SERVICE TECHNOLOGIE DE LA MESURE DANS LA GEOSPHERE

DÉPARTEMENT ANALYSE
ET SURVEILLANCE DE
L'ENVIRONNEMENT

TECHNICAL MANUAL

MICROBAROMETER
MB 2000

SERIAL NUMBER
HIGHER THAN 1100

L D G
TECHNICAL MANUAL
MICROBAROMETER

NOTICE N° =

DEPARTEMENT ANALYSE ET SURVEILLANCE DE L'ENVIRONNEMENT - TMG

B.P. 12 - F 91680 BRUYERES-LE-CHATEL - FRANCE

Téléphone : 33 (0) 1.69.26.50.51
Télécopieur : 33 (0) 1.69.26.49.49

TABLE OF CONTENTS

BLANK

LIST OF ILLUSTRATIONS

BLANK

LIST OF REVISIONS

REVISIONS No	DATE OF REVISION	INSERTION	
		DATE	BY

BLANK

LIST OF EFFECTIVE PAGES

DESIGNATION	PAGE	DATE	DESIGNATION	PAGE	DATE
Title page	0-1	Oct. 1998	4. Electronic	4-1	Oct. 1998
	0-2	Oct. 1998	Boards	4-2	Oct. 1998
				4-3	Oct. 1998
Table of	0-3	Oct. 1998		4-4	Oct. 1998
Contents	0-4	Blank		4-5	Oct. 1998
				4-6	Oct. 1998
List of	0-5	Oct. 1998		4-7/8	Oct. 1998
Illustrations	0-6	Blank		4-9	Oct. 1998
				4-10	Oct. 1998
List of	0-7	Oct. 1998		4-11	Oct. 1998
Revisions	0-8	Blank		4-12	Blank
				4-13	Oct. 1998
List of	0-9	Oct. 1998		4-14	Blank
Effective Pages	0-10	Blank			
			5. Illustrated	5-0-1	Oct. 1998
List of	0-11	Oct. 1998	parts list	5-0-2	Blank
Equipment	0-12	Blank		5-1-1	Oct. 1998
Modifications				5-1-2	Oct. 1998
				5-1-3	Oct. 1998
List of	0-13	Oct. 1998		5-1-4	Blank
Materials and	0-14	Blank		5-2-1	Oct. 1998
Equipment				5-2-2	Blank
				5-3-1	Oct. 1998
1. Introduction	1-1	Oct. 1998		5-3-2	Blank
	1-2	Blank		5-4-1	Oct. 1998
				5-4-2	Oct. 1998
2. General	2-1	Oct. 1998		5-4-3	Oct. 1998
Description	2-2	Oct. 1998		5-4-4	Blank
	2-3	Oct. 1998			
	2-4	Oct. 1998			
	2-5	Oct. 1998			
	2-6	Oct. 1998			
	2-7	Oct. 1998			
	2-8	Blank			
	2-9	Oct. 1998			
	2-10	Blank			
3. Operation	3-1	Oct. 1998			
	3-2	Oct. 1998			
	3-3	Oct. 1998			
	3-4	Blank			
	3-5/6	Oct. 1998			
	3-7	Oct. 1998			
	3-8	Oct. 1998			
	3-9	Oct. 1998			
	3-10	Oct. 1998			
	3-11	Oct. 1998			
	3-12	Oct. 1998			

BLANK

LIST OF EQUIPMENT MODIFICATIONS

INCLUDED IN REVISION	DESCRIPTION OF MODIFICATION

BLANK

LIST OF MATERIALS AND EQUIPMENT

DESCRIPTION	SUPPLIER COMPANY - ADDRESS	FUNCTION
Type KELLER Calibrator	KELLER BP 160 LA BOURSIDIERE RN 186 92350 LE PLESSIS-ROBINSON	§ 3.2.

BLANK

CHAPTER 1

INTRODUCTION

The microbarometer MB 2000 was developed in order to detect an air nuclear explosion. The sensitive part is set up with an aneroid barometric bellows which warps under atmospheric pressure change, a LVDT sensor measures this deformation. This one is performant and simple to implement. The electronic noise level is 2 mPa rms, between
1 and 10 Hz.

The filtered output passband is between 0.01 Hz and 27 Hz. It can be modified easily. A passband of 0.001 Hz to 40 Hz has already been used by the Laboratoire de Géophysique.

The running control is ensured by the atmospheric pressure measurement.

Digitization units, developed by LDG, are perfectly designed to use those sensors.

BLANK

CHAPTER 2

GENERAL DESCRIPTION

2.1. GENERAL (Figure 3-1)

The sensitive part is an aneroid barometric bellows (10) made of Durinval. The LVDT (Linear Variable Differential Transformer) displacement sensor (9), joined to a low noise electronics, measures the deformation of the barometric aneroid under atmospheric pressure change. The barometric aneroid displacement sensor unit of each microbarometer is temperature-calibrated to minimise its effects.

2.2. DESCRIPTION (Figure 3-1)

The microbarometer is presented as a cylinder of 15 cm diameter and 32 cm high. Its weight is 7 kg.

A 4-pin plug (5) is used to supply the sensor in 12 Volts. The signals are available on a second 7-pin plug (4).

The low part constitutes the measurement chamber (7), it consists of the barometric aneroid (10) and the LVDT displacement sensor (9). The chamber is connected to the atmospheric pressure by four nozzles (6). Each nozzle can receive a microporous hose or other to perform an infrasound filtering network in order to minimise pressure changes due to wind effects and reduce microbarometer background noise.

The high part is watertight and receives two electronic boards:

- A power supply board (2).

- A measurement board (3).

2.3. SPECIFICATIONS

2.3.1. Microbarometric aneroid characteristics

Provided by LDG, it is made of Durinval. The advantage is an elasticity module which does not vary significantly with temperature change.

It is designed to operate between 400 and 1200 hPa.

Means mechanical sensitivity: – 35 nm/Pa.

Acceleration sensitivity: vertical axis: $\simeq$ 0,400 V/g at PT9.

2.3.2. Characteristics of the LVDT differential transformer displacement sensor

Provided by LDG.

2.3.3. Characteristics of the measurement electronic board

- Quartz oscillator ultra stable in frequency and voltage.
- LVDT primary excitation frequency: 8 kHz.
- LVDT excitation level: 15.6 V peak to peak (symetrical excitation).

2.3.4. Characteristics of the microbarometer (Figure 2-1)

The sensor is designed to operate at ± 100 hPa of the atmospheric pressure, (standard 1000 hPa ± 100 hPa).

Sensitivity before filtering (DC-40 Hz band in PT9) is generally of – 1 mV/Pa, i.e. ± 10 Volts for ± 100 hPa.

Sensitivity after filtering (1/100 - 27 Hz band) is of 20 mV/Pa i.e. ± 10 Volts for ± 5 hPa.

This is the best sensitivity for 20 and 24 bits ADC use.

For 16 bits ADC, we can adjust the sentivity to 100 mV/P.

The electronic noise in the 0.01-10 Hz band is represented in figure 2.1.

2.3.5. Temperature characteristics (Figures 2-2 and 2-3)

Sensors are temperature-calibrated and -compensated in order to reduce their thermal sensitivity. The thermal drift after compensation is less than ± 0.1 hPa/°C.

Figure 2-2 the atmospheric pressure output of a microbarometer temperature-tested is compared to the one of a sensor placed at ambient temperature.

The temperature varies from – 25 to + 60 °C for 7 hours. The difference is at a maximum of 2 hPa between the 2 sensors whether 2.35 Pa/k. This variation corresponds to a continuous drift for a relatively rapid temperature variation: 12 °C/hour.

For a lower variation the sensor would reach its thermal balance and the drift would be less important.

In the filtered band (100 s) the variation between the 2 sensors is not to take into account (see figure 2-3).

2.3.6. Power Supply

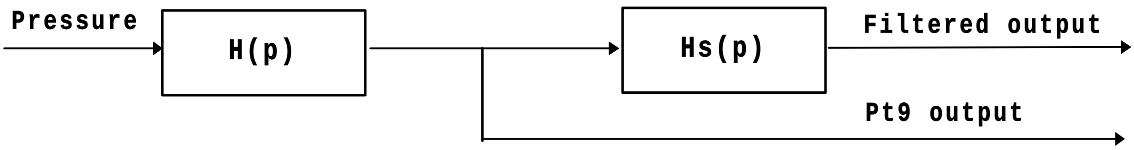
12 Volts/300 mA.

2.4. OPERATION PRINCIPLE (Figure 2-4)

An analog oscillator set at 8 kHz is carried out from a quartz and voltage reference oscillator. The voltage hence obtained (TP3-TP4) supplies the LVDT displacement sensor primary. The voltage obtained at secondary is demodulated with analog gates controlled by a signal delivered by PROM (PT5). The demodulated signal is then filtered (Low-Pass (LP) 40 Hz filter).

The sensitivity in PT9 is of – 1 mV/Pa (see § 3.2 Calibration). Before amplification, the signal continuous component is filtered with a 0.01 Hz high-pass filter. A second output AP measures the Atmospheric Pressure (AP) value and allows the running control of the unit.

2.5. MB2000 TRANSFERT FUNCTIONS



2.5.1. Pt9 output

With $p=j\omega$

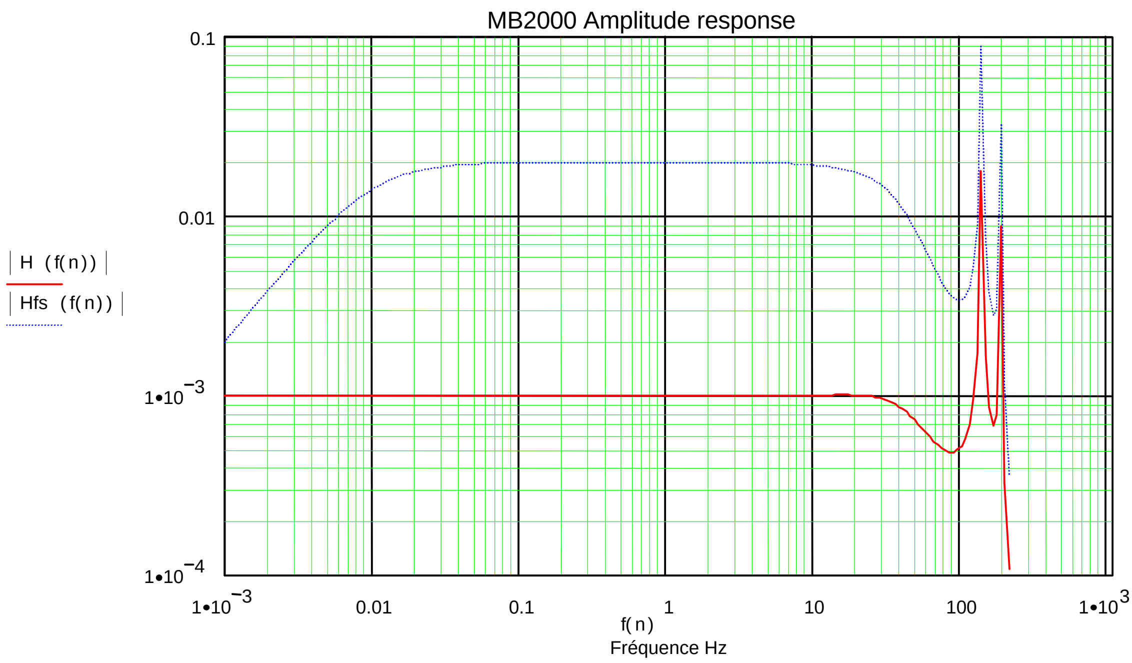
$$H(p)=\frac{b1*p+b0}{a6*p^6+a5*p^5+a4*p^4+a3*p^3+a2*p^2+a1*p+1}$$

