
"Engine stop or start" status
– "ENGINE" page.
– "VEHICLE" page.
"Flight" status
– "FLI" page.
– "VEHICLE" page.
"stop" (flight completion) status
– "ENGINE" page.
– "FLIGHT REPORT" page.
The pages available manually are:
– "ENGINE POWER CHECK" page.
– "PERFORMANCE" page.

AS350B3/EC130B4 Flight Manual will be best reference for Flight Mode operation.

VEMD Modes of Operation

- **Engine Stop or Start**
- **Flight**
- **Flight Completion**

VEMD Flight Parameters

	Parameter Increment
Fuel flow	3 Gal US/hr
	2 lbs/hr
Fuel Quantity	2 lbs
	3 Gal US
Digital NG	0.1%
T4	5 C
TQ	0.5%
Engine oil temp	1 C
Engine oil pressure	0.1 bar or 1 PSI
Voltage	0.2 V
Current	5 Amps
OAT	0.1 C or 0.2 F
Sling Load	1 KG or 2 lbs
Altitude	5 M or 10 FT
Flow Meter	1 Kg/H

VEMD Channel 1/2 Failure

The following functions are not available when only one lane is operating:

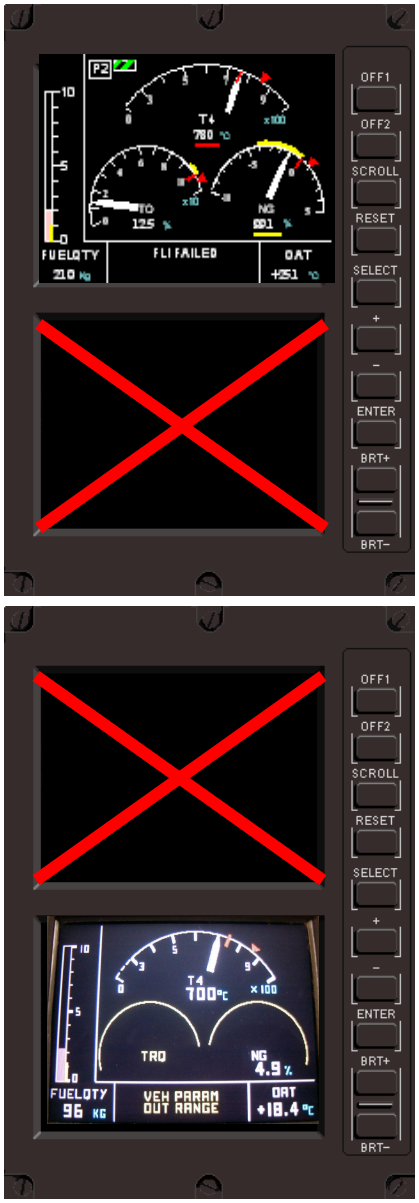
– "FLI" function (the FLI page is replaced by the "3 informations" page),
– "Engine Power Check" function,
– "NG and NF cycles calculation" function.
– “Performance Calculation” function.

When only lane 2 is operating (lane 1 failed or switched off), the "3 informations" page is displayed on the lower screen and the following parameters are displayed with a failure symbol:

– TQ (name of the parameter and the graduated sector in yellow color),
– DELTA NG (graduated in yellow color).

The value of the following parameters will be displayed:

– NG (value in measured by the VEMD),
– T4 temperature (measured by the VEMD),
– fuel contents,
– and the other parameters normally displayed on the "3 informations" page (except for TQ, DELTA NG, FF and RT).



Engine Page (Start) – Function Description

The "ENGINE" page displays the primary engine parameters and limitations as three separate indicators:

- **"T4" in degrees**
- **"TQ" in %**
- **"DNG" and "NG" in %.**

The VEMD displays different T4 limitations between the engine start status and the flight status. Refer to the Flight Manual, for a detailed description of the limitations.

The "ENGINE" page also displays:

- **the total fuel contents remaining as a digitized value and on gauge**
- **the status of the bleed valve**
- **the OAT reading**
- **the "P2" air bleed**
- **a message area that displays messages intended for the crew.**

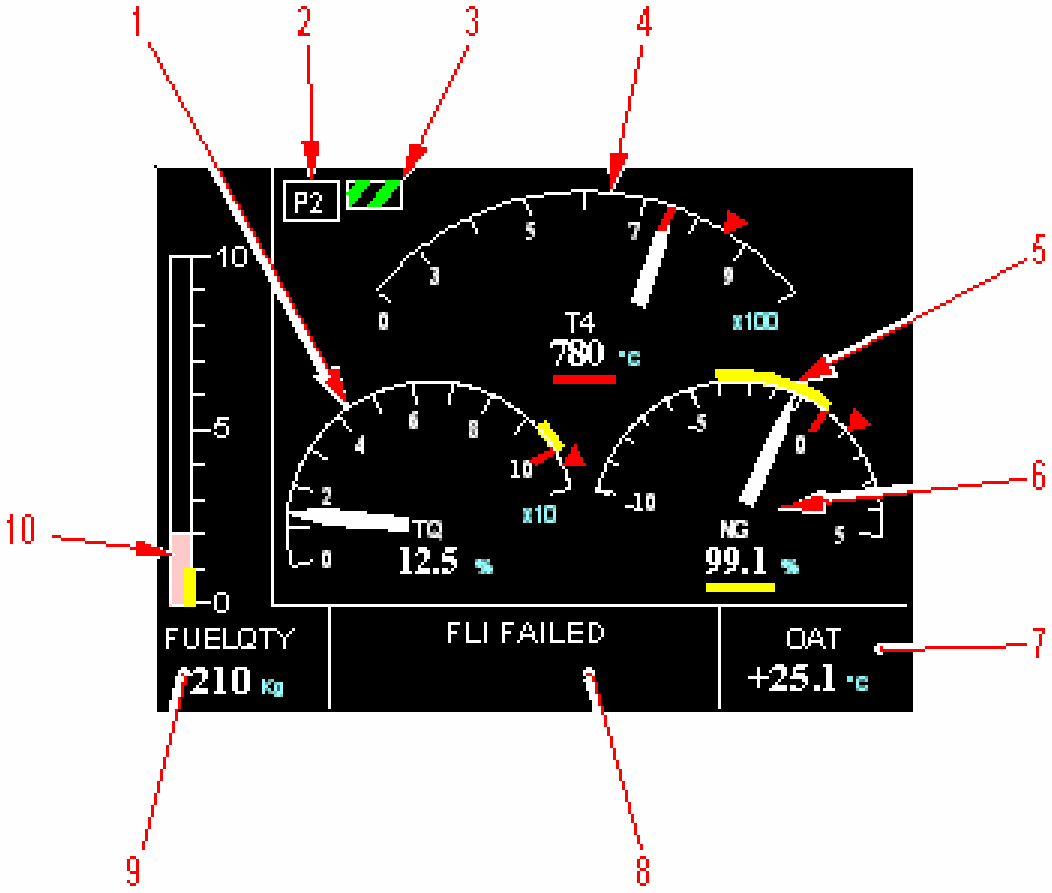
Engine Page (Start) – Function Description

- To correct the "T4" value, the VEMD measures the value of the two correction resistors located in the engine's conforming unit.

Pre -04 VEMD Version: "T4" is corrected upon initialization.
Post -04 VEMD Version: "T4" is corrected only when "T4" > 100°C.

- The TQ value is sent by the FADEC to the VEMD,
- NG limits are computed by the FADEC and sent to the VEMD which adjusts according to the electrical power supplied by the generator and the P0 VEMD internal sensor.

Engine Page (Start) – Flight Operation



1. TQ Indication
2. P2 air bleed indication
3. Status of bleed valve
4. T4 Indication
5. Delta NG Indication
6. NG Indication
7. OAT Indication
8. Message Area
9. Digital FQ Display
10. FQ Gauge

Failure Messages in "FLIGHT" Mode, "ENGINE" Page

The detection of a fault can generate the display of the following messages in a decreasing sequence of priority:

– "LANE 1 FAILED ->PRESS OFF 1 / LANE 2 FAILED -> PRESS OFF 2": These messages are displayed when the VEMD detects a significant failure in a module. As it fails the lane considered switches off the screen it controls (top screen for lane 1 module and bottom screen for lane 2 module). The "ENGINE" page is then displayed on the available screen.

– "VEH PARAM OVER LIMIT" (Pre -04 VEMD Version) or "VEH PARAM OUT RANGE" (Post -04 VEMD Version) : This message is displayed whenever a parameter normally displayed in the "VEHICLE" page reaches a yellow or red limitation, whereas the "VEHICLE" page is not shown on either screen (Refer to Flight Manual for a description of the limitations).

The engine oil temperature and pressure, battery temperature and battery/generator voltage and current are also taken into account here.

– FLI FAILED : The first limitation cannot be calculated because one of the:

. FADEC NG value is not valid,

. FADEC T4 value is not valid,

. FADEC NF value is not valid,

. P0, T0, NG parameters measured by the VEMD is not valid.

– FLI VALID -> PRESS RESET : The "FLI" function becomes valid again after failure. This message reports that the FLI page can be displayed again; it is erased once the RESET key has been pressed and the FLI page is displayed again.

– FLI FAILED -> CHECK PARAM : This message is displayed when:

. the difference between the NG value measured by the VEMD and the FADEC NG value is more than 1.5 %,

. the difference between the T4 values measured by the FADEC and the VEMD is more than 20°C (68°F),

. The difference between the FADEC TQ value and the mathematic engine model torque result must be between - 10 and + 15 without sand filter, and - 10 and + 12 with sand filter fitted.

Failure Messages in "FLIGHT" Mode, "ENGINE" Page

– CROSSTALK FAILED -> PRESS OFF2 : This message is displayed whenever a lane detects an invalidity of the inter-lane CROSSTALK line and parameter difference checks cannot be performed. This message is erased when the operator switches off the lane considered faulty.

– BRT CNTRL FAILED : This message is displayed whenever the BRT+ or BRT- switches are considered faulty. It is displayed for 30 sec. after the fault has been detected and then erased; it shall be displayed again if one of the BRT keys is pressed.

– "OVERLIMIT DETECTED" (Post -04 VEMD Version): This message is displayed when an overlimit is recorded. It will disappear during the next flight when NG > 40 %.

– "GPS NOT AVAILABLE" (Post -04 VEMD Version): This message is displayed when the optional GPS has been declared in the "CONFIG" mode but has not been detected by the VEMD. (Message is normal on ground because GPS is not active)

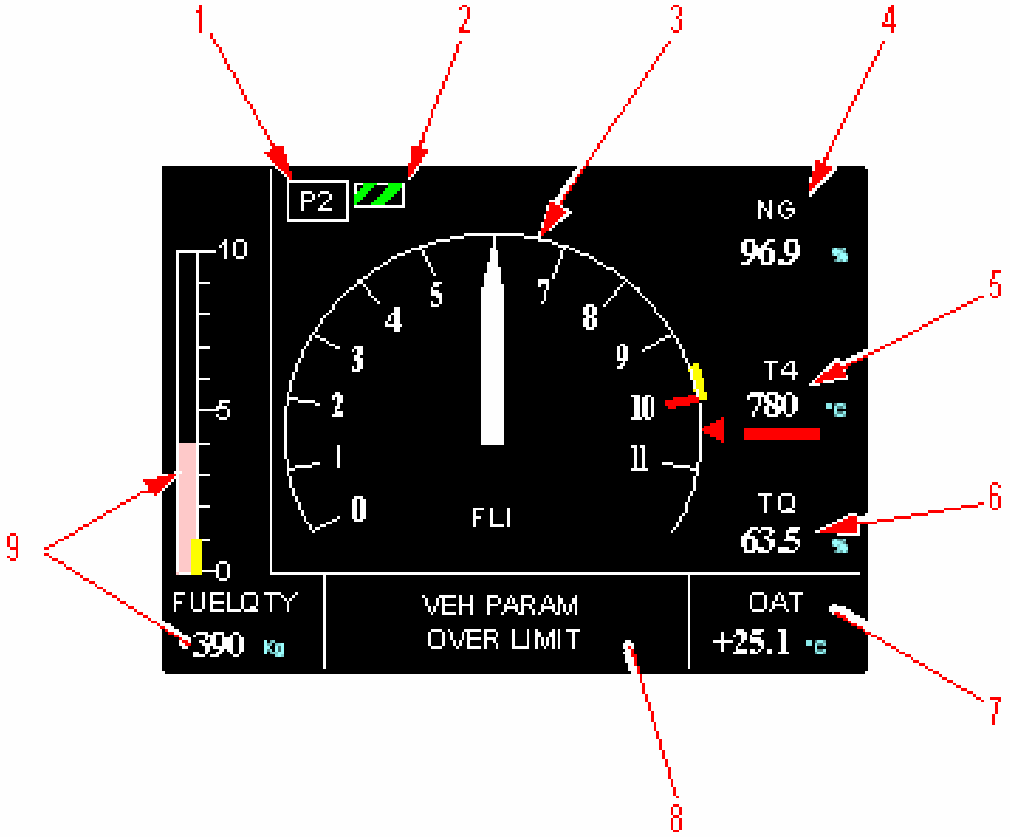
- “Loss of Parameters” - The loss of a parameter as a failure is detected involves a symbology change (Parameter value and unit erased, scale color change, graduations removal).

