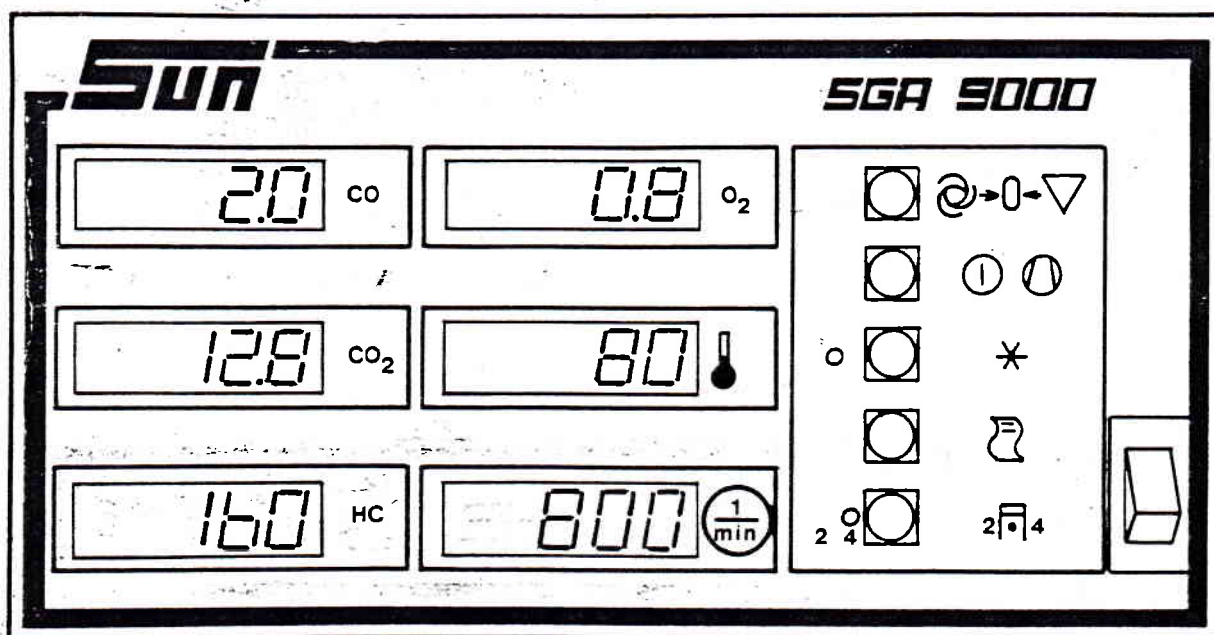


Model SGA-9000

Service/Repair Manual



SUN ELECTRIC EUROPE B.V.

SGA-9000

SUN GAS ANALYSER

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2) POWER SUPPLY & DISTRIBUTION

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SWITCHING SUPPLY

LINEAR SUPPLY

3) GAS PROCESSING

GAS BENCH(3 GAS)

ANALOG PROCESSING BD.

HEATER CONTROLLER BD.

4) DIGITAL PROCESSING BD.

5) CONTROLS & DISPLAYS

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O₂

PRINTER

REMOTE CONTROL

RPM

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7) TROUBLESHOOTING GUIDE

8) PARTS & ACCESSORIES

9) SOFTWARE REVISIONS

10) SERVICE BULLETINS

INTRODUCTION

THIS SGA-9000 SERVICE/REPAIR MANUAL HAS BEEN DIVIDED INTO SECTIONS AS OUTLINED BY THE TABLE OF CONTENTS. EACH SECTION DEALS WITH A SPECIFIC ASPECT OF THE ANALYSER.

BEFORE SERVICING THE TESTER THE BLOCK DIAGRAM, FLOW DIAGRAMS AND PNEUMATIC DIAGRAM ON PAGES 03 THRU 08 MUST BE FULLY UNDERSTOOD.

DURING SERVICING IT SHOULD FIRST BE ASCERTAINED AS TO WHETHER OR NOT THE TESTERS POWER SUPPLIES ARE FUNCTIONING CORRECTLY. REFER TO SECTION 2 FOR THE INFORMATION NECESSARY TO CHECK AND IF REQUIRED, REPAIR THESE SUPPLIES. AFTER CONFIRMING THE POWER SUPPLIES, THE FAULT SHOULD BE TRACED USING SECTION 7 TROUBLESHOOTING, IN CONJUNCTION WITH THE SECTION COVERING THE SUSPECTED AREA IN WHICH THE FAULT IS OCCURRING. AFTER REPAIRING THE TESTER THE CHECKOUT/CALIBRATION PROCEDURE SECTION 1 SHOULD BE CARRIED OUT.

GENERAL NOTES:

1. DO NOT REMOVE BOARDS OR DISCONNECT WHILE POWER IS ON!
2. FOLLOW THE TROUBLESHOOTING GUIDE'S DIRECTIONS CAREFULLY. DO NOT SKIP STEPS OR MAKE ASSUMPTIONS.
3. CHECK SOFTWARE REVISION LEVEL TO ENSURE THAT THE TESTER IS FUNCTIONING IN THE CORRECT MANNER FOR THAT SOFTWARE LEVEL (SEE SECTION 9).



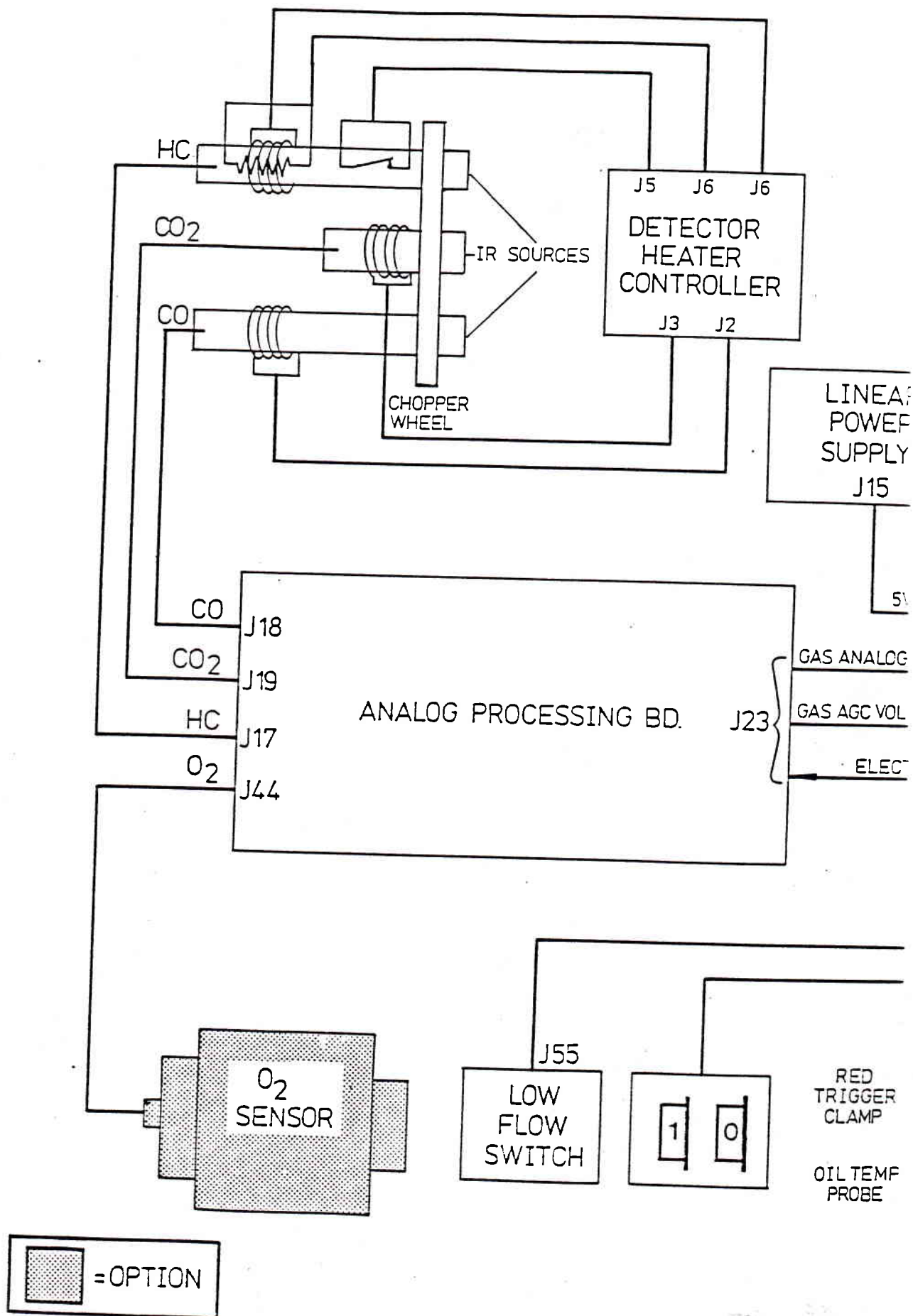
SGA-9000

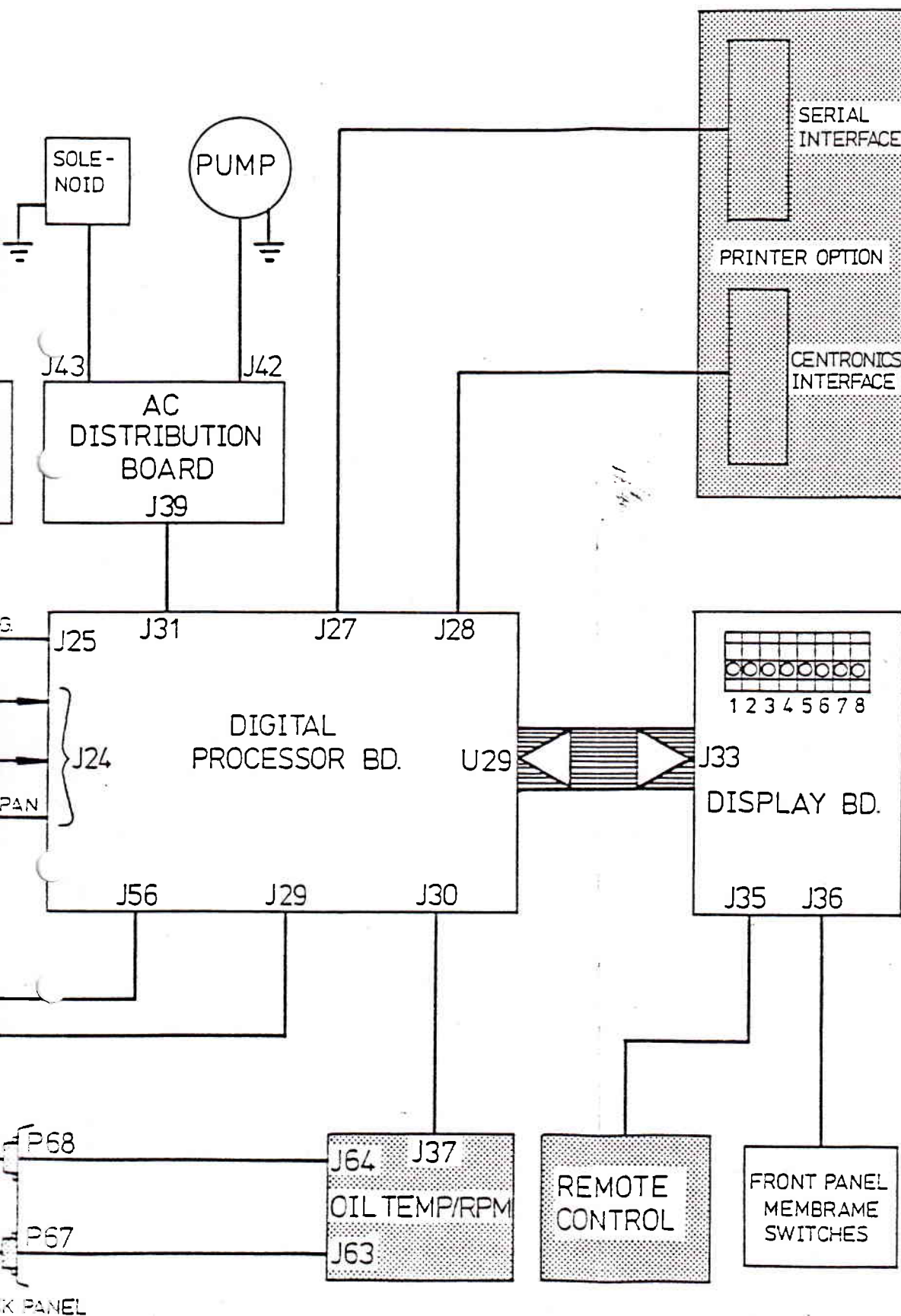
INTRODUCTION

PAGE 02

4. MAKE SURE YOU COMPLETELY UNDERSTAND THE TESTERS CAPABILITY (SEE NOTE 3).
FOR HELP IN THIS REGARD, CONSULT THE BLOCK AND FLOW DIAGRAMS ON PAGES 03
THRU 06.
5. EXTRA CARE MUST BE USED WHEN HANDLING THE DIGITAL PROCESSING BD BECAUSE IT
MAY BE DAMAGED BY STATIC ELECTRICITY DISCHARGES. WHEN THE BOARD IS NOT
CONNECTED IN THE TESTER IT SHOULD BE PLACED IN AN ANTI-STATIC BAG.
6. PAY CLOSE ATTENTION TO THE DASH NUMBERS AND REVISION LETTERS OF THE BOARDS.
WHEN ORDERING SPARE PARTS ALWAYS REFER TO SECTION 8 PARTS AND ACCESSORIES.
7. THIS MANUAL IS PRIMARILY FOR SERVICING THE SGA-9000 TO SUB-UNIT LEVEL ONLY.
HOWEVER, SHOULD THE SCHEMATICS FOR THE INDIVIDUAL SUB ASSEMBLIES BE
REQUIRED THEY WILL BE AVAILABLE AT YOUR MAIN SERVICE CENTER. A LIST OF SUB
ASSY NUMBERS AND THEIR CORRESPONDING SCHEMATIC NUMBERS CAN BE FOUND ON PAGE
21.
8. BEFORE USING THIS MANUAL REFER TO SECTION 10 SERVICE BULLETINS TO ENSURE
THAT YOU HAVE THE LATEST INFORMATION CONCERNING YOUR TESTER.

* * * * *



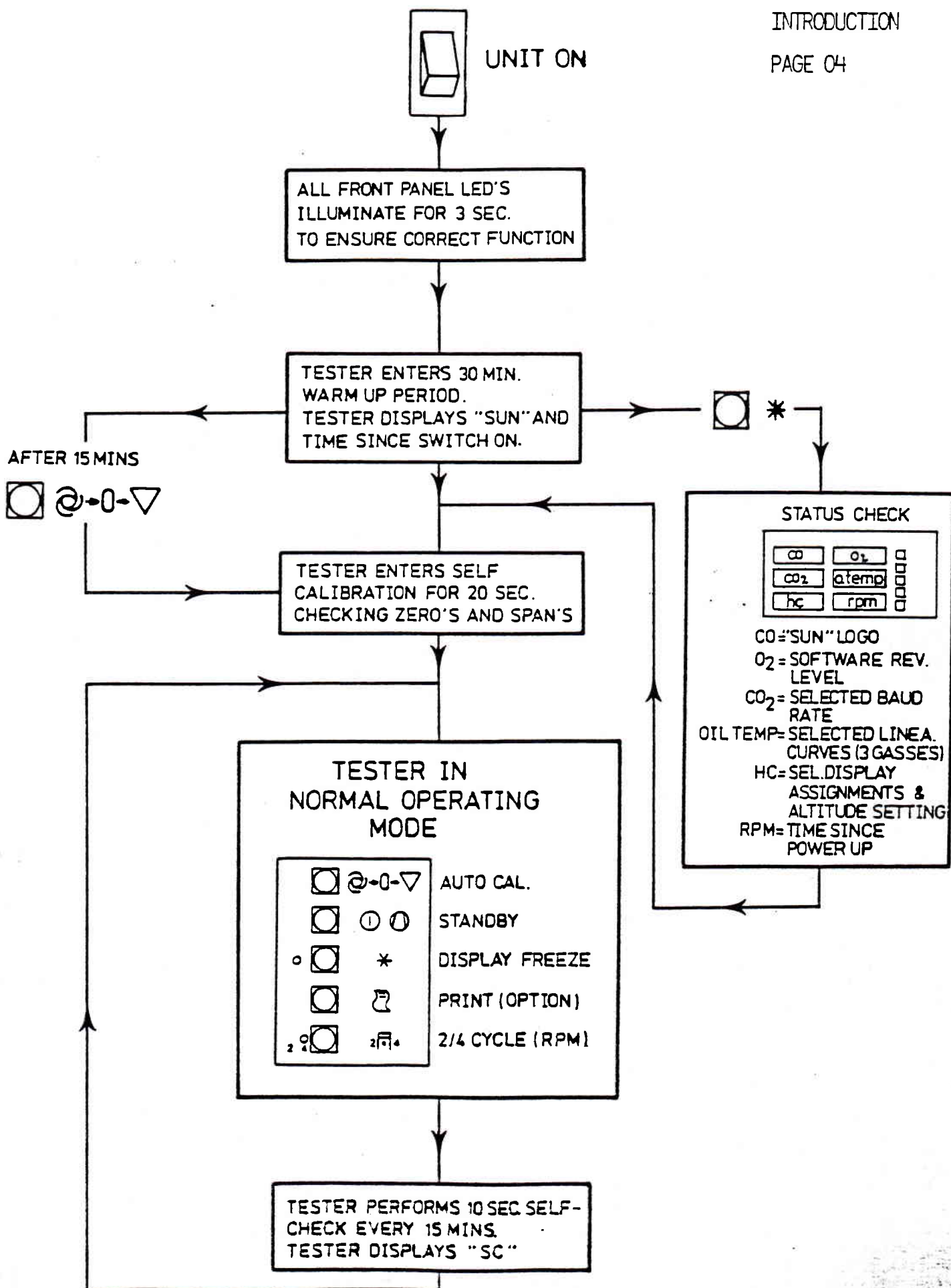


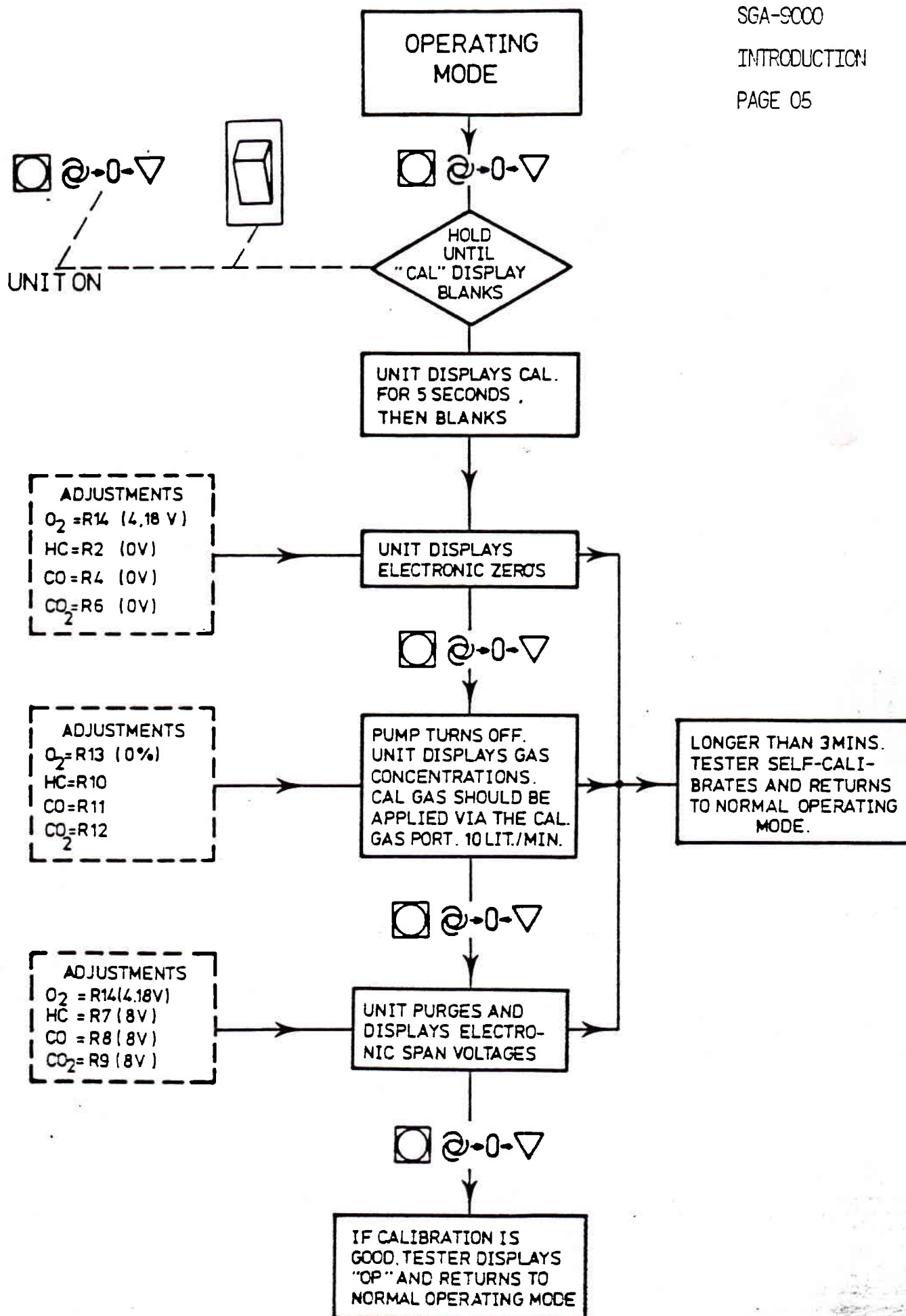
OPERATING FLOW DIAGRAM

SGA-9000

INTRODUCTION

PAGE 04





SERVICE MODE FLOW DIAGRAM

SGA-9000

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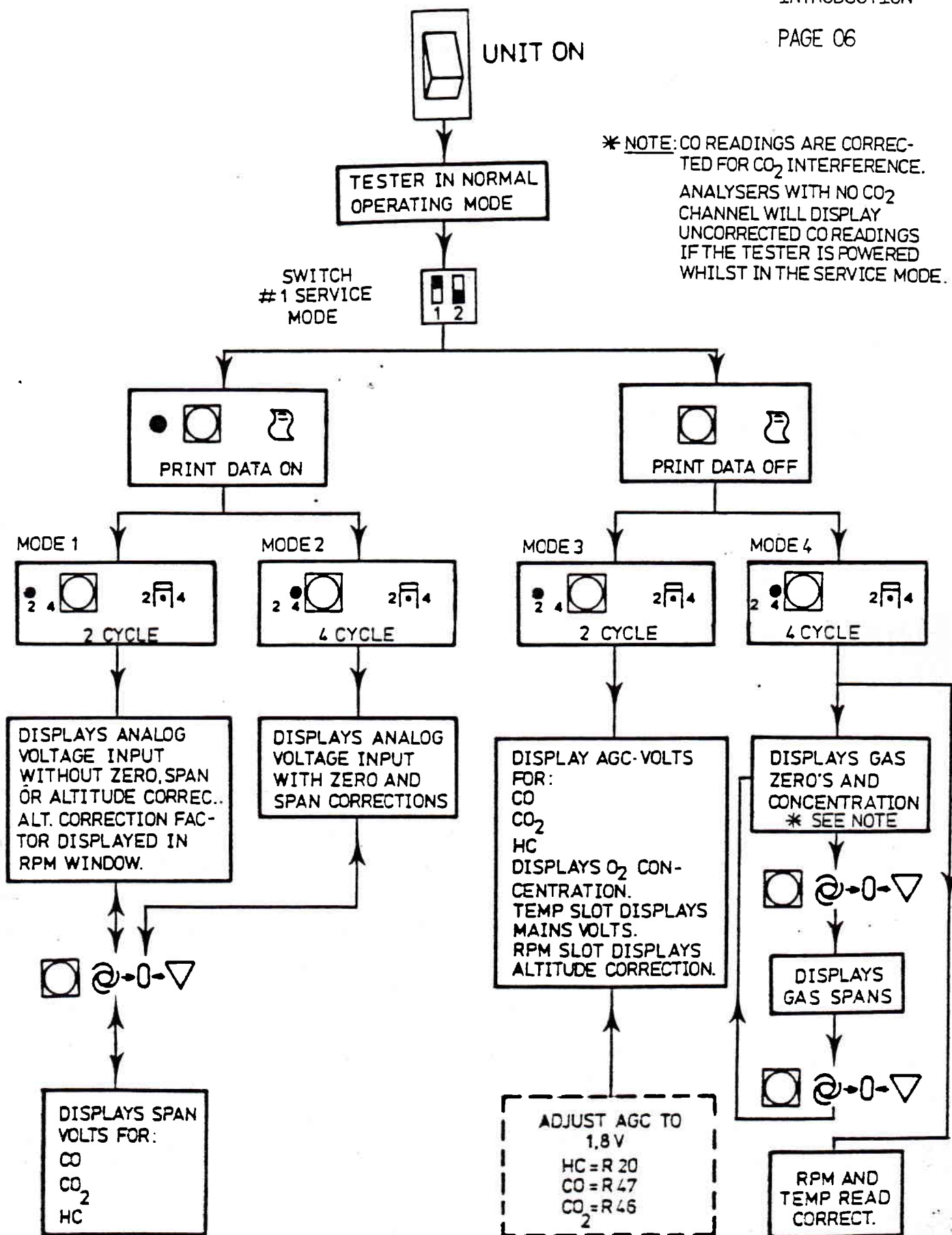
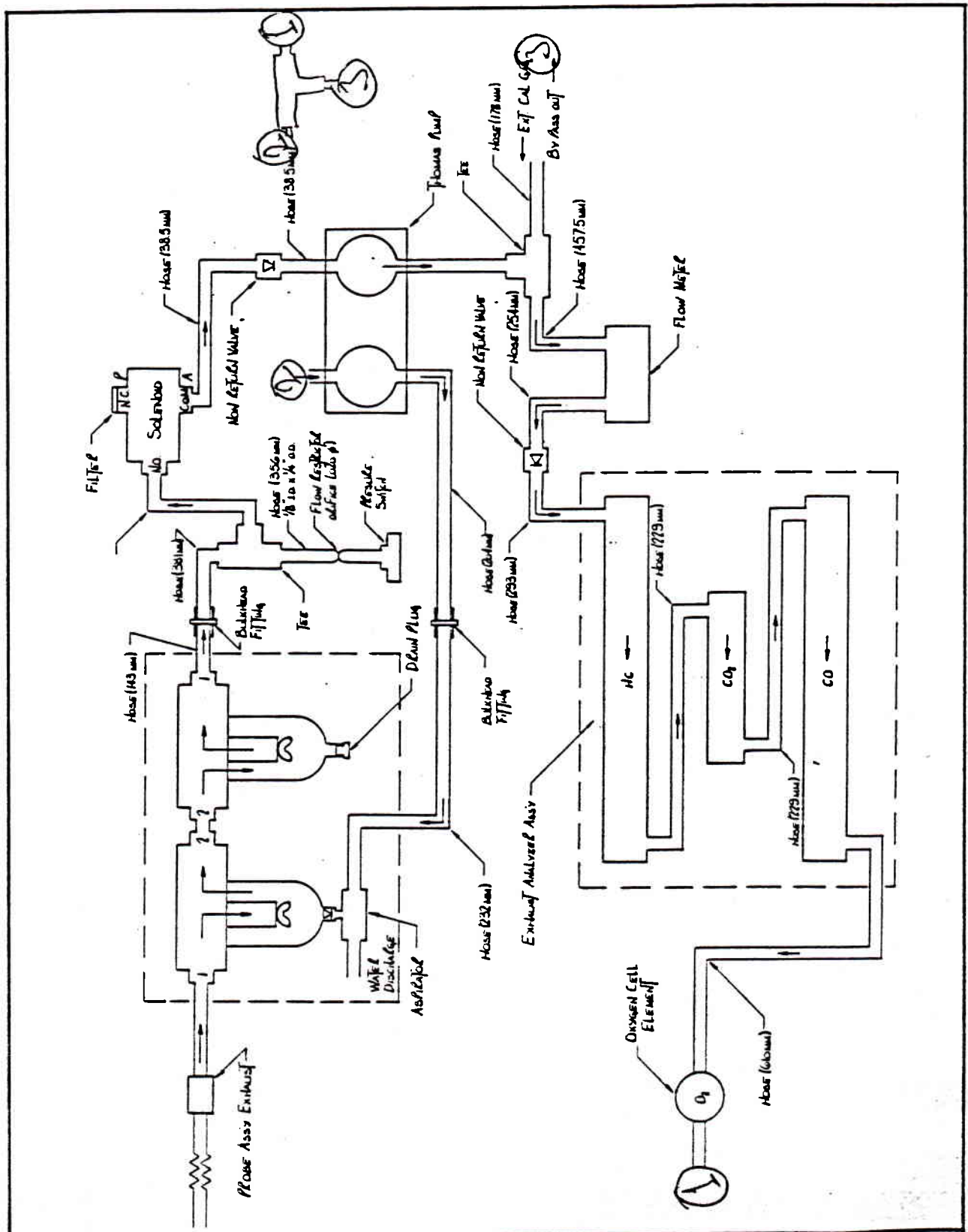