b1=2.133 E-9
b0=1 E-3

a6 = 1.89 E-17
a5 = 7.03 E-15
a4 = 3.757 E-11
a3 = 1.321 E-8
a2 = 1.823 E-5
a1 = 5.645 E-3

$$Hs(p)=\frac{318.31*p}{0.077*p^2+15.92*p+1}$$

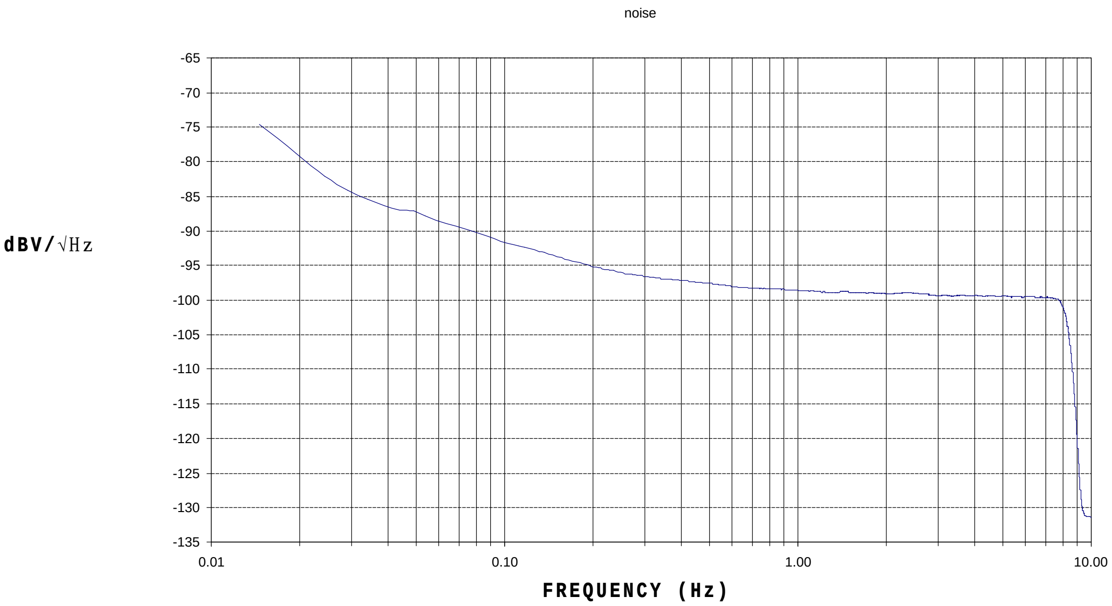
2.5.2. Amplitude response



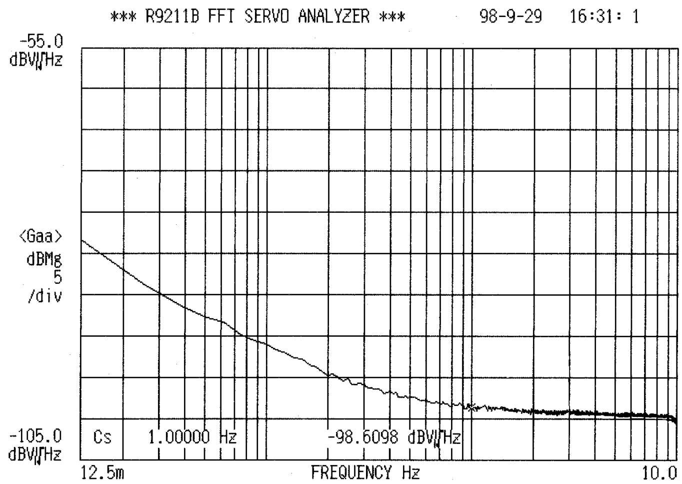
Electronic noise (band 0.01 - 10 Hz).

Sensitivity : 20 mV/Pa.

- Turquoise measurement with AUBRAC unit (NUM 24 bits).



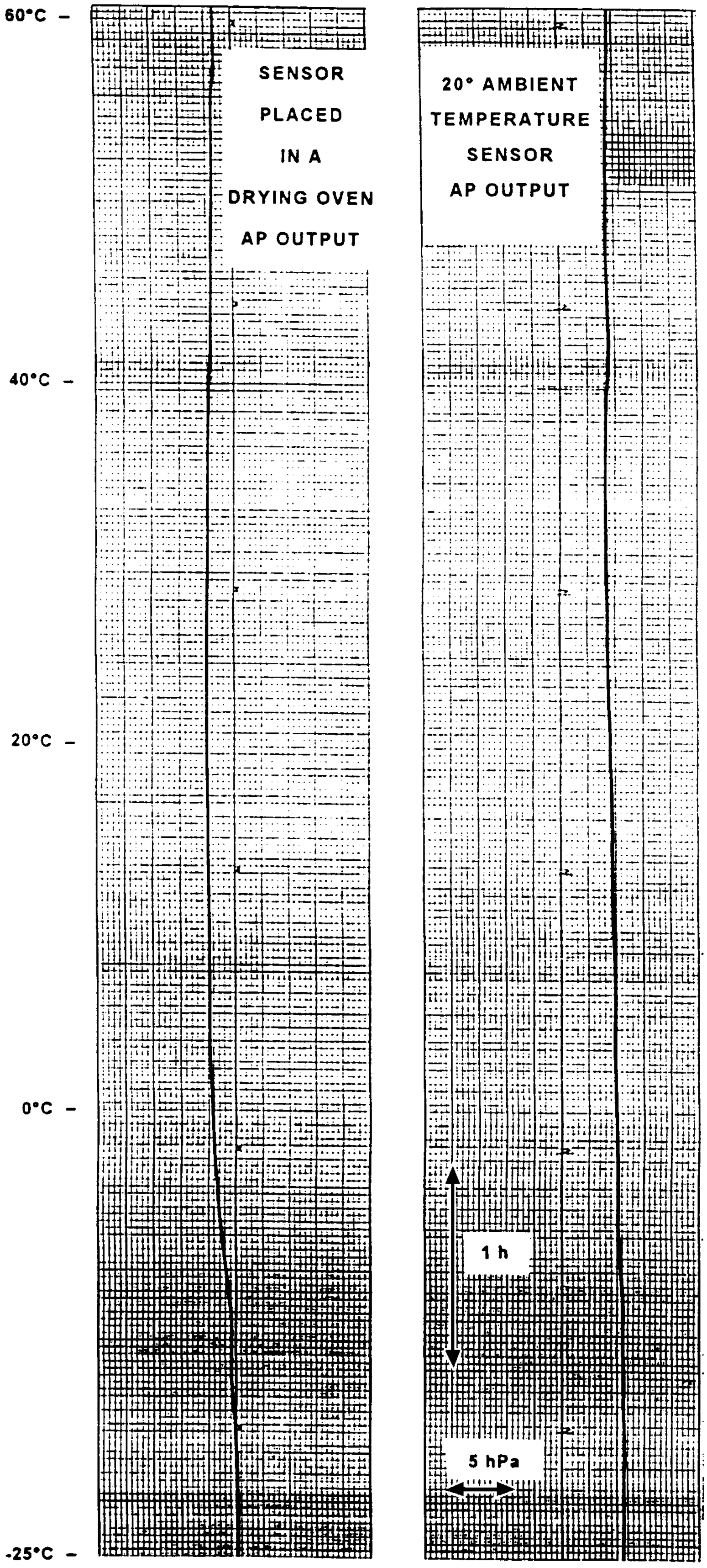
- ADVANTEST 9211C Analyser Measurement



<u>Measurements Conditions</u> :

- **Use Locked LVDT.**
- **Place sensor in a very low sismic noise environement.**
- **Wait dc offset and thermal stabilisation.**
- **Use a rectangular windowing.**
- **Process 250 average mini with no overlaping.**

Electronic Noise
Figure 2-1



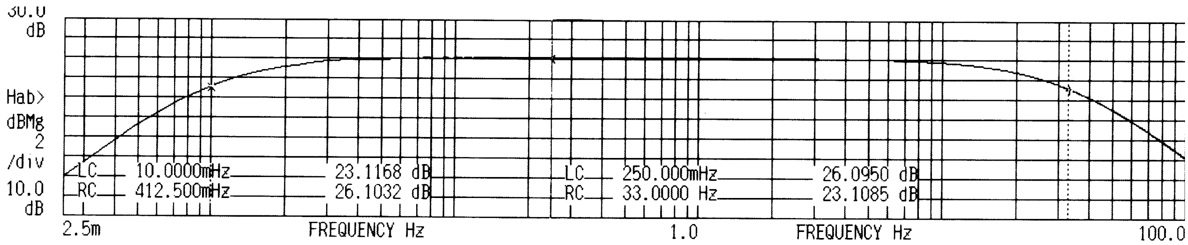
Temperature Characteristics
Figure 2-2

Static pressure calibration at different temperature (PT9 point)

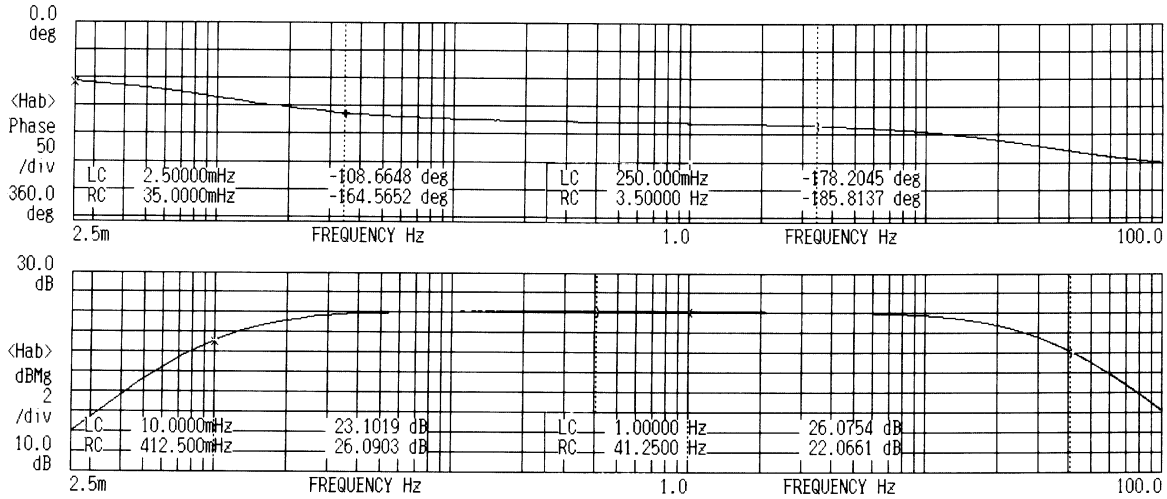
Parameter	Temperature °C	ΔP (hPa) ± 0.5hPa	Deviation %
Upper limit	+ 60	200	+ 3.70
Lower limit	- 25	200	- 4.40
Conditions & proceedings	12 hour Stabilisation	Keller Pressure Calibrator measurements	Maximum deviation measured

Hi-pass filter & output amplifier response at different temperature (20 mV/Pa output)