First Limit Indicator (FLI) Function Description

- The FLI is the margin between the pilot power request and the first present limitation (NG, T4, or TQ).
- The VEMD displays the "FLI" page when it detects the "flight" status.
- The VEMD monitors the "FLI" by analyzing the coherence of the three parameters (NG, T4, TQ).
- Therefore the pilot only has to observe the limits on the FLI scale and not consider the limits for each separate parameter.
- "NG" "T4" and "TQ" as values are converted into a common "FLI" reading comprised between 0 and 10.8.

NOTE: Refer to the Flight Manual for a detailed description of the limitations.

First Limit Indicator (FLI) Function Description



1. P2 air bleed indication
2. Status of bleed valve
3. FLI Dial
4. NG Indication
5. T4 Indication
6. TQ Indication
7. OAT Indication
8. Message Area
9. Digital FQ Display, FQ Gauge

Failure Messages in "FLIGHT" Mode, “FLI" Page

– "LANE 1 FAILED -> PRESS OFF 1 / LANE 2 FAILED -> PRESS OFF 2".

– "ENG PARAM OVER LIMIT" (Pre -04 VEMD Version) or "ENG PARAM OUT RANGE" (Post -04 VEMD Version): This message is displayed whenever a parameter normally displayed on the "ENGINE" page reaches a yellow or red limitation, whereas the "ENGINE" page is not shown on either screen. Included here are the DNG, NG, T4 and TQ parameters.

– "CROSSTALK FAILED -> PRESS OFF2".

– "BRT CNTRL FAILED".

– "GPS NOT AVAILABLE" (Post -04 VEMD Version).

– Loss of Parameters:

- A. The loss of the first limitation indication or one of the NG, T4, TQ parameters involves the automatic display of the "ENGINE" page.

  B. The loss of the parameter concerned is thus clearly indicated on the "ENGINE" page with a "FLI FAILED" message.

  C. As far as the other parameters are concerned, their loss Involves a symbology color change, the removal or their value and unit and the graduations.

VEHICLE Page Function Description

The "VEHICLE" page displays:
– Engine Oil temperature and
– Engine Oil Pressure pressure
(EOP and EOT limitations also)
– Current provided by the generator or consumed by the starter,
– BUS bar voltage
– Message area
– Fuel flow rate value (FF)
– Flight time remaining (END)

This Fuel Flow/END is provided by the engine metering value, if the flowmeter is declared not installed (N/I) on the "AIRCRAFT CONFIGURATION" page.
It may also be provided by an optional flowmeter in which case a flow unit must be selected on the "AIRCRAFT CONFIGURATION" page, under "FUEL FLOW".

– "LANE 1 FAILED -> PRESS OFF 1 / LANE 2 FAILED -> PRESS OFF 2".

– "ENG PARAM OVER LIMIT" (Pre -04 VEMD Version) or "ENG PARAM OUT RANGE" (Post -04 VEMD Version): This message is displayed whenever a parameter normally displayed on the "ENGINE" page reaches a yellow or red limitation, whereas the "ENGINE" page is not shown on either screen. Included here are the DNG, NG, T4 and TQ parameters.

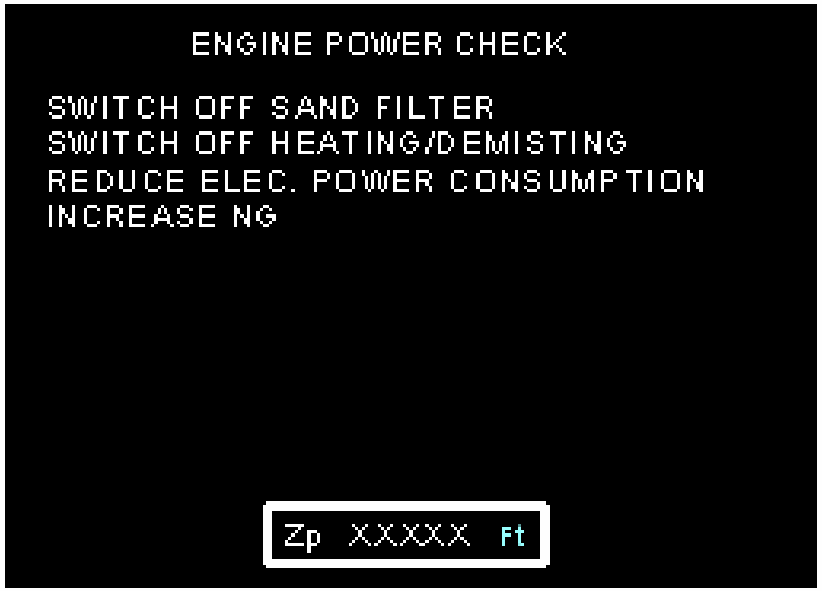
– "CROSSTALK FAILED -> PRESS OFF2".

– "BRT CNTRL FAILED".

– "GPS NOT AVAILABLE" (Post -04 VEMD Version).

– The loss of a parameter involves a symbology change (parameter value and unit removal, scale color and parameter name change, graduations removal).

Engine Power Check – Function Description

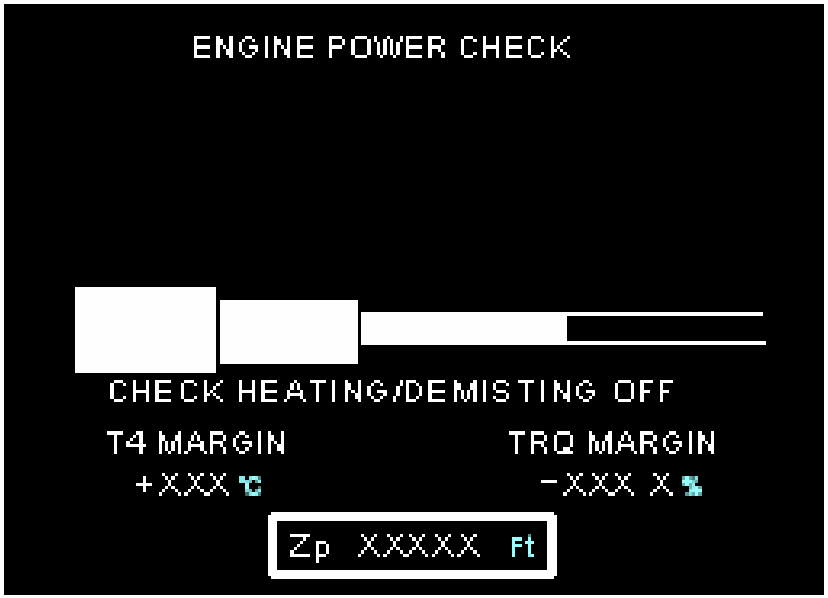


The "Engine Power Check" (EPC) function is activated by pressing on the "SCROLL" button.

The "ENGINE POWER CHECK" page is then displayed.

- **On this page, the VEMD shows the conditions to be respected for beginning an EPC.**
- **Each condition requires an action by the pilot. Once this action is performed, the line disappears.**
- **When all the conditions are satisfied, the EPC is conducted automatically.**

Engine Power Check – Function Description



The "ENGINE POWER CHECK" page then shows:

– an hourglass which fills as the EPC progresses.

– the altitude information Zp calculated using static pressure Ps.

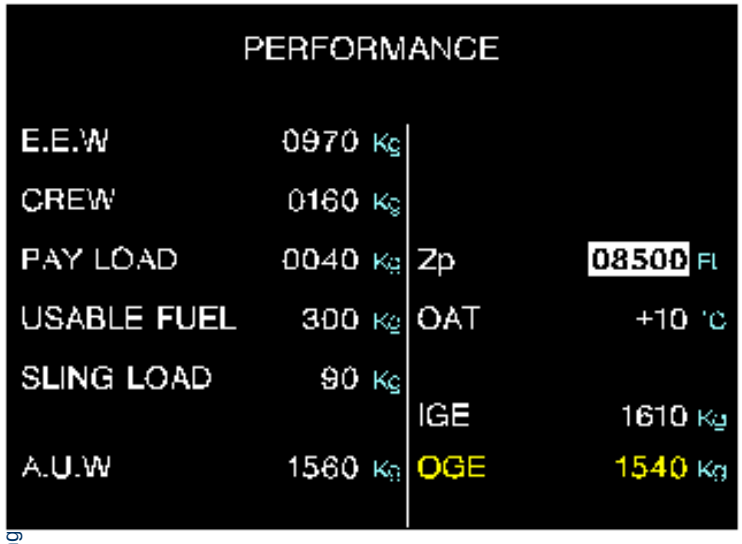
- The VEMD checks that the parameters required to calculate the EPC are stable for a period of 20 seconds, then orders the FADEC to execute the EPC.
- The FADEC performs the EPC and sends the results to the VEMD which adjusts the T4 and TQ margins as a function of P0, T0, IAS and whether a sand protection filter is fitted or not.
- Post -04 VEMD, if the FADEC sends the information EPC not valid to the VEMD, the message "EPC NOT VALID" is displayed on the screen.

Engine Power Check – Function Description

"ENGINE POWER CHECK RESULT" page displays on the screen.

- This page gives the T4 and TQ margins with a "BAD" or "GOOD" symbology depending on the circumstances.
- It also shows the values of the parameters which were used in the computation (NG, T4, TQ, NF, Zp, OAT).
- Pressing the "RESET" button during the EPC procedure causes the procedure to stop and display the nominal configuration.
- Pressing the "SCROLL" button during the EPC procedure causes the procedure to stop and permits the equipment to go to the following page.
- If one of the parameters required for the calculation is invalid, the VEMD displays the message: "EPC NOT AVAILABLE" - > "PRESS RESET".
- The EPC can only proceed when both calculation lanes are operational.

Performance Page – Function Description

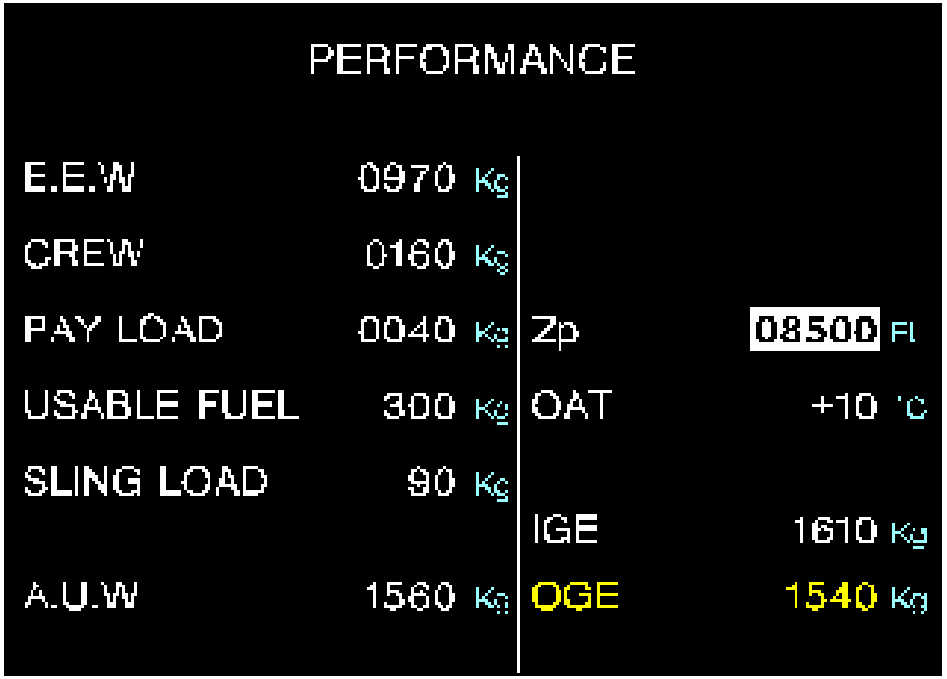


- The performance calculation function is activated as the SCROLL push-button is pressed (see AMM 31-61-00 for more details).
- Both calculation channels must be operational for the performance calculation function to be activated.
- As the "PERFORMANCE" page is displayed the status of adjustable fields corresponds to the data previously entered. The IGE or OGE values are displayed in yellow when they are lower than AUW.
- Whenever parameters are not available in the "USABLE FUEL" or "SLING LOAD" fields, the field "USABLE FUEL" or "SLING LOAD" is in yellow.