TABLE OF OPERATING / SERVICE MESSAGES

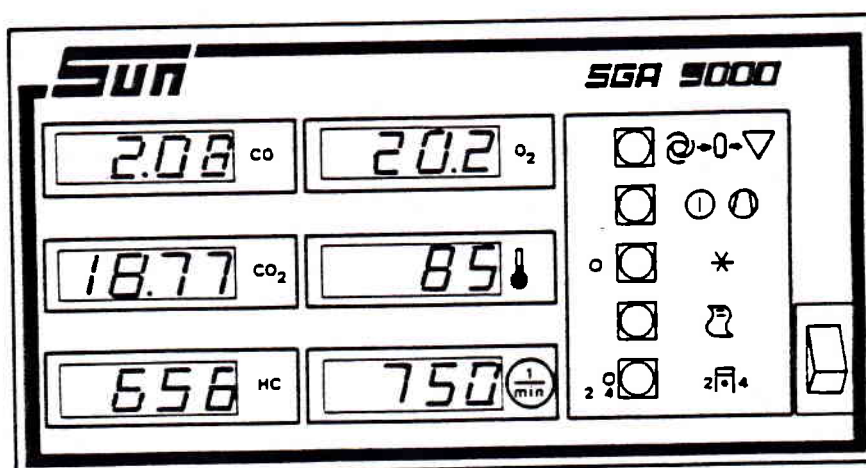
MESSAGE	DESCRIPTION	REFERENCE SECTION
"SUN"	SUN LOGO DURING WARM UP	SEE SECTION 1 (CHECKOUT)
"CAL"	TESTER IN SELF CALIBRATION TESTER CHECKS ZERO'S & SPANS	"
"SC"	TESTER IN SELF CHECK TESTER CHECKS ZERO'S	"
"LOF"	LOW FLOW STATE	"
"LEC"	LEAK DETECTED	"
"OP"	E SPAN IN LIMITS	SEE SECTION 1 (CALIBRATION)
"???"	E SPAN OUT OF LIMITS	"
"AGC"	AUTOMATIC GAIN CONTROL OUT OF LIMITS	"
"AC"	MAINS INPUT OUT OF LIMITS	"
"CR"	CALIBRATION REQUIRED. ZERO'S OUT OF TOLERANCE DURING SELF-CHECK OR CALIBRATION	TESTER REQUIRES MANUAL CALIBRATION SEE SECTION 1 (CALIBRATION)

PNEUMATIC FLOW DIAGRAM



OPERATORS INSTRUCTIONS

Model SGA-9000 Operator's Manual



OPERATORS INSTRUCTIONS



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	Page
ANALYZER DESCRIPTION	1
FRONT PANEL CONTROL	1
LED DISPLAYS	2
LED MESSAGES	2
MEASUREMENT MODE	3
MAINTENANCE AND SERVICE	5

OPERATORS INSTRUCTIONS



SUN ELECTRIC EUROPE B.V.

- 1 -

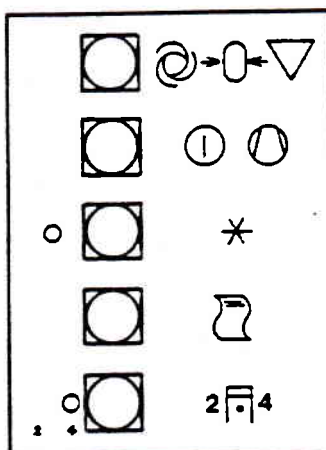
Analyzer Description

The Sun Gas Analyzer, Model SGA 9000, is a microprocessor-controlled four-gas analyzer which accurately measures the levels of Hydrocarbons (HC), Carbon Monoxide (CO), Carbon Dioxide (CO₂) and Oxygen in the exhaust emissions of petrol-driven engines. HC is measured as N-hexane in parts per million (ppm). CO, O₂ and CO₂ are measured in percent (%). Readings are digitally displayed on four continuously updated LED indicators, which may be frozen for analysis. An optional printer can be interfaced to Model SGA 9000 to provide a printed record of test results.

The unit has six operating modes: Warm-up, Stand-by, Electric Calibration, Measurement, Gas Calibration and Status. It is electrically self-calibrating and manually gas calibrated. All analyzer functions are continuously monitored by the microprocessor and appropriate messages displayed to indicate analyzer performance.

Front Panel Control

The five function switches each have an Indicator light which lights when the switch is in use.



Auto Cal

Depress and release to enter auto-calibration mode. Analyzer is automatically zeroed and spanned, then returned to normal operation.

Stand-by

Depress and release to shut off pump and clear displays. Press AUTO CAL to leave Stand-by mode.

Freeze

Depress and release to freeze displays at current measurement readings. Depress and release to return to normal operation.

OPERATORS INSTRUCTIONS

SUN ELECTRIC EUROPE B.V.

- 2 -

Print

Depress and release to print current measurement values. This switch is functional only if a printer is interfaced.

2/4 Stroke

Depress and release to change selection of 2 or 4 stroke engine for correct RPM indication.

LED DisplaysHydrocarbons (HC)

Readings in parts per million (ppm);
range from 0 - 9999 ppm.

Carbon Monoxide (CO)

Readings in percentages;
range from 0 - 10%.

Carbon Dioxide (CO2)

Readings in percentages;
range from 0 - 20%.

Oxygen (O2)

Readings in percentages;
range from 0 - 25%.

RPM/Clock

Displays elapsed time since power up until unit is warmed up, then displays RPM readings. Also displays elapsed time during gas calibration.

Temperature

Shows selected linearity curves for all three channels during warm-up, then displays oil temperature.

LED MessagesLOF

Indicates a low flow condition. Check hose and probe for restrictions. Check filter bowls for particulates.

AC

Indicates ac power input is out of acceptable range. Check ac voltage.

AGC

Appears normally during power-up. If this display occurs after warm-up, it means the Automatic Gain Control in analog electronics is out of tolerance.

Shut analyzer off and turn on again. Call for service if display appears again after warm-up.

CAL

Appears for 20 seconds while the analyzer is electrically self-calibrating.



OPERATORS INSTRUCTIONS



SUN ELECTRIC EUROPE B.V.

- 3 -

LEC

Appears if there is a leak in the sampling system.

SC

During normal operation, the analyzer will periodically enter a self-check mode, lasting for 10 seconds.
The above message appears on the gas displays.

Warm-up Procedure

- 1) Turn the power switch (white rocker switch on right side of the front panel) on. After power-up, each LED display and switch indicator light should light simultaneously for 3 seconds. Verify that the displays and indicators are functional.
- 2) After 3 seconds, all displays except RPM will show SUN, which will remain for the 30 minute warm-up. The RPM display will show the elapsed time since power-up.
- 3) After 30 minutes, the analyzer will automatically enter the self-calibration routine, and the displays will show the CAL message.
- 4) After 20 seconds, the gas displays will begin to show readings. "SC" appears every 15 minutes or 10 seconds.
- 5) The warm-up period can be shortened: 15 minutes. Do this by pressing and releasing the "autocalibrate" button, after 15 minutes of warm-up. The analyzer then goes into calibration for 20 seconds.
Whenever possible, it is recommended that the entire 30 minute warm-up period elapses. More accurate readings are thus obtained during the first minutes of operation.
- 6) It is recommended to leave the tester switched on all day, this does not shorten the lifetime of the system. However, when not in use it is best to put the tester in the stand-by mode by pressing the  button. To return to measurement mode, press the  button. The tester will perform the 20 seconds calibration procedure, and be ready for use.

Measurement Mode

Prior to emissions testing, simple preliminary tests should be performed to assure the integrity of the system.

Low Flow Indicator Test

- 1) To check the low flow indicator, block off the sample inlet holes at the probe tip. The gas displays should flash the message LOF, indicating a low flow condition.
- 2) When the inlet holes are cleared, the LOF message should disappear. If it does not, clean the sample hose and probe. See SAMPLE FILTER MAINTENANCE.

OPERATORS INSTRUCTIONS



SUN ELECTRIC EUROPE B.V.

- 4 -

Leak Check

- 1) To check for leaks in the sampling system, block off the sample inlet holes on the probe tip. If the LOF message does not appear, there is a serious leak in the sampling system.
- 2) When the LOF message appears, press and release the STANDBY switch to shut down the pump for 10 seconds and cancel the displays.
- 3) If a leak is detected before the 10 seconds are up, the display will show the LEC message. Check filter bowl seatings and probe and hose connections.
- 4) If no leak is detected, the pump will resume operation and the displays will once again flash the LOF message. Clear sample holes and proceed with testing.

CO, CO₂, HC, O₂ measurement

Exhaust gas samples are continuously gathered by means of the exhaust sampling probe inserted into the vehicle's tailpipe. The microprocessor determines the exact amount of HC, CO, CO₂ and O₂ contained on the sample and reads out the measurements on the digital displays. Besides measuring emission levels to determine compliance with legal standards, emission tests can be performed at various speeds and conditions to quickly uncover a variety of engine, ignition, and fuel system service requirements.

NOTE 1: Insert the sampling probe approximately 12" into the vehicle tailpipe. Do not leave the probe in the tailpipe when measurements are not being taken. This will shorten the life of the filter bowl elements.

NOTE 2: After having removed the sample probe from the exhaust tailpipe, the HC readings, unlike the CO-indication, will not immediately return to zero, but still indicate some 15/20 ppm. This is caused by unburnt petrol, left behind in the sample tube. During normal testing, this will not lead to a too high HC-indication, as the low level of HC is completely absorbed by the exhaust gas.

OPERATORS INSTRUCTIONS



SUN ELECTRIC EUROPE BV

- 5 -

RPM measurements (optional)

Clamp the red trigger pick-up around one of the cars spark plug leads. Select 2 or 4 stroke with  button, to get correct RPM-Indication.

Oil temperature measurements (optional)

Insert oil temperature probe in place of the engines dip stick. It is recommended to wait till the oil has reached a temperature of 75°C to obtain accurate CO-readings.

Maintenance and Service

The SUN SGA 9000 is a precision diagnostic instrument that requires little care. The maintenance and service procedures presented in this section are those which the operator can perform. All other service should be performed by an authorized SUN representative.

Important: failure to maintain filter elements voids warranty.

Sample hose maintenance

Periodically inspect the sample hose for any sign of damage such as leaks, cuts, kinks, etc. Also, check sample hose connections for tightness. Replace hose if necessary. Blow out hose once a week with compressed air to remove any dirt or condensed water.

Probe maintenance

Frequently inspect the sample probe for damage. Check for clogged holes in probe tip. If the holes are clogged, use a piece of stiff wire to dislodge and remove any foreign matter.

Filter maintenance

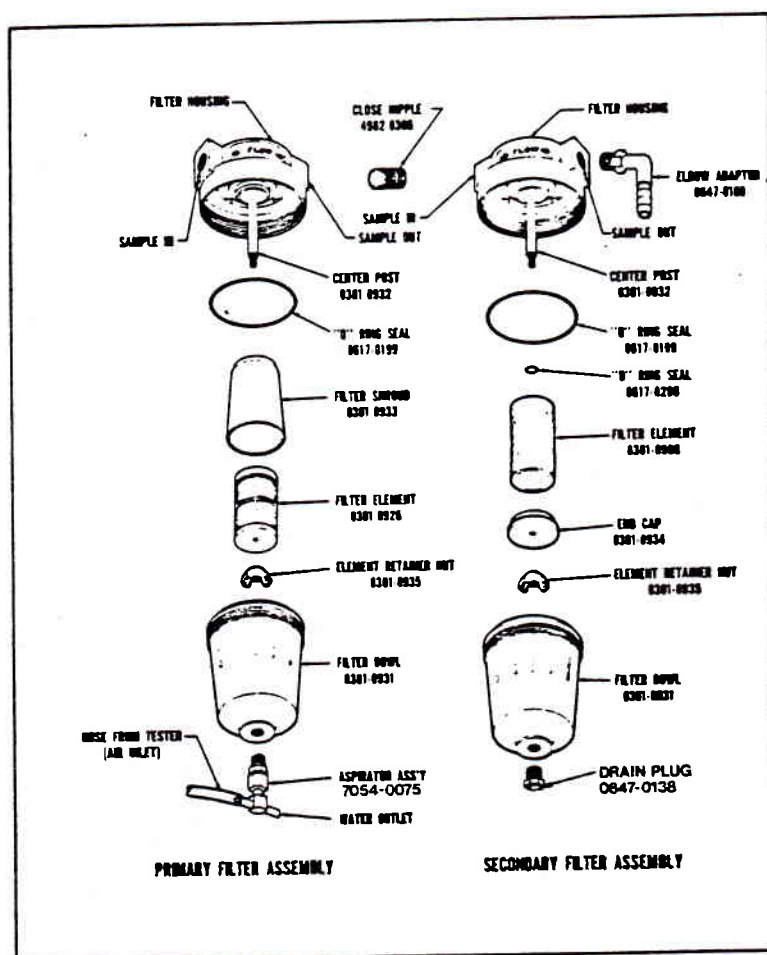
The primary and secondary filters should be cleaned and/or replaced when the LOF (low flow) message comes on. Although, it is recommended that the sample probe be inspected and cleaned, before replacing the filters.

OPERATORS INSTRUCTIONS



SUN ELECTRIC EUROPE B.V.

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Sample Filter Assemblies



OPERATORS INSTRUCTIONS



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Primary filter service

The primary filter may be cleaned or replaced. The filter element can be washed out in a mild soap and water solution. Do not use a brush or compressed air, this might damage the fine, 75 mu, filter mesh.

Allow the element to dry before reassembly.

Caution: When removing or replacing the filter bowl, be careful not to damage the "O" ring, and make sure the ring is properly positioned.

It is recommended to put some vaseline on the bowl's thread, before reassembling.

Secondary filter service

The secondary (paper) filter element must be replaced when it becomes dirty or clogged.

If necessary, wash out filter bowl when replacing the filter element.

GENERAL MAINTENANCE

THE SGA-9000 IS A PRECISION MEASURING DEVICE THAT REQUIRES LITTLE MAINTENANCE. HOWEVER THE FOLLOWING STEPS SHOULD BE PERFORMED AS A MATTER OF ROUTINE, DURING EVERY VISIT OF THE SERVICE ENGINEER.

THIS GENERAL MAINTENANCE MUST BE CARRIED OUT BEFORE CALIBRATION OR REPAIR.

STEP 1: SAMPLE HOSE MAINTENANCE

INSPECT THE SAMPLE HOSE FOR ANY SIGN OF DAMAGE SUCH AS LEAKS, CUTS, KINKS ECT. CHECK SAMPLE HOSE CONNECTION TO THE TESTER. IF NECESSARY REPLACE SAMPLE HOSE. BLOW OUT THE SAMPLE HOSE WITH COMPRESSED AIR TO REMOVE ANY DIRT OR CONDENSED WATER.

STEP 2: SAMPLE PROBE MAINTENANCE

INSPECT THE SAMPLE PROBE FOR DAMAGE OR BLOCKAGE. IF NECESSARY USE A PIECE OF STIFF WIRE TO DISLODGE AND REMOVE ANY FOREIGN MATTER.

STEP 3: SAMPLE FILTER MAINTENANCE

INSPECT THE PRIMARY AND SECONDARY FILTERS. CLEAN AND/OR REPLACE AS NECESSARY. ENSURE FILTER BOWLS ARE SEATED CORRECTLY.

STEP 4: FAN FILTER MAINTENANCE

REMOVE AND CLEAN THE FAN FILTER USING COMPRESSED AIR.

STEP 5: EXTERNAL FLOW CONNECTIONS

ENSURE THAT ALL EXTERNAL PIPES ARE CONNECTED SECURELY, IF FITTED CHECK THE O₂ SENSOR IS SEATED CORRECTLY.

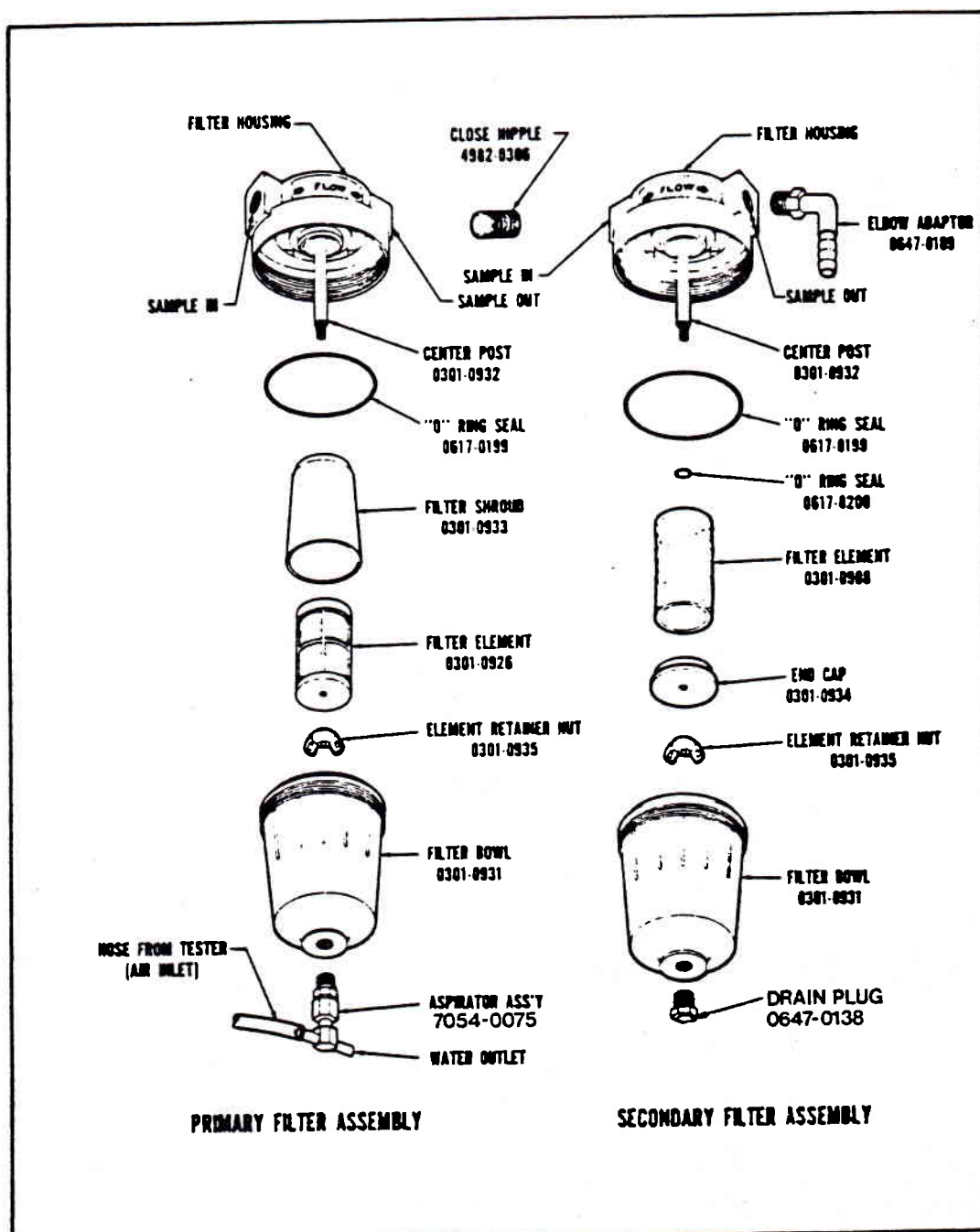
STEP 6: LOF AND LEC CHECKS

CHECK THE TESTER PASSES THE LOW FLOW AND LEAK CHECKS (SEE SECTION 1 CALIBRATION PROCEDURE, TESTER PREPARATION).

STEP 7: CLEAN TESTER

IF NECESSARY WIPE THE TESTER CLEAN USING A DAMP CLOTH.

SAMPLE FILTER ASSEMBLIES



LIST OF SCHEMATICS

1. SYSTEM INTERCONNECTION DIAGRAM

2. ANALOG PROCESSING BD

3. FRONT PANEL (DISPLAY BD)

4. DIGITAL-PROCESSOR BD

5. DIGITAL-PROCESSOR BD

6. LINEAR POWER SUPPLY

7. SWITCHING POWER SUPPLY

8. AC DISTRIBUTION BD

9. HEATER CONTROLLER BD

10. PNEUMATIC FLOW DIAGRAM

11. OIL TEMP/RPM BD

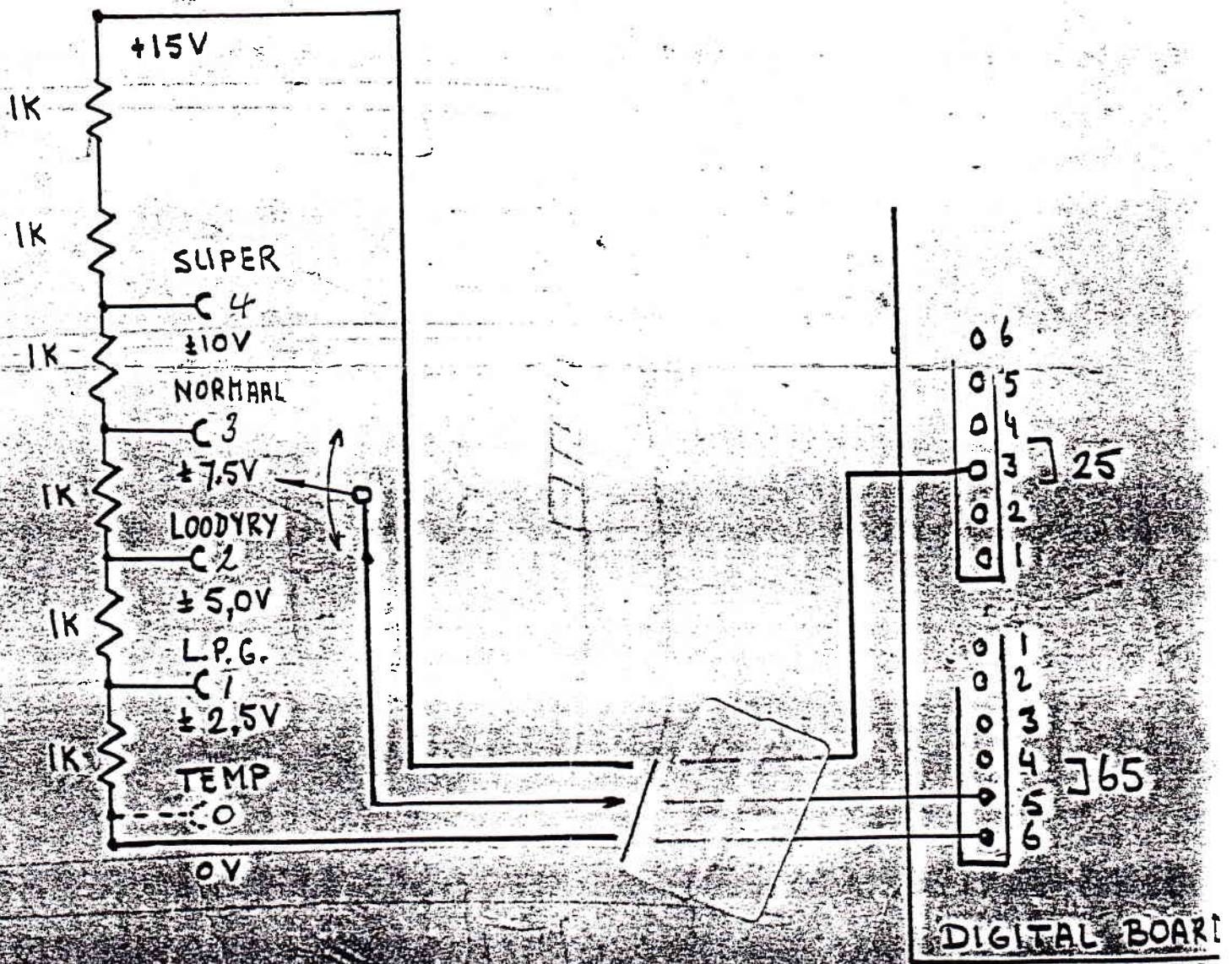
ASSY	SCHEMATIC
	9300563
	9300528
SGA 9200-430 (7001-9102)	9300532
SGA 9200-604	9300524 SHT1
SGA 9200-604	9300524 SHT2
SGA 9200-432 (7001-9104)	9300540
SGA 9200-455 (7001-9103)	9300536
SGA 9200-433 (7001-9105)	9300544
SGA 9200-572 (7001E9310-03)	7092E9310-04
	7092E9310-50
(7001E9310-21)	7092E9310-37