T = - 25°C



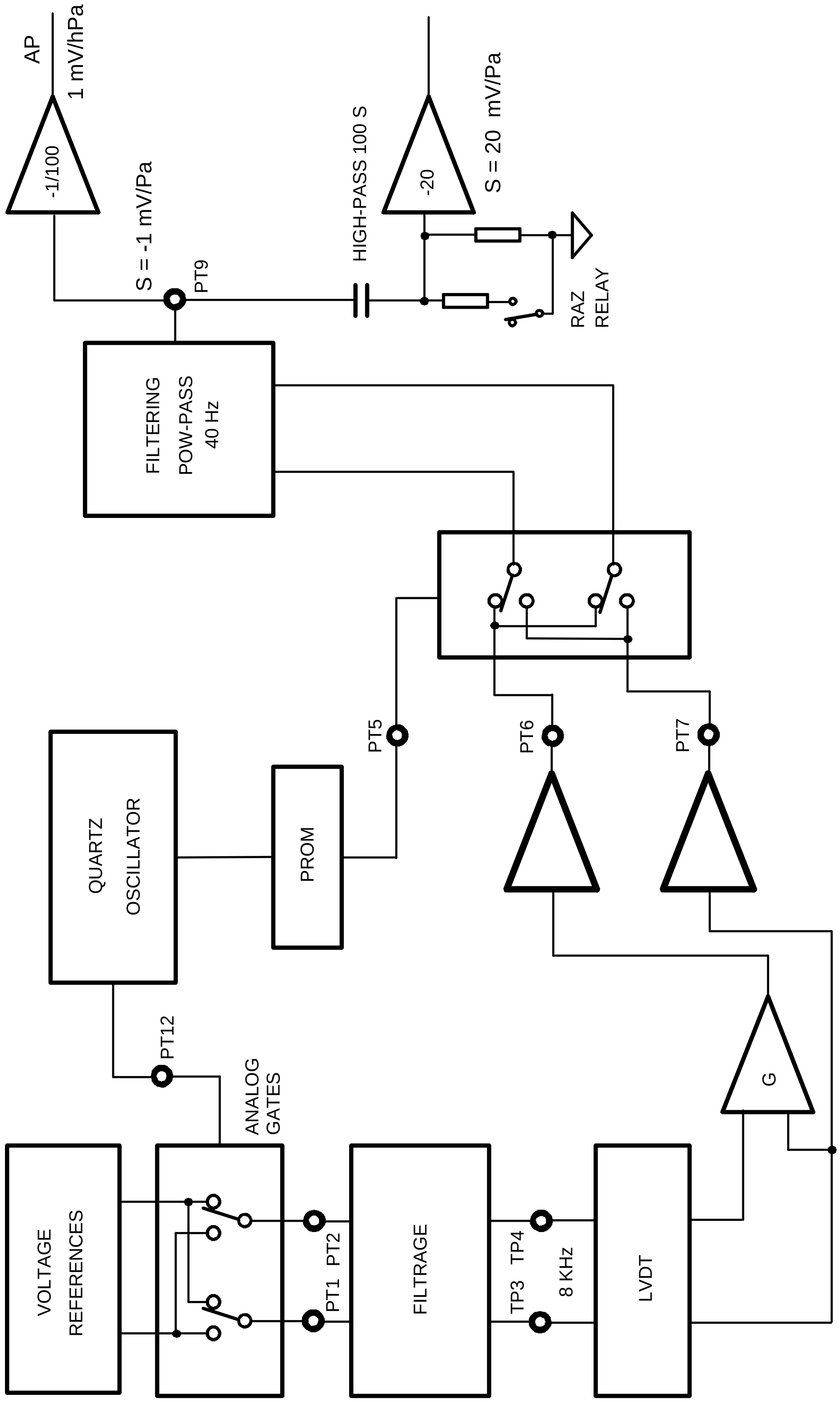
T = 60°C



Parameter	Temperature °C	Calculated Gain	Deviation %
Upper limit	+ 60	26.02	+ 0.2
Lower limit	- 25	26.02	- 0.3
Conditions & proceedings	12 hour Stabilisation		Maximum deviation measured

Temperature Characteristics
Pressure Sensitivity
Figure 2-3

BLANK



Operation Principle - Synoptic
Figure 2-4

BLANK

CHAPTER 3

OPERATION

3.1. CONNECTIONS (Figures 3-1, 3-2 and 3-3)

The sensor is supplied with + 12 volts by a 4-pins male Jupiter plug (5).

The filtered signal and the atmospheric pressure are connected to the 7-pins female Jupiter plug (4).

The wiring is presented in figures 3-2 and 3-3 for two types of units used at LDG (VANOISE and AUBRAC).

3.2. CALIBRATION (Figures 2-4 and 4-3)

The calibration is carried out in laboratory in order to adjust the sensitivity. The sensor maximum dynamic is set to ± 100 hPa atmospheric pressure. In standard 900 - 1100 hPa. The sensitivity at PT9 point is of 1 mV/Pa (see synoptic figure 2-4 or measurement board diagram figure 4-3). Use a low pressure KELLER calibrator (–1...2 bar)

Adjustment for the measurement range 900 - 1100 hPa :

(1) For a pressure of almost 1000 hPa, adjust the mechanical position of the LVDT to obtain 0V in PT9.

(2) Set the sensor to be calibrated + calibrator in high pressure (100 hPa), rise the voltage U1 in PT9.

Adjust P1 to obtain U1 = – 10 Volts.

(3) Put the unit in low pressure (– 100 hPa), rise the voltage U2 in PT9 (it must be closed to + 10 Volts).

Adjust P1 to obtain $U'2 = U2 \times 20 / (|U2|+|U1|)$.

(4) Put the unit in high pressure (100 hPa), rise the voltage U'1

$|U'2|+|U'1|$ must be equal to 20 Volts.

Adjust P1 to obtain this result if necessary.

(5) Set the microbarometer to the atmospheric pressure (AP), increase pressure with a reference barometer control and calculate the corresponding voltage value U3 on PT9:

U3 (V) = – [AP (hPa) – 1000] x 0.1.

Adjust the LVDT mechanical adjustment to measure the voltage U3 calculated above at PT9.

Example: if AP = 1020 hPa, U3 = – (1020 – 1000) x 0.1 = – 2 V.

Block the LVDT sensor with 3 screws provided for this use.

(6) Adjustment of the atmospheric pressure output:

The voltage value of the output AP is equal to the voltage measured on PT9 x – 0.01 + 1000 (in mV). In the example presented below, values must be:

(2000 x 0.01 + 1000) soit 20 + 1000 = 1020 mV.

which corresponds to the atmospheric pressure value in hPA. The adjustment may be improved by adjusting the potentiometer P3.

3.3. <u>FILTERED OUTPUT</u> (Figures 3-4 and 3-5)

The characteristics of the standard filtered output are summarised in the table figure 3-4. The characteristics of this output are compared with the Expert Group proposals.

3.3.1. Passband (Figures 3-5 and 4-1)

The standard passband is set at 0.01-27 Hz. It is easy to modify the cut frequency of the high-pass filter by changing the resistor R26. (See the parts list of the measurement board figure 4-1).

3.3.2. Sensitivity (Figure 4-1)

The standard sensitivity is of 20 mV/Pa. Only replace the resistor R27 to modify the value.

$$S\ (mV/Pa) = \frac{R27\ (k\Omega)}{R21\ (k\Omega)}$$ (Do not change R21)

The condensator C28 must be recalculated to consider the modification of the cut frequency of the low-pass filter.

→ R27 * C28 = Inchanged

3.4. FILTERING NETWORKS (Figures 3-6 and 3-7)

For best results in infrasound detection, you must use microbarometer with a wind noise reducing system connected on each inlet.

This system performs an acoustical sum of infrasound and wind noise signals on a large area.

The size of this system depends of the wind speed and the lowest frequency that you want monitor. Many solutions exist, like microporous hoses, array of mesh wired mouth with rigid pipes, or large mesh wired enclosure.

These solutions are dependant of local weather conditions. Using microporous hoses is a very low cost solution but only for dry countries because the porous hoses have decreasing perfomances in variable weather conditions. If you have severe watering conditions with very low wind, you must use large mesh wired enclosures. The best performing solution is an array of mesh wired mouth distributed on a large area. It’s a very weather insensible solution with best noise reducing.

On figure 3-6 have been traced :

1- Acoustic noise without noise reducing system

2- Acoustic noise with mesh wired enclosure

3- Acoustic noise with 12.5 m microporous hoses

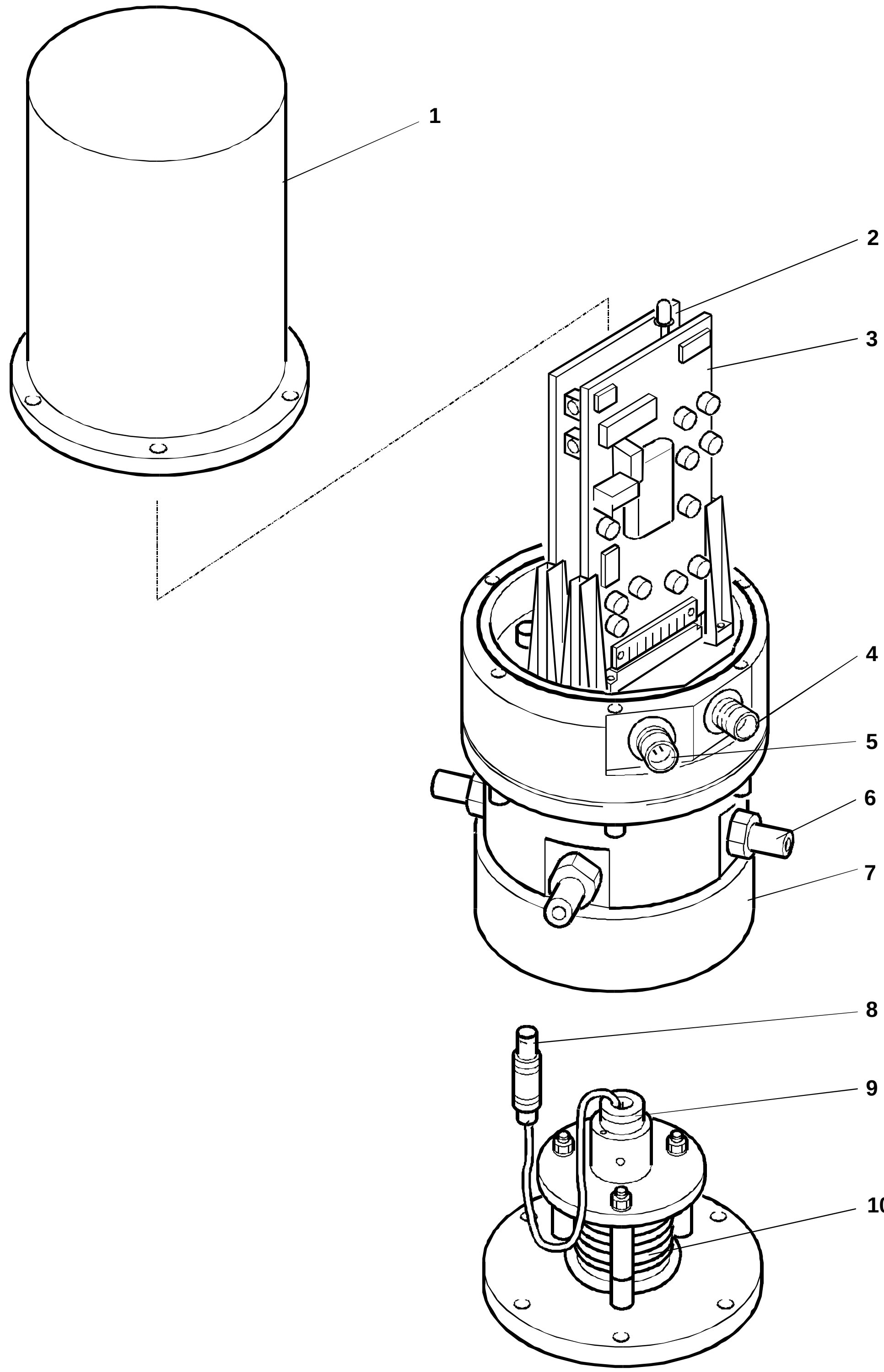
4- Acoustic noise with 32 mesh wired mouth array ditributed on a 16 m area

5- Sensor electronic noise

The wind speed during these measurements is 4 m/s.