The AUW field is in yellow too and will not take the unavailable parameter in its calculation.

- Should one of the parameters (OAT or "Zp"(Hp)) be invalid, the IGE and OGE weight calculations are not performed. Only the sum of weights (AUW) is calculated.
- The message "PERFORMANCE NOT AVAILABLE" is displayed at the top of the PERFORMANCE page (can be displayed there is an issue with P0 or one of the lanes are off).

Performance Page – Function Description



Note: The minimum default weight of crew is 80 kg and the weight values entered during the last flight are memorized.

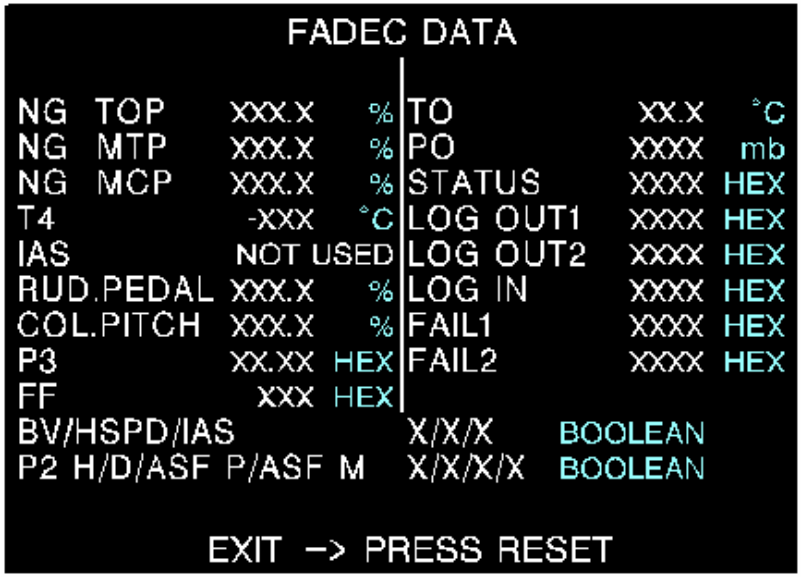
Parameters acquired by the VEMD:

- **USABLE FUEL weight**
- **Optional SLING LOAD**

The "performance calculation" calculates the following:

- **Max take-off weight in ground effect IGE and the maximum weight out of ground effect OGE from the following parameters acquired by the VEMD:**
  - **a. Pressure Altitude "Zp" (Hp) (calculated from the static pressure P0 measured by the VEMD.**
  - **b. OAT**
- **It is possible to modify the "Zp" (Hp) and OAT values in order to calculate anticipated IGE and OGE weights.**
- **The VEMD computes the maximum all-up weight (AUW) as a function of the following parameters entered by the pilot:**
  - **a. Empty Equipped Weight (EEW)**
  - **b. CREW weight**
  - **c. PAY LOAD**

FADEC Data Page – Function Description



- The "FADEC" message display function can only be activated if the "FLI" or "ENGINE" pages are displayed.
- Depressing the "SELECT" button permits the activation of this function.
- A special symbology in the message area reveals that the function is activated.
- Depressing the button "+" or "-" scrolls the output FADEC: FADEC failures, P0, T4, P3, NF, NG, discrete outputs data.
- Depressing the "SELECT" button deactivates this function.

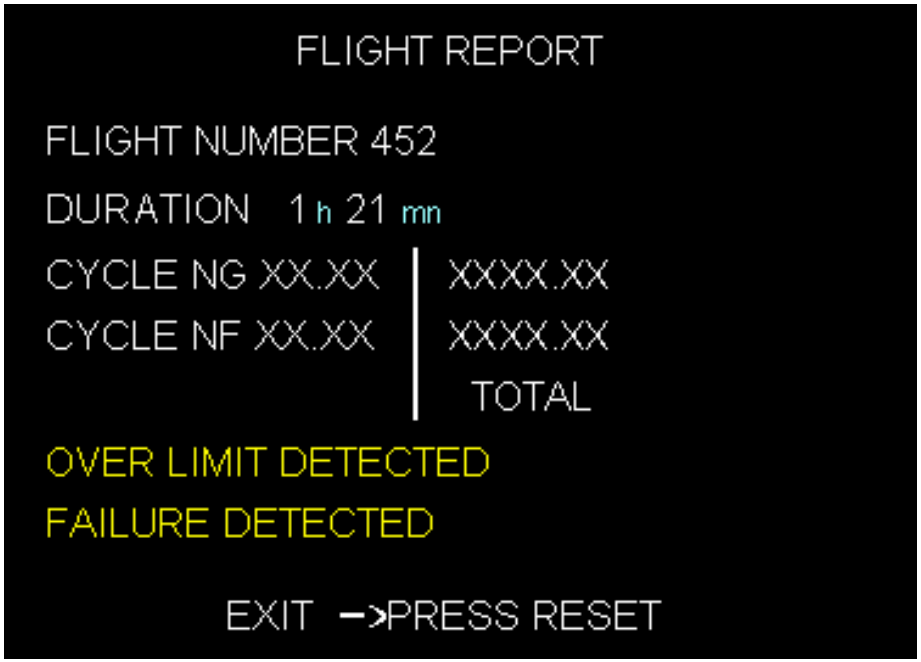
Depress the "+" key successively to scroll the following information:

- FADEC STATUS (FADEC status),
- FADEC LOG01 (FADEC logic output 1)
- FADEC LOG02 (FADEC logic output 2)
- FADEC LOGIN (FADEC logic input),
- FAIL1 (FADEC No 1 failure message)
- FAIL2 (FADEC No 2 failure message)
- FADEC P0 (P0 static pressure value measured by the FADEC)
- FADEC P3 (P3 pressure value measured by the FADEC),
- FADEC T4 (T4 value measured by the FADEC)
- FADEC NF (NF value measured by the FADEC)
- FADEC NG (NG value measured by the FADEC).

Depress the "-" key to return to the preceeding parameter.

Depress the "SELECT" key to deactivate the FADEC message display function.

Flight Report Page – Function Description



Note: The engine and free turbine cycles integrators are to be considered as partial integrators. They are useful to the pilot for recording the engine cycles in the aircraft log book.
But they provide no indication of the total number of cycles of the installed engine.
These integrators return to zero after 999 cycles.

This page is displayed at the end of the flight when the VEMD detects the "engine stop" status; the data presented are:

- **VEMD flight number which increments when, at the end of a "flight" status, the NG drops below 10 % and NR is lower than 70 rpm.**
- **VEMD flight duration (Starts when the NG value rises above 60 %, stops when the NG value decreases and drops below 50 %)**
- **Number of NG cycles recorded during the flight.**
- **Total number of NG cycles recorded by the VEMD,**
- **Number of free turbine (NF) cycles recorded during the flight**
- **Total number of free turbine (NF) cycles) recorded by the VEMD,**
- **Message indicating the exceedance of one limitation,**
- **Message indicating a failure detection during the flight**

The flight report shall be stored and displayed again in "MAINT" mode only.

Section 6 – Maintenance Mode

CPDS Phases of Operation

- There are 3 phases corresponding to 3 modes ...

GROUND PHASE

Ground Status:
VEMD detects Engine Stop

FLIGHT PHASE

Start status:
Ng is between 10 % and 60 %.
FLIGHT status:
Ng is higher than 60 %

SHUTDOWN PHASE

GROUND status:
Ng is lower than 10 % and NR lower than 70 RPM

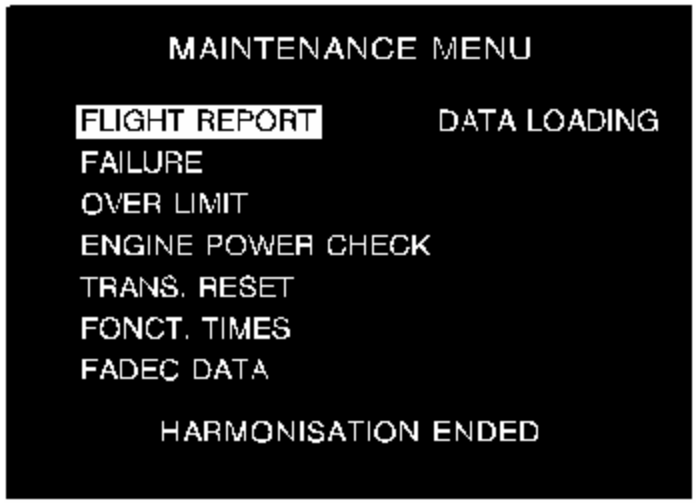
- **CONFIGURATION mode**
- **FLIGHT mode**
- **MAINTENANCE mode**

Initiating Maintenance Mode - VEMD

The MAINTENANCE mode can only be activated when the engine is detected in the «ground» state.

To access to this mode:

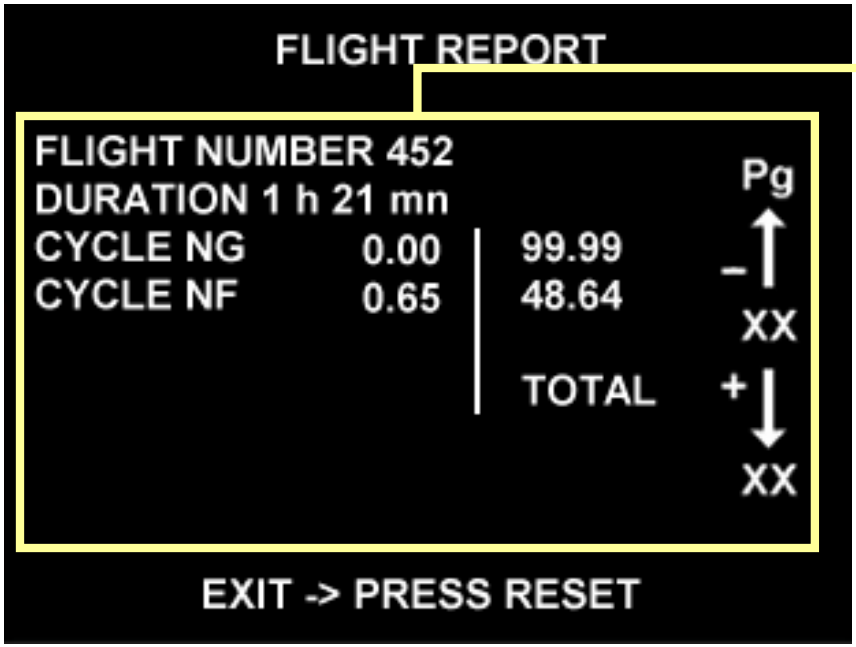
1. Switch off the VEMD.
2. On the VEMD, simultaneously press and hold keys SCROLL and RESET, press key OFF 1 and key OFF 2 briefly after one another until the message “RELEASE KEY” is shown on the top and bottom VEMD displays, then release the keys.