SGA 9000
Lambda

J25-3 →

J65 - 5.4,8k

J65 - 5-6 2,2kΩ



TEKENING 1

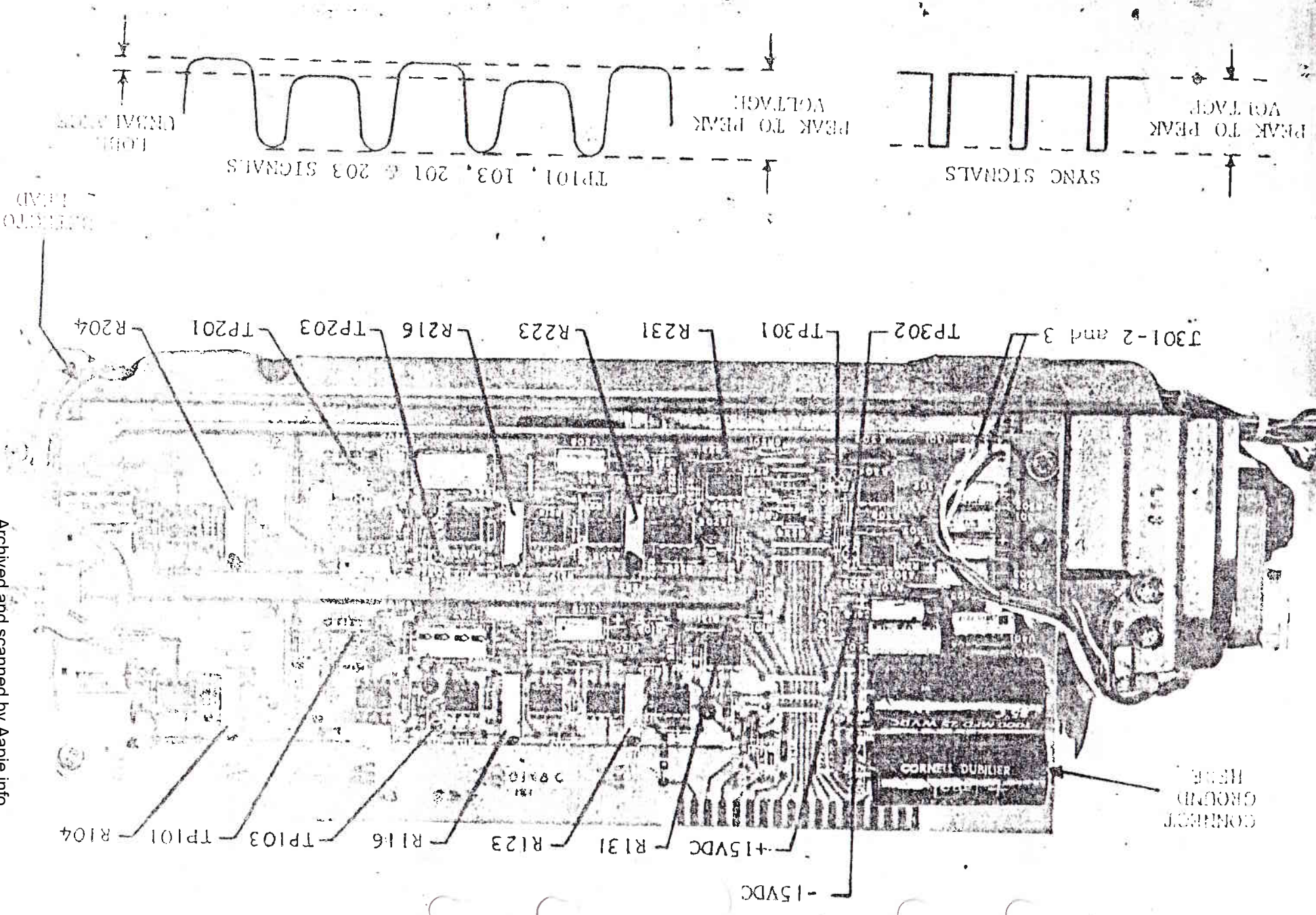
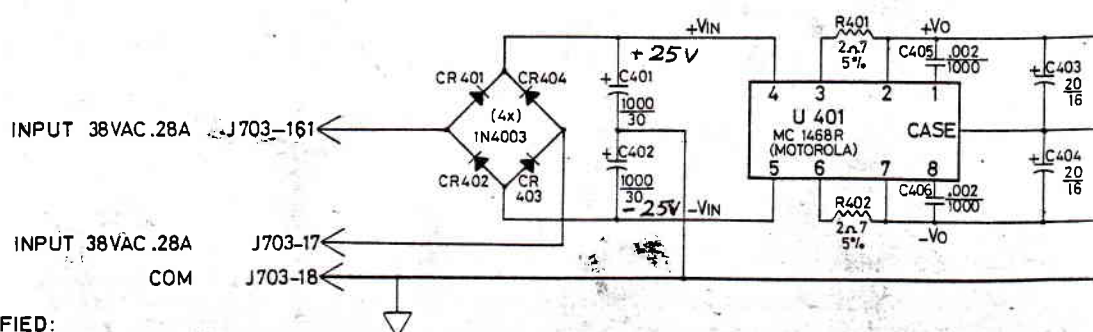
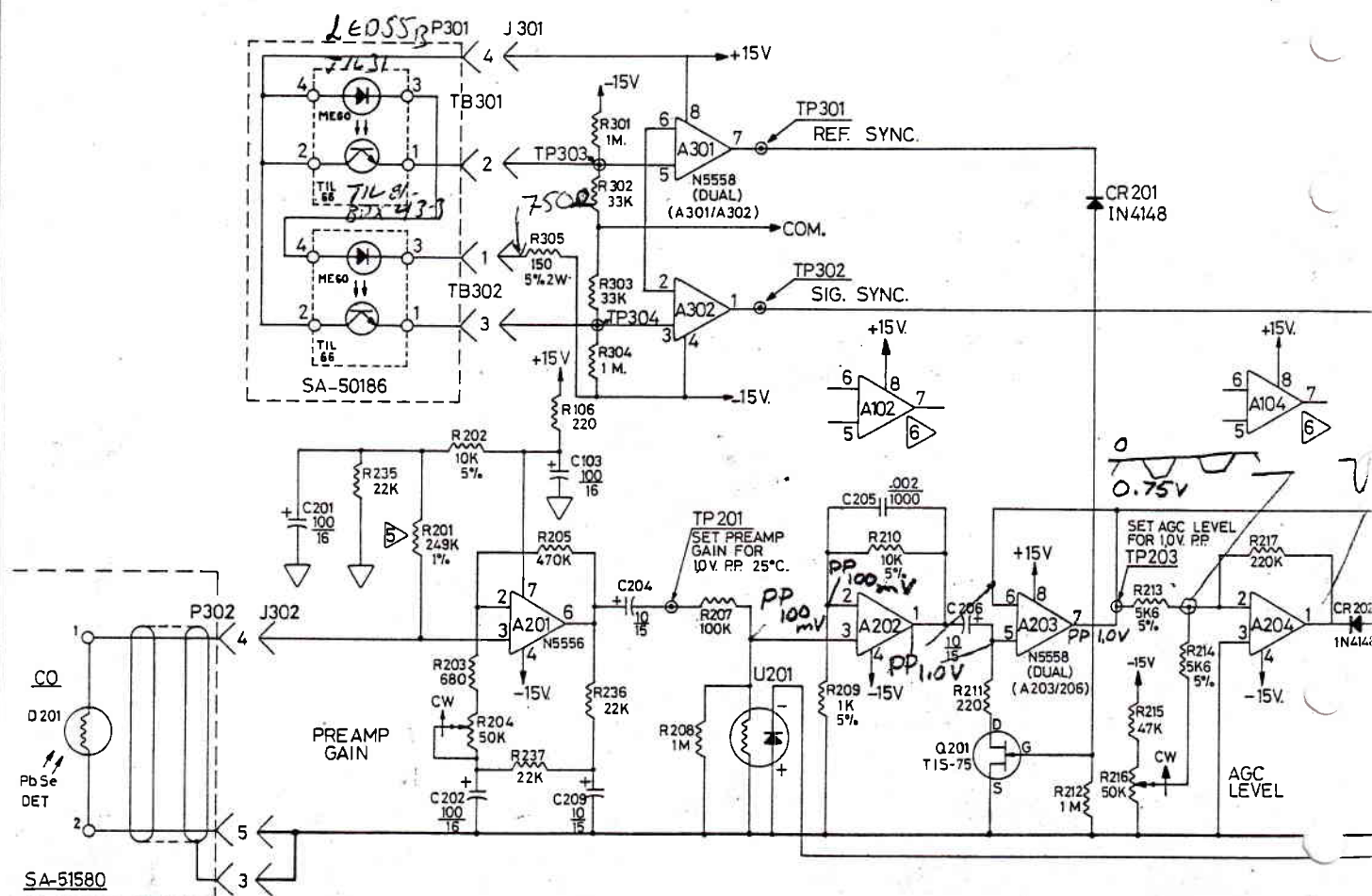


FIGURE V-1



 BORTTAGES, self underifron
 3  4



NOTES:UNLESS OTHERWISE SPECIFIED:

1. ALL RESISTANCE VALUES ARE IN OHMS 10% 1/4 W.
2. ALL CAPACITANCE VALUES ARE IN MFD/VOLTS.
3. LAST USED REFERENCE DESIGNATIONS ARE:
A107, A207, A302, C103, C209, C406, CR206, CR404, D201, J302, J703,
Q202, Q402, R106, R238, R305, R404, TP203, TP302, U201, U401.

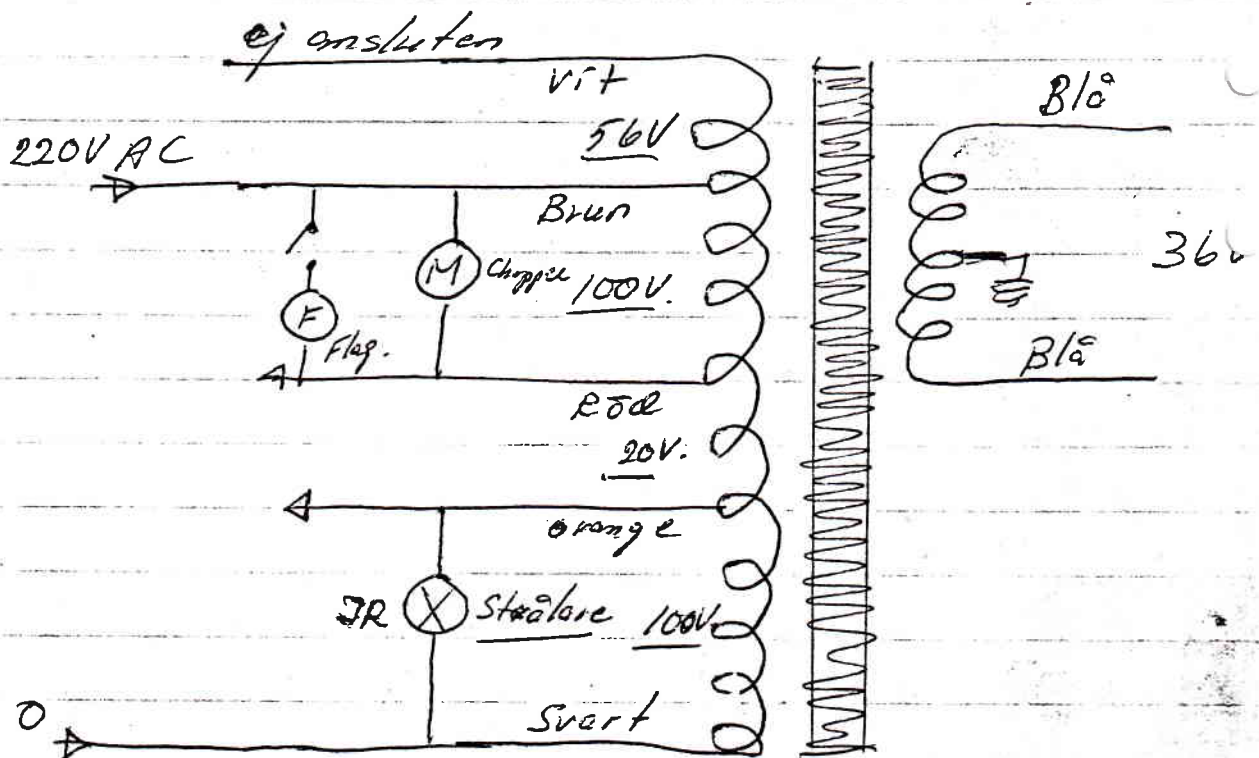
4. REFERENCE DESIGNATIONS NOT USED ARE:
A101, A103, A106, C101, C102, C104 THRU C109, C203, CR
D101, J701, J702, Q101, Q102, R101 THRU R105, R107 THRU
R206, R233, TP101, TP102, TP103, U101.
R201 IS 249K MIN TO 499K MAX METALFILM

5 R201 IS 249K MIN TO 499K MAX METALFILM

Transformator Koppling.

Sun EPA-70.

7049-0985.



Förbrukning ca 40VA

MAINS TERMINAL S1
BLOCK 4WAY MAINS 2.1/277

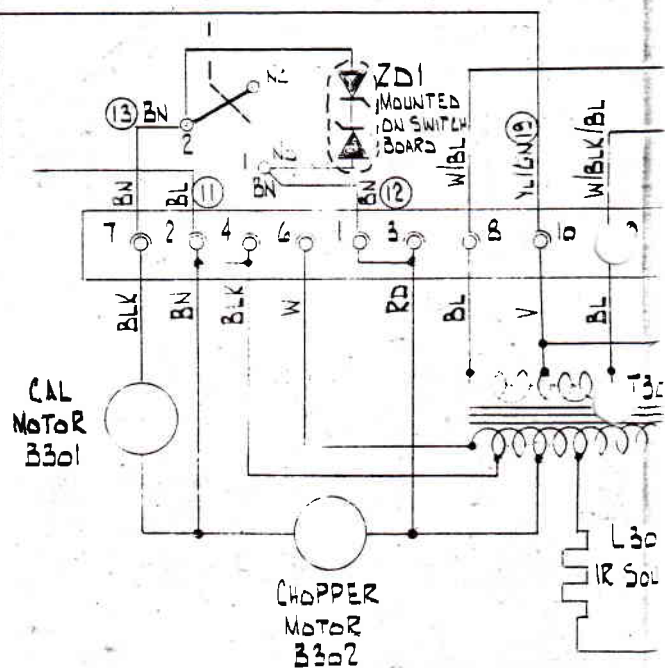


SEE NOTE 3.

1. NUMBER SHOWN THUS :- (12) REFER TO CABLE MARKERS

2 LETTERS (A,B,C) & NUMBERS (1 TO 6) ON S2, S3 & S4
REFER TO TERMINAL ON SWITCH PCB. DRG. NO. C3457

3. WHEN A 240V PUMP MOTOR (M2) IS FITTED THE CONNECTION FROM S2-5 TO TS1 LINE IS RE-ROUTED TO VOLTAGE SELECTOR 240V TERMINAL (SHOWN BY DOTTED LINE).
TO MODIFY EQUIPMENTS CONNECTED FOR 220V PUMP MOTOR :- REMOVE LEAD BN (6) FROM TS1 LINE TERMINAL, CUT OFF CONNECTOR, STRIP WIRE END, RE-ROUTE THE LEAD AND SOLDER DIRECT TO VOLTAGE SELECTOR AT BN (20).



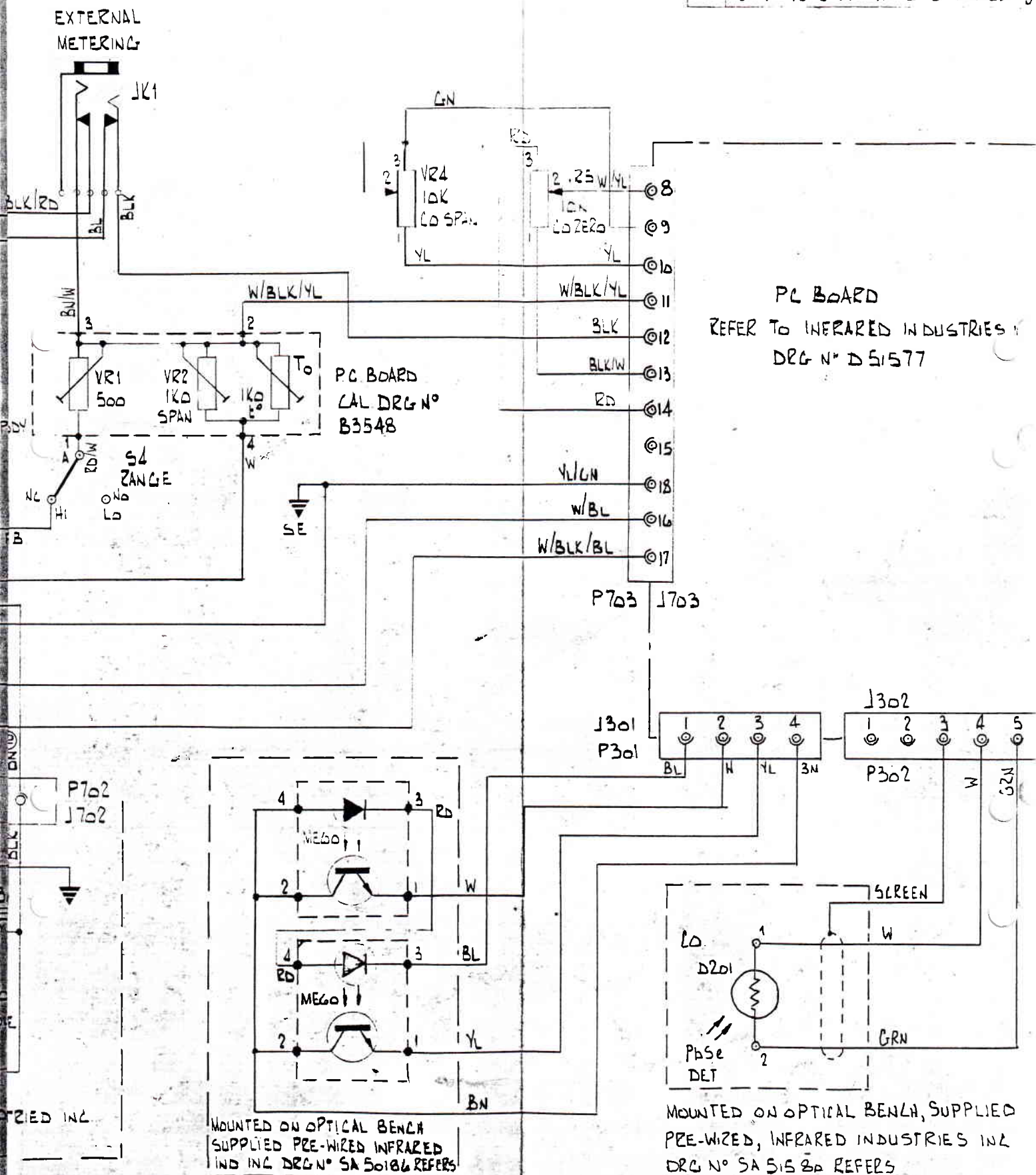
OPTICAL BENCH, SUPPLIED PRE-WIRED, INFRARED AND
DEC NO SA-51679 REFERS

This drawing is the property of Suntester Ltd. and is issued on condition that reproduction or disclosure without permission is forbidden.

Sun **TESTER LIMITED**

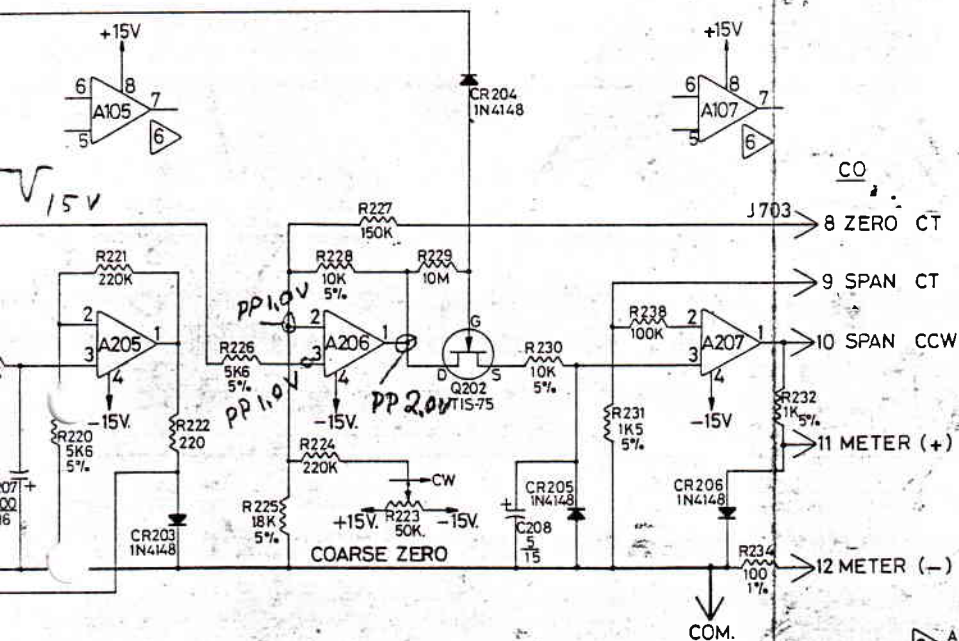
OLDMEDOW ROAD, KING'S LYNN, NORFOLK

ISS	EC NO.	NOTES
A	-	13-10-76 J.R.T.
B	1283	11-2-77 J.R.T.
C	1309	10-6-77 NOTE 3 ADDED. J



DESIGNED ON MODELS	EPA-70					TITLE
TOLERANCES	MATERIAL	FINISH				SCHEMATIC WIRING DIAGRAM FOR EPA-70
GENERAL	SCALE	DRAWN	CHK'D	APP'D	DRG NO	C3555
DECIMAL		TLB 20-2-76	J.R.T.E. 1-12-76			
OLE DIA.						

Mole Schedule						Revisions		
Code	Qty.	Dia.	Sym	Date	ECN	Description	Check	Appr.



6 A102, A104, A105, A107 ARE UNUSED PORTIONS OF DUAL OPERATIONAL AMPLIFIERS CONTAINING RESPECTIVELY; A202, A204, A205, A207.

→ +15 VDC
→ J703-13 +15VDC OUTPUT
→ J703-14 -15VDC OUTPUT
→ -15 VDC
→ COM.

THRU CR106,

Item	Qty.	Dwg./Part no.	Description	Mat'l Spec.	Remarks
Scale			Date		Remarks
Drawn by			780320		
Checked by					
Approved					Finish
Unless otherwise specified: Dimensions are in mm.; Tolerances on: Angles $\pm 0.5^\circ$ Holes ± 0.1 Rets ± 0.5					
Description SCHEMATIC DIAGRAM MODEL7006 (CO)				Dwg. no.	
INFRARED ANALYZER 220VAC 50Hz				51577	
Sun ELECTRIC (NEDERLAND) B.V. AMSTERDAM - HOLLAND		A1		Sheet of	Issue
Automaat recht voorbehouden volgens de wet				Code	
				Project no.	



SUN ELECTRIC EUROPE B.V.

SECTION 1

SET UP / CHECKOUT

AND CALIBRATION

PROCEDURES

PAGES

1. SET UP	01 THRU 10
2. CHECKOUT	11 THRU 15
3. CALIBRATION	16 THRU 26



SGA-9000

SET UP / CHECKOUT AND
CALIBRATION PROCEDURES

SECTION 01

PAGE 01

1. SET UP

THE SGA-9000 HAS VARIOUS MODES OF OPERATION. TO ENSURE THE TESTER IS SET UP CORRECTLY, THE FOLLOWING SET UP INSTRUCTIONS MUST BE FOLLOWED BEFORE ANY CALIBRATION OR CHECKS MAY BE MADE.

I. ALTITUDE (REAR PANEL)

II. LINEARITY CURVE SELECTION (DIGITAL-PROCESS BD)

III. BAUD RATE (PRINTER OPTION) (DIGITAL-PROCESS BD)

IV. JUMPER POSITIONS (DIGITAL-PROCESS BD)

V. JUMPER POSITIONS (ANALOG PROCESS BD)

VI. DIP SWITCHES (U6) (DISPLAY BD)



SGA-9000

SET UP / CHECKOUT AND
CALIBRATION PROCEDURES

SECTION 01

PAGE 02

I. ALTITUDE (REAR PANEL)

THE ALTITUDE AT WHICH THE TESTER IS SITUATED MUST BE SET VIA THE THUMBWHEEL SWITCHES ON THE REAR OF THE TESTER.

OBTAIN THE ALTITUDE AT WHICH THE TESTER IS SITUATED (IF NECESSARY CONTACT THE LOCAL AIRFIELD).

USING THE FORMULAE BELOW ENTER THE CORRECT THUMBWHEEL SETTING.

NOTE: IF ALTITUDE IS INCORRECTLY ENTERED GAS CALIBRATION IS INVALIDATED.

FORMULAE:

THUMBWHEEL SETTING X 100 = ALTITUDE IN METERS.

EXAMPLE A.

03 = 300 METERS

EXAMPLE B.

21 = 2100 METERS

THE ALTITUDE SETTING MAY BE MONITORED IN THE TESTER STATUS CHECK (SEE OPERATING FLOW DIAGRAM INTRODUCTION PAGE 04).

SGA-9000

SET UP / CHECKOUT AND
CALIBRATION PROCEDURES

SECTION 01

PAGE 03

0 0 0 0 0 0 0
6 7 6 5 3 2 1

II. LINEARITY CURVE SELECTION (DIGITAL-PROCESS BD)

NOTE: THIS SELECTION AFFECTS TESTER ACCURACY AND MUST BE SET CORRECTLY.

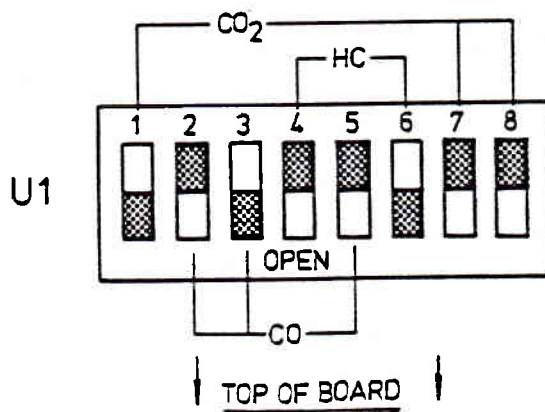
THE LINEARITY CURVE SELECTION FOR ALL THREE GASSES IS SET VIA DIP SWITCHES U1. ALL GASSES MUST BE SET TO LINEARITY CURVE 3. THIS IS ACHIEVED WITH THE FOLLOWING SETTING OF U1.

HC CURVE 3 = S4 CLOSED, S6 OPEN

CO CURVE 3 = S2 CLOSED, S3 OPEN, S5 CLOSED

CO₂ CURVE 3 = S1 OPEN, S7 CLOSED, S8 CLOSED

COMPLETE SETTING OF U1



THE LINEARITY CURVES SELECTED MAY BE MONITORED IN THE TESTER STATUS CHECK.
(SEE OPERATING FLOW DIAGRAM INTRODUCTION PAGE 04).



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III. BAUD RATE (PRINTER OPTION) (DIGITAL-PROCESS BD)

WHEN USING THE SGA-9000 WITH A PRINTER IT IS POSSIBLE TO SET THE TESTER
BAUD RATE TO MATCH THE BAUD RATE OF THE SELECTED PRINTER.