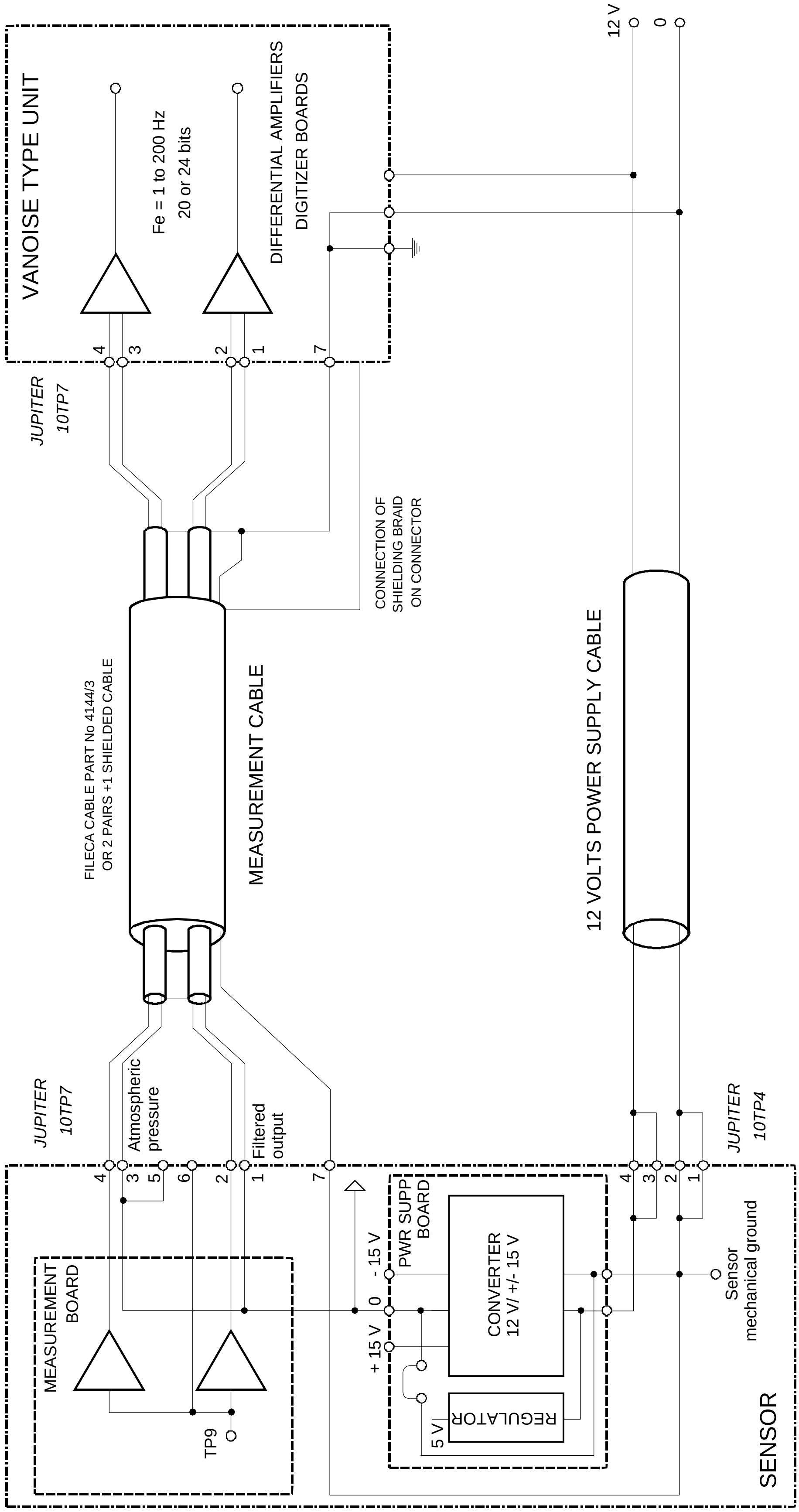
On fig 3-7 have been represented an infrasound signal generated by supersonic aircraft Concorde

BLANK

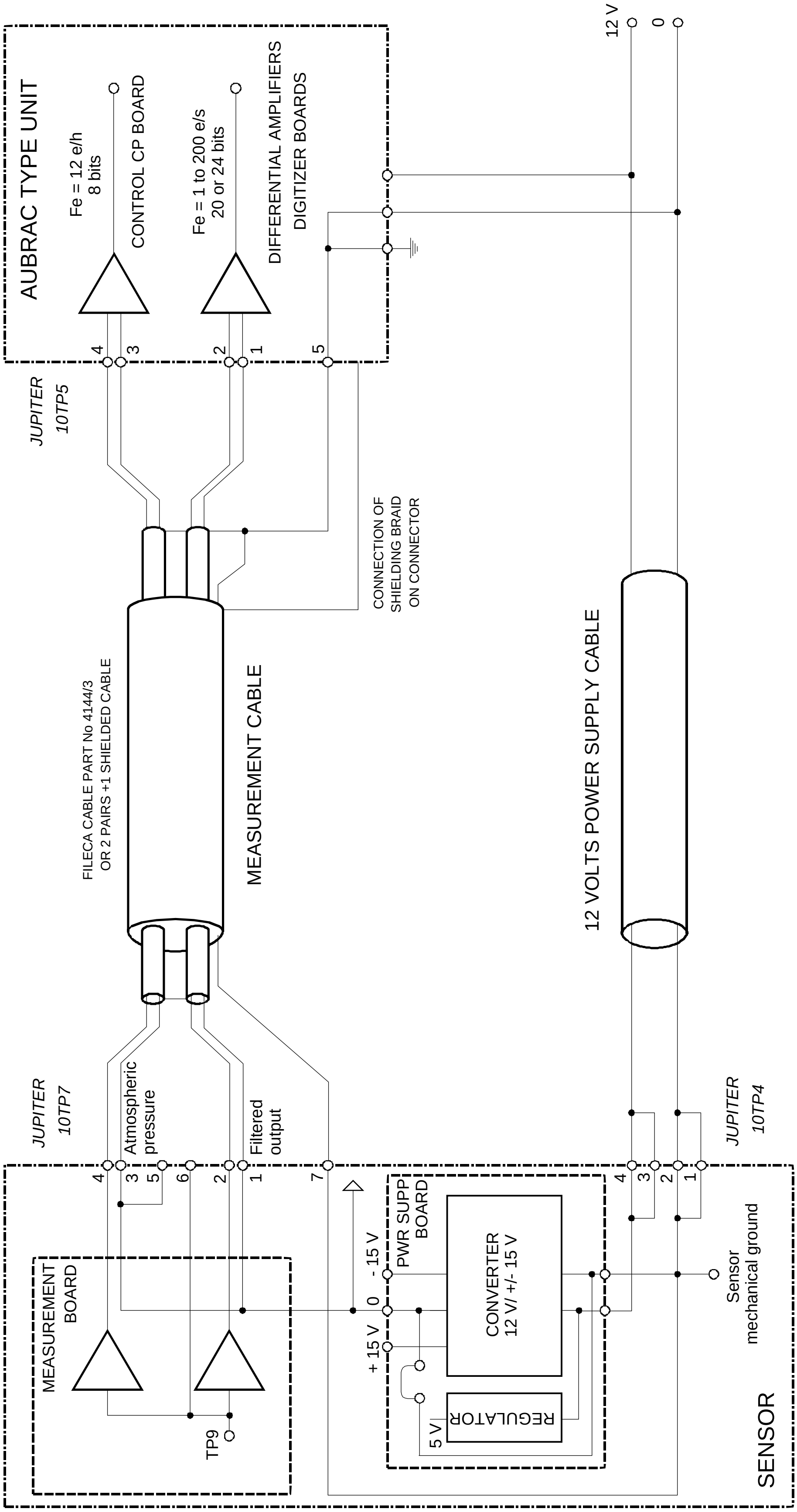


1. COVER.
2. POWER SUPPLY BOARD.
3. MEASUREMENT BOARD.
4. SIGNAL OUTPUT PLUG.
5. POWER SUPPLY PLUG.
6. NOZZLES (4).
7. MEASUREMENT CHAMBER.
8. LVDT JUNCTION CONNECTOR.
9. LVDT DISPLACEMENT SENSOR.
10. BAROMETRIC ANEROID.