MAINTENANCE Mode

V2005 SW Version Shown

Displayed Parameters - Flight Report

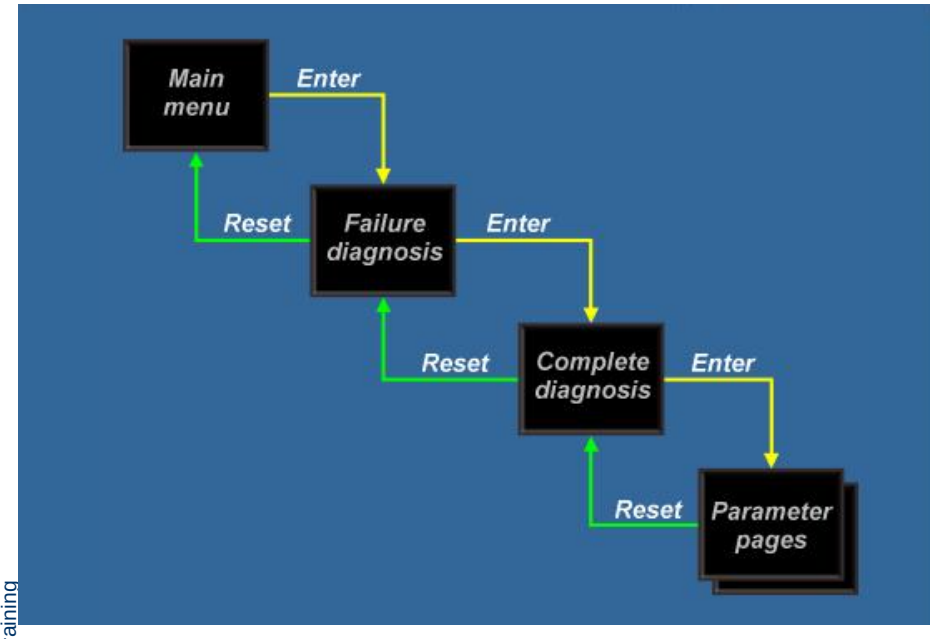


FLIGHT REPORT

The submenu FLIGHT REPORT is equivalent to the FLIGHT REPORT page in FLIGHT mode. See Page 68 for Flight Report details.

- Data stored during the the last 31 (Pre -04 VEMD Version) or 32 (Post -04 VEMD Version) flight reports.
- The symbology on the right side of the screen helps indicate which page is being displayed.
- The "-" key allows accessing the oldest flight reports and the "+" key the most recent ones.
- Whenever the "FLIGHT REPORT" function is selected in the "MAINTENANCE MENU", the most recent flight report is displayed on the screen.

Failure Analysis – Maintenance Mode



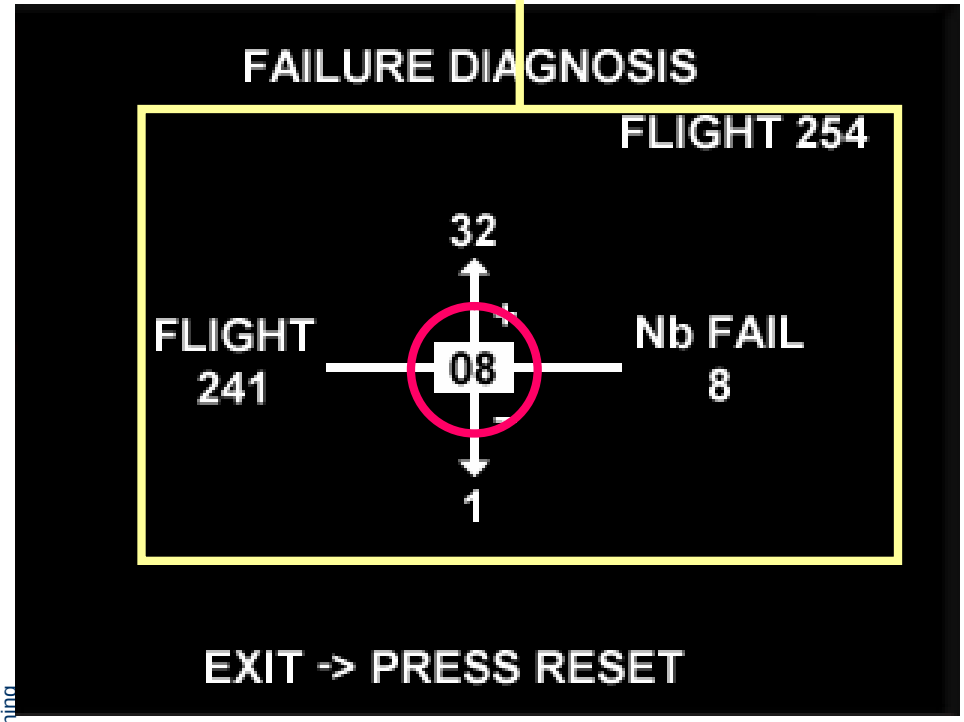
FAILURE

- The FAILURE pages provide the crew members with the detected failures which was recorded by the VEMD during the last and previous flights.

- The submenu FAILURE comprises of a selection page, a diagnosis page and parameter pages (if applicable depending on the fault).

The VEMD can record up to 256 (Pre -04 VEMD Version) or 250 (Post -04 VEMD Version) faults detected by the self-tests. These are recorded in a memory that erases the oldest failures to store the most recent ones (when the number of recorded failures is more than allowed MAX).

Selecting a Flight - Failure Anaylsis



The following buttons are enabled in submenu FAILURE DIAGNOSIS:

– RESET - returns to the MAINTENANCE MENU page.

– ENTER - changes to the SUBSYSTEM SELECTION page.

FAILURE (continued)

- The FAILURE DIAGNOSIS page is displayed when the submenu FAILURE is activated.
- The « + » and « - » keys of VEMD are used to select one flight amongst the several stored flights. The **selected flight** is associated to a flight number and to the detected failure number.
- The numbers on the FAILURE DIAGNOSIS page have the following meaning:

– No. right/top - flight number for next flight (FLIGHT REPORT for next flight is created at the landing).

– No. left - flight number.

– No. right - number of defects for the displayed flight.

– No. top - number of flights with defects.

Complete Diagnosis - Failure Anaylsis

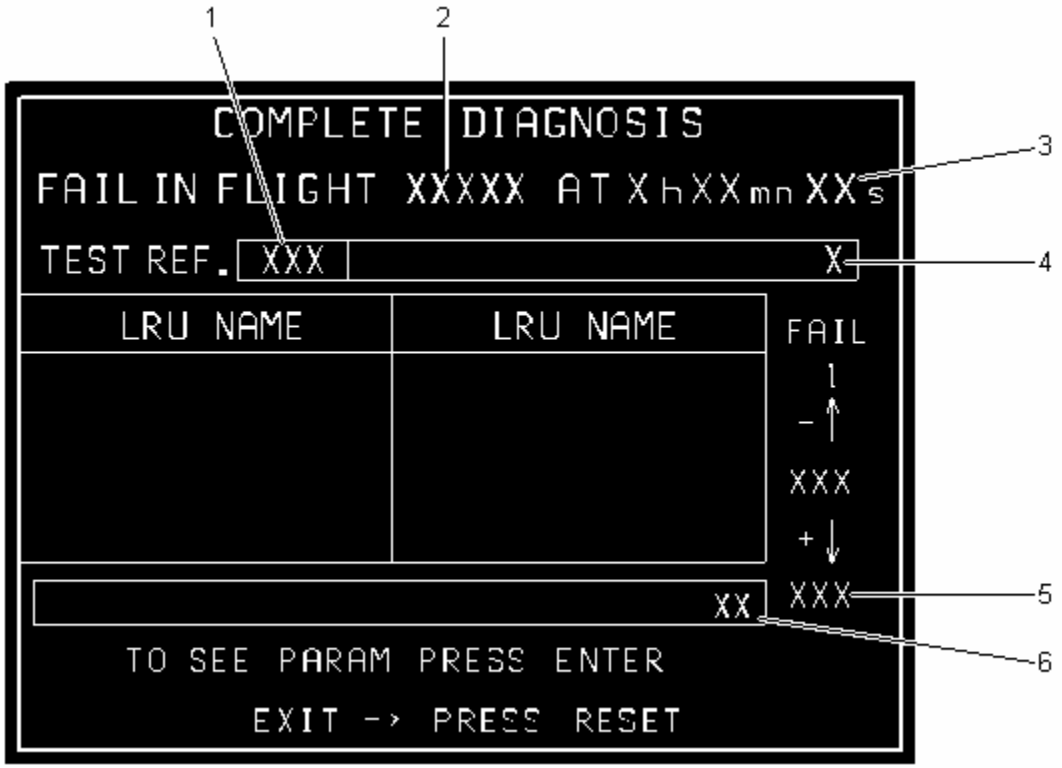
The numbers on the COMPLETE DIAGNOSIS page have the following meaning:

1. **Failure code**
2. **Flight number**
3. **Time at occurrence of the displayed.**
4. **Occurrence of defect with the following meaning:**

L - defect in the VEMD top module.
R - defect in the VEMD bottom.

5. **Number of defects for the displayed flight**
6. **Type of defect with the following meaning:**

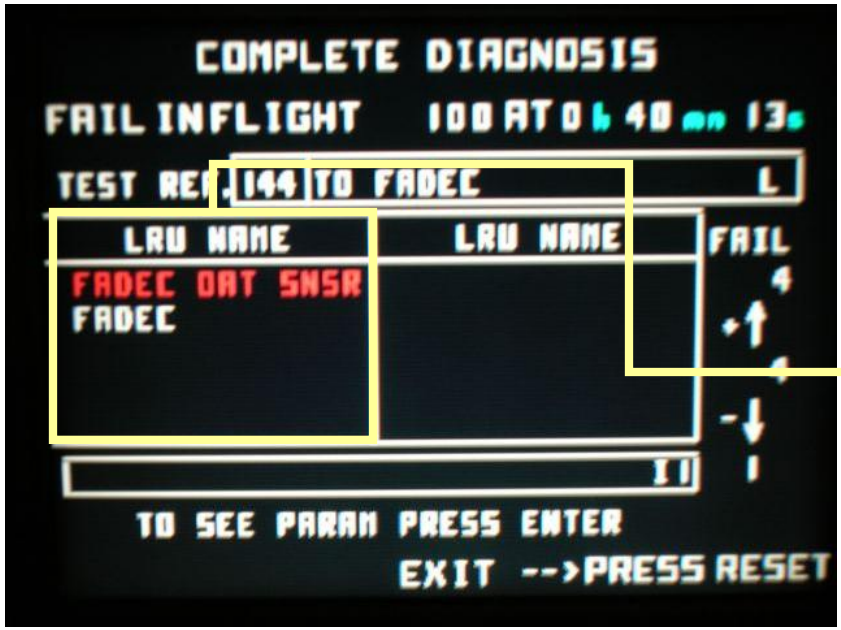
I X - Intermittent defect, occurred X number of times (not present at the landing).
P - permanent defect (present at the landing).



The following buttons are enabled in submenu COMPLETE DIAGNOSIS:

- **"+" and "-" - switches between the older and newer defects.**
- **ENTER - if the message TO SEE PARAM PRESS ENTER is displayed, the COMPLETE DIAGNOSIS page is replaced by the PARAMETERS pages.**
- **RESET - returns to the SUBSYSTEM SELECTION page.**

LRU NAME - Failure Anaylsis



Note: When the VEMD gives a list of the components likely to be involved, it is necessary to check the wiring of the installations concerned for defects.

The LRUs likely to be involved are presented according to their order of probability with a color code:

– Red for the component most likely involved,

– Yellow to distinguish several elements likely to be involved although the faulty element cannot be identified accurately,

– White for the components most unlikely involved.

The following color combinations may be found:

– A single red element,

– A red element and one or several white elements,

– Several yellow elements,

– One or several yellow elements and one or several white elements.