THE FOLLOWING BAUD RATES ARE SELECTED BY SETTING U2 AS FOLLOWS:

BAUD RATE	U2 SETTING			
	S1	S2	S3	S4
110	C	C	C	N/U
150	C	C	O	N/U
300	C	O	C	N/U
600	C	O	O	N/U
1200	O	C	C	N/U
2400	O	C	O	N/U
4800	O	O	C	N/U
9600	O	O	O	N/U

O = OPEN

C = CLOSED

N/U = NOT USED

THE BAUD RATE SELECTED MAY BE MONITORED IN THE TESTER STATUS CHECK. (SEE
OPERATING FLOW DIAGRAM INTRODUCTION PAGE 04 .)

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IV. JUMPER POSITIONS (DIGITAL-PROCESS BD)

THERE ARE FOUR JUMPER POSITIONS ON THE DIGITAL PROCESSOR BD. THESE ARE FACTORY SET HOWEVER THEY MAY BE CHECKED TO SEE IF THEY CONFORM TO THE TABLE BELOW:

JUMPER	IN/OUT	FUNCTION
JP 1	IN (A TO B)	SELECTS COMMON ANALOG GROUND INPUT FOR INCOMING SIGNALS.
JP 2	IN (A TO B)	SELECTS TIMER INTERRUPT (TRAP).
JP 3	IN (A TO C OR B TO C)	SELECTS THE 20V INPUT RANGE OF THE A TO D CONVERTER.
JP 4	IN (A TO B)	SELECTS COMMON ANALOG AND DIGITAL GROUND FOR THE A TO D CONVERTER

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V. JUMPER POSITIONS (ANALOG PROCESS BD)

THE ANALOG PROCESSING BD CONTAINS EIGHT JUMERS. THE POSITIONING OF THESE JUMPERS VARIES DEPENDING UPON WHAT GASSES ARE BEING MEASURED AND WHAT THE MAINS FREQUENCY IS.

THE FOLLOWING TABLE SHOWS WHAT JUMPERS ARE REQUIRED FOR THE THREE DIFFERENT GAS COMBINATIONS:

	3GAS HC/CO/CO ₂	2GAS HC/CO	2GAS CO/CO ₂
JP1	A — B	A — B	B — C
JP2 50 Hz	A — B	A — B	A — B
JP2 60 Hz	B — C	B — C	B — C
JP3	A — B	A — B	B — C
JP4	B — C	B — C	A — B
JP5	B — C	B — C	A — B
JP6	IN	IN	NOT USED
JP7	IN	IN	IN
JP8	IN	NOT USED	IN

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VI. DIP SWITCHES (U6) (DISPLAY BD)

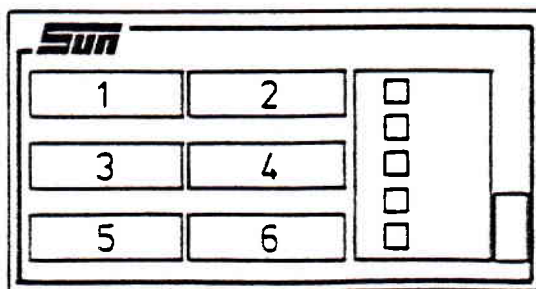
THE TEN DIP SWITCHES ON THE DISPLAY BD (EIGHT ON U6 AND TWO LOCATED ON THE TOP RIGHTHAND SIDE OF THE DISPLAY BD). PERFORM VARIOUS FUNCTIONS WITHIN THE TESTER. THESE ARE AS FOLLOWS:

DISPLAY SELECTION U6 - 1, 3, 7 + 8.

U6 SWITCHES S1, S3, S7 AND S8 ALLOW THE SERVICE ENGINEER TO SELECT WHICH READINGS APPEAR IN WHICH WINDOWS ACCORDING TO THE CUSTOMERS WISHES. THIS SELECTION IS DEPENDANT UPON WHAT OPTIONS ARE AVAILABLE. THE TABLE ON PAGE 08 INDICATES THE MAXIMUM NUMBER OF VARIATIONS POSSIBLE ASSUMING ALL DISPLAYS ARE AVAILABLE, AND THEIR CORRESPONDING SWITCH POSITIONS.

NOTE: FOR THE TESTER TO ACCEPT THE NEW DISPLAY ALLOCATION IT IS NECESSARY TO SWITCH THE TESTER OFF AND ON.

KEY TO DISPLAY POSITIONS.



THE DISPLAY LOCATION SETTING MAY BE MONITORED IN THE TESTER STATUS CHECK.
(SEE OPERATING FLOW DIAGRAM INTRODUCTION PAGE 04).

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DISPLAY SELECTION TABLE

display indication tester sta- tus mode	SWITCH POSITION C=CLOSED O=OPEN					SLOT 1	SLOT 2	SLOT 3	SLOT 4	SLOT 5	SLOT 6
	S1	S3	S8	S7							
0	C	C	C	C		CO	O ₂	CO ₂	TEMP	HC	RPM
1	C	C	C	O		CO	O ₂	HC	TEMP	CO ₂	RPM
2	C	C	O	C		CO	TEMP	HC	RPM	O ₂	CO ₂
3	C	C	O	O		CO	TEMP	CO ₂	RPM	O ₂	HC
4	C	O	C	C		CO	TEMP	HC	O ₂	CO ₂	RPM
5	C	O	C	O		CO	HC	CO ₂	O ₂	RPM	TEMP
6	C	O	O	C		CO	O ₂	HC	RPM	CO ₂	TEMP
7	C	O	O	O		CO	O ₂	CO ₂	RPM	HC	TEMP
8	O	C	C	C		CO	HC	CO ₂	RPM	O ₂	TEMP
9	O	C	C	O		CO	O ₂	HC	RPM	CO ₂	TEMP
A	O	C	O	C		CO	CO ₂	HC	RPM	O ₂	TEMP
B	O	C	O	O		CO	RPM	CO ₂	O ₂	HC	TEMP
C	O	O	C	C		CO	RPM	HC	O ₂	CO ₂	TEMP
D	O	O	C	O		CO	TEMP	CO ₂	O ₂	HC	RPM
E	O	O	O	C		CO	CO ₂	HC	O ₂	TEMP	RPM
F	O	O	O	O		CO	HC	CO ₂	O ₂	TEMP	RPM



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MAINS VOLTAGE SELECTION U6 - 2

U6 SWITCH 2 INFORMS THE DIGITAL-PROCESSOR WHETHER THE TESTER IS OPERATING ON 220V OR 110V MAINS.

NOT USED WITH SOFTWARE REVISION 3.5.

SERVICE MODE U6 - 4

U6 SWITCH 4 ALLOWS THE SERVICE ENGINEER TO ENTER THE SERVICE MODE. FOR EASE OF OPERATION AN AUXILIARY SWITCH THAT IS CONNECTED IN PARALLEL WITH SWITCH 4 HAS BEEN PLACED AT THE TOP RIGHTHAND CORNER OF THE DISPLAY BD. TO ALLOW THE USE OF THIS AUXILIARY SWITCH, S4 SHOULD BE LEFT IN THE OPEN POSITION.

NOTE: FOR SERVICE MODE OPERATION SEE SERVICE MODE FLOW DIAGRAM PAGE 06
INTRODUCTION.

SELF CHECK U6 - 5

U6 SWITCH 5 ENABLES THE SERVICE ENGINEER TO INHIBIT THE TESTERS AUTOMATIC SELF CHECK FACILITY. SELF CHECK IS INHIBITED WHEN S5 IS OPEN.

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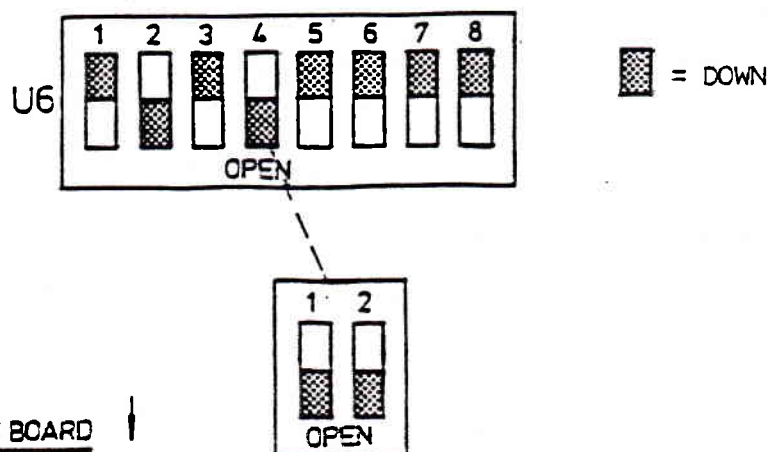
UNCOMPENSATED CO U6 - 6

U6 SWITCH 6 ALLOWS THE SERVICE ENGINEER TO DISPLAY UNCORRECTED CO READINGS IN THE O₂ WINDOW. THE TESTER NORMALLY COMPENSATES THE CO READING FOR CO₂ INTERFERENCE BY EITHER USING, AN ASSUMED VALUE OF 12% CO₂ OR IF AVAILABLE THE ACTUAL CO₂ READING.

WITH S6 IN THE OPEN POSITION THE SERVICE ENGINEER IS ABLE TO VIEW THE CO READING BEFORE COMPENSATION TAKES PLACE.

THIS IS OF PARTICULAR USE IN FRANCE WHERE IT IS A REQUIREMENT OF THE EMISSION TESTING APPROVAL AUTHORITIES.

U6 SETTINGS FOR NORMAL OPERATION



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2. CHECKOUT

NOTE: BEFORE THE CHECKOUT PROCEDURE MAY BE CARRIED OUT FIRST ENSURE THAT THE SET UP PROCEDURE HAS BEEN FULLY IMPLEMENTED.

CHECKS:

STEP 1: PRE ENERGISE CHECKS.

CHECK: THE SAMPLE PROBE AND HOSE ARE IN GOOD CONDITION WITH NO HOLES OR CRIMPS.

CHECK: O₂ DETECTOR IS SEATED TIGHTLY (OPTION).

CHECK: SAMPLE FILTER ELEMENTS ARE CLEAN.

CHECK: FAN FILTER ON REAR PANEL IS CLEAN.

IF NECESSARY PERFORM THE GENERAL MAINTENANCE PROCEDURE PAGE 18 INTRODUCTION.

STEP 2: ENERGISE TESTER.

CHECK: ALL SEGMENTS, DECIMAL POINTS AND LED'S ON THE FRONT PANEL LIGHT.

CHECK: AFTER THREE SECONDS "SUN" APPEARS AND THE TESTER BEGINS A 30 MIN. COUNT-DOWN PERIOD.

CHECK: THE PUMP IS RUNNING.

CHECK: REAR PANEL FAN IS RUNNING.



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STEP 3: FRONT PANEL CHECKS.

PRESS AND RELEASE THE * HOLD BUTTON DURING WARM UP PERIOD.

CHECK: SYSTEM STATUS CHECK DATA APPEARS:

I. CO DISPLAY CONTAINS: "SUN".

II. CO₂ DISPLAY CONTAINS: THE PRE-SELECTED BAUD RATE.

III. HC DISPLAY CONTAINS: LEFTMOST DIGIT DISPLAY CONFIGURATION CODE. TWO
RIGHTMOST DIGITS DISPLAY ALTITUDE SETTING.

IV. O₂ DISPLAY CONTAINS: SOFTWARE REVISION LEVEL (SEE SECTION 9 SOFTWARE
REVISIONS).

V. TEMP DISPLAY CONTAINS: LINEARITY CURVES SELECTED. (NOTE ALL THREE
CURVES MUST BE SET TO "3" SEE SET UP.)

VI. RPM DISPLAY CONTAINS: COUNTDOWN CLOCK.

PRESS AND RELEASE ALL OTHER FRONT PANEL BUTTONS.

CHECK: TESTER DOES NOT RESPOND.



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SWITCH TESTER OFF.

HOLD DOWN THE AUTOCALIBRATE BUTTON    WHILST ENERGISING THE TESTER.
RELEASE IT IMMEDIATELY AFTER THE DISPLAYS FLASH AND BLANK.

CHECK: THE TESTER BY-PASSES THE 30 MIN. WARM UP PERIOD AND ENTERS THE
OPERATING MODE.

CHECK: THE FOUR CYCLE LED IS LIT.

NOTE: THE TESTER MAY FLASH ONE OR MORE OF THE FOLLOWING MESSAGES, THIS IS
NORMAL: "AC", "LOF" OR "AGC".

THE AGC MESSAGE MUST DISAPPEAR WITHIN 5 MINUTES.

PRESS AND RELEASE THE STANDBY BUTTON  .

CHECK: ALL DISPLAYS BLANK AND THE PUMP STOPS.

CHECK: THE BACKLIT DISPLAY SYMBOLS AND STANDBY LED ARE LIT.

PRESS AND RELEASE THE AUTOCALIBRATE BUTTON   .

CHECK: THE TESTER ENTERS A TWENTY SECOND CAL PERIOD DISPLAYING CAL.



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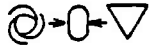
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CHECK: PUMP STARTS RUNNING.

CHECK: AIR SOLENOID OPENS (AUDIBLE CLICK).

CHECK: AFTER 20 SEC. THE TESTER RETURNS TO THE OPERATING MODE.

PRESS AND RELEASE AUTOCALIBRATE BUTTON  . IMMEDIATELY THE TESTER
EXITS THE 20 SEC. CAL MODE. PRESS AND RELEASE THE FREEZE BUTTON *.

CHECK: THE FREEZE LED LIGHTS AND THE DISPLAYED READINGS ARE FROZEN.

PRESS AND RELEASE THE FREEZE BUTTON * .

CHECK: THE FREEZE LED EXTINGUISHES AND THE DISPLAYS START UPDATING.

PRESS AND RELEASE THE PRINT BUTTON  .

CHECK: THE PRINT LED LIGHTS AND AFTER A FEW SECONDS EXTINGUISHES.

PRESS AND RELEASE THE 2-4 CYCLE BUTTON  .

CHECK: THE 2 CYCLE LED LIGHTS.

PRESS AND RELEASE THE 2-4 CYCLE BUTTON  .

CHECK: THE 4 CYCLE LED LIGHTS.



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STEP 4: REMOTE CONTROL CHECK. SEE SECTION 6 OPTIONS.

STEP 5: PRINTER CHECK. SEE SECTION 6 OPTIONS.

STEP 6: OIL TEMP/RPM CHECK. SEE SECTION 6 OPTIONS.

STEP 7: OPERATIONAL CHECK.

SET TESTER TO THE NORMAL OPERATING MODE.

CHECK: THE TESTER PERFORMS A SELF CHECK EVERY FIFTEEN MINUTES.
(TESTER DISPLAYS "SC" FOR 10 SECONDS.)

BLOCK SAMPLE INLET PORT.

CHECK: THE TESTER FLASHES THE LOW FLOW MESSAGE "LOF".

PRESS AND RELEASE THE STANDBY BUTTON ① ②. AFTER 5 SEC. REMOVE THE BLOCKAGE
FROM THE SAMPLE INLET PORT.

CHECK: THE TESTER DISPLAYS THE LEAKAGE MESSAGE "LEC". THE TESTER THEN
RETURNS TO THE OPERATING MODE.

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3. CALIBRATION PROCEDURE

NOTE: BEFORE CALIBRATION MAY BE CARRIED OUT ALL SET UP AND CHECKOUT PROCEDURES AS OUTLINED IN 1 AND 2 MUST BE IMPLEMENTED.

EQUIPMENT REQUIRED: DVM TYPE FLUKE 8060A OR EQUIVALENT.

<u>CALIBRATION GAS</u>	
ANALYSERS WITH CO ₂ CHANNEL	CO ₂ = 12% APPROX. .
	CO = 4% APPROX.
	HC = 3000 PPM C ₃ H ₈ APPROX.
	BALANCE = NITROGEN
	ANALYSERS WITH NO CO ₂ CHANNEL

TESTER PREPARATION

ENERGISE TESTER AND ALLOW A MINIMUM OF 30 MINS FOR WARM UP.

CONNECT THE EXHAUST PROBE AND HOSE TO THE TESTER. BLOCK THE HOLES IN THE END OF THE SAMPLING PROBE. CHECK THAT AFTER A FEW SECONDS THE LOW FLOW MESSAGE "LOF" IS FLASHED. UNCOVER THE INLET HOLES AND CHECK THE "LOF" MESSAGE CEASES.

BLOCK THE HOLES IN THE END OF THE SAMPLING PROBE. WHILST THE "LOF" MESSAGE IS DISPLAYED PRESS AND RELEASE THE STANDBY BUTTON ① ① . FOR 10 SECONDS THE PUMP WILL STOP AND THE DISPLAYS FREEZE.

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IF NO LEAKS ARE DETECTED THE PUMP STARTS AND THE DISPLAYS AGAIN FLASH "LOF".
SHOULD A LEAK BE DETECTED THE TESTER WILL DISPLAY "LEC".

NOTE: IF THE TESTER FAILS EITHER THE "LOF" OR "LEC" TESTS THE PNEUMATIC
SAMPLING SYSTEM MUST BE CHECKED (SEE GENERAL MAINTENANCE PAGE 18
INTRODUCTION AND SECTION 7 TROUBLESHOOTING) BEFORE CALIBRATION CAN
COMMENCE.

CHECK AND NOTE THE FLOW RATE THROUGH THE GAS BENCH BY OBSERVING THE FLOW
METER ON THE REAR OF THE TESTER. THIS WILL BE USED DURING THE GAS CALIBRATION
PROCEDURE.

CALIBRATION:

A) AC MAINS VOLTAGE INDICATION/LOCK OUT ADJUSTMENT.

B) GAS CALIBRATION CO, HC, CO₂ AND O₂.

I) AGC ADJUSTMENT (CO, HC + CO₂).

II) ZERO ADJUSTMENT.

III) GAIN ADJUSTMENT.

IV) E-SPAN ADJUSTMENT (CO, HC + CO₂).

V) CALIBRATION CHECK.

C) OIL TEMP/RPM CALIBRATION.



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A) AC MAINS VOLTAGE INDICATION/LOCK OUT ADJUSTMENT.

NOTE: THIS ADJUSTMENT IS FACTORY SET AND SHOULD ONLY BE CARRIED OUT IF THE TESTER IS DISPLAYING THE "AC" MESSAGE OR THE DISPLAYED AC VOLTAGE (SEE SERVICE MODE FLOW DIAGRAM PAGE 06 INTRODUCTION) APPEARS TO BE INCORRECT.

STEP 1: CONNECT THE DMM ACROSS THE MAINS AC LINE INPUT. NOTE READING.

STEP 2: CONNECT THE DMM ON 20V DC RANGE BETWEEN TP 7 (GND) AND J 15 PIN 5 ON THE LINEAR SUPPLY.

STEP 3: USING THE GRAPH FIG 1 FIND WHAT DC VOLTAGE AT J 15 PIN 5 CORRESPONDS TO THE AC LINE VOLTAGE NOTED IN STEP 1.

EXAMPLE 225 V MAINS LINE VOLTAGE = 5.00 V @ J15 - 5

STEP 4: ADJUST R 1 ON THE LINEAR SUPPLY UNTIL THE DMM INDICATES THE VOLTAGE FOUND IN STEP 3.

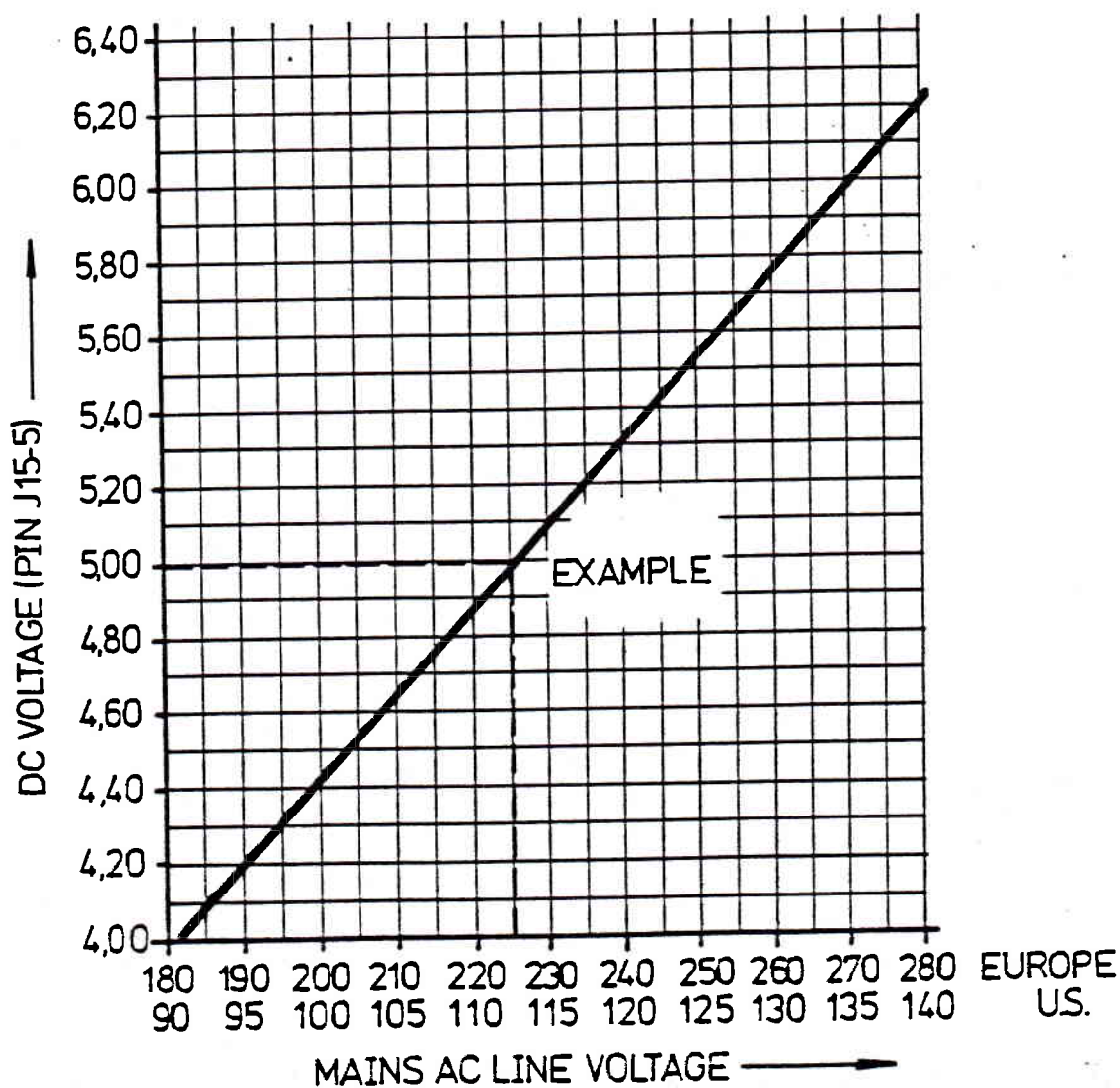
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FIG. 1



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B) GAS CALIBRATION CO, HC, CO₂ + O₂.

NOTE: FOR TWO GAS (HC, CO) ANALYSERS THE FOLLOWING PROCEDURE MAY BE USED IGNORING CO₂ ADJUSTMENTS. HOWEVER WHEN SETTING "GAIN" CALIBRATION CARE MUST BE TAKEN TO ENSURE WHETHER THE CO READINGS ARE COMPENSATED OR UNCOMPENSATED, FOR CO₂ INTERFERENCE.

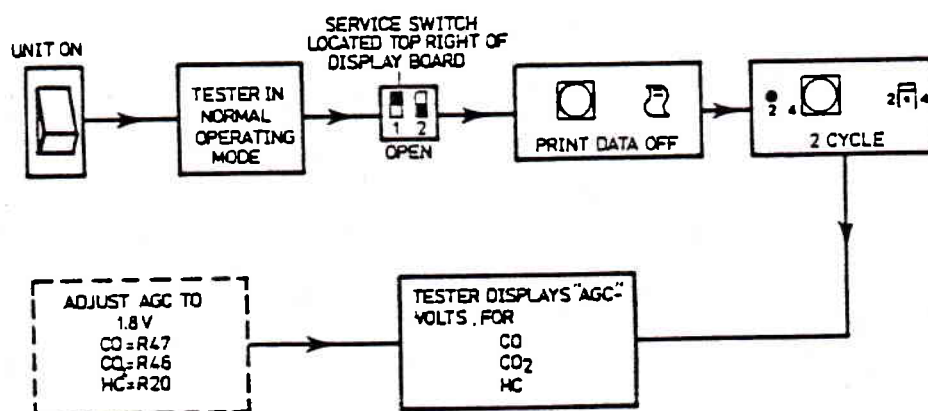
ACCESS TO ALL GAS CALIBRATION ADJUSTMENTS IS THROUGH THE REMOVEABLE PANEL IN THE TOP OF THE TESTER.

NOTE: GAS CALIBRATION SHOULD BE CARRIED OUT WITH THE TESTER COVER FITTED.

I) AGC ADJUSTMENT (CO, HC + CO₂).

NOTE: THIS ADJUSTMENT NEED ONLY BE CARRIED OUT IF THE TESTER IS DISPLAYING THE "AGC" MESSAGE OR IF THE SERVICE ENGINEER SUSPECTS AN AGC PROBLEM.

SET THE TESTER AS FOLLOWS:



THE AGC POTENTIOMETERS ARE LOCATED ON THE GAS PROCESSING BD. (SEE FIG 2.)

ADJUST AGC VOLTS TO 1.8 V

NOTE: CARE MUST BE TAKEN WHILST MAKING THESE ADJUSTMENTS AS THE POSSIBILITY OF CAUSING A SHORT CIRCUIT ON EITHER THE GAS PROCESSING BD OR DIGITAL PROCESSING BD EXISTS.