Description
Figure 3-1



Digitization Unit Sensor Junction Cable
VANOISE Type
Figure 3-2

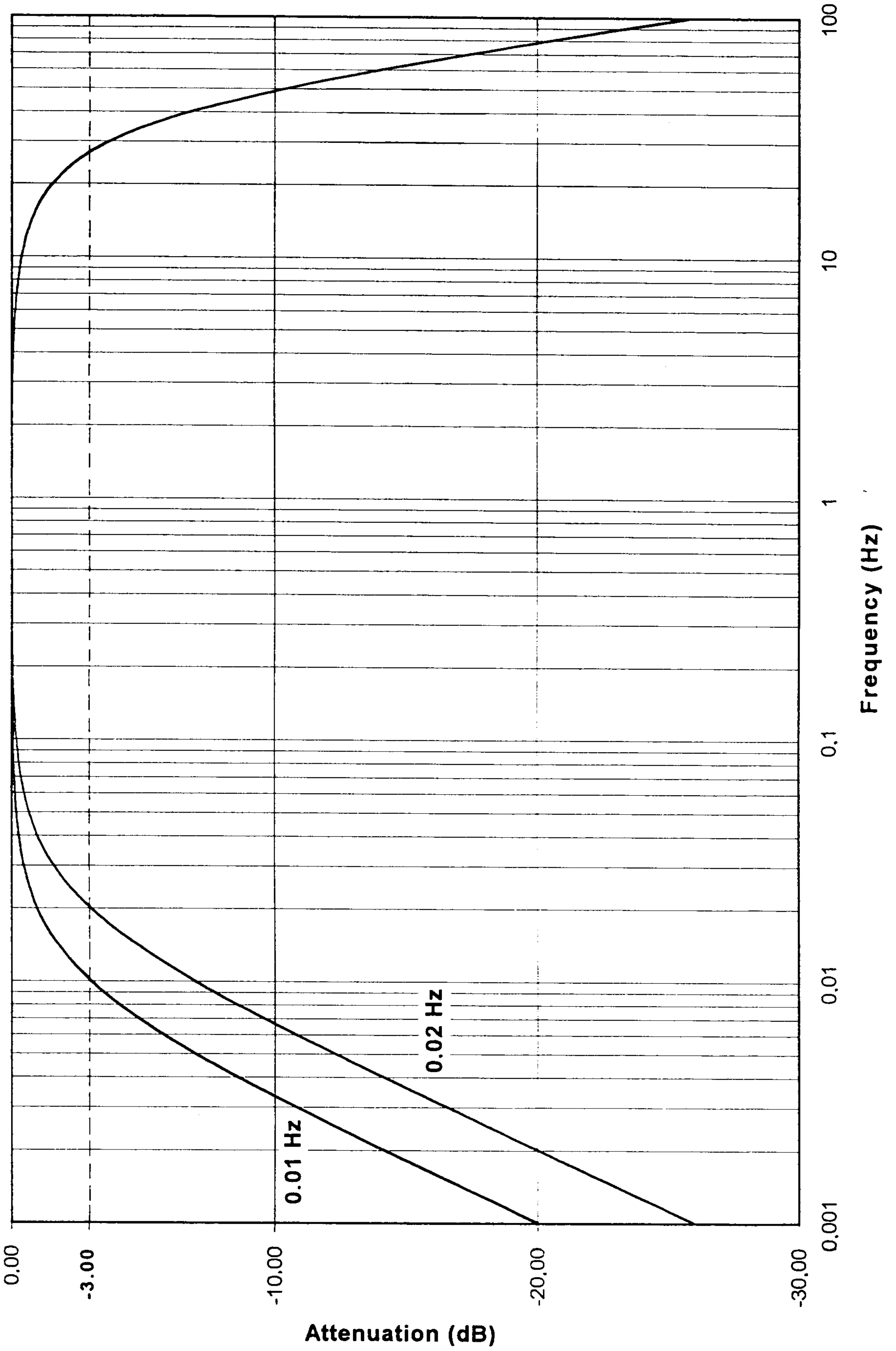


Digitization Unit Sensor Junction Cable
AUBRAC Type
Figure 3-3

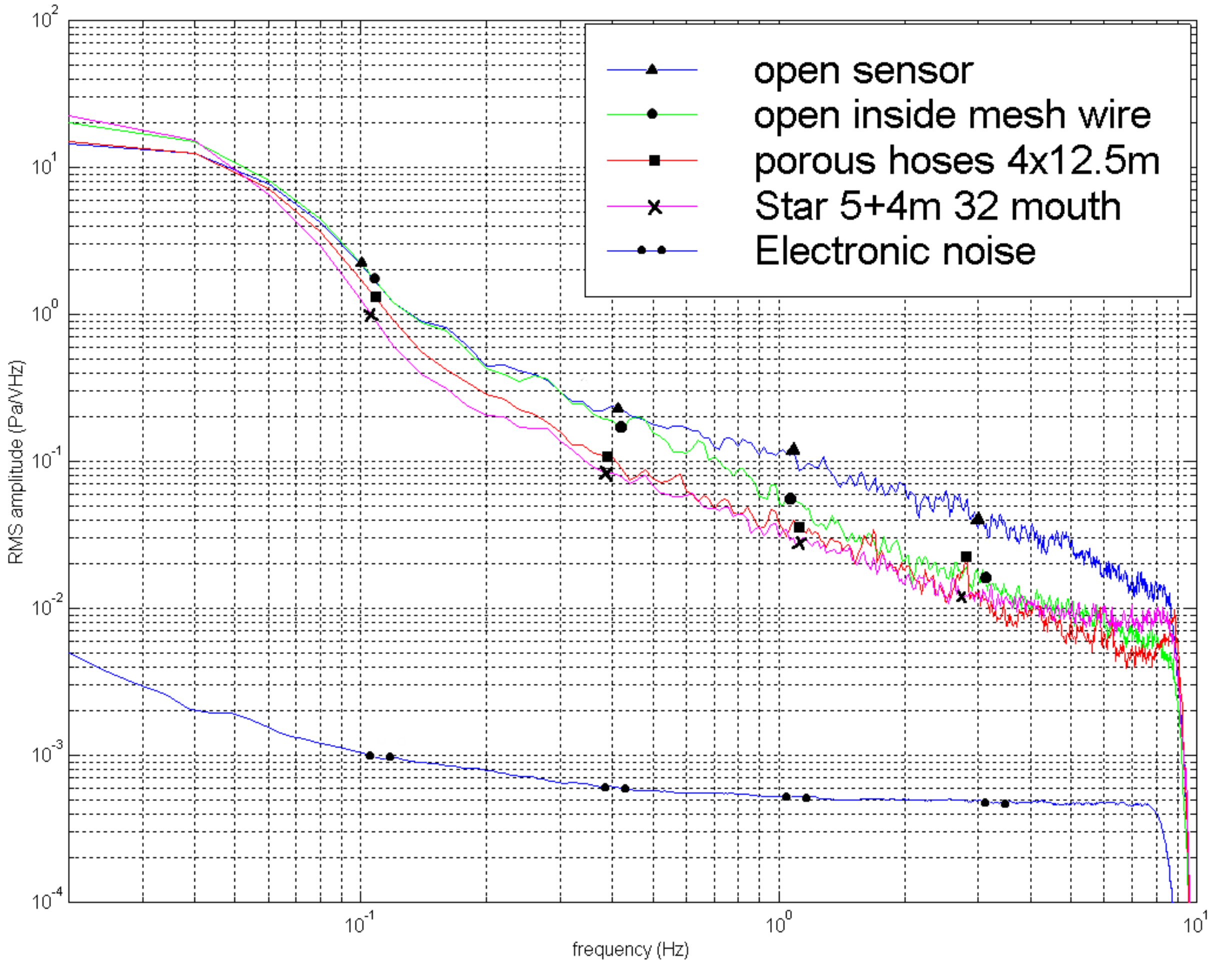
		Specifications WGB/TL/8 April 1997	DASE Sensor with 20 bits DASE ADC	DASE Sensor with 24 bits DASE ADC
MB 2000 Sensor	Range		200 hPa pp	200 hPa pp
	Bandwidth (Hz)		0 - 40	0 - 40
	Sensitivity		1 mV / Pa	1 mV / Pa
	Electronic noise @ 1 Hz (1)	$\leq 0.63\ mPa/\sqrt{Hz}$	$0.6\ mPa/\sqrt{Hz}$	$0.6\ mPa/\sqrt{Hz}$
	Electronic noise (0.02 - 4 Hz)		2 mPa rms	2 mPa rms
	Dynamic range (2)		134 dB	134 dB
MB 2000 Signal output	Range		1000 Pa pp	1000 Pa pp
	Bandwidth (Hz)	0.02 - 4	0.01 - 27	0.01 - 27
	Sensitivity		20 mV / Pa	20 mV / Pa
	Electronic noise (0.02 - 4 Hz)		2 mPa rms	2 mPa rms
	Dynamic range (2)		108 dB	108 dB
Digitizer	Antialiasing filter (Hz)	≥ 4 Hz	4 Hz	4 Hz
	Sampling Frequency	≥ 10 Hz	10 Hz	10 Hz
	Digitizing range		20 V	32 V
	Input range		20 V	20 V
	Digitizing output		20 bits	24 bits
	count	$\approx 1 mPa$	0.95 mPa	0.095 mPa
	Digitizing noise		0.57 mPa rms	0.105 mPa rms
	Dynamic (2)		119 dB	133 dB
System	Full Scale		1000 Pa pp	1000 Pa pp
	Noise		2.1 mPa rms	2.0 mPa rms
	Dynamic (2)	$\geq 108\ dB$	108 dB	133 dB

(1) 18 dB below minimum acoustic noise $(5 mPa / \sqrt{Hz}\ @\ 1 Hz)$
(2) ½ Full scale / Noise

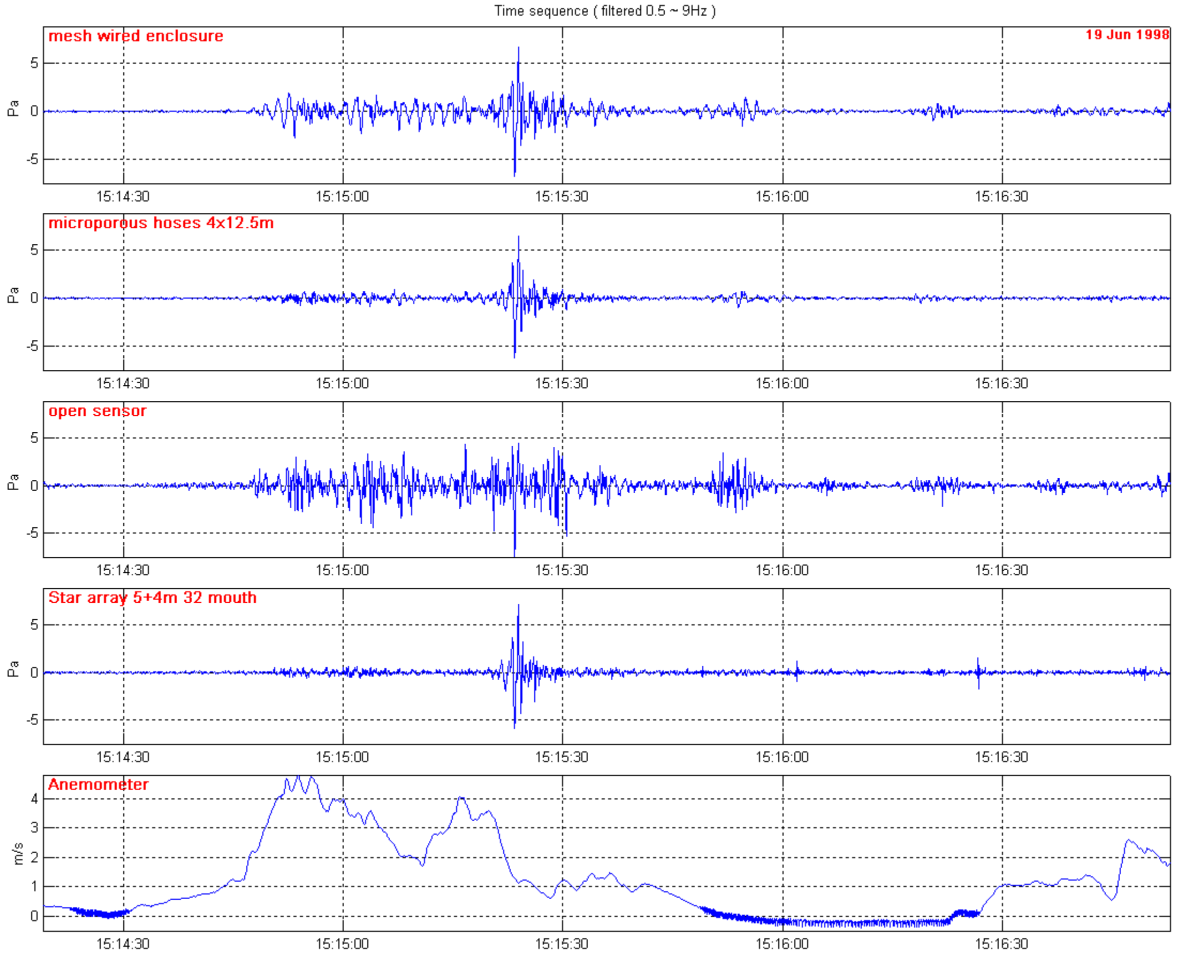
Comparison Between the DASE
and the Expert Group Proposals
Figure 3-4



Frequency Band
Figure 3-5



Noise Measurements
Figure 3-6



Example of Infrasond Signals
Figure 3-7

CHAPTER 4

ELECTRONIC BOARDS

4.1. POWER SUPPLY BOARD (Figures 4-4 to 4-6)

The power supply board provides, from a + 12 V arrival, the voltages + 5 V, + 15 V and – 15 V used on the measurement board.