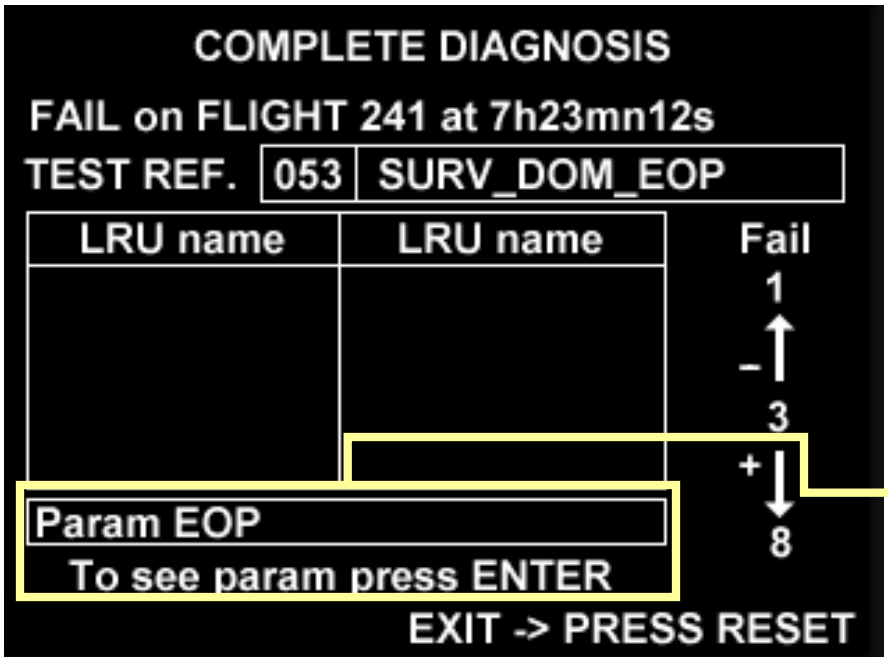
The names of the LRUs likely to be displayed are defined on the next slide:

LRU NAME - Failure Anaylsis

LABEL	DESCRIPTION
NG SENSOR	
T4 SENSOR V	T4 sensor for VEMD
T4 MATCHING V	T4 matching box for VEMD
OAT SENSOR	OAT sensor
EOT/EOP SNSR	Engine oil temperature / pressure sensor
FUEL FLOW SNSR	Fuel flow sensor
FUEL FLOW RES	Fuel flow resistance for fuel temperature measurement
FUEL GAGE	Fuel gage
NR SENSOR	NR sensor
NF SENSOR	NF sensor
P2-ASF-P	Antisand filter powered discrete
P2-ASF-M	Antisand filter mounted discrete
SLING SENSOR	Sling charge sensor
LEFT MODULE	Left module (lane 1)
RIGHT MODULE	Right module (lane 2)
ASU	Ancillary system unit
ENGINE	Engine
MGB	Main gear box
GENERATOR	Generator
TRQ SENSOR	Torque sensor
AIR BLDV	Air bleed valve

LABEL	DESCRIPTION
TRQ MATCHING	Torque matching box
NGA SENSOR	NGA sensor for FADEC installation
NGB SENSOR	NGB sensor for FADEC installation
NFA SENSOR	NFA sensor for FADEC installation
NFB SENSOR	NFB sensor for FADEC installation
T4 SENSOR F	T4 sensor for FADEC installation
T4 MATCHING F	T4 matching for FADEC installation
P0 SENSOR	P0 for FADEC installation
P3 SENSOR	P3 for FADEC installation
SW ENGINE CTL	Switch engine control
RUD. PEDAL	RUD. PEDAL for FADEC installation
COL PITCH POT	Collective pitch potentiometer
AU F MTR VAL	Automatic fuel metering valve
COLL LVR THR V	Collective lever throttle valve
PWR SPLY	Power supply
ON OFF EV	ON / OFF electrovalve
ALTERNATOR	
FADEC	Full Authority Digital Engine Control

Parameter Pages - Complete Diagnosis



Pressing the "ENTER" key helps access the "PARAMETER 1, 2 or 3" page according to the failure detected and the parameter involved. This selection proceeds automatically once the "ENTER" key has been pressed.

- **"PARAMETER" pages cannot be displayed if the diagnosis is displayed on the screen controlled by lane 1 with the failure detected by lane 2 and vice versa.**
- **To visualize the parameters recorded by lane 2, it is necessary to get access to the "MAINT" mode in single lane operation with lane 2 only.**
- **To visualize the parameters recorded by lane 1, it is necessary to get access to the "MAINT" mode with the two calculation lanes in operation, or in single lane operation with lane 1 only.**

Parameter Pages - Complete Diagnosis

The VEMD delivers the value of those parameters measured and recorded before failure detection (Column -XXs) and upon failure detection (FAIL column) their measurement unit.

	-XXs	FAIL	
NG	XXX.X	XXX.X	%
NG F.	XXX.X	XXX.X	%
TRQ F.	XXX.X	XXX.X	%
T4	XXX	XXX	°C
T4 F.	XXX	XXX	°C
NF	XXXXX	XXXXX	RPM
NF F.	XXXXX	XXXXX	°C
FAIL1	XXXX	XXXX	RPM
FAIL2	XXXX	XXXX	HEX
OUT1	XXXX	XXXX	HEX
OUT2	XXXX	XXXX	HEX
IN	XXXX	XXXX	HEX

	-XXs	FAIL	
NG	XXX.X	XXX.X	%
TRQ	XXX.X	XXX.X	%
T4	-XXX	-XXX	°C
T4A	XXXXX.X	XXXXX.X	Ω
T4B	XXXXX.X	XXXXX.X	Ω
P0	XXXX.X	XXXX.X	mB
OAT	-XX.X	-XX.X	°C
I/GEN	-XX.X	-XX.X	A
U/BUS	XX.X	XX.X	V
NF	XXXXX	XXXXX	RPM
NR	XXX	XXX	RPM
	-XXXX	-XXXX	A
H/B/P2 P/M	X/X/X/X	X/X/X/X	BOOLEAN

		FAIL	
EOP		XX.XX	bar
EOT		-XXX	°C
FQ		XXX.X	Kg
FT		XXX.X	°C
FF		XXX.X	Kg/h
SLING		XXXX	Kg
OAT		XX	°C

Overlimit – Function Description

THE LIMITATION EXCEEDANCE VALUES RECORDED BY THE VEMD ARE GIVEN BY WAY OF AN INDICATION.
REFER TO THE FLIGHT MANUAL AND TO THE AIRCRAFT MAINTENANCE MANUAL FOR A DETAILED DESCRIPTION OF THE LIMITATIONS AND FOR THE ACTIONS TO BE TAKEN IF THESE LIMITATIONS ARE EXCEEDED.

This function accesses the last 31 (Pre -04 VEMD Version) or 32 (Post -04 VEMD Version) "OVER LIMIT" pages that were recorded. The symbology on the right side allows finding one's way in those 31 or 32 pages.
Whenever the "OVER LIMIT" function is activated the page displays the last limitation exceedances recorded.

The "-" key gives access to the oldest limitation exceedance pages and the "+" keys to the most recent ones.
The "OVER LIMIT" page displays for a given flight :
- **the flight number during which the limitations were exceeded**
- **the time spent above the TQ limitations**
- **the time spent above the T4 limitations**
- **the time spent above the NG limitations**
- **the time spent above the NF limitations**
- **the five maximum values above the NR limitation.**

Overlimit – Function Description

“TQ” LIMITATION EXCEEDANCES

" >TRQ TRA"

– The value "XXXmn XXs >TRQ TRA" corresponds to the time during which the torque value TQ has been comprised between 105 % and 110 %.

" >TRQ MED"

– The value "XXXmn XXs >TRQ MED" corresponds to the time during which the torque value TQ has been comprised between 110 % and 118 %.

" >TRQ EXT"

– The value "XXXmn XXs >TRQ EXT" corresponds to the time during which the torque value TQ has exceeded 118 %.

"MAX" column

– The value "MAX" corresponds to the maximum TQ value which has been reached from the moment the torque value made the VEMD record a limitation exceedance. Any exceedance of the TQ limitation is recorded immediately, i.e. as soon as the limit was exceeded (no recording delay).

“T4” LIMITATION EXCEEDANCES

Pre -04 VEMD Version, T4 is displayed with 3 digits.

Post -04 VEMD Version, T4 is displayed with 4 digits (recording of values > 1000°C).

" >T4 LOW"

– the value "XXXmn XXs >T4 LOW" corresponds to the time during which the T4 value has been comprised between 750°C (842°F) and 865°C (1589°F), during the starting phase. The time is counted after 10 seconds have passed.

Example: If the time passed in that temperature range is 12 seconds, 2 seconds are shown on the T4 LOW line.

" >T4 MED“

– The value "XXXmn XXs >T4 MED" corresponds to the time during which the T4 value has been above 865°C (1589°F) during the starting phase and between 915°C (1679°F) and 941°C (1726°F) during the flight phase.

The time is counted after 10 seconds of exceeding the limitation have passed.

" >T4 HI"

– The value "XXXmn XXs >T4 HI" corresponds to the time during which the T4 value has been above 941°C (1726°F).

"MAX" column: "T4 MAX"

– This corresponds to the maximum T4 value which has been reached during the starting phase.

"MAX" column: "T4 MAX"

– This corresponds to the maximum T4 value which has been reached during the flight phase.

Overlimit – Function Description

"NG" LIMITATION EXCEEDANCES

" >NG MNT"

" >NG TRA"

– The value "XXXmn XXs >NG TRA" corresponds to the time during which the NG value has been above 102.3 %. Any exceedance of the " >NG TRA" limitation is recorded immediately by the VEMD (no recording delay).

"MAX" column

– The value "MAX" corresponds to the maximum NG value which has been reached from the moment the NG value made the VEMD record a limitation exceedance.

"NF" LIMITATION EXCEEDANCE

The monitoring of the NF limitation exceedances is active only in the "FLIGHT" mode (100 Nf for 406 rpm):

" >NF TRA“

– The value "XXXmn XXs >NF TRA" corresponds to the time during which the NF value has been comprised between 120 % and 150 %.

" >NF EXT“

– The value "XXXmn XXs >NF EXT" corresponds to the time during which the NF value has been above 150 %.

"MAX" column

– The value "MAX" corresponds to the maximum Nf value which has been reached from the moment the NF value made the VEMD record a limitation exceedance.

"NR" LIMITATION EXCEEDANCE

The VEMD records the 5 highest NR values which are measured above 430 rpm.

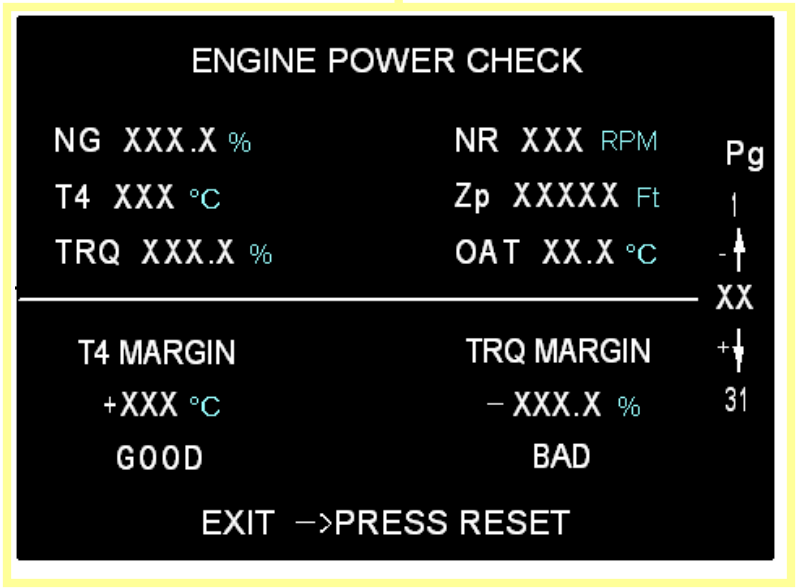
A value is recorded at the time of a limit cycle as defined below:

– The NR value increases above 430 RPM.

– The NR value reaches its highest value.

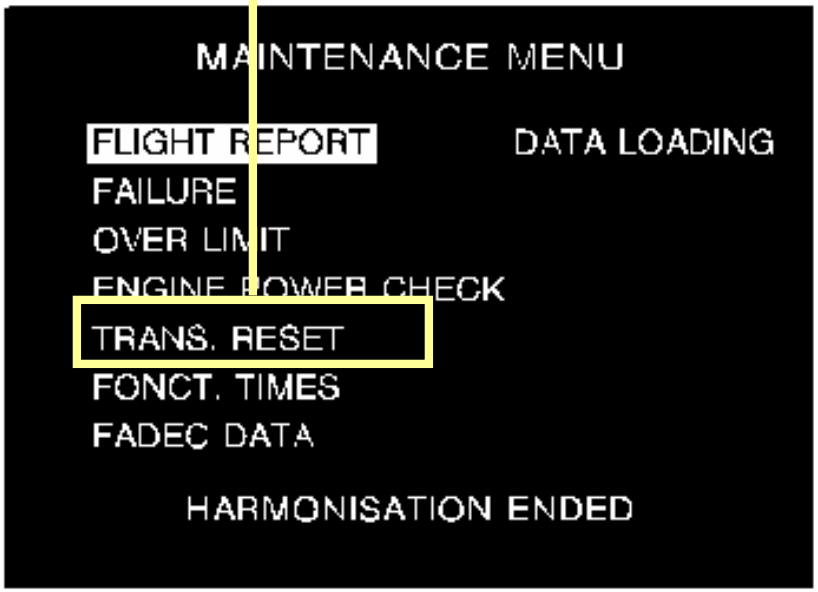
– The NR value drops below 426 RPM.