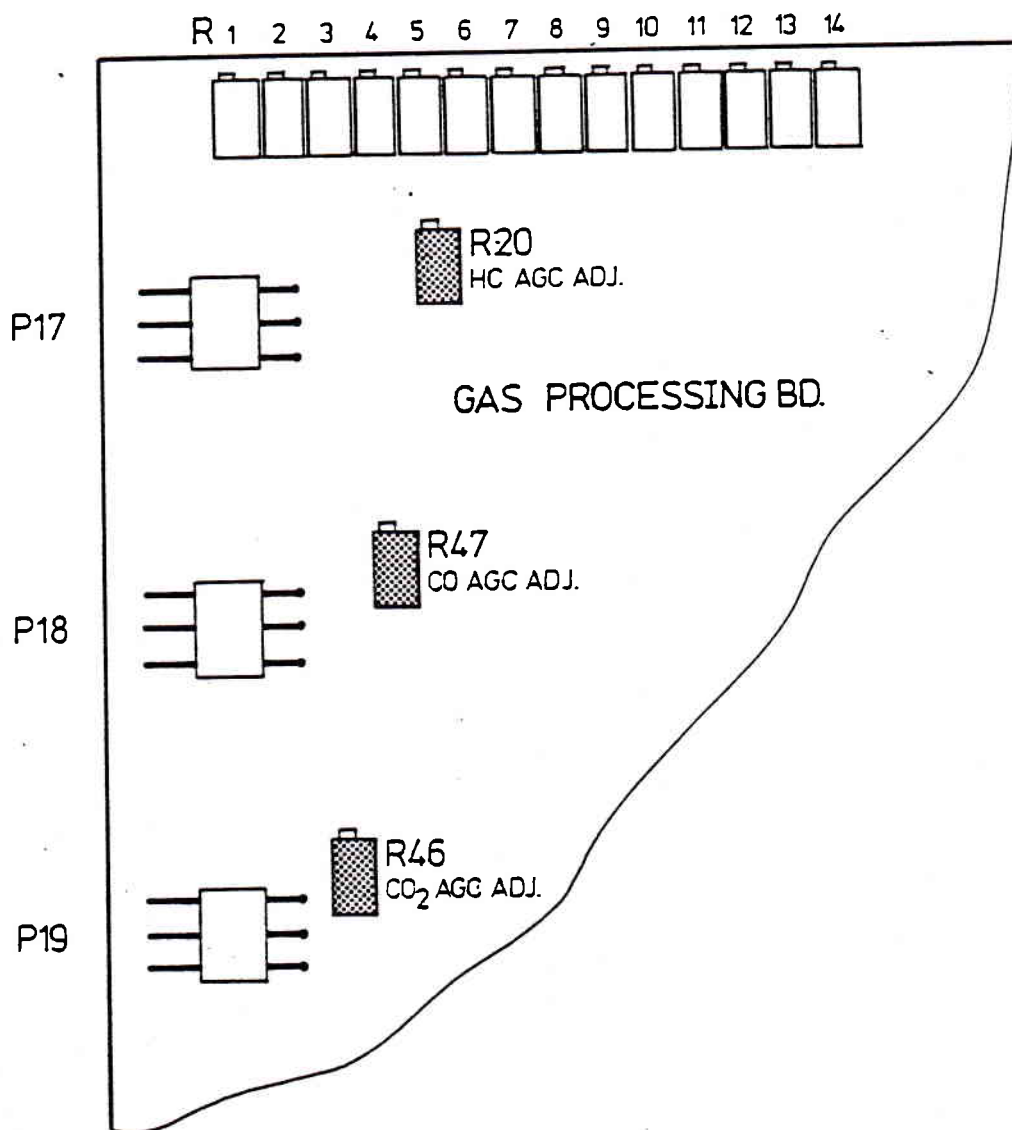
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FIG. 2



ADJUST AGC VOLTS TO 1.8 V

RETURN TESTER TO THE NORMAL OPERATING MODE BY SWITCHING THE SERVICE MODE
SWITCH BACK TO ITS ORIGINAL OPEN POSITION.

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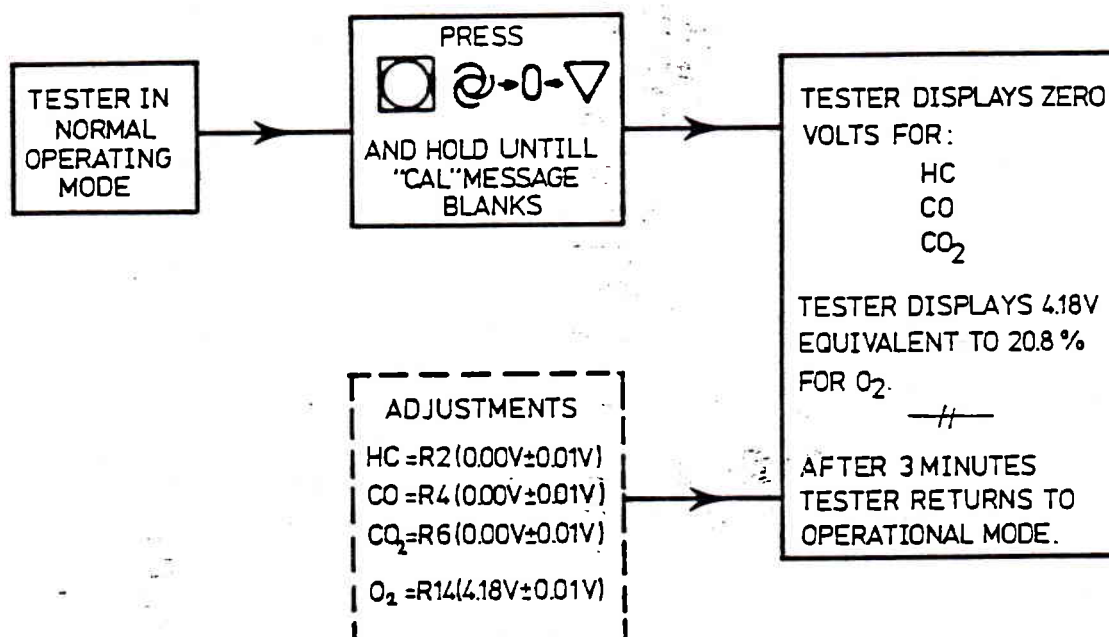
CALIBRATION PROCEDURES

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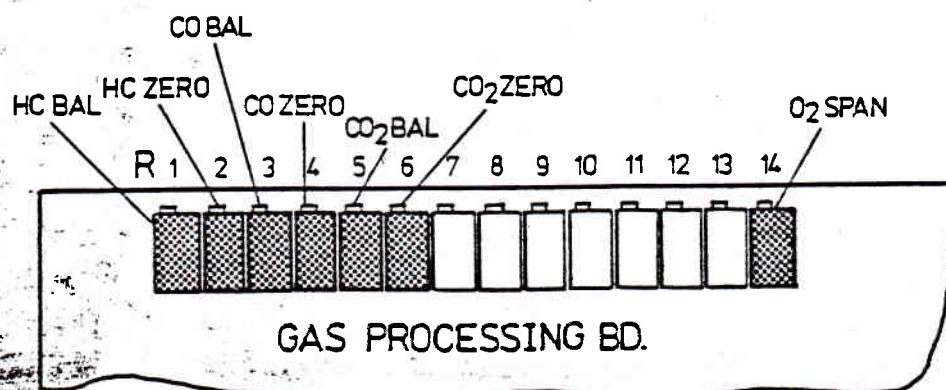
PAGE 22

II) ZERO ADJUSTMENT

SET THE TESTER AS FOLLOWS :



NOTE: IF IT IS NOT POSSIBLE TO ZERO HC, CO AND CO₂ WITH THE ZERO POTENTIOMETERS, BALANCE POTENTIOMETERS R1, R3 AND R5 MAY BE USED.



ZERO CALIBRATION MUST BE COMPLETED WITHIN 3 MINUTES OR THE TESTER WILL RETURN TO THE OPERATING MODE.

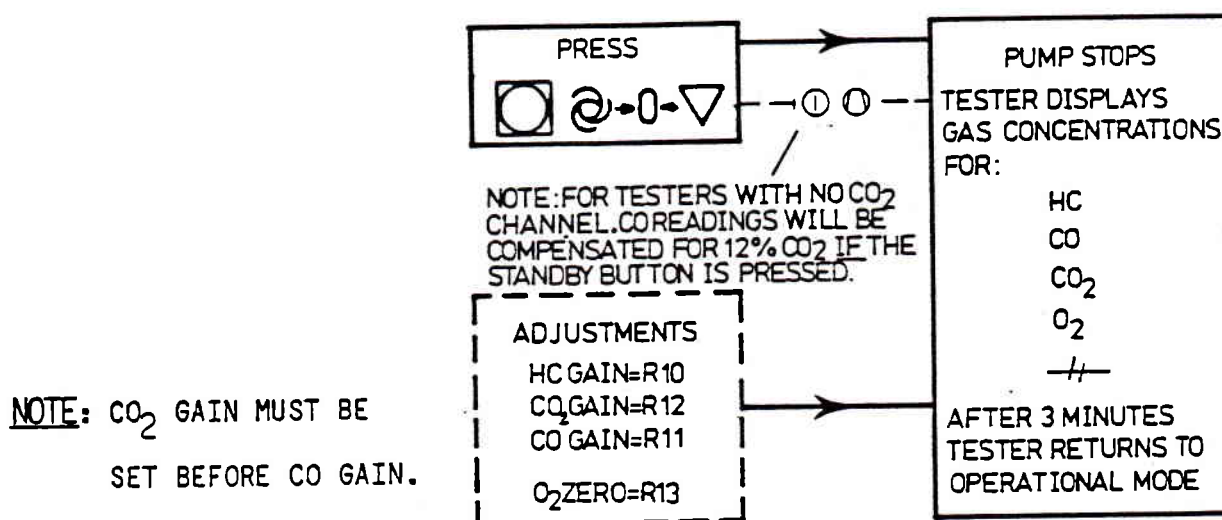
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III) GAIN ADJUSTMENT



STEP 1: APPLY THE CALIBRATION GAS (SEE "IMPORTANT" (2 GAS ANALYSERS) PAGE 24) TO THE CAL INLET ON THE REAR OF THE TESTER AT THE FLOW RATE RECORDED DURING THE TESTER PREPARATION.

STEP 2: ADJUST THE APPROPRIATE GAIN CONTROLS UNTIL THE DISPLAYED READING CORRESPONDS TO THE READING ON THE GAS CERTIFICATION LABEL FOR HC, CO AND CO₂. **NOTE:** DUE TO CO₂ COMPENSATED CO READINGS CO₂ GAIN MUST BE SET BEFORE CO GAIN.

NOTE: WHEN CALIBRATION HC USING PROPANE (C₃H₈) THE LABEL CONCENTRATION MUST BE MULTIPLIED BY THE PEF (PROPANE EQUIVALENCY FACTOR) NUMBER ON THE REAR OF THE TESTER.

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EXAMPLE: LABEL READING X P.E.F. = HC, PPM.

3000 PPM X 0.53 = 1590.

STEP 3: ALLOW 1 OR 2 MINUTES FOR THE O₂ READING TO REACH ITS LOWEST VALUE.

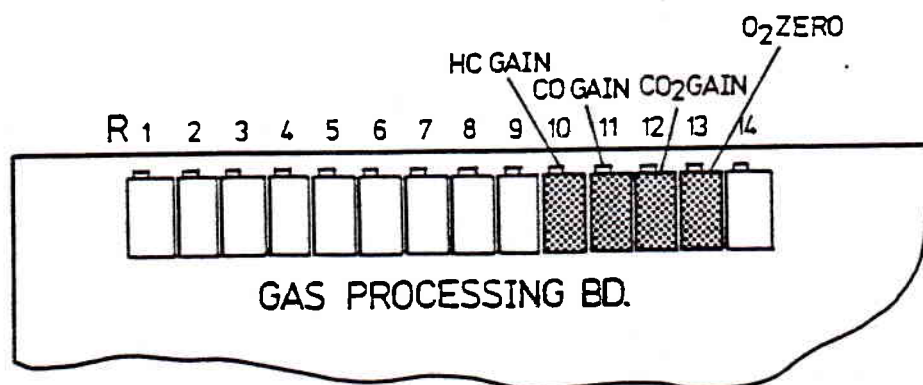
ADJUST O₂ ZERO FOR 0.00. THE O₂ READING WILL NOT READ NEGATIVE

THEREFORE ALLOW A SLIGHT POSITIVE OFFSET TO ENSURE ZERO SETTING.

IMPORTANT (TWO GAS ANALYSERS)

WHEN CALIBRATING TESTERS WITH NO CO₂ CHANNEL THE CALIBRATION GAS MUST CONTAIN EITHER NO CO₂ OR 12% CO₂. THE CO READING DURING CALIBRATION WILL BE UNCOMPENSATED UNLESS THE STANDBY BUTTON IS PRESSED DURING GAIN CAL.

ON HC, CO, CO₂ TESTERS WITH THE O₂ OPTION AN UNCORRECTED CO READING MAY BE DISPLAYED IN THE O₂ SLOT. THIS IS ACHIEVED BY OPENING SWITCH U6-6 ON THE DISPLAY BD (SEE SET UP). WITH UNCOMPENSATED CO READINGS THE SERVICE ENGINEER MAY USE CAL GAS WITH NO CO₂.



GAIN CALIBRATION MUST BE COMPLETED WITHIN 3 MINUTES OR THE TESTER WILL RETURN TO THE NORMAL OPERATING MODE.

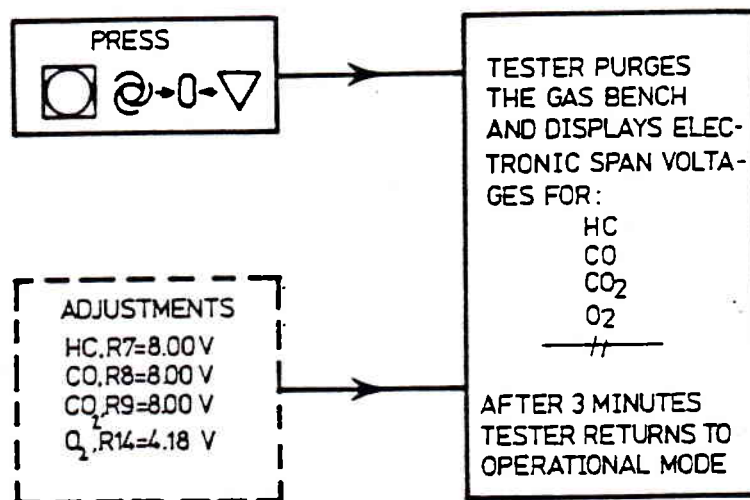
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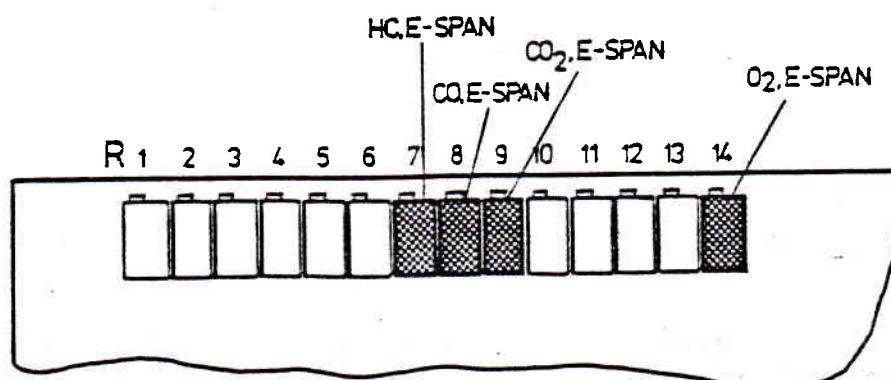
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IV) E-SPAN ADJUSTMENT (CO, HC + CO₂)



STEP 1: ADJUST THE APPROPRIATE SPAN CONTROL UNTIL HC, CO AND CO₂ READ 8.00 v.

STEP 2: ALLOW THE O₂ READING 2 MINUTES TO SETTLE. IF NECESSARY ADJUST O₂ SPAN CONTROL FOR READING OF 4.18 v.



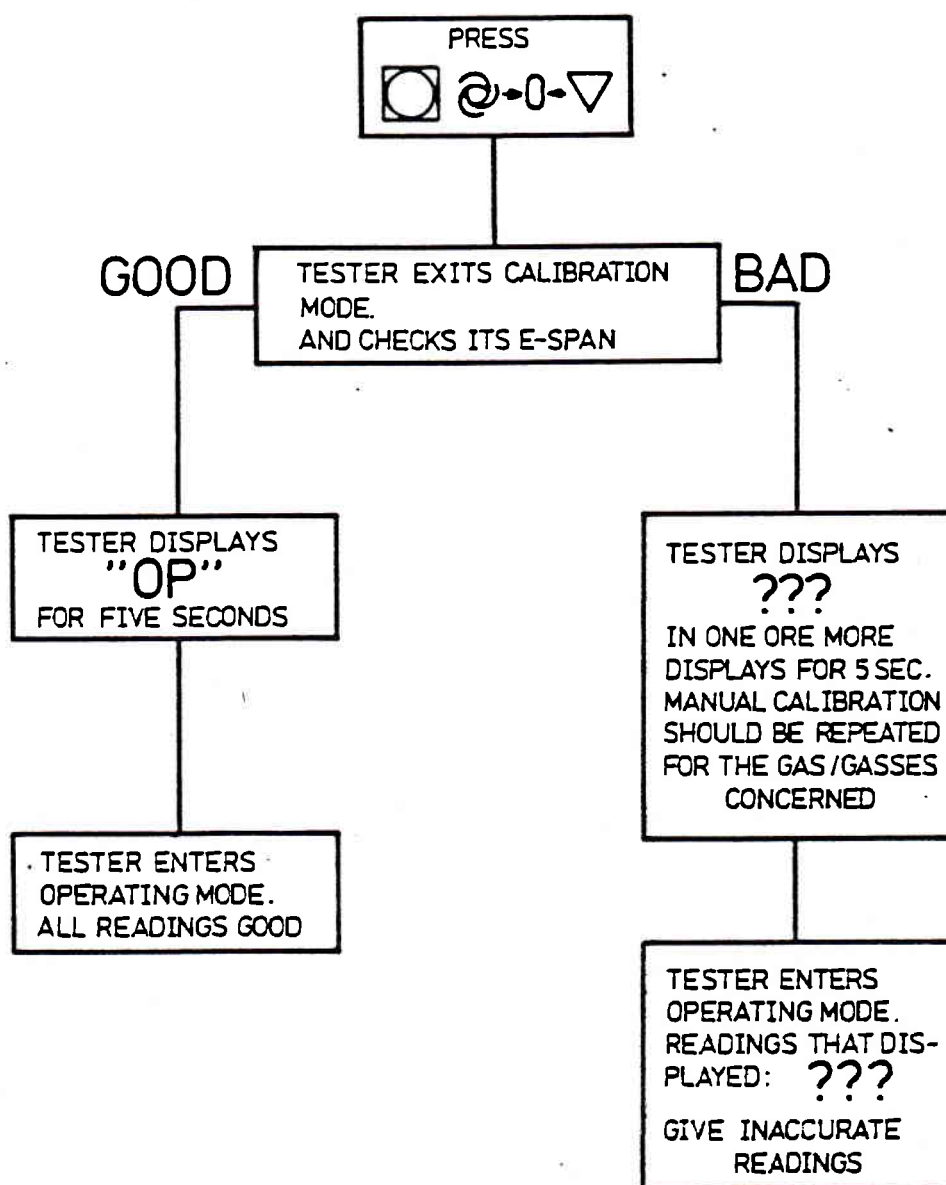
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V) CALIBRATION CHECK



C) OIL TEMP/RPM CAL

SEE SECTION 6 OPTIONS.



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SECTION 2
POWER SUPPLY
AND
DISTRIBUTION

	PAGE
1.1. AC POWER FLOW	01
1.2. AC POWER FLOW DIAGRAM	02
1.3. AC DISTRIBUTION BD	03 THRU 04
2.1. LV POWER DISTRIBUTION	05 THRU 06
2.2. SWITCHING POWER SUPPLY	07 THRU 09
2.3. LINEAR SUPPLY	10 THRU 12
2.4. LV POWER DISTRIBUTION DIAGRAM	13
3. TROUBLESHOOTING	14 THRU 17



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POWER SUPPLY &

DISTRIBUTION

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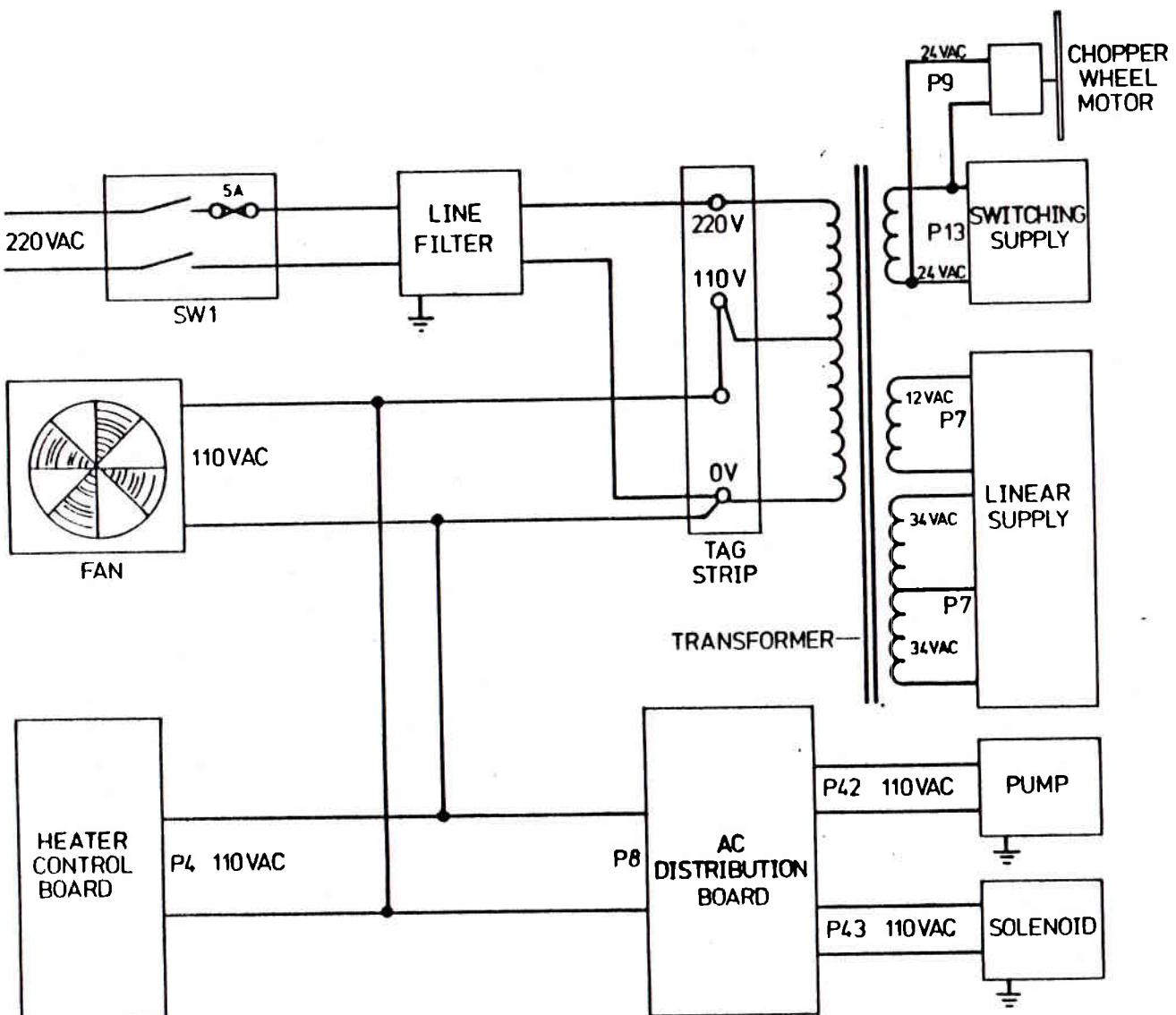
1.1. AC POWER FLOW

AC POWER ENTERS THE TESTER VIA A THREE CONDUCTOR CABLE. THE YELLOW/GREEN LEAD (EARTH) MUST BE CONNECTED TO A SOLID EARTH/CHASSIS GROUND. FAILURE TO DO THIS RESULTS IN A SAFETY HAZARD.

THE BROWN (LIVE) AND BLUE (NEUTRAL) LEADS ARE CONNECTED TO A FUSED (5A) TWIN POLE MAINS SWITCH. THE SWITCHED LIVE AND NEUTRAL LINES ARE THEN CONNECTED TO A LINE FILTER. THE OUTPUT OF THE LINE FILTER IS CONNECTED TO THE TAG STRIP.

THE TAG STRIP ACTS AS THE MAINS DISTRIBUTION POINT FOR THE TESTER. SEE AC FLOW DIAGRAM PAGE 02.

1.2. AC POWER FLOW DIAGRAM

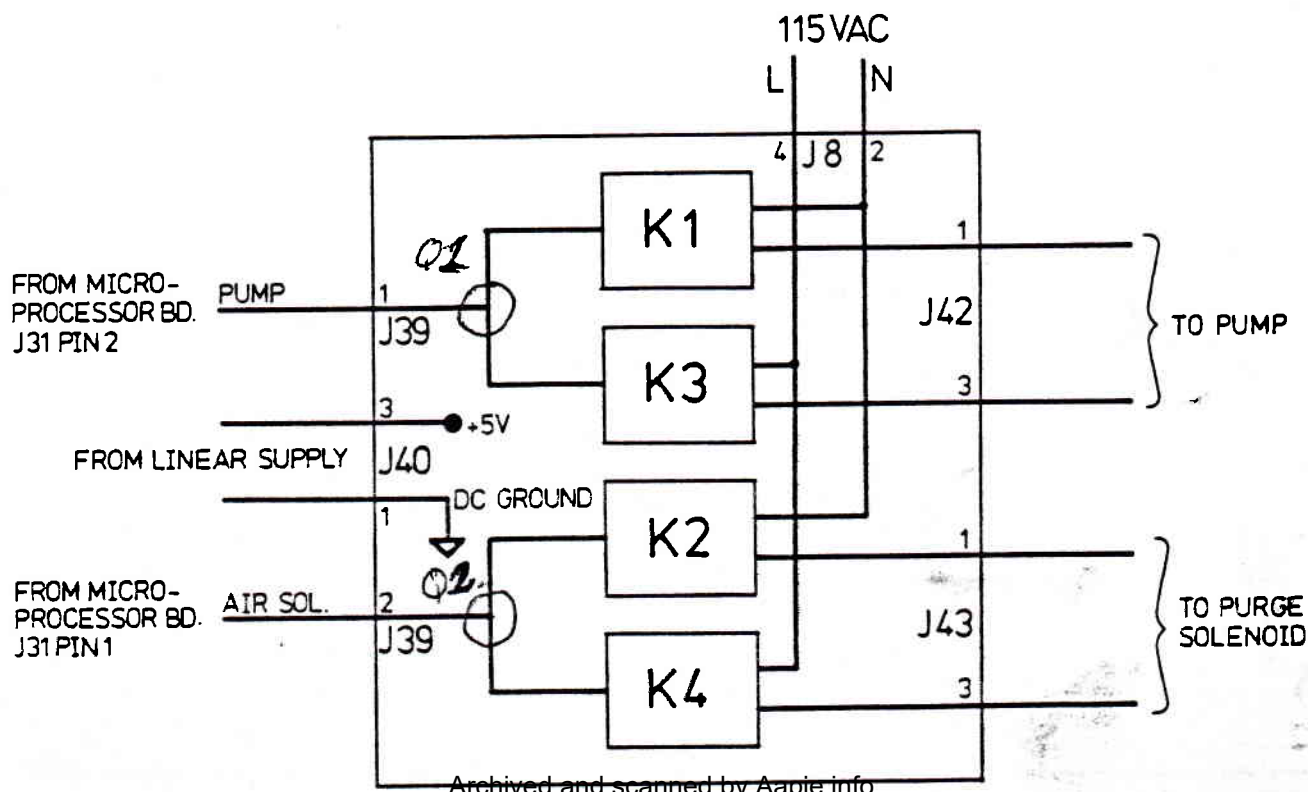


1.3. AC DISTRIBUTION BD

THE AC DISTRIBUTION BD IS RESPONSIBLE FOR SWITCHING THE 115 V AC SUPPLIES TO THE PUMP AND PURGE SOLENOID.

THE CONTROL LINES FROM THE DIGITAL-PROCESSOR BD ENTER THE BOARD AT J39 PINS 1 AND 2.

EACH LINE SWITCHES IT OWN TRANSISTOR THAT INTURN ACTIVATES TWO OPTOCOUPLED DIAC SWITCHES. THESE OPTO DEVICES ISOLATE THE SWITCH LINES FROM THE 115 V AC. TWO DEVICES ARE USED TO ENABLE BOTH THE SWITCHING OF THE LIVE AND NEUTRAL LINES. A + 5V LINE FROM THE LINEAR SUPPLY IS USED TO POWER THE BOARD.