It is based on a DC/DC PM962 (MA2) converter for the ± 15 V and on a LM140 (MA1) converter for the + 5 V.

A fuse (F1) protects the unit.

4.2. MEASUREMENT BOARD (Figures 4-1 to 4-3)

Measurement board consists of 3 sub-assemblies:

- A 8 kHz logic oscillator.
- A 8 kHz analog oscillator.
- A synchronous demodulator + filtering and amplification.

4.2.1. 8 kHz logic oscillator

It is made of a quartz (Y1 = 4096 kHz) and counters/dividers (MN2-MN3) in order to obtain, in one hand, a 8 kHz signal to pilot the analog oscillator to the primary and on the other hand, a PROM addressing (MN4) allowing the synchronous demodulation of the signal from the secondary.

4.2.2. 8 kHz analog oscillator

A rectangular signal of 8 kHz frequency and ± 6.9 V amplitude is constituted from voltage references (CR1-CR2) and analog gates (MA1) controlled by the logic oscillator. This signal is then filtered (MA2-MA4/MA3-MA5) in order to obtain a ± 7.8 V sinusoid amplitude driving the LVDT primary.

4.2.3. Demodulator, filter and amplifier

The signal at the LVDT secondary is amplified by a first stage (MA16) then demodulated by analog gates (MA8 - in synchronisation with primary signal) and rectified (MA9).

A first filter (Fc = 40 Hz - MA10) provides a continuous voltage of – 1 mV/Pa. A second filter at 100 s (C29/R26) and an amplifier/low-pass filter stage (MA12-34 Hz) set the signal to a sensitivity of 20 mV/Pa.

Another output (MA13) allows to obtain the atmospheric pressure (AP).

A relay (K1) initialises the filter 100 s by downloading the capacity at power-up.

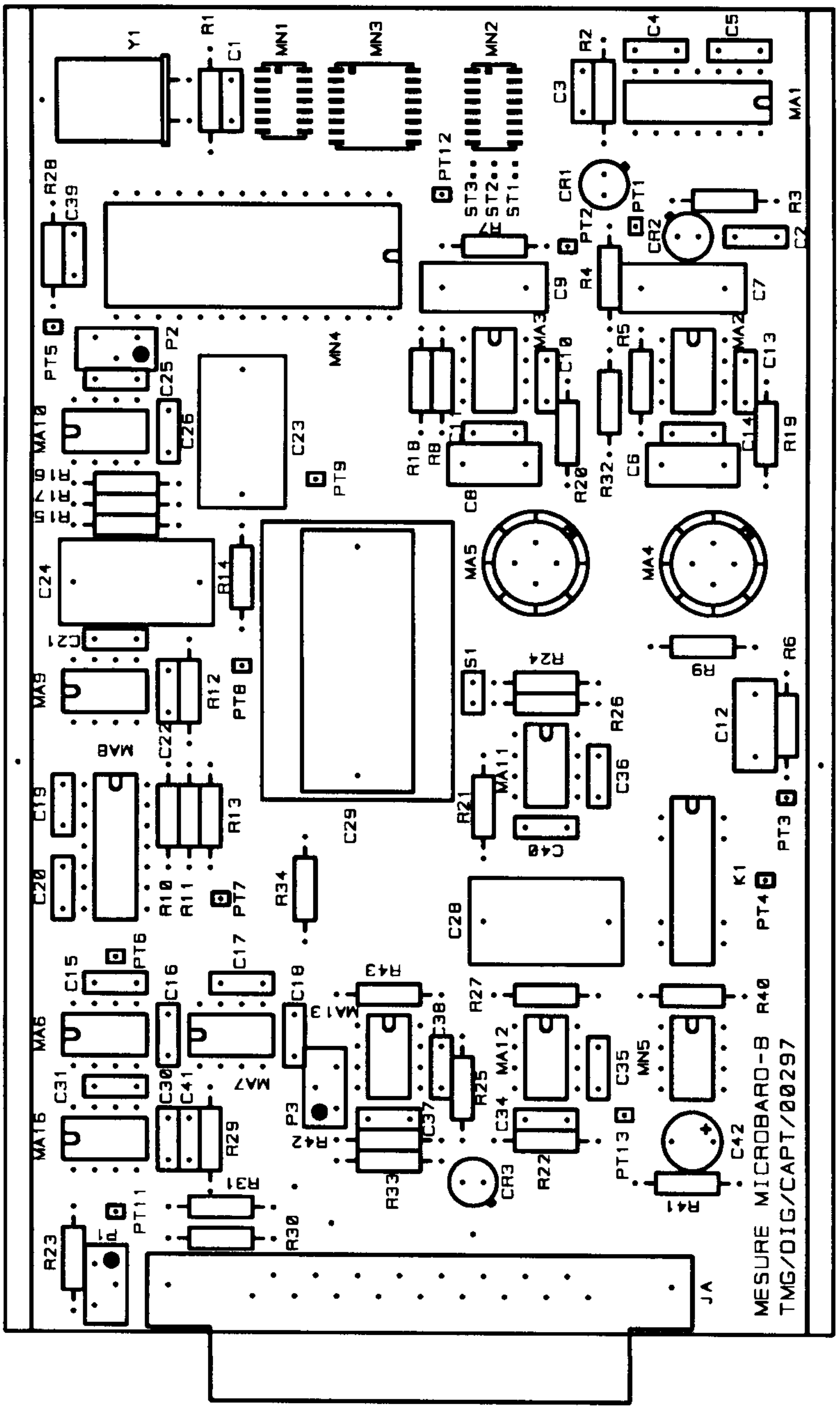
Item	Qty	Designation	Manufacturer	Remarks
		<u>CONDENSATOR</u>		
C1	1	C680 10 pF		
C2, C3	2	EC05 1 nF		
C4, C5,				
C10, C11,				
C13, C14,				
C15, C16,				
C17, C18,				
C19, C20,				
C21, C22,				
C25, C26,				
C30, C31,				
C34, C35,				
C36, C37,				
C38, C40	24	EC05 22 nF		
C6, C8	2	CKM501 5 nF 160 V 1%		
C7, C9	2	CKM501 10 nF 160 V 1%		
C12	1	CTS7 4.7 µF 16 V	FIRADEC	
C23, C24	2	CKB501 0.47 µF 160 V 1%		
C28	1	CKB501 47 nF 160 V 1%		
C29	1	CKB501 22 µF 40 V 1%		
		Double layout 10 µF or 22 µF		
C42	1	Tantale 100 µF 16 V		
C39	1	EC05 270 pF		
C41	1	EC05 330 pF		
		<u>DIODE</u>		
CR1, CR2,				
CR3	3	LM329AH		
		<u>POTENTIOMETER</u>		
P1	1	T63YA 1 kΩ		
P2	1	T63YA 10 kΩ		
P3	1	T63YA 1 kΩ		
		<u>QUARTZ</u>		
Y1	1	HC49U 4096 kHz		
		<u>RELAY</u>		
K1	1	D31 A5150	CELDUC	

Item	Qty	Designation	Manufacturer	Remarks
		<u>INTEGRATED CIRCUIT</u>		
MA1, MA8	2	AD7512KQ	ANALOG DEVICE	
MA2, MA3,				
MA6, MA7,				
MA9, MA10,				
MA12,MA13,				
MA16,	9	OP27EJ TO99		
MA4, MA5	2	LT1010MH with radiator	LT	
MA11	1	OPA111BM		
MN5	1	CD40107		
MN1	1	CD4012BE		
MN2	1	CD4040BE		
MN3	1	CD4520BE		
MN4	1	27C64BQE + support		
		<u>CONNECTOR</u>		
JA	1	HE701F 17 pts	SOCAPEX	
		<u>WRAPPING</u>		
S1	1	2 pts		
		<u>TERMINAL</u>		
PT1 to PT9	9		LOUPOT	
PT11 to PT13	3		LOUPOT	
		<u>RESISTOR</u>		
	1	NY4 15 M 10%	SFERNICE	
R1				
R2, R3,	3	RCMX02 K3 2 k 1%	SFERNICE	
R25				
R4, R5,	4	RCMX02 K3 4.02 k 1%	SFERNICE	
R7, R8	2	RCMX02 K3 25.5 Ω 1%	SFERNICE	
R6, R9				
R10, R11	4	RCMX02 K3 4.99 k 1%	SFERNICE	
R12, R13	2	RCMX02 K3 8.45 k 1%	SFERNICE	
R14, R15	1	RCMX02 K3 9.09 k 1%	SFERNICE	
R42	1	RCMX02 K3 562 Ω 1%	SFERNICE	
R16				
R17, R22				
R23, R31,	5	RCMX02 K3 1 k 1%	SFERNICE	
R43				

Edition: 06/96

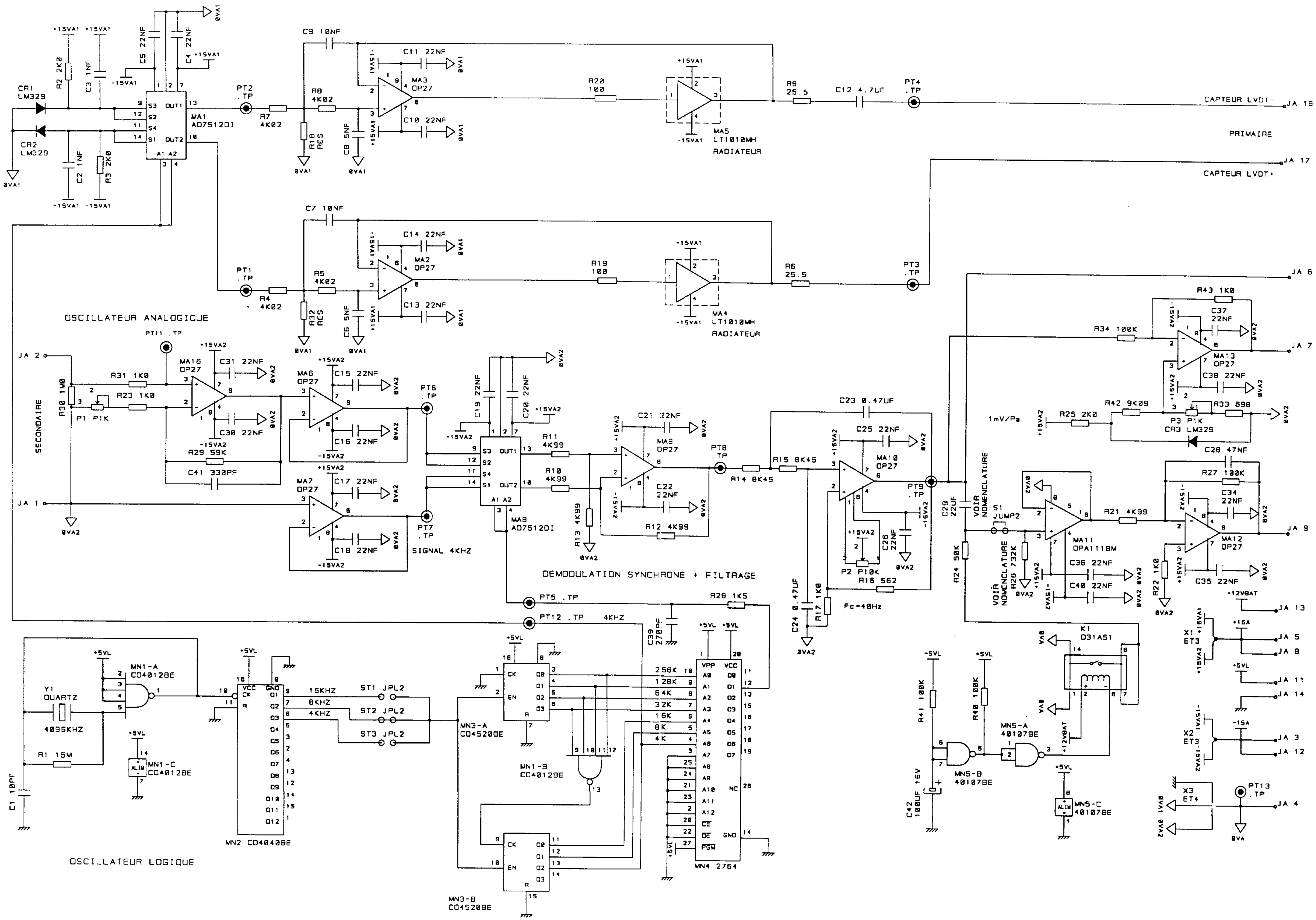
Measurement Board
Parts List
Figure 4-1 (2/3)