Engine Power Check – Maintenance Mode



- This function displays the last eight Engine Power Checks and the parameters used for calculation.
- This function is accessible in single lane operation only, with lane 2 operative and lane 1 inoperative.
- The EPC pages shall be displayed on the bottom screen controlled by lane 2 only.
- Whenever the "ENGINE POWER CHECK" function is selected in twin lane operation (lane 1 and 2 operative), or in single lane operation (lane 1 only) the VEMD shall display the "MODE NOT AVAILABLE" and "CHECK LANE 2" messages.
- Whenever the "ENGINE POWER CHECK" function is selected with only lane 2 energized :
- The symbology to the right side of the screen allows indicating which page is being displayed; the "-" key helps access the oldest EPC and the "+" key the most recent ones.
- The contents of the "ENGINE POWER CHECK" page in the "MAINT" mode are equivalent to those of the "ENGINE POWER CHECK RESULT" in the "FLIGHT" mode.

Trans. Reset – Maintenance Mode



TRANSFER DATA

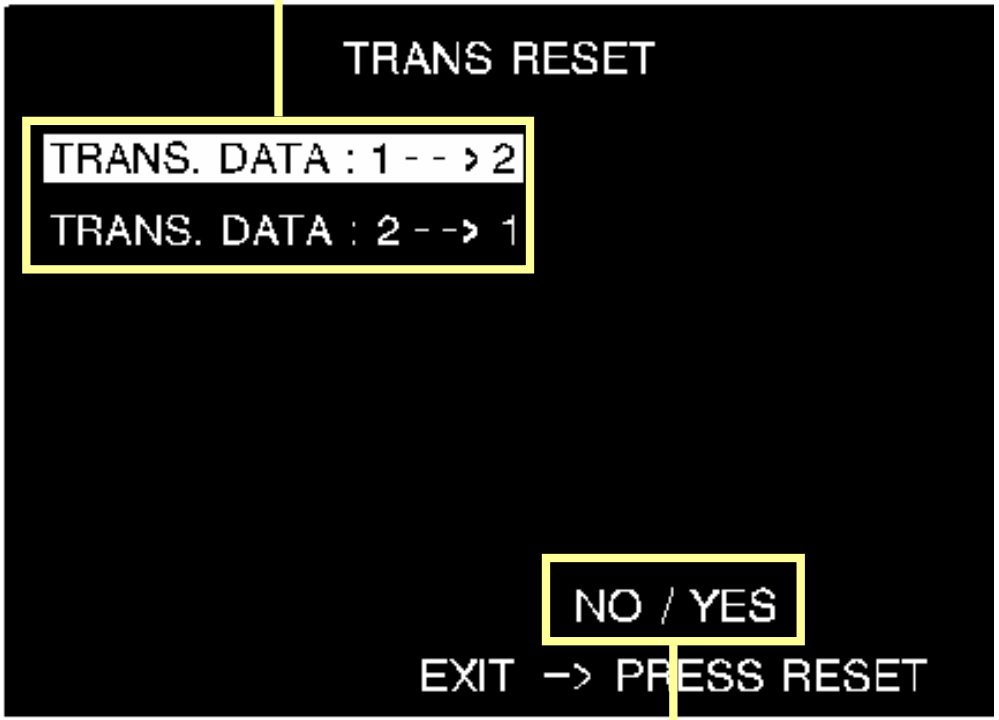
The VEMD consists of 2 internal and independent modules.
This function transfers information from one calculation module to the other (aircraft configuration data, calibration of the torque and different VEMD internal parameters).

Sometimes it can be useful to harmonize data of both VEMD modules.

(IE. **Config Differs ---> Maintenance)**

This function is accessible only if both calculation lanes are operative. Otherwise, a "MODE NOT AVAILABLE" and "SWITCH ON BOTH LANES" messages are displayed on the "MAINTENANCE MENU" page as the "TRANS. RESET" function selection.

Initiating Trans. Reset

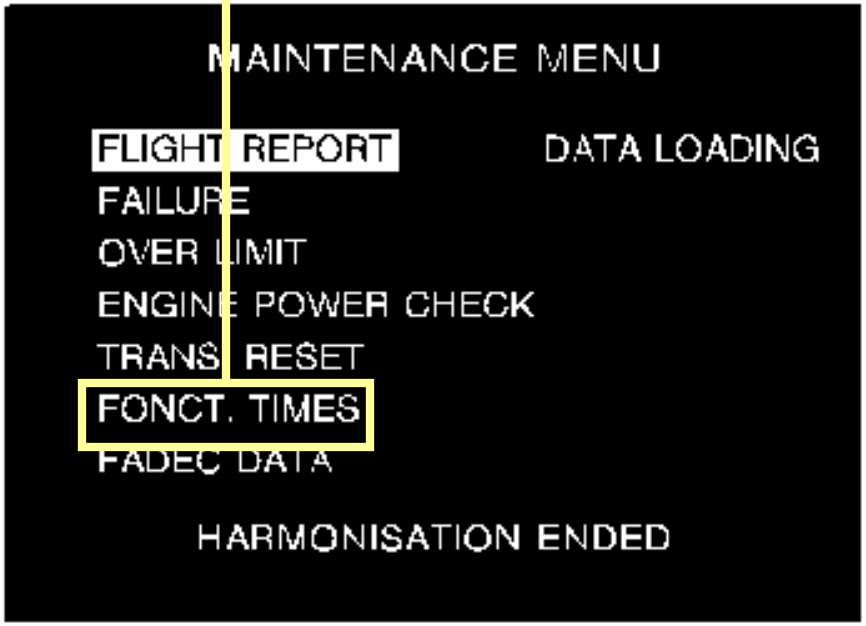


The transfer way selection is made by selecting a data transfer:

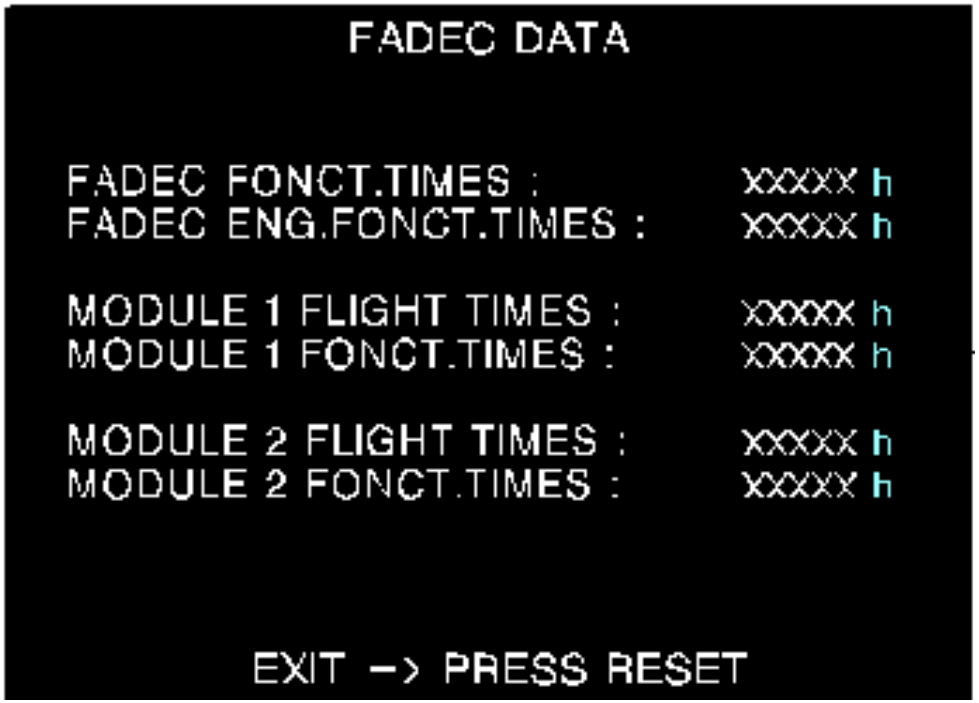
- from module 1 to module 2
  or
- from module 2 to module 1

By selecting « YES » or « NO », the transfer demand can be validated or rejected.

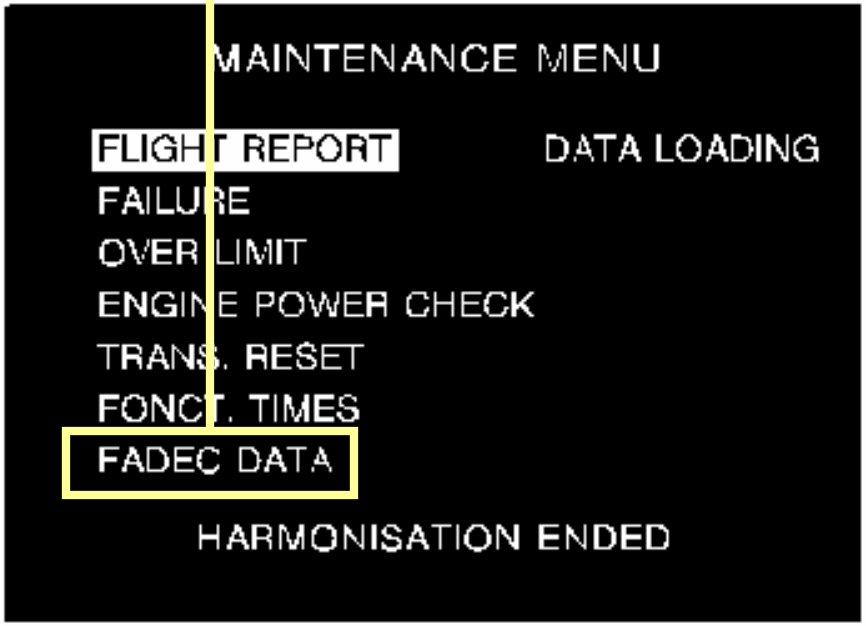
Funct. Times – Maintenance Mode



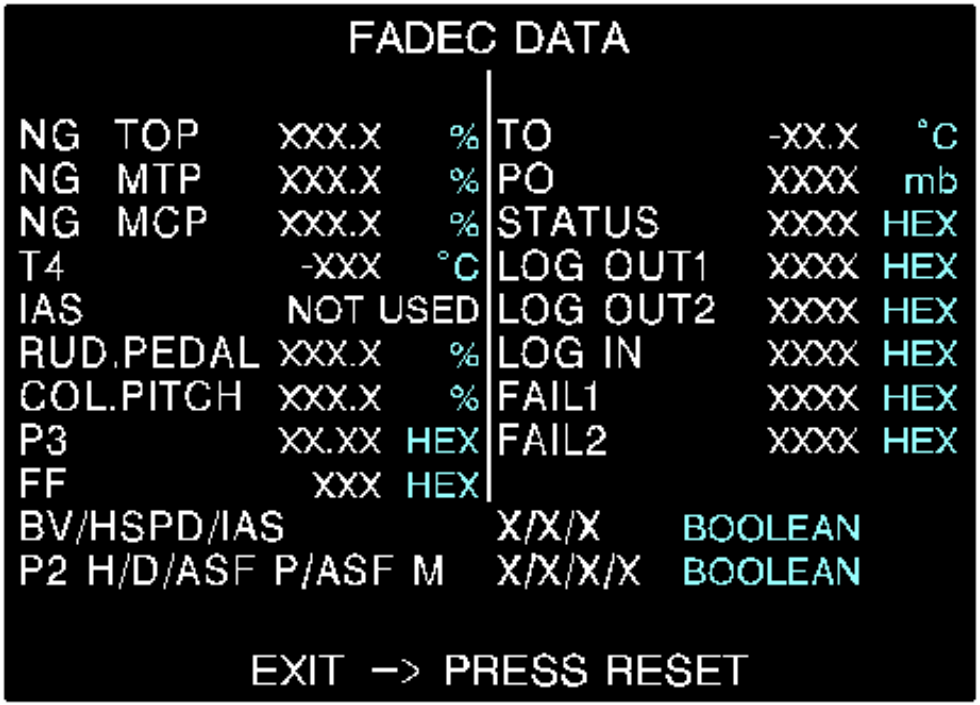
The submenu FONCT. TIMES displays the operating time of VEMD Module 1, VEMD Module 2 and FADEC.