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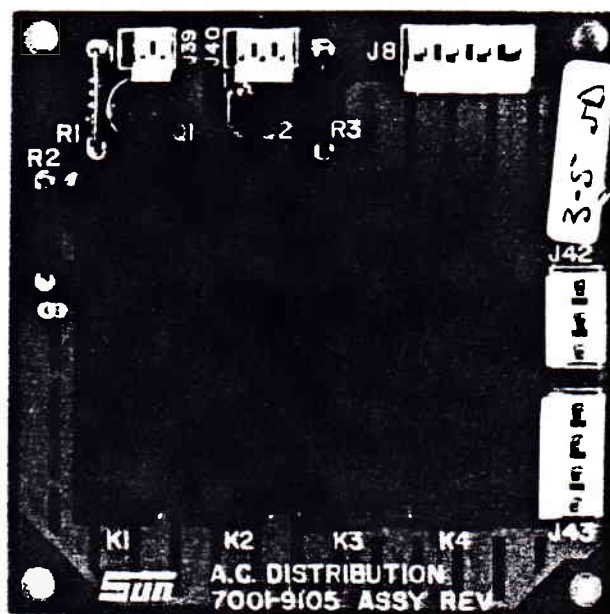
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AC DISTRIBUTION BD



2.1. LV POWER DISTRIBUTION

THE LOW VOLTAGE SUPPLIES REQUIRED FOR CORRECT TESTER OPERATION ARE GENERATED BY EITHER THE LINEAR POWER SUPPLY (+12 V, -12 V AND +5V), THE SWITCHING POWER SUPPLY (+5V), OR LOCALLY (-5V).

THE FOLLOWING TABLE SHOWS THE SUPPLY, ITS ORIGIN AND ITS DESTINATION(S).

ORIGIN	VOLTAGE	DESTINATION
LINEAR SUPPLY		ANALOG PROCESS BD.
J14 { PIN 1 PIN 2 PIN 3 PIN 4 PIN 5	+ 5V 0V (GND) +15V 0V (GND) -15V	{ PIN 1 PIN 2 PIN 3 PIN 4 PIN 5 J22
GENERATED LOCALLY FROM THE -15V	- 5V	TP 23
LINEAR SUPPLY		DIGITAL PROCESS BD
J15 { PIN 1 PIN 2 PIN 3 PIN 4 PIN 5 PIN 6	+ 5V 0V (GND) +15V 0V (GND) VAR 5V (UNREG) -15V	{ PIN 1 PIN 2 PIN 3 PIN 4 PIN 5 PIN 6 J25



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ORIGIN	VOLTAGE	DESTINATION
LINEAR SUPPLY J20 { PIN 1 PIN 2	+ 5V 0V (GND)	FRONT PANEL BD PIN 2 } PIN 1 } J34
LINEAR SUPPLY J21 { PIN 1 PIN 2	0V (GND) + 5V	AC DIST. BD PIN 1 } PIN 3 } J40
LINEAR SUPPLY J52 { PIN 1 PIN 2 PIN 3 PIN 4 PIN 5	+ 5V 0V (GND) +15V 0V (GND) -15V	OIL TEMP/RPM BD (OPTION) PIN 3 } PIN 5 } J53
SWITCHING SUPPLY J10 J11 J12	5V 5V 5V	SOURCES HC IR SOURCE CO IR SOURCE CO ₂ IR SOURCE
SWITCHING SUPPLY J50	+5V GND	FRONT PANEL BD PIN 2 } J51 PIN 1 }



2.2 SWITCHING POWER SUPPLY

DUE TO THE VARIATION IN LOAD PRESENTED TO THE 5V LINE BY THE IR SOURCES (HOT AND COLD), AND THE FRONT PANEL DISPLAY BD (ALL DISPLAYS/NO DISPLAYS), A SWITCHING SUPPLY IS USED TO SOURCE THIS LINE.

THE SWITCHING SUPPLY PROVIDES A STABLE, HIGH CURRENT SOURCED, 5V SUPPLY IN THE FOLLOWING MANNER:

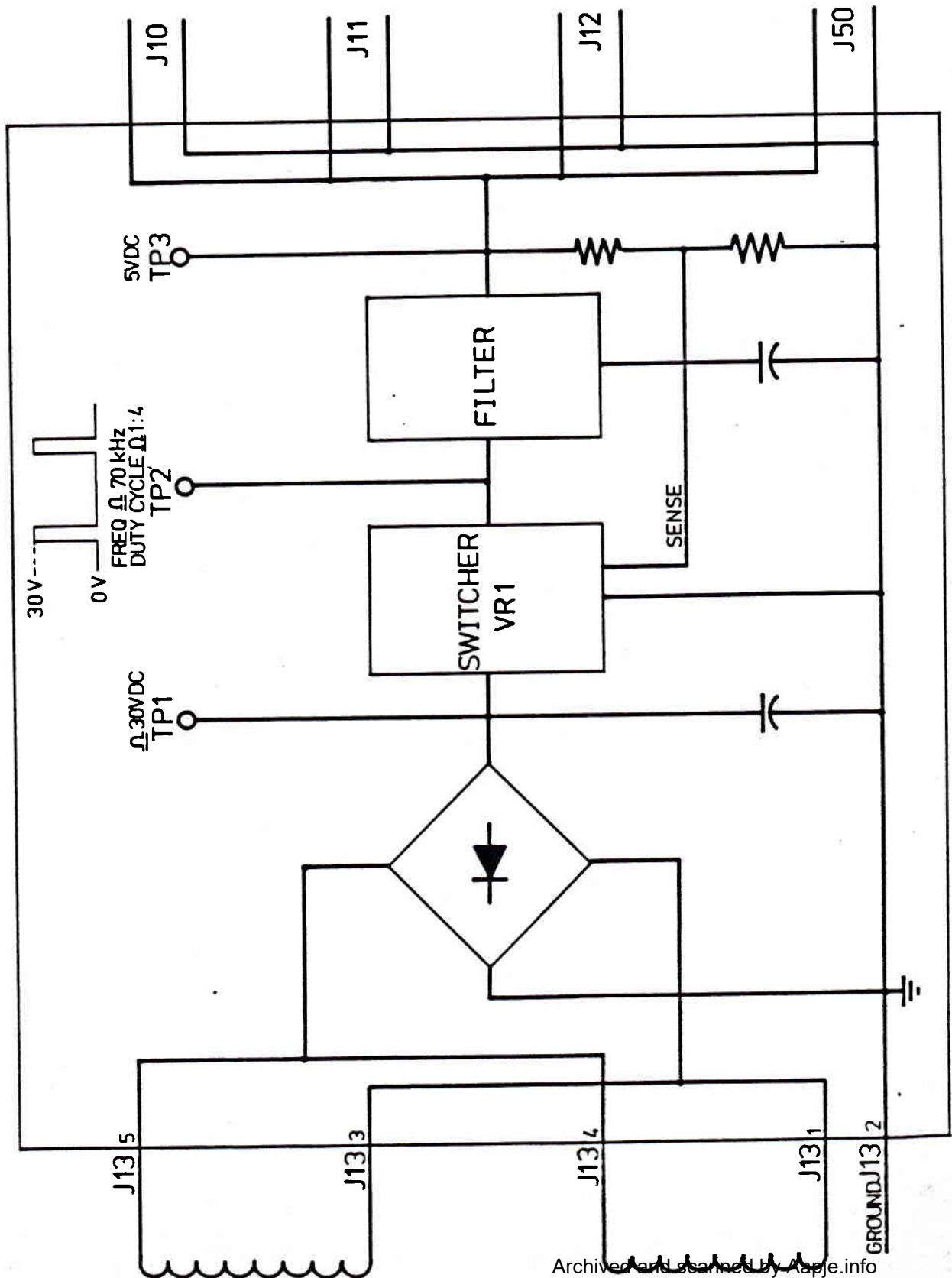
THE SUPPLY IS FED WITH $\pm 23V$ AC FROM TWO SECONDARY WINDINGS OF THE MAINS TRANSFORMER CONNECTED IN PARALLEL. THE AC POWER ENTERS THE SUPPLY AT J13 PINS 1/3 AND 4/5. PIN 2 PROVIDES A CHASSIS GND CONNECTION.

THE AC POWER IS FULL WAVE RECTIFIED BY D2 AND THE RESULTANT 30V DC (TP 1) IS FED TO THE SWITCHING DEVICE VR 1.

THE SWITCHER VR 1 CHOPS THE 30V DC INTO PULSES AT A FREQUENCY OF APPROXIMATELY 70 KHZ, WITH A DUTY CYCLE OF $\pm 1:4$. THE CHOPPED SIGNAL IS THEN FILTERED AND THE RESULTANT 5V DC (TP 3) IS OUTPUTTED AT J10 (HC SOURCE), J11 (CO SOURCE), J12 (CO₂ SOURCE) AND J50 (FRONT PANEL BD).

THE SWITCHER SENSES THE OUTPUT VOLTAGE BY MEANS OF A POTENTIAL DIVIDER AND VARIES ITS DUTY CYCLE TO MAINTAIN THE SUPPLY AT 5V INDEPENDANT OF THE LOAD CONDITIONS PRESENTED BY THE SOURCES AND DISPLAY BD.

SWITCHING POWER SUPPLY





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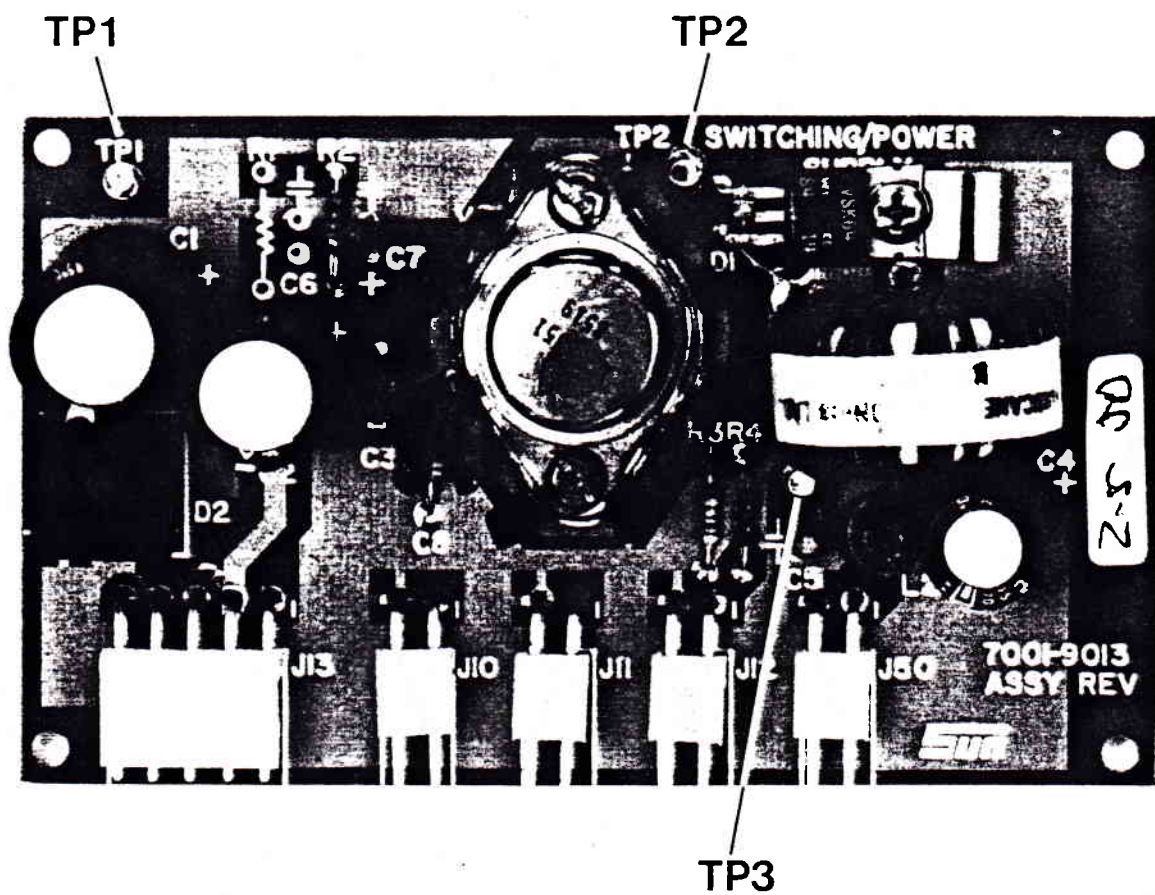
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SWITCHING POWER SUPPLY



2.3 LINEAR SUPPLY

THE LINEAR SUPPLY IS RESPONSIBLE FOR PRODUCING THE FOLLOWING SUPPLIES:

- A) +15V 0V -15V
- B) + 5V 0V
- C) VARIABLE +5V UNREGULATED

A) +15V 0V -15V

A CENTER TAPPED SECONDARY WINDING IS FED TO THE BOARD AT J7 PINS 1, 2 AND 3. THE CENTER TAP (PIN 2) IS CONNECTED TO GROUND (TP 7) AND IS USED AS COMMON GROUND FOR BOTH THE +15V AND -15V SUPPLIES.

THE TWO HALVES OF THE WINDING ARE FED TO THE BRIDGE RECTIFIER D4. AFTER FULL WAVE RECTIFICATION THE PLUS AND MINUS OUTPUTS ARE SMOOTHED AND THE RESULTANT +24V (TP 5) AND -24V (TP 4) ARE FED TO THEIR RESPECTIVE $\pm 15V$ REGULATORS. THE REGULATED OUTPUTS +15V (TP 6) AND -15V (TP 3) ARE THEN SMOOTHED BEFORE BEING OUTPUTTED TO VARIOUS AREAS OF THE TESTER (SEE LV DISTRIBUTION 2.1)

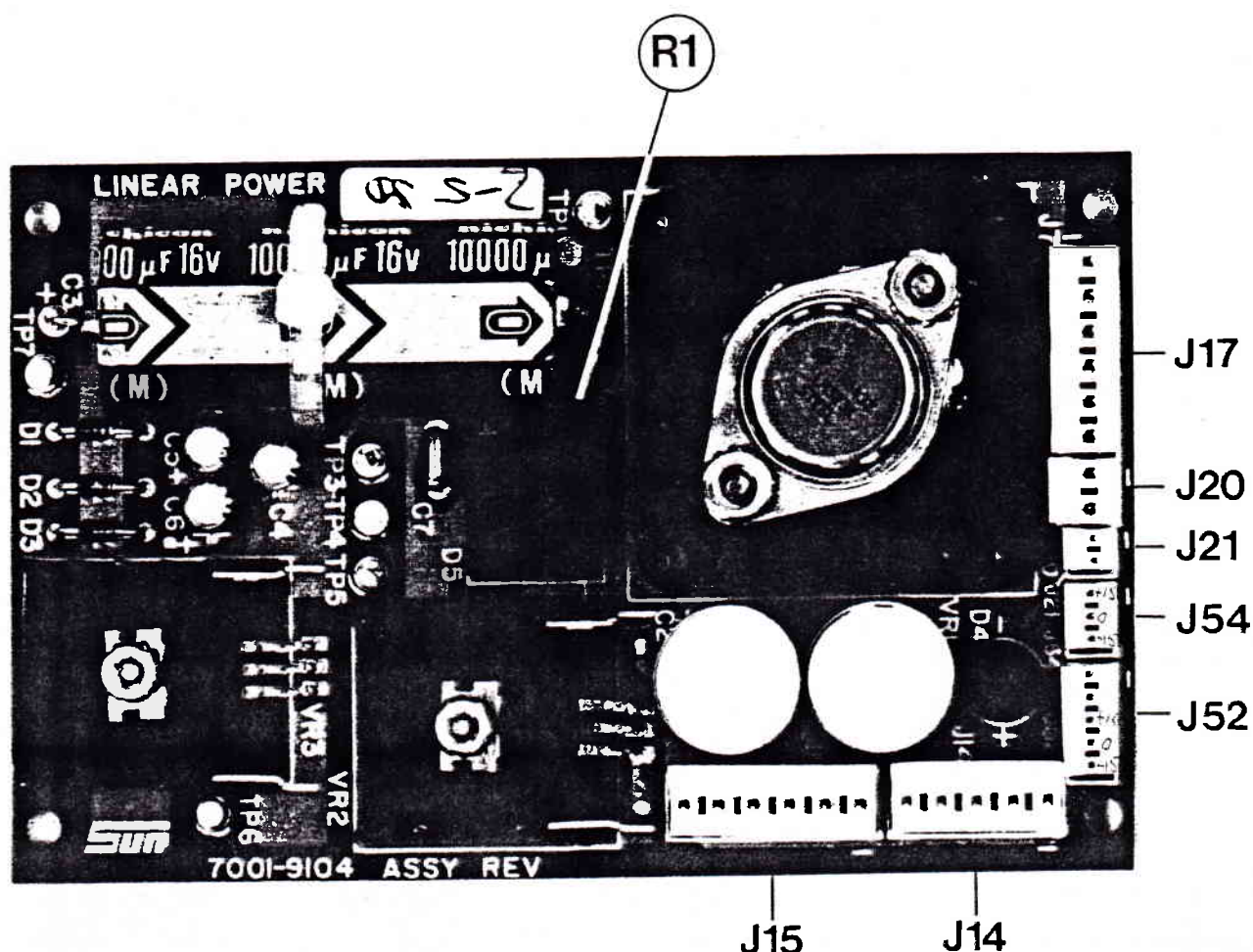
B) +5V 0V

A SECONDARY WINDING IS FED TO THE BOARD AT J7 PINS 5 AND 6. THE AC SUPPLY IS FULLWAVE RECTIFIED BY BRIDGE RECTIFIER D5. THE OUTPUT OF D5 IS THEN SMOOTHED AND THE RESULTANT UNREGULATED +9V (TP 2) FED TO THE 5V REGULATOR. THE REGULATED 5V OUTPUT (TP 1) IS THEN SMOOTHED BEFORE BEING OUTPUTTED TO VARIOUS AREAS OF THE TESTER (SEE LV DISTRIBUTION 2.1).

C) VARIABLE +5V UNREGULATED

THE MICRO PROCESSOR BD REQUIRES AN UNREGULATED 5V TO ENABLE IT TO DISPLAY THE MAINS VOLTAGE AND IF NECESSARY WARN AGAINST HIGH OR LOW MAINS. THE +5V UNREG. IS OBTAINED FROM A POT R1 SITUATED ACROSS, THE UNREGULATED 9V FEED (TP 2) TO THE 5V REGULATOR, AND GROUND. FOR ADJUSTMENT OF R1 SEE SECTION 1. CHECKOUT AND CALIBRATION.

LINEAR POWER SUPPLY



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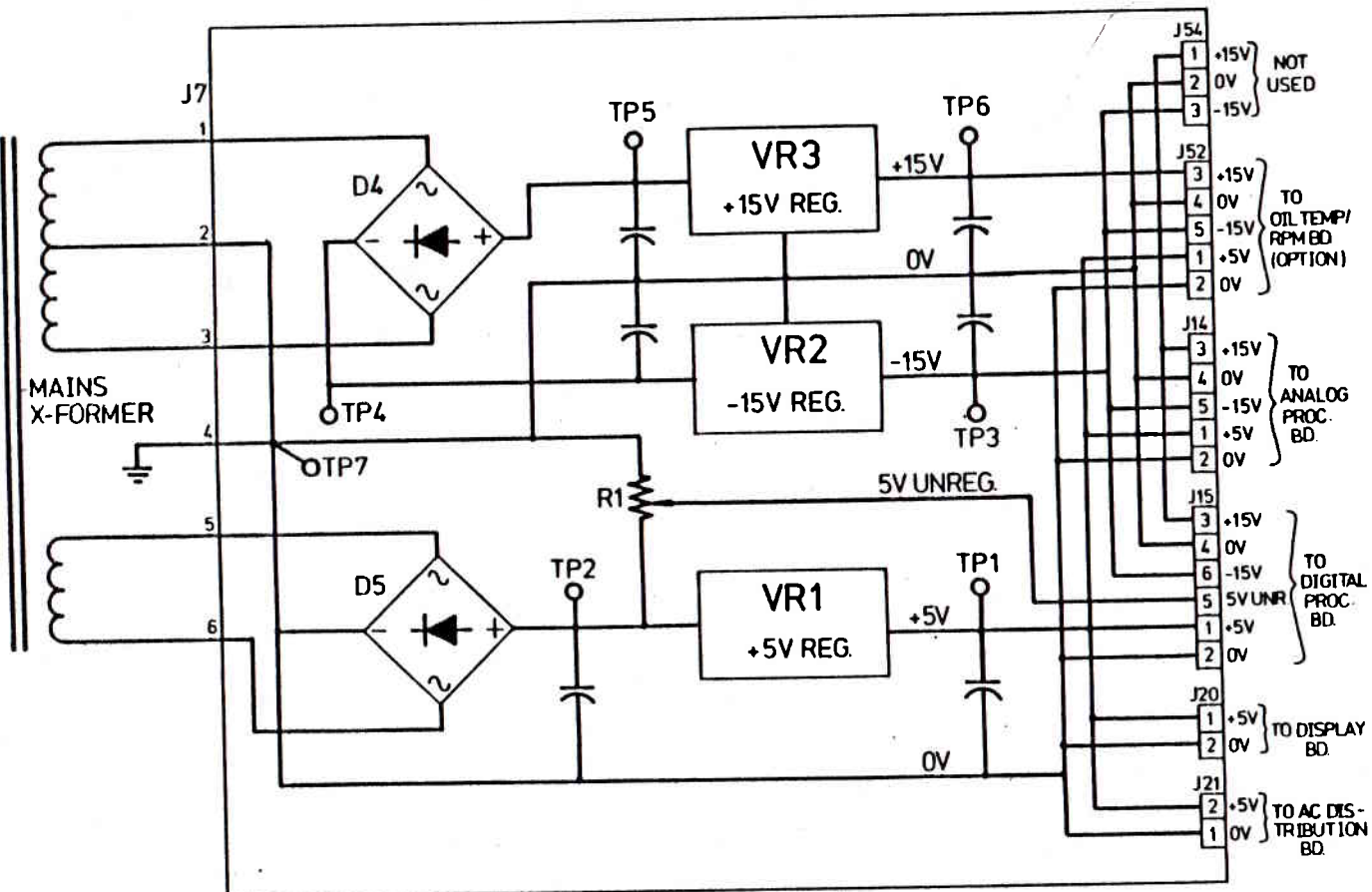
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BLOCK DIAGRAM LINEAR POWER SUPPLY





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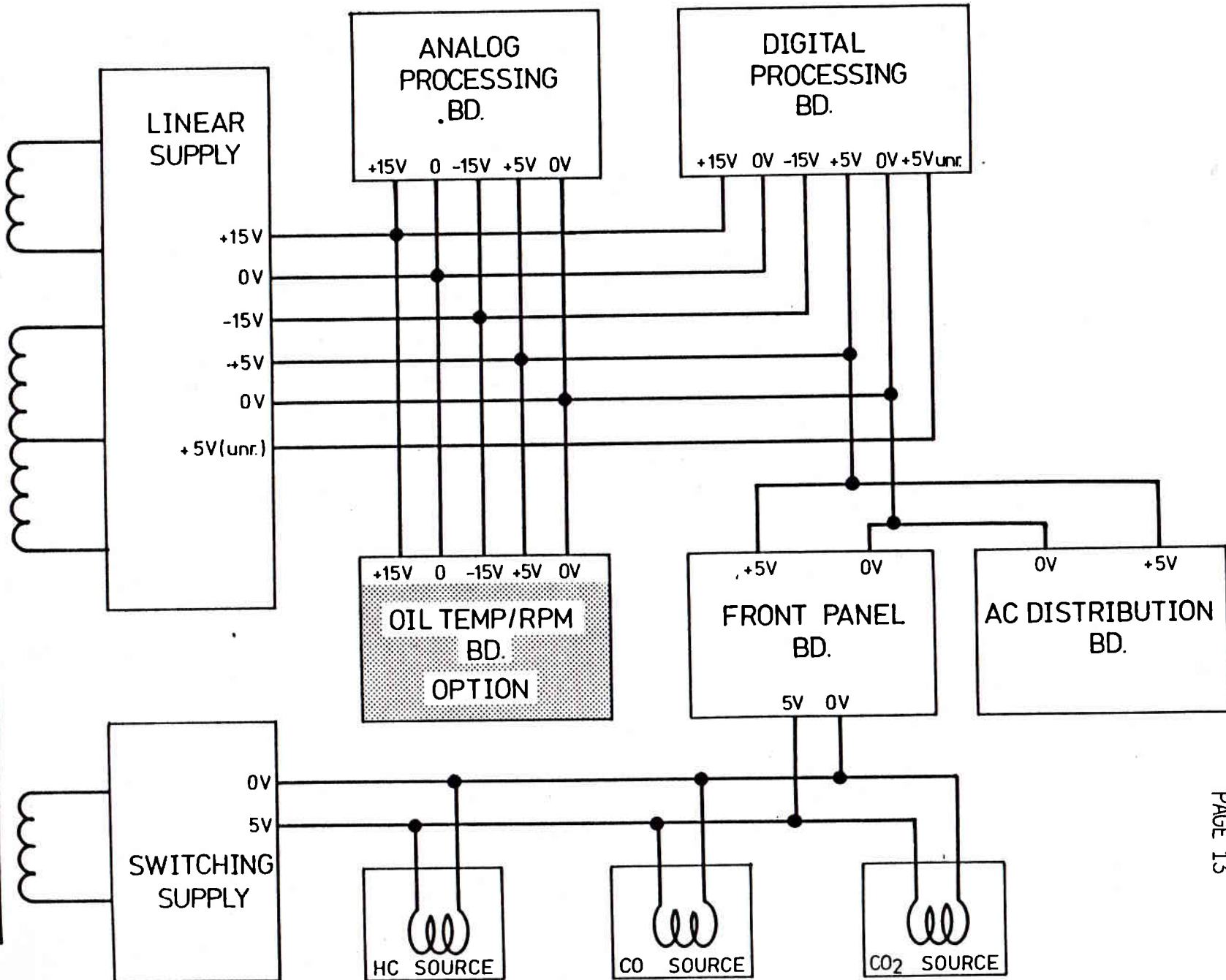
POWER SUPPLY &

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2.4 L.V. POWER DISTRIBUTION





3. TROUBLESHOOTING GUIDE

THIS TROUBLESHOOTING SECTION IS ONLY A GUIDE AND MUST BE USED IN CONJUNCTION WITH THE REST OF THE MANUAL.

BEFORE CHECKING THE DC SUPPLIES ENSURE THAT THE AC MAINS SUPPLY IS GOOD.

SYMPTON: FAN DOES NOT RUN.

CHECK: 1. MAINS PLUG

2. MAINS SWITCH

3. MAINS FUSE (LOCATED IN THE MAINS SWITCH)

4. LINE FILTER

IF BAD REPLACE AS NECESSARY.

IF GOOD CHECK FOR 115 V AC AT THE FAN.

IF GOOD REPLACE FAN.

IF BAD REPLACE MAINS TRANSFORMER.