Item	Qty	Designation	Manufacturer	Remarks
R19, R20	2	RCMX02 K3 100 Ω 1%	SFERNICE	
R21	1	RCMX02 K3 4.99 k 1%	SFERNICE	
R24	1	RCMX02 K3 49.9 k 1%	SFERNICE	
R26	1	RCMX02 K3 805 k 1% High-pass 50 s for C29 10 µF	SFERNICE	
R26	1	RCMX02 K3 365 k 1% High-pass 50 s for C29 22 µF	SFERNICE	
R26	1	RCMX02 K3 1.62 M 1% High-pass 100 s for C29 10 µF	SFERNICE	
R26	1	RCMX02 K3 732 k 1% High-pass 100 s for C29 22 µF	SFERNICE	
R27, R34 R40, R41	4	RCMX02 K3 100 k 1%	SFERNICE	
R28	1	RCMX02 K3 1.5 k 1%	SFERNICE	
R29	1	RCMX02 K3 59 k 1%	SFERNICE	
R30	1	RCMX02 K3 1 M 1%	SFERNICE	
R33	1	RCMX02 K3 690 k 1%	SFERNICE	



Edition: 01/97

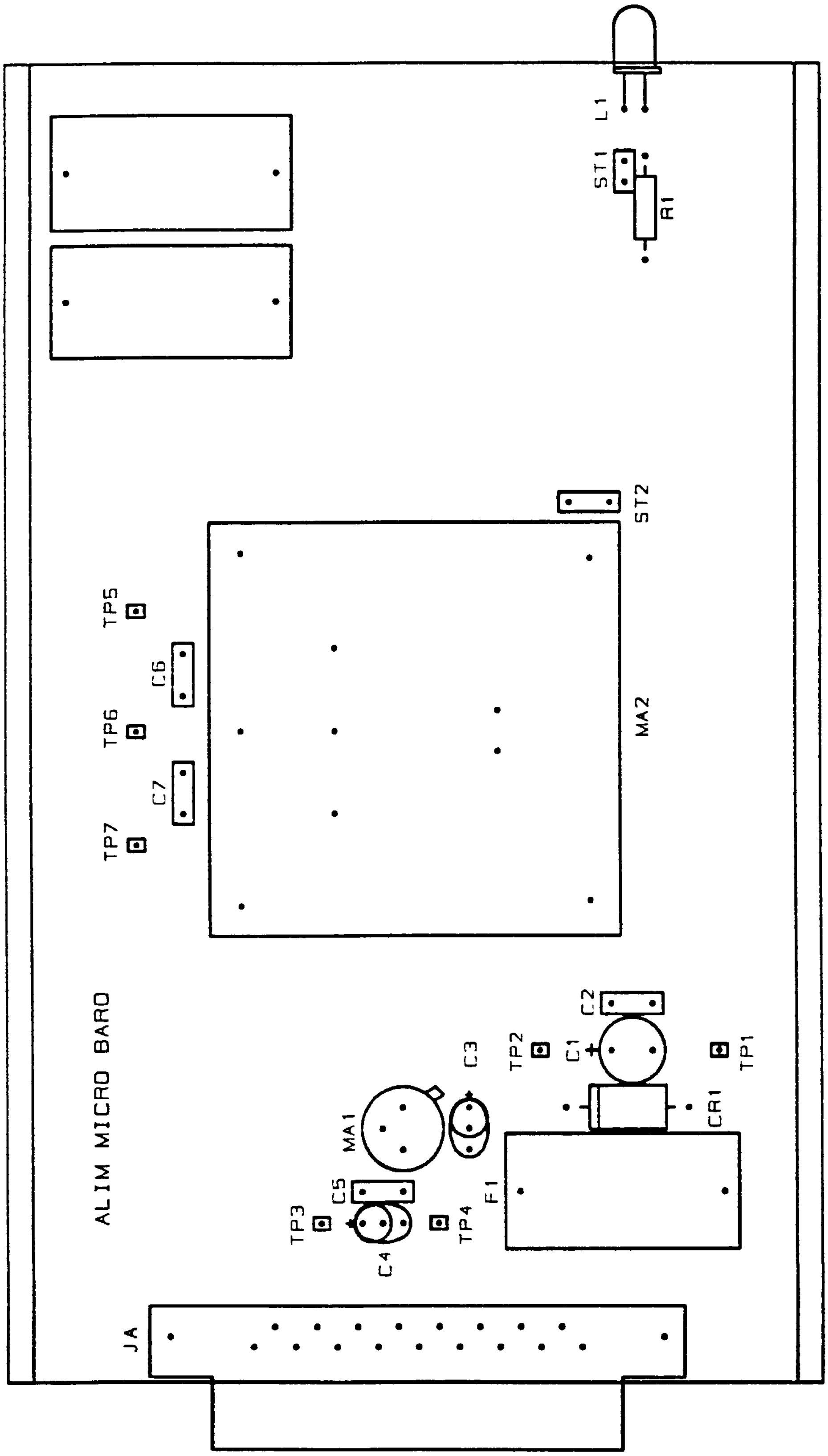
Measurement Board
Equipment
Figure 4-2


OSCILLATEUR ANALOGIQUE
SECONDAIRE
SIGNAL 4KHZ
DEMODULATION SYNCHRONE + FILTRAGE
OSCILLATEUR LOGIQUE
CAPTEUR LVDT-
PRIMAIRE
CAPTEUR LVDT+
MA1 AD7512DI
MA3 OP27
MA2 OP27
MA5 LT1010MH
MA4 LT1010MH
RADIATEUR
MA16 OP27
MA6 OP27
MA7 OP27
MA8 AD7512DI
MA9 OP27
MA10 OP27
MA11 OPA111BM
MA12 OP27
MA13 OP27
CR1 LM329
CR2 LM329
CR3 LM329
Y1 QUARTZ 4096KHZ
MN1-A CD4012BE
MN1-B CD4012BE
MN1-C CD4012BE
MN2 CD4040BE
MN3-A CD4520BE
MN3-B CD4520BE
MN4 2764
MN5-A 4010BE
MN5-B 4010BE
MN5-C 4010BE
K1 D31A51
X1 ET3
X2 ET3
X3 ET4
1mV/Pa
Fc=40Hz
VOIR NOMENCLATURE
S1 JUMP2

Item	Qty	Designation	Manufacturer	Remarks
C1	1	TANTALE CONDENSATOR 22 µF 25 V		
C2, C5				
C6, C7,	4	CONDENSATOR EC05 100 nF		
C3, C4,	2	TANTALE CONDENSATOR 1 µF 35 V		
CR1	1	DIODE 1N5400		
F1	1	FUSE SUPPORT 5x20 0031-8211	CEHESS/	
F1	1	FUSE 0.5 A	SCHURTER	
L1	1	RED LED ∅ 5		
MA1	1	INTEGRATED CIRCUIT LM140LAH-5.0		
MA2	1	INTEGRATED CIRCUIT PM962	COMPUTER	
			PRODUCTS	
		or 12015-200	CALEX	
R1	1	RESISTOR NY4 3,9 k 1%		
ST1, ST2	2	WRAPPING 2 pts		
TP1 to TP7	7	TERMINAL	LOUPOT	
JA	1	CONNECTOR HE701F 17 pts		

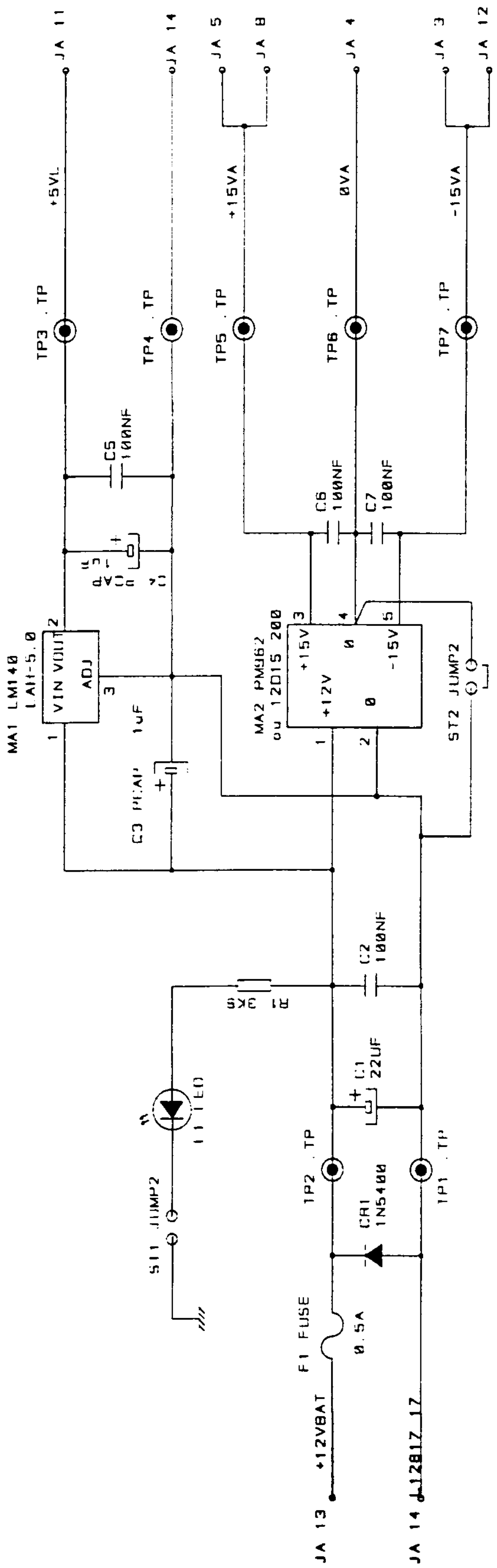
Edition: 02/96

Power Supply Board
Parts List
Figure 4-4



Edition: 02/96

Power Supply Board
Equipment
Figure 4-5



Power Supply Board
Electrical Diagram
Figure 4-6

BLANK

POWER SUPPLY BOARD	MEASUREMENT BOARD	POWER SUPPLY PLUG MALE	SIGNAL OUTPUT PLUG FEMALE	FUNCTIONS
	1	Black		LVDT secondary - Lemo 4 pins - 1
	2	Red		LVDT secondary - Lemo 4 pins - 4
3	Blue 3			- 15 V
4	Black 4	Black	**1 - 3 - 5**	0VA
5	Red 5			+ 15 V
	6	Blue	**6**	PT9 output
	7	Green	**4**	AP
	8			
	9	Yellow	**2**	Filtered output
	10			
11	Mauve 11			+ 5 V
	12			
13	Red 13	Red **3 - 4**		+ 12 V
14	Black 14	Black **1 - 2** Black	**7**	Black Mechanical ground - 0 V
	15			
	16	Brown		LVDT primary - Lemo 4 pins - 2
	17	Orange		LVDT primary - Lemo 4 pins - 3

Wiring
Figure 4-7

BLANK

CHAPTER 5

ILLUSTRATED PARTS LIST

BLANK

5.1. INTRODUCTION

5.1.1. General

The purpose of the illustrated parts list is to identify all the components in the equipment.