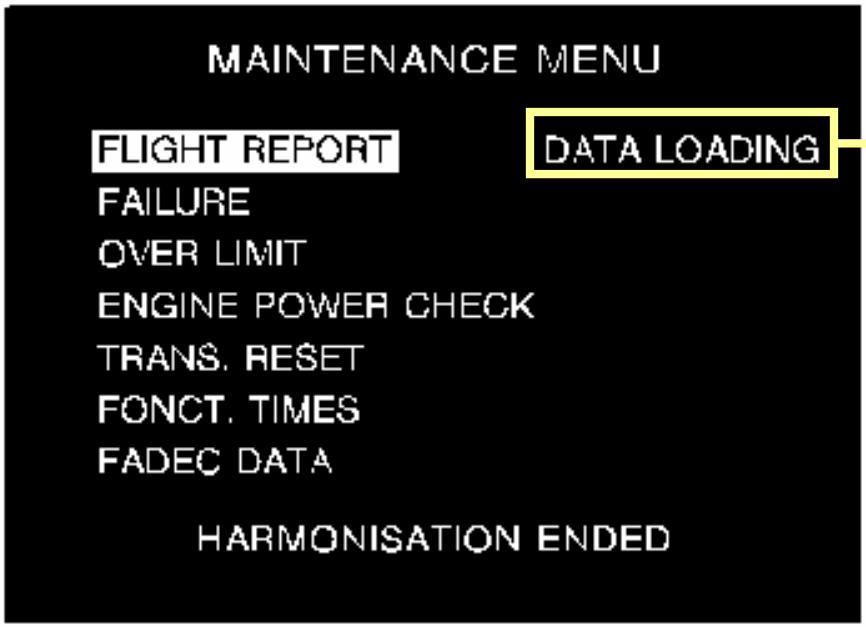
FADEC DATA – Maintenance Mode



This function displays the data provided by the FADEC computer (through the ARINC 429 cable). See Page 67 for more details



DATALOADING – Maintenance



DATALOADING

- This function requires the application of the Eurocopter Maintenance Connector Kit and Eurocopter Dataloading software
- This function, which is only accessible when the two computing lanes are operative, is used to unload the data recorded by the VEMD to a PC for analysis of the various pages accessible under the "MAINT" mode (failures, flight reports, overlimits, EPC, etc.).
- The unloaded data will be dated provided the VEMD is coupled to the optional GPS (Arinc 429 link) and the latter has been properly declared in the "CONFIG" mode.

Section 7 – VEMD Troubleshooting Methods

The VEMD centralizes failure information coming from:

- Different helicopter sensors,

- Other system equipment.

At the power up, the VEMD will execute the initialization BIT (Built-In-Test), in order to rapidly check the general functional condition of the equipment.

Trouble shooting can be done by three following ways:

- The failures are detected visually on the unit.

- The VEMD displays error messages during the initialization and operational phases.

- The failures that are not displayed in operational phases will be stored in memory. The maintenance mode can be enabled in order to display the failure information.

Visual Troubleshooting for the VEMD

UNIT/LRU	Visual Effect Description	Procedure	Comments
VEMD	**Abnormal luminance, brightness or contrast**	**Replace the defective LRU.**	
VEMD	**Black screen**	**Check Circuit Breakers.** **Replace the defective LRU.**	**Black Screen is different from a Lane Failure. A black screen will be indicative of an internal hardware failure (IE Power Supply), which is preventing from the screen from powering up.**
VEMD	**Abnormal Symbol logy display**	**Replace the defective LRU.**	**Does not refer to inaccurate parameter display, which is typically not caused by the VEMD.**
VEMD	**Abnormal color uniformity defaults**	**Replace the defective LRU.**	
	Screen fails (flickering, jittering)	**Replace the defective LRU.**	
VEMD	**Keyboard backlighting failure**	**Replace the defective LRU.**	
VEMD	**Keys or pushbuttons damaged**	**Replace the defective LRU.**	**On the unit keypad, there is an internal circuit behind the buttons, which may defective or damaged.**
VEMD	**Power off not possible**	**Replace the defective LRU.**	**On the unit, there is an internal circuit behind the keypad, which may defective or damaged. Temporarily, you can power off on the VEMD from the Master Battery Bus Switch.**
VEMD	**Power on not possible**	**Replace the defective LRU.**	**On the unit keypad, there is a internal circuit behind the buttons, which may defective or damaged. Temporarily, you can power on the VEMD from the Master Battery Bus Switch.**
VEMD	**Video Test Screen Does not Appear**	**Check wiring. Replace the defective LRU.**	**VEMD Test Screen is activated by applying a ground on VEMD Input J4, Pin ' a'. The Video Test Switch forces a ground to the VEMD input.**

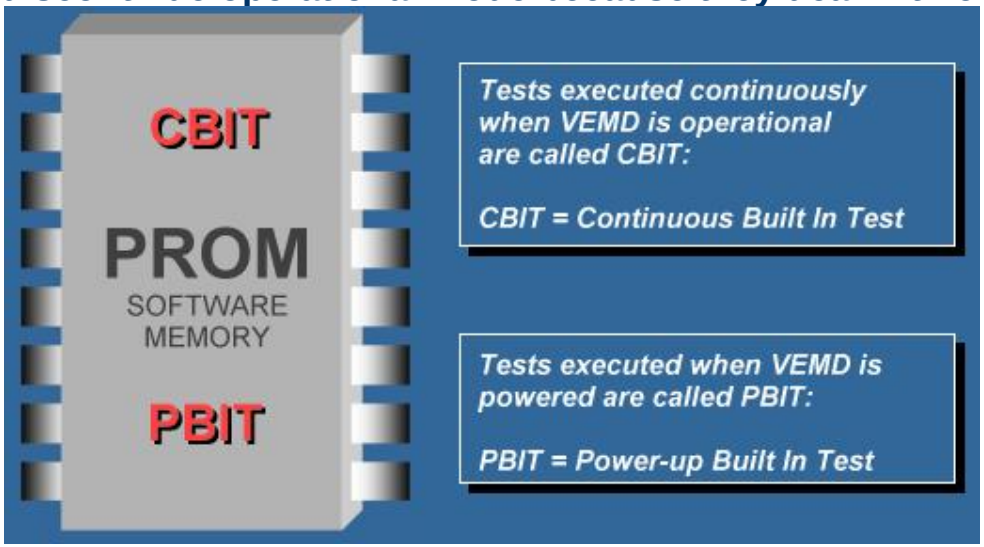
Description of VEMD Displayed Messages

Please refer to the Eurocopter AS350B3/EC130B4 AMM/SDS 31-61-00 for description of displayed messages.

CPDS Detection of Internal/External Failures

The detection and localization of failures is composed of the following steps:
- Execution of the tests,
- Storage all the data linked to the failure,
- Notification of the failure,
- Localization of the faulty LRU.
-Built-In Tests (BIT) shall be performed by the VEMD to accomplish internal testing of hardware and software functions autonomously.

There are two types of BIT and external test performed by the CPDS:
- PBIT (Power on Built In Test)
The test of this type is triggered in power-up initialization phase and major failed PBITs can prevent VEMD Operation (IE Lane Failure). In general, PBITs focus on internal hardware and software tests.
- CBIT (Continuous Built In Test)
The test of this type is triggered continuously in operational phase (Flight) and a majority of the tests can not cause the VEMD to discontinue operational mode because they deal with external failures.

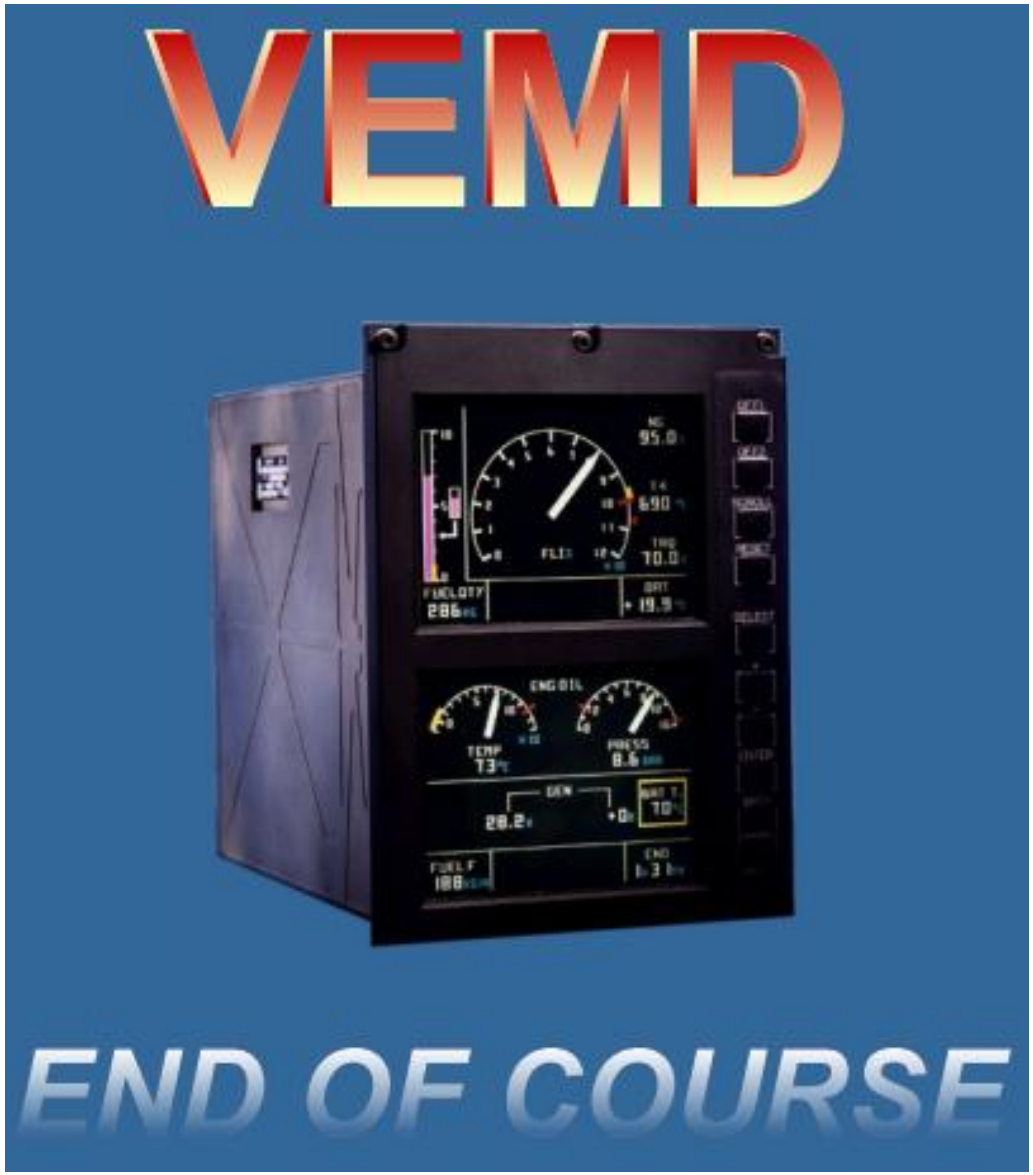


VEMD BIT Tests

Please refer to the Eurocopter AS350B3/EC130B4 AMM/SDS 31-61-00 for Maintenance Failure Code Tables.

- Tests with "FCODE" less than "45" are due to THALES requirements. In other words, codes due to internal VEMD hardware and software tests failing.
- Tests with "FCODE" greater than "44" are due to Eurocopter requirements. In other words, codes due to some software functionality to Eurocopter Specification.