DC POWER SUPPLIES

THE DC POWER SUPPLY OF THE SGA-9000 CAN EFFECTIVELY BE SPLIT INTO THREE AREAS:

1. SWITCHING SUPPLY.

2. LINEAR SUPPLY.

3. -5V SUPPLY (GENERATED ON THE ANALOG PROCESSING BD).



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THE FOLLOWING SYMPTOMS INDICATE WHICH SUPPLY IS AT FAULT, HOWEVER THESE SYMPTOMS MAY BE CAUSED BY FAILURES ELSEWHERE IN THE TESTER.

1) SWITCHING SUPPLY

SYMPTOM: NO FRONT PANEL ILLUMINATION. ALL ELSE GOOD.

THE METHOD OF REPAIR CONSISTS OF VERIFYING THE SUPPLY AND IF NECESSARY REPLACING IT. IF THE SUPPLY APPEARS TO BE BEING PULLED DOWN THE OFFENDING SUB UNIT SHOULD BE TRACED AND REPLACED.

CHECK FOR +5V BETWEEN TP 3 AND GND ON THE SWITCHING SUPPLY.

THE FOLLOWING TABLE GIVES AN INDICATION OF THE IMPEADANCES PRESENTED TO THE SWITCHING SUPPLY BY THE SUB UNITS.

NOTE: ALL MEASUREMENTS SHOULD BE MADE WITH A FLUKE 8060A DMM OR EQUIVALENT MULTIMETER ON THE LOWEST POSSIBLE RANGE. IF THIS METER IS NOT AVAILABLE IGNOR THE READINGS IN THE TABLE AND CHECK FOR NO SHORT CIRCUITS.

HC SOURCE COLD = 3 - 4 Ω

CO SOURCE COLD = 3 - 4 Ω

CO₂ SOURCE COLD = 3 - 4 Ω

DISPLAY BD + PROBE OF DVM TO J51-1 = APPROX 200 K Ω .



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IF ALL IMPEADANCES GOOD REPLACE:

1. SWITCHING SUPPLY
2. MAINS TRANSFORMER

2. LINEAR SUPPLY

SYMPTOM: VARIOUS.

THE LINEAR SUPPLY SHOULD BE CHECKED FOR ALL FAULT CONDITIONS.

REMOVE THE LINEAR SUPPLY FROM ITS STAND OFFS TO ALLOW ACCESS TO THE TP'S.

USING A DMM CHECK FOR THE FOLLOWING VOLTAGES AT THEIR RESPECTIVE TP'S.

TP7 = GROUND

TP6 = +15V

TP3 = -15V

TP1 = + 5V

IF +/-15V IS BAD REMOVE INTURN:

J14 (ANALOG PROCESSING BD)

J15 (DIGITAL PROCESSING BD)

J52 (OIL TEMP RPM OPTION)

IF THE SUPPLY IS STILL BAD REPLACE:

1. LINEAR SUPPLY
2. MAINS TRANSFORMER

IF THE SUPPLY RECOVERS REPLACE THE OFFENDING SUB UNIT.

IF +5V IS BAD REMOVE INTURN:

- J14 (ANALOG PROCESSING BD)
- J15 (DIGITAL PROCESSING BD)
- J20 (DISPLAY BD)
- J21 (AC DISTRIBUTION BD)
- J52 (OIL TEMP/RPM OPTION)

IF THE SUPPLY IS STILL BAD REPLACE:

1. LINEAR SUPPLY
2. MAINS TRANSFORMER

IF THE SUPPLY RECOVERS REPLACE THE OFFENDING SUB UNIT.

3) -5V SUPPLY (GENERATED ON THE ANALOG PROCESSING BD)

SYMPTOM: TESTER DISPLAYS AGC IN HC, CO AND CO₂ GAS WINDOWS. WARM UP PERIOD OK.

REMOVE ANALOG PROCESSING BD FROM ITS STAND OFFS. USING A DMM CHECK FOR -5V BETWEEN TP11 (GND) AND TP23.

IF BAD CHECK FOR -15V BETWEEN TP11 (GND) AND TP10.

IF GOOD REPLACE ANALOG PROCESSING BD.

IF BAD SEE 2 LINEAR SUPPLY.



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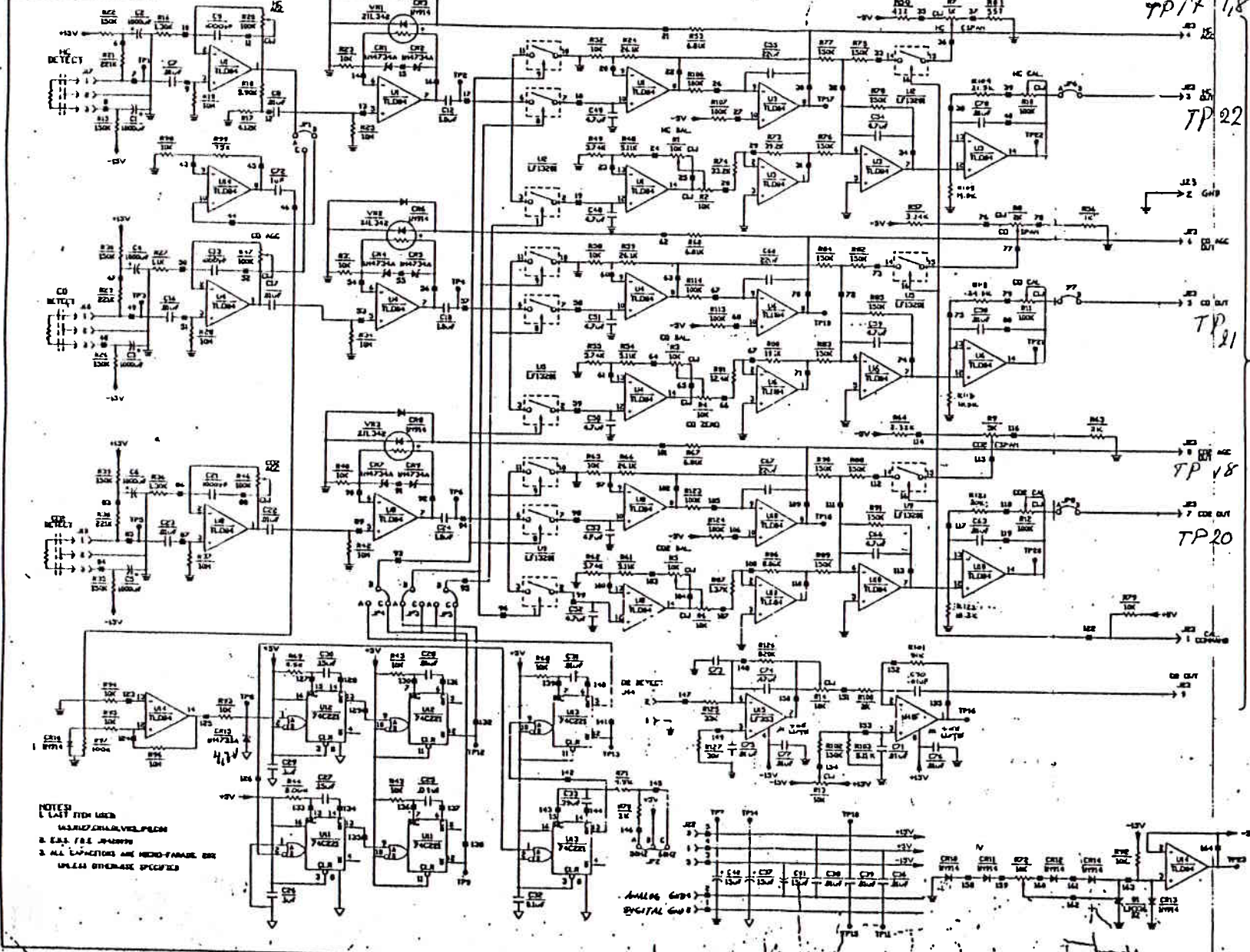
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GAS PROCESSING

	PAGES
1. GAS BENCH (HC, CO, CO ₂)	01 THRU 03
2. ANALOG PROCESSING BD	04 THRU 13
3. HEATER CONTROLLER BD	14 THRU 15
4. GAS PROCESSING BLOCK DIAGRAM	16

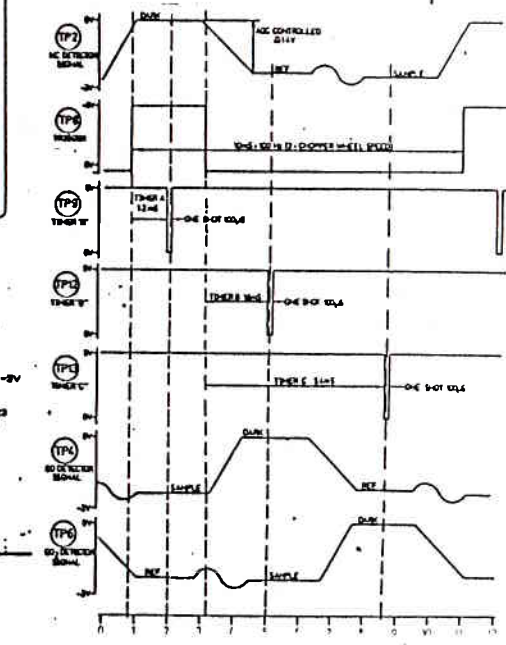
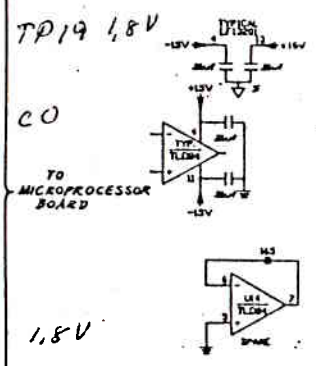
Analog heart

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LIST OF MATERIAL			
QTY REQD	PART NO.	DESCRIPTION	ITEM NO

REV	DESCRIPTION	DATE
A	REV EDO 04-214	1-7-74
B	REV EDO 04-215	



NOTES:
1. LAY WITH LENS
2. ESD PROTECTION
3. ALL CAPACITORS ARE HIGH-PASS OR
UNLESS OTHERWISE SPECIFIED

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GAS PROCESSING

SECTION 03

PAGE 01

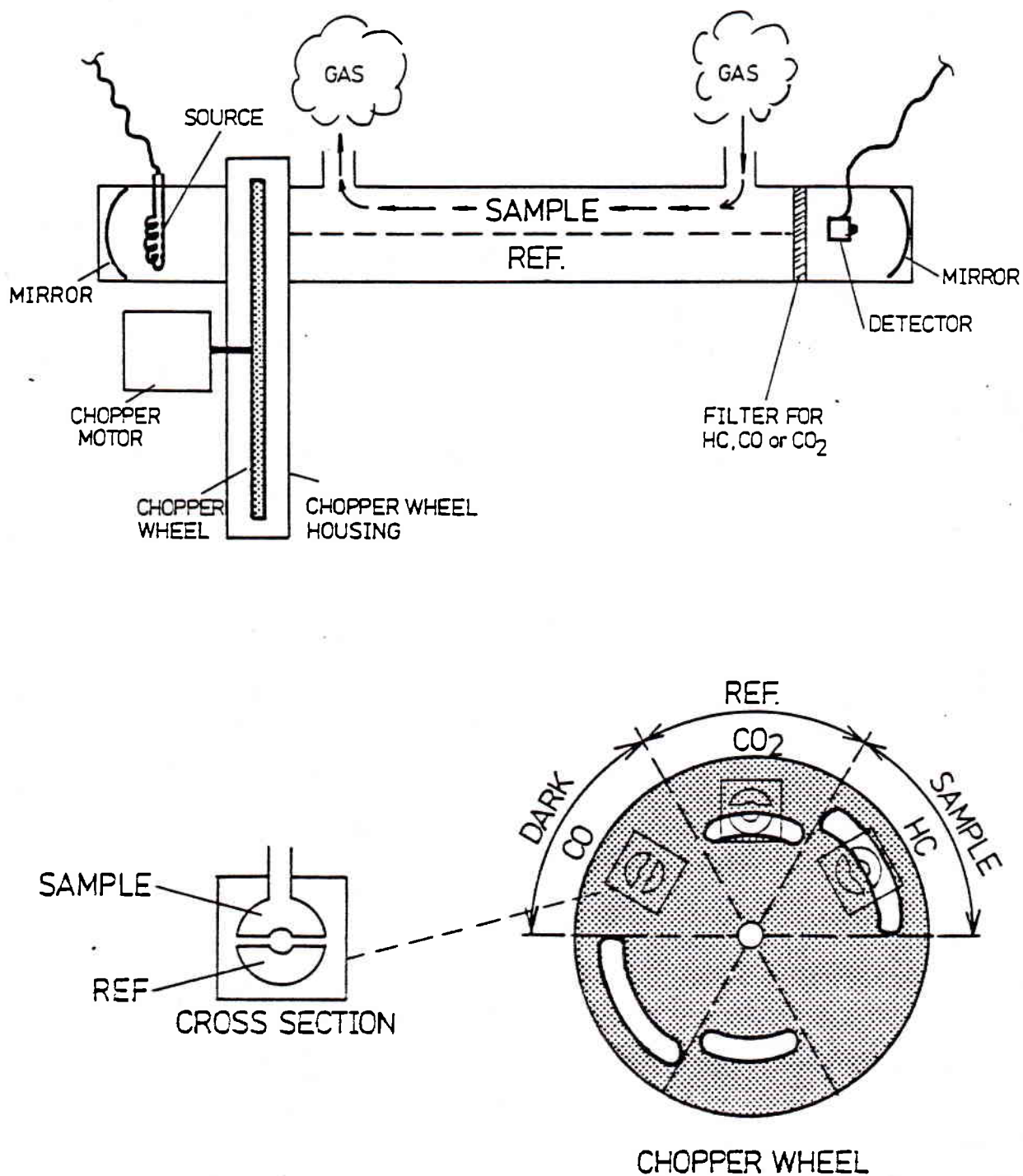
1) GAS BENCH (HC, CO, CO₂)

AT THE HEART OF THE SGA-9000 MEASURING SYSTEM IS AN INFRA-RED GAS BENCH THAT IS CAPABLE OF PRODUCING A SIGNAL THAT IS PROPORTIONAL TO THE HC, CO AND CO₂ (DEPENDING UPON OPTIONS) CONCENTRATIONS OF A CAR'S EXHAUST GASSES.

THE PRINCIPLE OF OPERATION IS TO PASS INFRARED LIGHT THROUGH BOTH A SAMPLE AND REFERENCE SECTION OF A TUBE AND MEASURE THE DIFFERENCE IN THE IR ABSORPTION FACTOR. IT IS ALSO NECESSARY TO HAVE A KNOWN ZERO (DARK) PERIOD SO AS TO BE ABLE TO COMPENSATE FOR ANY DRIFT. TO GENERATE THESE THREE DISTINCT PERIODS A MOTOR IS USED TO DRIVE A CHOPPER WHEEL THAT PASSES BETWEEN THE IR SOURCE AND THE DETECTOR. THIS METHOD IS DUPLICATED FOR ALL THREE GASSES. (SEE FIG 1.)

TO ENSURE, THAT EACH DETECTOR RESPONDS TO ONLY THE IR ABSORPTION OF THE GAS WHICH IT IS MEASURING, AN OPTICAL FILTER IS PLACED IN FRONT OF THE DETECTOR THAT ONLY ALLOWS THAT PART OF THE IR SPECTRUM THAT CORRESPONDS TO THAT PARTICULAR GAS TO PASS (HC, CO OR CO₂).

FIG. 1



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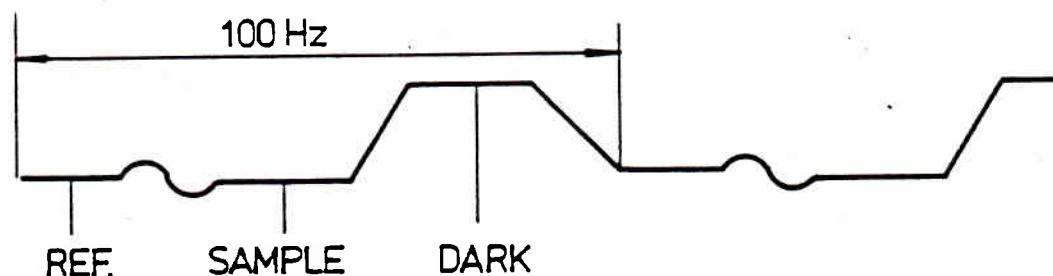
GAS PROCESSING

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AS THE CHOPPER WHEEL ROTATES AT THE MAINS FREQUENCY (50 HZ) AND THE DETECTOR SEES TWO COMPLETE REF. SAMPLE DARK PERIODS PER REVOLUTION THE OUTPUT OF THE DETECTOR HAS A FREQUENCY OF 100 HZ. (SEE FIG 2.)

FIG. 2 DETECTOR SIGNAL AFTER AMPLIFICATION



DUE TO THE MECHANICAL POSITIONING OF THE DETECTORS AROUND THE CHOPPER WHEEL HOUSING THE DETECTOR WAVE FORMS ARE PHASE SHIFTED.

THE SOURCES ON THE GAS BENCH ARE POWERED FROM 5V DC. (SEE SWITCHING SUPPLY SECTION 2.)

THE THREE DETECTORS OUTPUTS ARE CONNECTED TO THE GAS PROCESSING BD AT:

HC J17

CO J18

CO₂ J19



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2) ANALOG PROCESSING BD

NOTE: FOR O₂ PROCESSING SEE SECTION 6 OPTIONS.

A. GENERAL

THE GAS PROCESSING BD IS RESPONSIBLE FOR CONVERTING THE OUTPUT FROM THE IR DETECTORS INTO AN ANALOG VOLTAGE SUITABLE FOR READING BY THE DIGITAL-PROCESSOR BD.

B. PRINCIPLE OF OPERATION

THE ANALOG PROCESSING BD CONVERTS THE DETECTOR SIGNAL INTO A DC VOLTAGE BY UTILATING THREE TIMERS THAT CAUSE FET SWITCHES TO SAMPLE THE DETECTOR WAVEFORM, DURING ITS THREE DISTINCT PERIODS ("DARK", "REF" AND "SAMPLE").

THE SIGNAL LEVEL DURING THE "DARK" PERIOD IS GROUNDED THUS FORMING A REFERENCE VALUE. THE INSTANTANEOUS "REF" AND "SAMPLE" VALUES ARE STORED IN CAPACITORS. THE "DARK" AND "REF" VALUES ARE THEN COMPARED AND USED TO DRIVE AN AGC NETWORK THAT MAINTAINS A STABLE SIGNAL AMPLITUDE TO NEGATE ANY DRIFTING IN THE CIRCUITRY, DETECTORS, SOURCES, ETC.

ONCE A STABLE SIGNAL HAS BEEN ESTABLISHED THE "REF" AND "SAMPLE" VALUES ARE COMPARED, AND THE DIFFERENCE IS OUTPUTTED AS A DC LEVEL, WHICH IS PROPORTIONAL TO THE AMOUNT OF GAS IN THE SAMPLE. AN IDENTICAL SEPARATE CHANNEL IS USED FOR ALL THREE GASSES.

C. FUNCTIONAL DESCRIPTION

THIS FUNCTIONAL DESCRIPTION APPLIES TO A THREE GAS BENCH WITH THE FOLLOWING JUMPER POSITIONS:

JP1	A - B	(HC TRIGGER CHANNEL)
JP2	A - B	(50 HZ)
JP3	A - B	TP 12 = HC REF. CO DARK. CO ₂ SAMPLE
JP4	B - C	TP 9 = HC DARK. CO SAMPLE. CO ₂ REF
JP5	B - C	TP 13 = HC SAMPLE. CO REF. CO ₂ DARK

THE JUMPER POSITIONS DEPEND UPON THE TYPE AND NUMBER OF GASSES TO BE MEASURED. SEE TABLE PAGE 11 FOR THE VARIOUS COMBINATIONS OF JUMPER POSITIONS.

FOR A FULL UNDERSTANDING OF THE PROCESSING BD. THE FOLLOWING DESCRIPTION SHOULD BE USED IN CONJUNCTION WITH THE BLOCK DIAGRAM AND WAVEFORMS ON PAGES 10 AND 12.

THE HC, CO AND CO₂ DETECTOR SIGNALS ENTER THE BD AT J17, 18 AND 19 RESPECTIVELY. EACH SIGNAL IS THEN PROCESSED IN AN IDENTICAL FASHION. HOWEVER DUE TO THE PHYSICAL POSITIONING OF THE SAMPLE TUBES ON THE GAS BENCH THE TIMING SEQUENCE OF THE SAMPLE AND HOLD SWITCHES VARIES FOR EACH CHANNEL. ONE OF THE INCOMING DETECTOR SIGNALS IS USED AS THE TRIGGER SIGNAL THAT INITIATES THE TIMING SEQUENCE.



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TRIGGER CHANNEL AND TIMING

THE TRIGGER CHANNEL IS EITHER:

TRIGGER CHANNEL	GAS OPTIONS	JP1
HC	HC, CO, CO ₂	A - B
HC	HC, CO	A - B
CO	CO, CO ₂	A - C

THE HC SIGNAL IS FED VIA JP1 TO U14 WHERE IT IS AMPLIFIED AND CONVERTED INTO A SQUAREWAVE THAT CORRESPONDS TO THE "DARK" PERIOD OF THE DETECTOR SIGNAL (TP8).

THE LEADING EDGE OF THIS TRIGGER SIGNAL IS THEN USED TO INITIATE THE FIRST HALF OF THE DUAL MONOSTABLE: U11. TWO OTHER DUAL MONOSTABLES U12 AND U13 ARE TRIGGERED FROM THE FALLING EDGE. AFTER INDIVIDUAL PRESET TIMES DETERMINED BY EXTERNAL TIMING COMPONENTS THE SECOND HALVES OF THE DUAL MONO'S ARE FIRED GIVING NEGATIVE 100 μ S PULSES AT THEIR OUTPUTS. DUE TO THE TIMING OF THE FIRST HALF OF THE THREE MONO STABLES THE 100 μ S PULSES AT TP9, TP12 AND TP13 CORRESPOND APPROXIAMATELY TO THE CENTER OF THE "DARK", REFERENCE, AND SAMPLE PERIODS OF THE HC WAVEFORM (SEE WAVEFORMS PAGE 10).

THESE PULSES ARE THEN CONNECTED VIA JUMPERS J3, J4 AND J5 TO THE ACTIVATE LINES OF A SERIES OF FET SWITCHES. THE JUMPERS JP3, JP4 AND JP5 SHOULD BE POSITIONED TO ENSURE THAT THE CORRECT PORTION OF EACH DETECTOR SIGNAL IS STORED IN ITS CORRECT CAPACITOR (SEE JUMPER TABLE PAGE 11).

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DUE TO THE PHASE SHIFT OF THE THREE DETECTOR SIGNALS EACH TIMER SAMPLES A DIFFERENT PORTION OF EACH SIGNAL. FOR THE HC/CO/CO₂ TESTER THIS IS AS FOLLOWS.

	HC	CO	CO ₂
TIMER A	DARK	SAMPLE	REF
TIMER B	REF	DARK	SAMPLE
TIMER C	SAMPLE	REF	DARK

GAS PROCESSING

THE FOLLOWING DESCRIPTION IS BASED UPON THE HC CHANNEL BUT APPLIES TO ALL CHANNELS.

THE HC DETECTOR SIGNAL IS FED TO A VARIABLE GAIN AMPLIFIER AND THEN TO AN AMPLIFIER WHOSE GAIN IS CONTROLLED BY AN OPTO COUPLER. THE SIGNAL (TP2) IS THEN FED TO THREE FET SWITCHES WHERE THE INSTANTANEOUS VALUES CORRESPONDING TO THE "DARK", "REF" AND "SAMPLE" PORTIONS OF THE SIGNAL ARE SWITCHED TO DARK (GND) AND REF AND SAMPLE TO CAPACITORS C2 AND C3 BY THE TIMING PULSES (SEE TRIGGER CHANNEL AND TIMING).

THE GROUND (DARK) VALUE AND C2 (REF) VALUE ARE THEN COMPARED. THE DIFFERENCE IS COMPARED TO A REFERENCE -5V AND THE RESULTANT OUTPUT USED TO CONTROL THE OPTO COUPLER WHICH INTURN VARIES THE GAIN OF THE SECOND STAGE AMPLIFIER. TO MAINTAIN A CONSTANT SIGNAL AMPLITUDE.



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THIS AMPLITUDE IS FIXED AT APPROXIMATELY 1.4V DARK TO REFERENCE AMPLITUDE (TP2). BY MANUALLY VARYING THE GAIN OF THE FIRST STAGE AMPLIFIER USING R20 THE AGC POT, THE AGC CIRCUIT MAY BE SET TO ITS OPTIMUM OPERATING POINT, THIS CORRESPONDS TO 1.8V DC AT TP17. THIS VOLTAGE IS ALSO OUTPUTTED AT J23-4 TO BE DISPLAYED ON THE FRONT PANEL IN THE SERVICE MODE (SEE CALIBRATION PROCEDURE SECTION 1).

HAVING ESTABLISHED A STABLE SIGNAL AMPLITUDE THE C2 (REF) AND C3 (SAMPLE) VALUES MAY BE COMPARED, AND THE DIFFERENCE OUTPUTTED AS THE GAS ANALOG VOLTAGE.

TO OBTAIN THE DIFFERENCE BETWEEN THE REF AND THE SAMPLE VALUES, THE SAMPLE VALUE IS FIRST INVERTED AND THEN ADDED TO THE REF VALUE. THE RESULTING OUTPUT BEING THE DIFFERENCE.

ZERO: A MANUAL ZERO (R1/R2) IS AVAILABLE BY ADJUSTING THE

SAMPLE VALUE BEFORE COMPARISON. THIS IS DONE TO ALLOW FOR MANUAL ZERO CALIBRATION BY BALANCING THE REF AND SAMPLE VALUES WHEN NO GAS IS APPLIED TO THE TESTER.

DURING EITHER THE SELF CHECK OR CAL MODE THE PROCESSING BD TAKES A NEW ZERO WHICH AUTOMATICALLY COMPENSATES FOR ANY IMBALANCE BETWEEN REF AND SAMPLE. HOWEVER IF THIS IMBALANCE EXCEEDS +2V GAS ANALOG THE TESTER DISPLAYS "CR" AND MANUAL CALIBRATION IS NECESSARY. THIS WOULD PRIMARILY BE DUE TO DIRT BUILD-UP ON THE SAMPLE TUBE WINDOWS. IT MAY BE NECESSARY TO REPLACE THE SAMPLE TUBE BEFORE ZEROING IS POSSIBLE.