The illustrated parts list comprises the following sections:

5.1. Introduction

5.2. List of manufacturers

5.3. Directory of manufacturer's part numbers

5.4. Detailed parts list

5.1.2 Using the detailed parts list

The detailed parts list gives and illustrates the parts making up the assembly in question.

The various columns of the parts list pages are laid out in the following way:

- 1st column - Figure - Reference (Figure No. and reference).
- 2nd column - Manufacturer's P/N.
- 3rd column - Description.
- 4th column - Validity.
- 5th column - Qty per assembly.

1) Figure No. and reference

Each assembly, sub-assembly and part with a part number and which appears in the parts list has a reference number.

The number of the figure to which the references belongs is shown on the line at the top of each page.

The assemblies, sub-assemblies and parts listed, but not illustrated, are identified by a hyphen (-) placed in front of the reference number of these assemblies, sub-assemblies and parts.

A letter index placed in front of the reference number refers to the corresponding release of the figure.

2) Manufacturers' P/N

A manufacturer's P/N is given to each assembly, sub-assembly and part, whether or not illustrated.

3) Description

The description is presented using a system of tabulations showing the relationship between the various parts:

1 2 3 4 5 6 7

Assembly
. Basic parts of the assembly
. Sub-assemblies
. Attaching and/or storage parts of sub-assembly XXX
  * * *
. . Basic parts of the sub-assembly
. . Sub-sub-assembly
. . Attaching and/or storage parts of sub-sub-assembly XXX
    * * *
. . . Basic parts of the sub-sub-assembly, etc.

The manufacturer's code is mentioned for all items not belonging to the manufacturer of the complete equipment.

The manufacturer's code, along with the symbol "NP" (not procurable) are placed at the far right-hand end of the 1st line of the description.

4) Validity

An alphanumeric code gives the compatibility of the sub-assemblies and basic parts with respect to the next higher assemblies or sub-assemblies.

When compatibility is total, the "VALIDITY" column will be left blank.

This code corresponds to the reference of the next higher assemblies or sub-assemblies.

Example: Validity 1A, 1B, 1C is written 1ABC.

5) Quantity per assembly

This column gives the number of parts needed for one (1) next higher assembly.

In some cases, the quantity is replaced by the letters RF (Reference) and AR (As Requested).

5.1.3. Symbols and abbreviations used

- DET: Detail
- DIA: Diameter
- FIG: Figure number
- INT: Internal
- NP: Not physically procurable
- QTY: Quantity
- R: Revision
- RF: Mentioned for reference only

5.1.4. Revision

When a reference is modified, added or deleted, the letter "R" is marked opposite it in the right-hand margin (the issue date changes).

"R" appears in the right-hand margin opposite the page number when all the references are modified, and in the case of a new page.

BLANK

5.2. LIST OF MANUFACTURERS

MANUFACTURER'S CODE	NAME - ADDRESS	
F6131	JUPITER SA (CONSTRUCTION ELECTRIQUES) 95 Rue du Docteur ROUX 94100 St MAUR-DES-FOSSES	FRANCE
F6162	SOCAPEX - AMPHENOL 5 Rue du President KRUGER 92403 COURBEVOIE CEDEX	FRANCE
F9049	LEMO FRANCE SARL Allée des Erables ZAC PARIS NORD 2 93420 VILLEPINTE	FRANCE
DASE-TMG	DASE-TMG B.P. 12 91680 BRUYERES-LE-CHATEL	FRANCE

BLANK

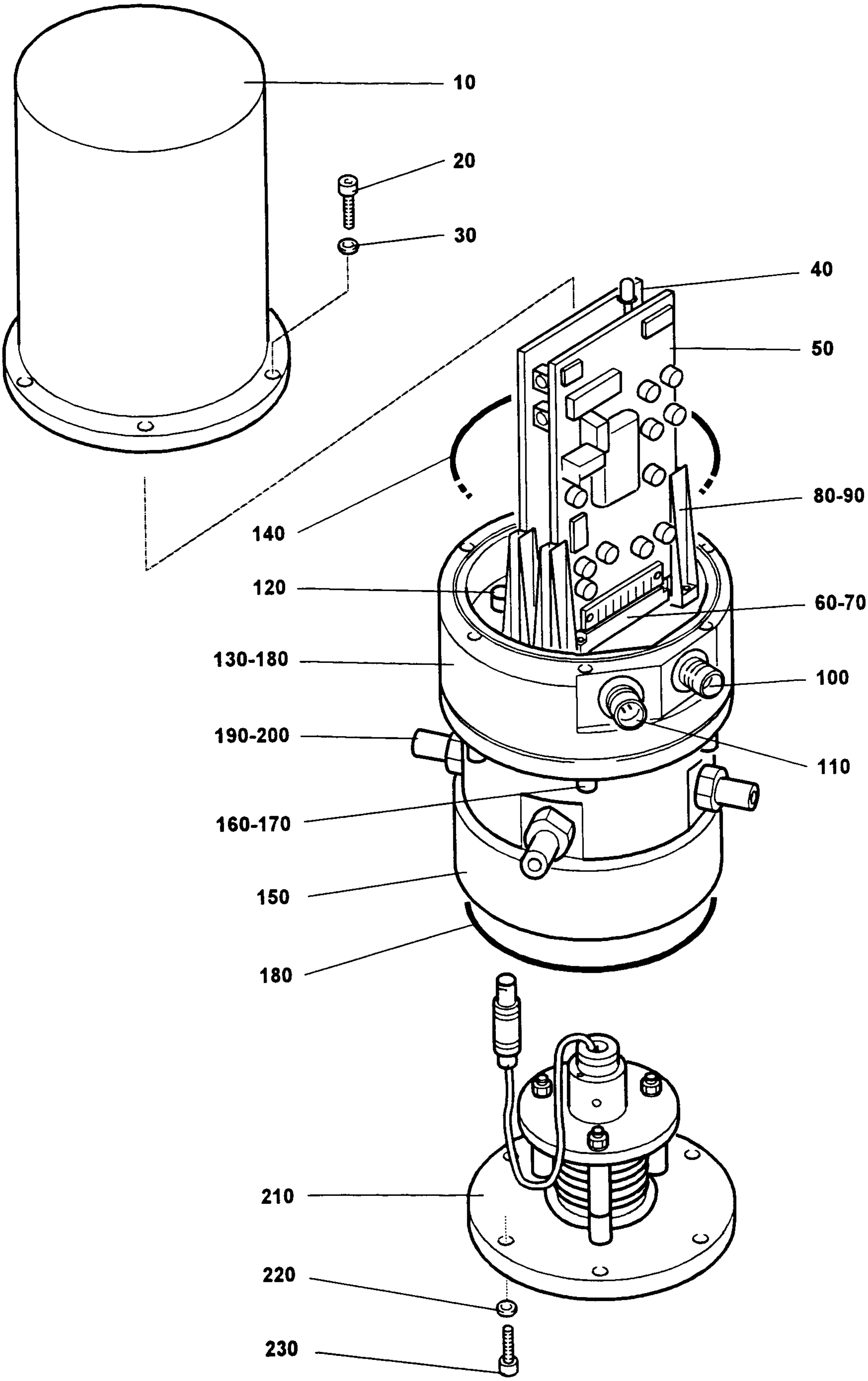
5.3. DIRECTORY OF MANUFACTURER'S PART NUMBERS

MANUFACTURER'S P/N	FIGURE	ITEM	QUANTITY
ALIMBARO-C00	5-1	040A	1
C-M3X10	5-1	070A	4
C-M3X10	5-1	090A	8
CHC-M5X16	5-1	160A	6
CHC-M5X16	5-1	220A	6
CHC-M5X20	5-1	020A	6
GRS6031VR	5-1	080A	4
M5U	5-1	030A	6
M5U	5-1	170A	6
M5U	5-1	230A	6
MIBAR01-C00	5-1	050A	1
REO-1-M4	5-1	120A	1
RERF10TP07-20	5-1	100A	1
RERM10TP04-20	5-1	110A	1
050-95RXC	5-1	-001A	RF
051-95RXC-ASY	5-1	210A	1
052-95RXC	5-1	150A	1
058-95RXC	5-1	130A	1
085-95RXC	5-1	190A	4
104-5-2-3	5-1	180A	2
124-5-3	5-1	140A	1
17-1-1-6	5-1	200A	4
254-17-AFZ	5-1	060A	2

– Item not illustrated

BLANK

5.4. DETAILED PARTS LIST



Microbarometer
Figure 5-1

FIG ITEM	MANUFACTURER'S PART NUMBER	DESCRIPTION 12345	USAGE CODE	VALID	QTY
5-1					
-001A	050-95RXC	MICROBAROMETER			RF
010A	059-95RXC	.COVER			1
		ATTACHING PARTS			
020A	CHC-M5X20	.SCREW, STAINLESS STEEL			6
030A	M5U	.WRAPPING, STAINLESS STEEL			6
		* * *			
040A	ALIMBARO-C00	.POWER SUPPLY BOARD			1
050A	MIBAR01-C00	.MEASUREMENT BOARD			1
060A	254-17-AFZ	.FEMALE SUPPORT	F6162		2
		ATTACHING PARTS			
070A	C-M3X10	.SCREW, STAINLESS STEEL			4
		* * *			
080A	GRS6031VR	.BOARD GUIDE (THOMAS/BETTS)			4
		ATTACHING PARTS			
090A	C-M3X10	.SCREW, STAINLESS STEEL			8
		* * *			
100A	RERF10TP07-20	.FEMALE CONNECTOR	F6131		1
110A	RERM10TP04-20	.MALE CONNECTOR	F6131		1
120A	REO-1-M4	.CONNECTOR	F9049		1
130A	058-95RXC	.MAIN FLANGE			1
140A	124-5-3	.SEAL ∅ 124.5, ROPE ∅ 3			1
150A	052-95RXC	.CYLINDER			1
		ATTACHING PARTS			
160A	CHC-M5X16	.SCREW, STAINLESS STEEL			6
170A	M5U	.WRAPPING, STAINLESS STEEL			6
		* * *			
180A	104-5-2-3	.SEAL ∅ 104.5, ROPE ∅ 2.3			2
190A	085-95RXC	.JOINT			4
200A	17-1-1-6	.SEAL ∅ 17.1, CORDE ∅ 1.6			4
210A	051-95RXC-ASY	.JOINED MEASUREMENT BELLOWS			1
		ATTACHING PARTS			
220A	CHC-M5X16	.SCREW, STAINLESS STEEL			6
230A	M5U	.WRAPPING, STAINLESS STEEL			6
		* * *			

– Item not illustrated

BLANK