End of Training



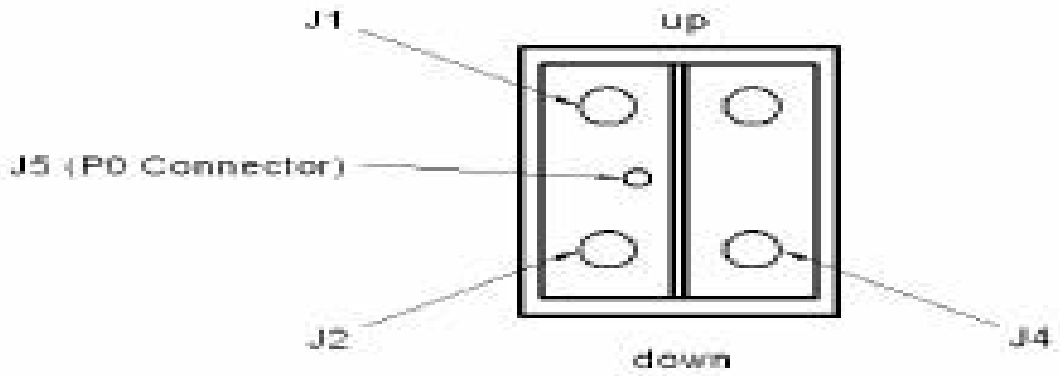
Appendix A – VEMD Interface

2. D. Input/Output Interface Connections (For B19030.. Versions : K/M./S.).

(1) Connector Types

- Electrical connectors : J1, J2, and J4 are the same type, but have different pin arrangements.
- Pneumatic connector : J5

DRAWING CONNECTOR LABEL	FUNCTION	CONNECTOR STANDARD REFERENCE	CONNECTOR SPECIFIC REFERENCE
J1	I/O signals	MBL00R24C61P	-
J2	I/O signals	MBL00R24C61PW	-
J4	I/O signals	MBL00R24C61PX	-
J5	PO sensor	-	MS-33649-5 type



Connectors J1 to J5 for I/O Interface
Figure 202

Appendix A – VEMD J1 Pin Table

2. D. (2) J1 Connector

Pin	Contact gauge	SIGNAL TYPE	In/ Out	Minimum wire gauge	SIGNAL NAME
C	20	+ 28V	I	24	POWER 1
B	20	- 0/28V	I	24	POWER 1
K	20	+ 32V	I	24	LIGHTING
i	20	- 0/32V	I	24	LIGHTING
AA	20	s GND 32V	I		LIGHTING
a	20	DISCRETE IN	I	24	BLD VAL
Z	20	DISCRETE IN	I	24	P2-H
u	20	DISCRETE IN	I	24	ASF-M
GG	20	DISCRETE IN	I	24	HIGH SPEED
NN	20	DISCRETE IN	I	24	P2-ASF-P
JJ	20	DISCRETE OUT	O	24	SPARE
KK	20	PWM OUT	O	24	FLI WARNING
X	20	+ 10V	I	24	FQ
W	20	- 0/10V	I	24	FQ
s	20	s GND 10V	I	24	FQ
V	20	+ 10V	I	24	SPARE
r	20	- 0/10V	I	24	SPARE
EE	20	s GND 10V	I	24	SPARE
Y	20	+ 10V	I	24	SLING
t	20	- 0/10V	I	24	SLING
FF	20	s GND 10V	I	24	SLING
c	20	+ 250mV	I	22	START C
v	20	- 0/250mV	I	22	START C
HH	20	s GND 250mV	I	22	START C
A	20	+ SUPPLY	O	22	SPARE
w	20	- 0/SUPPLY	O	22	SPARE
b	20	GND 250mV	O		SPARE
D	20	M+ RESIST 0.5mA	I	24	EOT
E	20	M- RESIST 0.5mA	I	24	EOT
e	20	C1 RESIST 0.5mA	I		EOT

Appendix A – VEMD J1 Pin Table

J1 Connector (Cont'd)

Pin	Contact gauge	SIGNAL TYPE	In/ Out	Minimum wire gauge	SIGNAL NAME
d	20	C2 RESIST 0.5mA	I	24	EOT
x	20	s GND R 0.5mA	I	24	EOT
P	20	h ARINC 429 IN	I	24	CROSS TALK
n	20	l ARINC 429 IN	I	24	CROSS TALK
m	20	s GND A 429 IN	I	24	CROSS TALK
R	20	h ARINC 429 OUT	O	24	CROSS TALK
S	20	l ARINC 429 OUT	O	24	CROSS TALK
p	20	s GND A 429 OUT	O	24	CROSS TALK
T	20	h ARINC 429 IN	I	24	NC
U	20	l ARINC 429 IN	I	24	NC
q	20	s GND A 429 IN	I	24	NC
F	20	+ LOW FREQ	I	24	FF1
G	20	- LOW FREQ	I	24	FF1
y	20	s GND LF	I	24	FF1
f	20	LF RESISTANCE	I	24	FF1-RT
g	20	LF RESISTANCE	I	24	FF1-RT
z	20	s GND LF R	I	24	FF1-RT
M	20	h RS485	I/O	24	MAINTENANCE
k	20	l RS485	I/O	24	MAINTENANCE
BB	20	s GND RS485	I	24	MAINTENANCE
H	20	h RS422 IN	I	24	SPARE
J	20	l RS422 IN	I	24	SPARE
h	20	s GND RS422 IN	I	24	SPARE
DD	20	h RS422 OUT	I	24	SPARE
MM	20	l RS422 OUT	I	24	SPARE
CC	20	s GND RS422 OUT	I	24	SPARE
LL	20	Electrical bonding	I	20	CASE GND
PP	20	GND DISCRETE			0V Ref
L	20	RESERVED			
N	20	RESERVED			
j	20	RESERVED			

Appendix A – VEMD J2 Pin Table

2. D. (3) J2 Connector

Pin	Contact gauge	SIGNAL TYPE	In/ Out	Minimum wire gauge	SIGNAL NAME
A	20	Cr Thermocouple	I	22	T4
B	20	A1 Thermocouple	I	22	T4
c	20	s GND Thermocouple	I	22	T4
b	20	+ R1 Thermocouple	I	24	T4-R1
w	20	- R1 Thermocouple	I	24	T4-R1
v	20	s GND R1 Thermo	I	24	T4-R1
D	20	+ R2 Thermocouple	I	24	T4-R2
d	20	- R2 Thermocouple	I	24	T4-R2
C	20	s GND R2 Thermo	I	24	T4-R2
LL	20	DISCRETE IN	I	24	IAS
KK	20	DISCRETE IN	I	24	P2-D
MM	20	DISCRETE IN	I	24	SPARE
N	20	+ 10V	I	24	SPARE
m	20	- 0/10V	I	24	SPARE
CC	20	s GND 10V	I	24	SPARE
M	20	+ 10V	I	24	NR
k	20	- 0/10V	I	24	NR
BB	20	s GND 10V	I	24	NR
W	20	+ 32V	I	24	V
X	20	- 0/32V	I	24	V
s	20	s GND 32V	I	24	V
L	20	+ 250mV	I		GEN C
j	20	- 0/250mV	I		GEN C
K	20	s GND 250mV	I		GEN C
J	20	+ SUPPLY	O		SPARE
i	20	- O/SUPPLY	O		SPARE
AA	20	GND 250mV	O		SPARE
g	20	+ 250mV	I	22	SPARE
h	20	- 0/250mV	I	22	SPARE
G	20	s GND 250mV	I	22	SPARE

Appendix A – VEMD J2 Pin Table

J2 Connector (Cont'd)

Pin	Contact gauge	SIGNAL TYPE	In/ Out	Minimum wire gauge	SIGNAL NAME
H	20	+ SUPPLY	O	22	SPARE
y	20	- O/SUPPLY	O	22	SPARE
z	20	GND 250mV	O		SPARE
R	20	h ARINC 429 IN	I	24	FADEC
p	20	l ARINC 429 IN	I	24	FADEC
EE	20	s GND A 429 IN	I	24	FADEC
P	20	h ARINC 429 IN	I	24	SPARE
n	20	l ARINC 429 IN	I	24	SPARE
DD	20	s GND A 429 IN	I	24	SPARE
T	20	+ HG FREQUENCY	I	24	NG
U	20	- HG FREQUENCY	I	24	NG
q	20	s HG FREQUENCY	I	24	NG
F	20	M+ RESIST 1mA	I	24	OAT
E	20	M- RESIST 1mA	I	24	OAT
e	20	C1 RESIST 1mA	I		OAT
f	20	C2 RESIST 1mA	I	24	OAT
x	20	s GND R 1mA	I	24	OAT
S	20	NC			
V	20	NC			
Y	20	NC			
Z	20	NC			
a	20	NC			
r	20	NC			
t	20	NC			
u	20	NC			
FF	20	NC			
GG	20	NC			
HH	20	NC			
JJ	20	NC			
NN	20	NC			
PP	20	NC			

Appendix A – VEMD J4 Pin Table

2. D (4) J4 Connector

Pin	Contact gauge	SIGNAL TYPE	In/ Out	Minimum wire gauge	SIGNAL NAME
C	20	+ 28V	I	24	POWER 2
B	20	- 0/28V	I	24	POWER 2
K	20	+ 32V	I		NC
i	20	- 0/32V	I		NC
AA	20	s GND 32V	I		NC
a	20	DISCRETE IN	I	24	TEST
Z	20	DISCRETE IN	I	24	SCROLL
u	20	DISCRETE IN	I	24	NC
GG	20	DISCRETE IN	I	24	DAY/NIGHT
NN	20	DISCRETE IN	I	24	NC
JJ	20	DISCRETE OUT	O	24	NC
KK	20	PWM OUT	O	24	NC
X	20	+ 10V	I	24	EOP
W	20	- 0/10V	I	24	EOP
s	20	s GND 10V	I	24	EOP
V	20	+ 10V	I	24	SPARE
r	20	- 0/10V	I	24	SPARE
EE	20	s GND 10V	I	24	SPARE
Y	20	+ 10V	I	24	NC
t	20	- 0/10V	I	24	NC
FF	20	s GND 10V	I	24	NC
c	20	+ 250mV	I	22	NC
v	20	- 0/250mV	I	22	NC
HH	20	s GND 250mV	I	22	NC
A	20	+ SUPPLY	O	22	NC
w	20	- 0/SUPPLY	O	22	NC
b	20	GND 250mV	O		NC
D	20	M+ RESIST 0.5mA	I	24	NC
E	20	M- RESIST 0.5mA	I	24	NC
e	20	C1 RESIST 0.5mA	I		NC

Appendix A – VEMD J4 Pin Table

J4 Connector (Cont'd)

Pin	Contact gauge	SIGNAL TYPE	In/ Out	Minimum wire gauge	SIGNAL NAME
d	20	C2 RESIST 0.5mA	I	24	NC
x	20	s GND R 0.5mA	I	24	NC
P	20	h ARINC 429 IN	I	24	CROSS TALK
n	20	l ARINC 429 IN	I	24	CROSS TALK
m	20	s GND A 429 IN	I	24	CROSS TALK
R	20	h ARINC 429 OUT	O	24	CROSS TALK
S	20	l ARINC 429 OUT	O	24	CROSS TALK
p	20	s GND A 429 OUT	O	24	CROSS TALK
T	20	h ARINC 429 IN	I	24	NC
U	20	l ARINC 429 IN	I	24	NC
q	20	s GND A 429 IN	I	24	NC
F	20	+ LOW FREQ	I	24	NC
G	20	- LOW FREQ	I	24	NC
y	20	s GND LF	I	24	NC
f	20	LF RESISTANCE	I	24	NC
g	20	LF RESISTANCE	I	24	NC
z	20	s GND LF R	I	24	NC
M	20	h RS485	I/O	24	MAINTENANCE
k	20	l RS485	I/O	24	MAINTENANCE
BB	20	s GND RS485	I	24	MAINTENANCE
H	20	h RS422 IN	I	24	NC
J	20	l RS422 IN	I	24	NC
h	20	s GND RS422 IN	I	24	NC
DD	20	h RS422 OUT	I	24	NC
MM	20	l RS422 OUT	I	24	NC
CC	20	s GND RS422 OUT	I	24	NC
LL	20	Electrical bonding	I	20	
PP	20	GND DISCRETE			
L	20	RESERVED			
N	20	RESERVED			
j	20	RESERVED			