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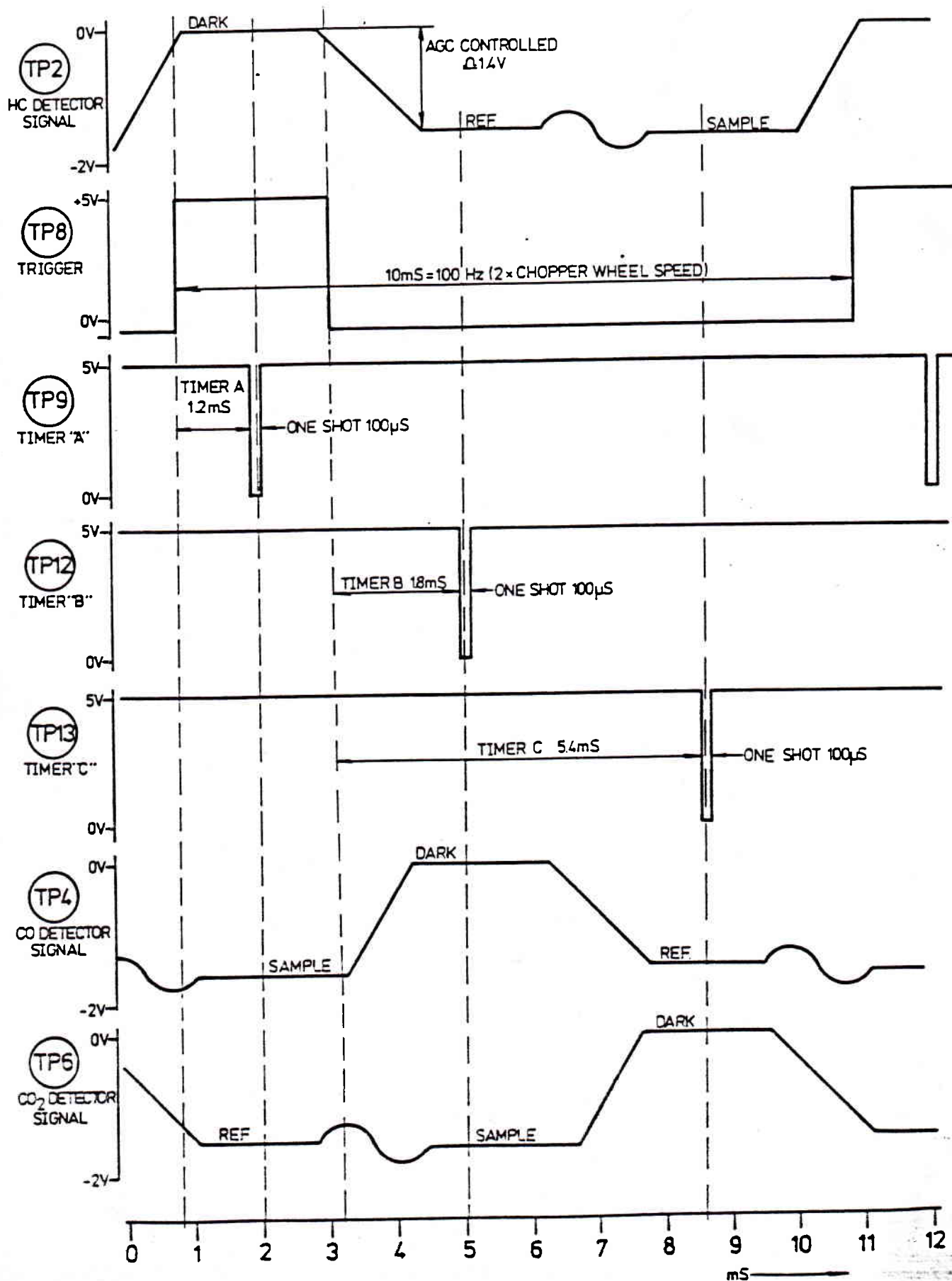
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GAIN: BEFORE OUTPUTTING THE GAS ANALOG SIGNAL IT IS FED TO A VARIABLE GAIN AMPLIFIER. R10 ALLOWS FOR GAIN ADJUSTMENT. THIS ADJUSTMENT IS MADE USING A KNOWN CALIBRATION GAS (SEE CALIBRATION PROCEDURE SECTION 1).

E-SPAN: PROVISION IS MADE TO INJECT A SPAN VOLTAGE TO THE OUTPUT STAGE OF THE GAS CHANNEL. THIS IS INITIATED BY THE CAL COMMAND FROM THE DIGITAL-PROCESSOR BD. DURING SELF CHECK OR CALIBRATION. THE SPAN VOLTAGE IS ADJUSTABLE AND SHOULD BE SET TO 8V GAS ANA USING R7 (SEE CALIBRATION PROCEDURE SECTION 1). THE DIGITAL-PROCESSOR BD USES THIS SIGNAL TO SET THE UPPER REFERENCE LEVEL FOR THE A TO D CONVERTER. SHOULD THE SPAN VOLTAGE BE OUT OF TOLERANCE DURING CALIBRATION OR SELF CHECK THE TESTER WILL TEMPORARILY DISPLAY "???" INSTEAD OF "OP".

-5V REF: THE -5V REF USED BY THE PROCESSING BD IS GENERATED LOCALLY FROM THE -15V SUPPLY LINE, AND IS ADJUSTABLE BY R72.

WAVEFORMS



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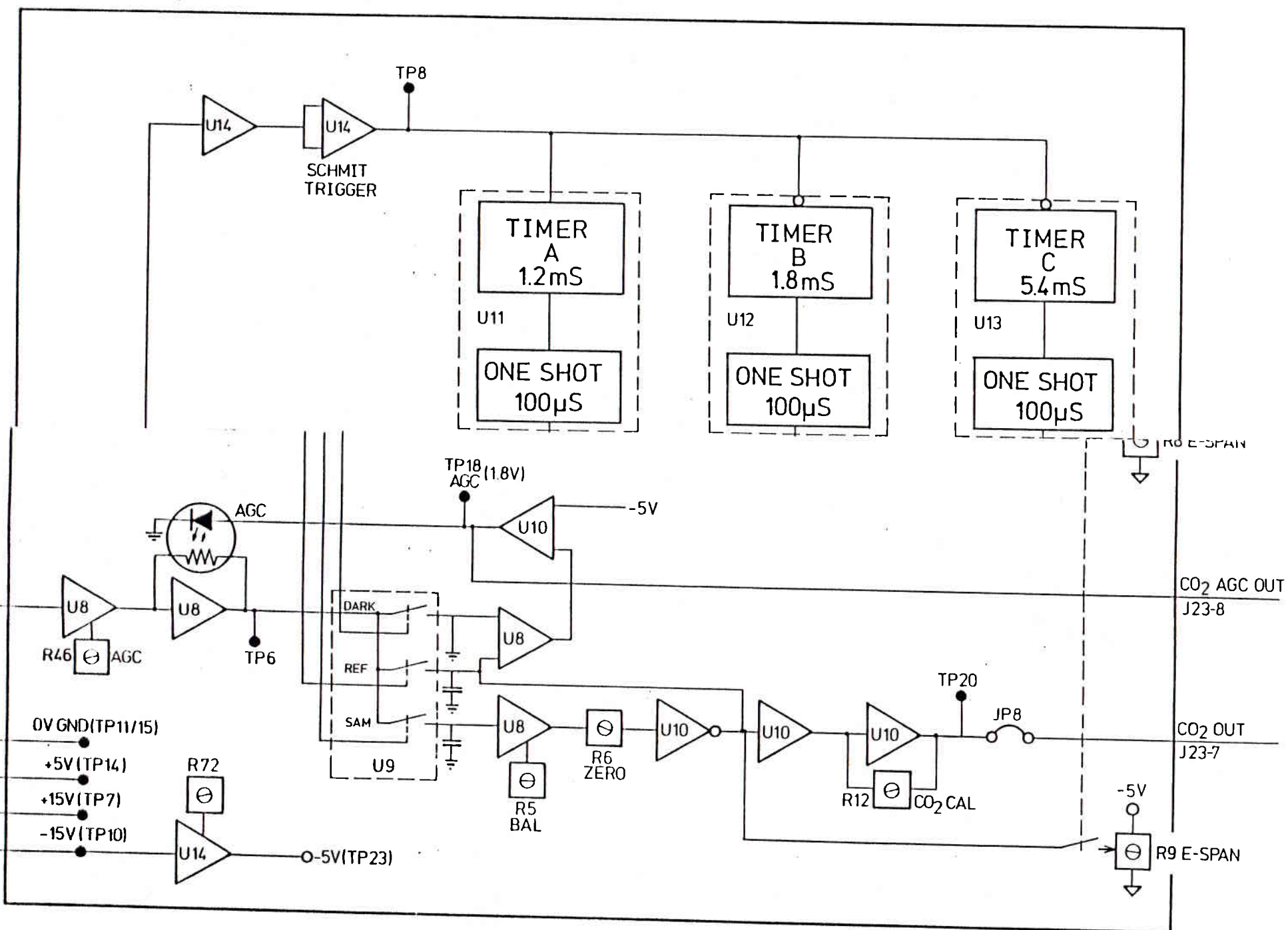
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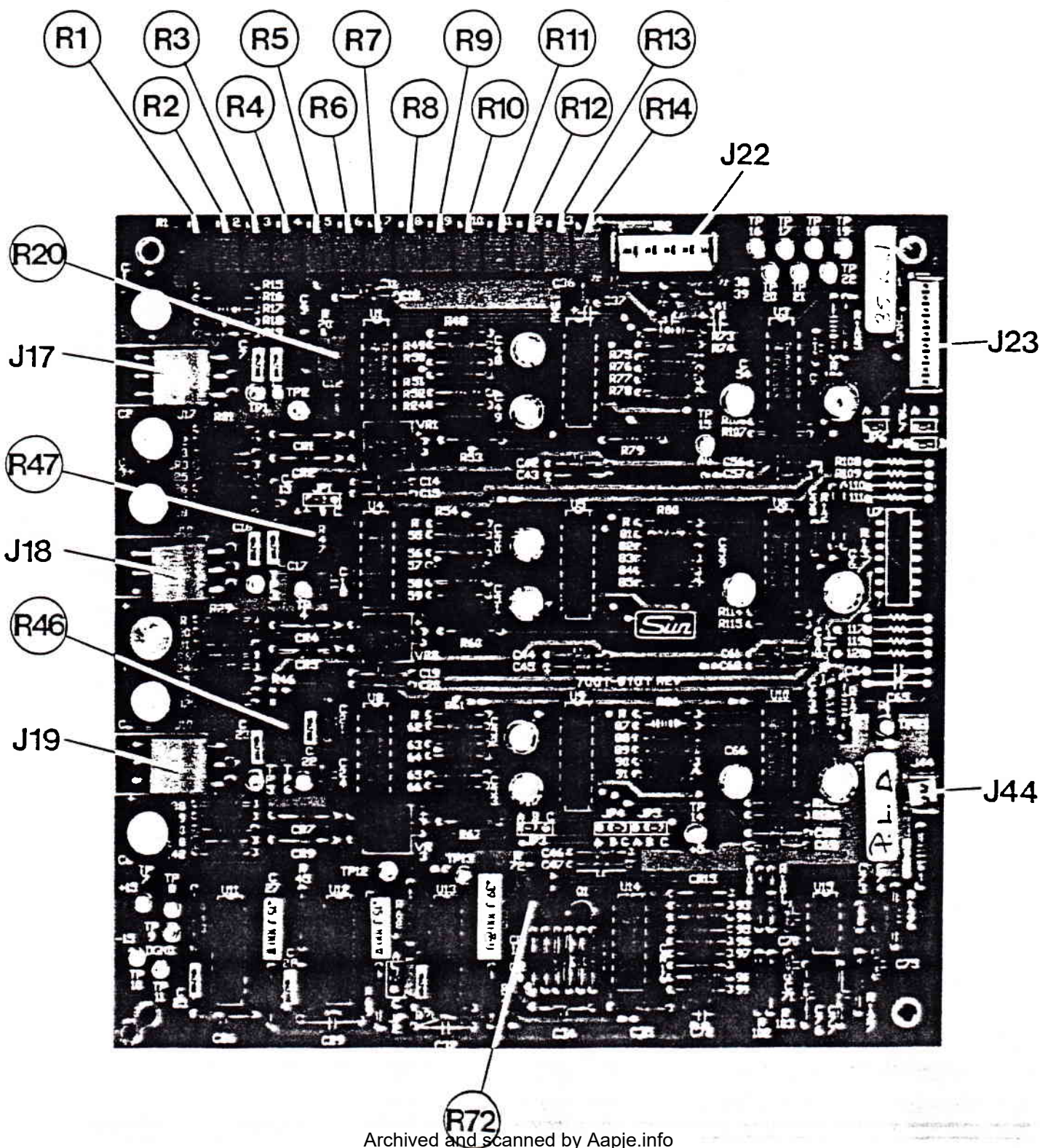
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TABLE OF JUMPER POSITIONS

	3GAS HC/CO/CO ₂	2GAS HC/CO	2GAS CO/CO ₂
JP1	A — B	A — B	B — C
JP2 50 Hz	A — B	A — B	A — B
JP2 60 Hz	B — C	B — C	B — C
JP3	A — B	A — B	B — C
JP4	B — C	B — C	A — B
JP5	B — C	B — C	A — B
JP6	IN	IN	NOT USED
JP7	IN	IN	IN
JP8	IN	NOT USED	IN



ANALOG PROCESSING BD

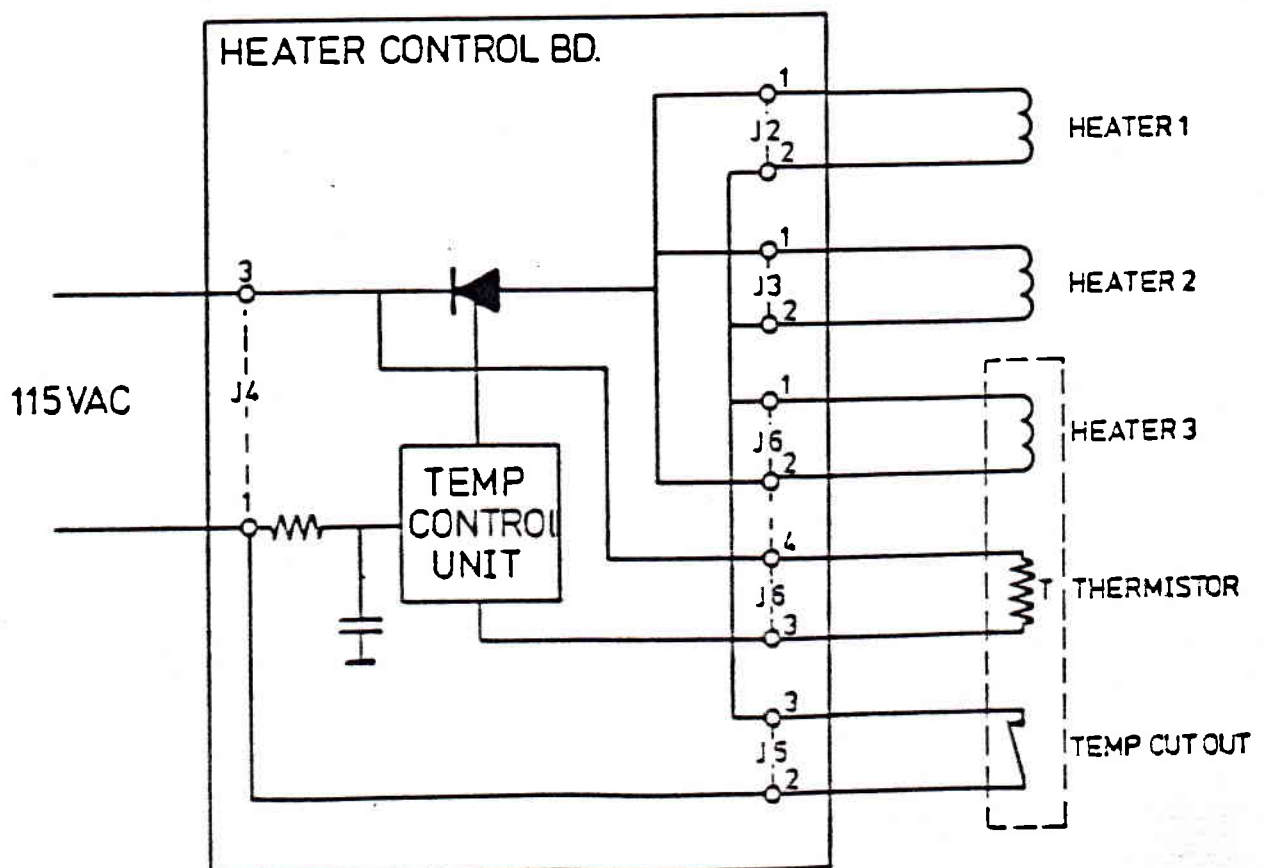


3. HEATER CONTROLLER BD

THE HEATER CONTROL BD IS SITUATED ON THE CHOPPER WHEEL CASING AND REGULATES THE HEATER TEMPERATURE.

A THYRISTOR IS USED TO VARY THE AMOUNT OF POWER FED TO THE HEATERS FROM THE 115V SUPPLY LINE. THE THYRISTOR IS CONTROLLED BY A THYRISTOR DRIVER CIRCUIT WHICH IS IN TURN CONTROLLED BY A THERMISTOR LOCATED IN THE HC CHANNEL HEATER. A TEMPERATURE CUT OUT SWITCH IS ALSO FITTED TO THE HC CHANNEL FOR PROTECTION.

THE TEMPERATURE IS PRE-SET AND NOT ADJUSTABLE.



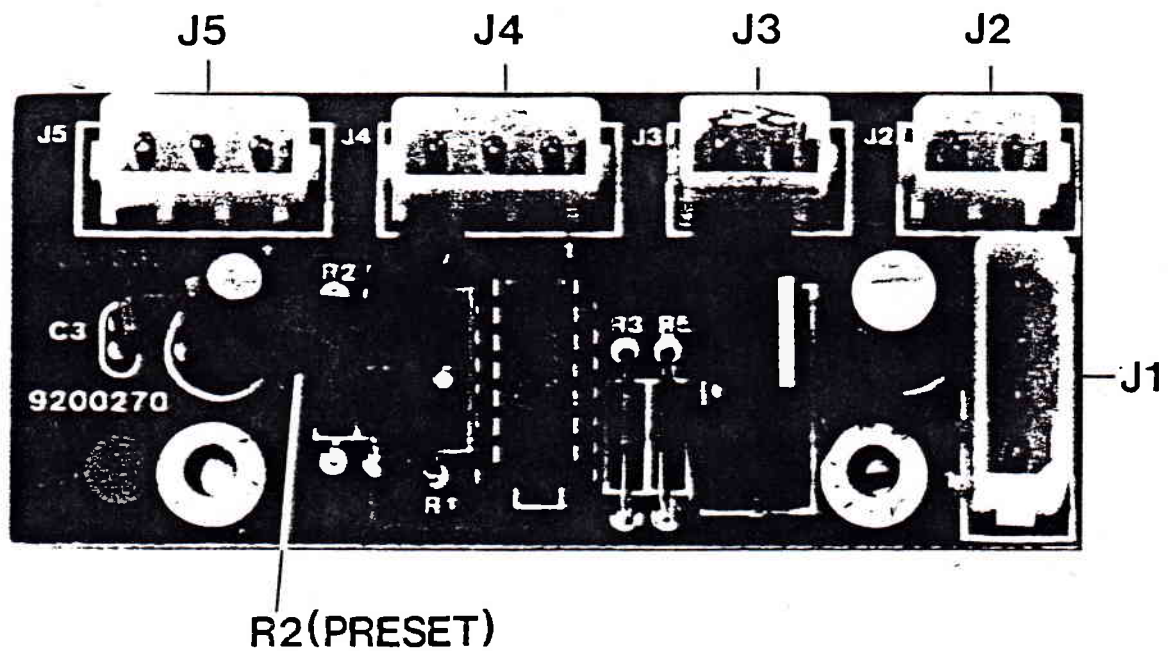
SGA-9000

GAS PROCESSING

SECTION 03

PAGE 15

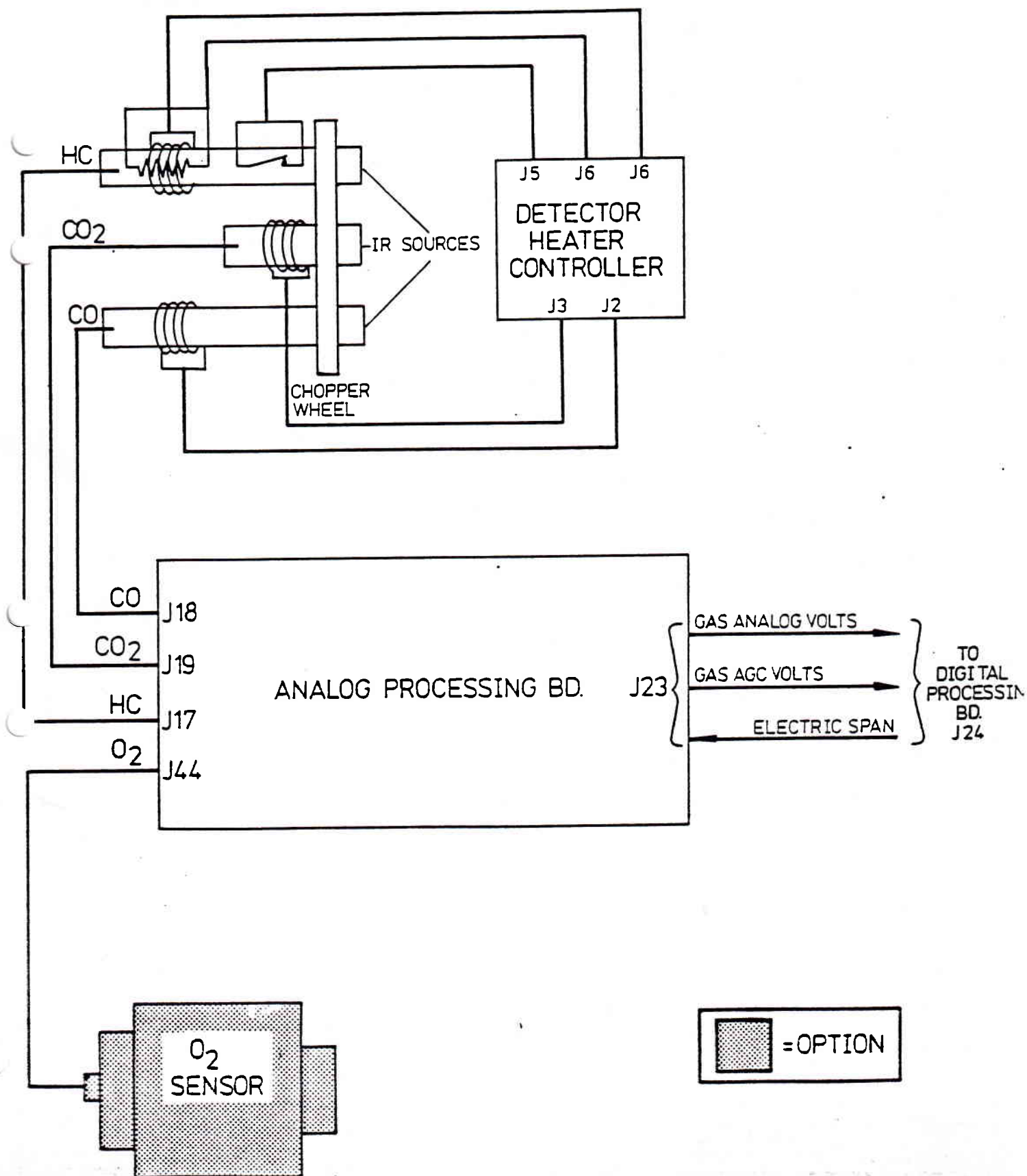
HEATER CONTROLLER BD

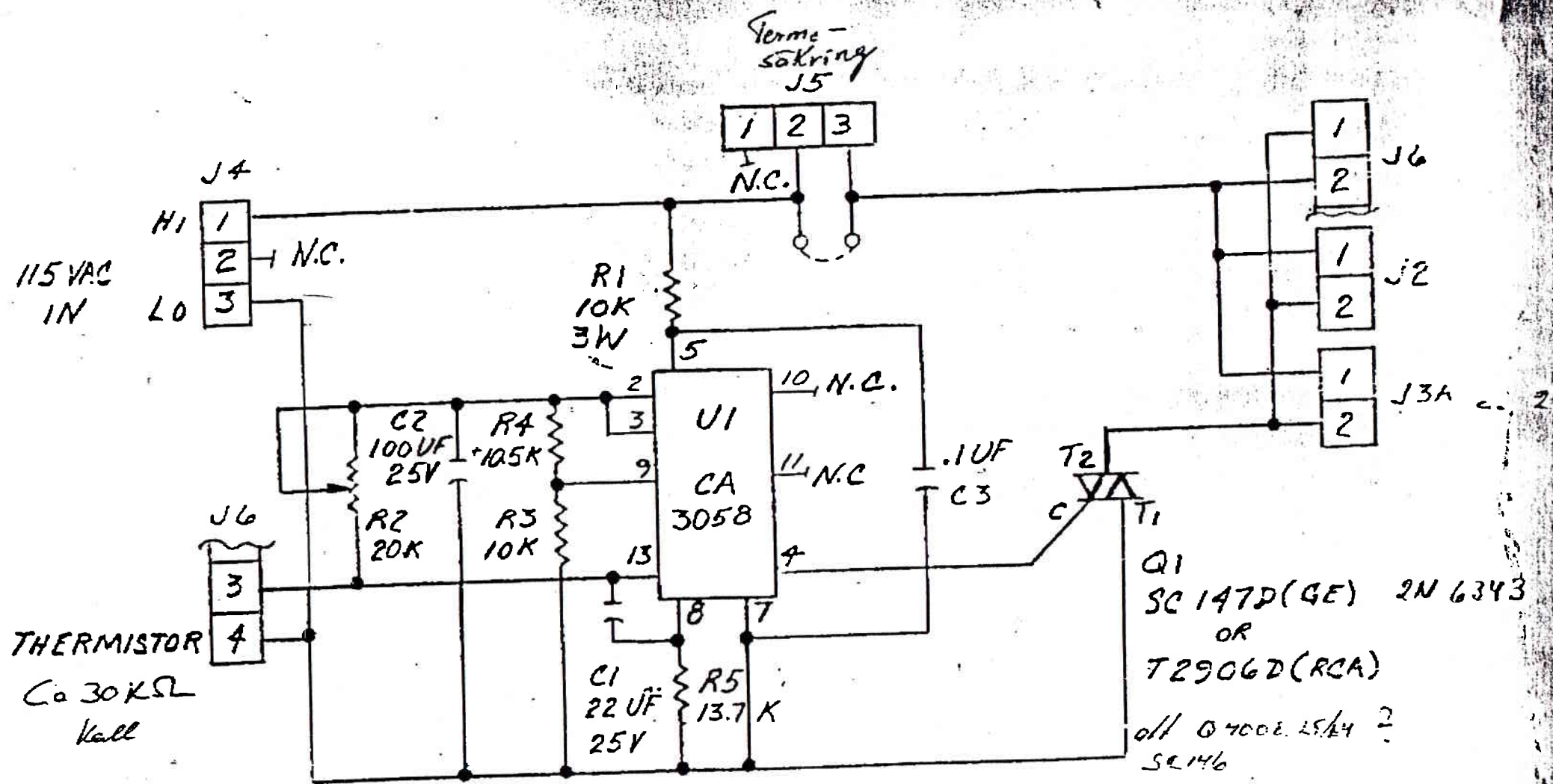


R1 10K 3W
R2
R3
R4
R5

C1
C2
C3
T1
IC

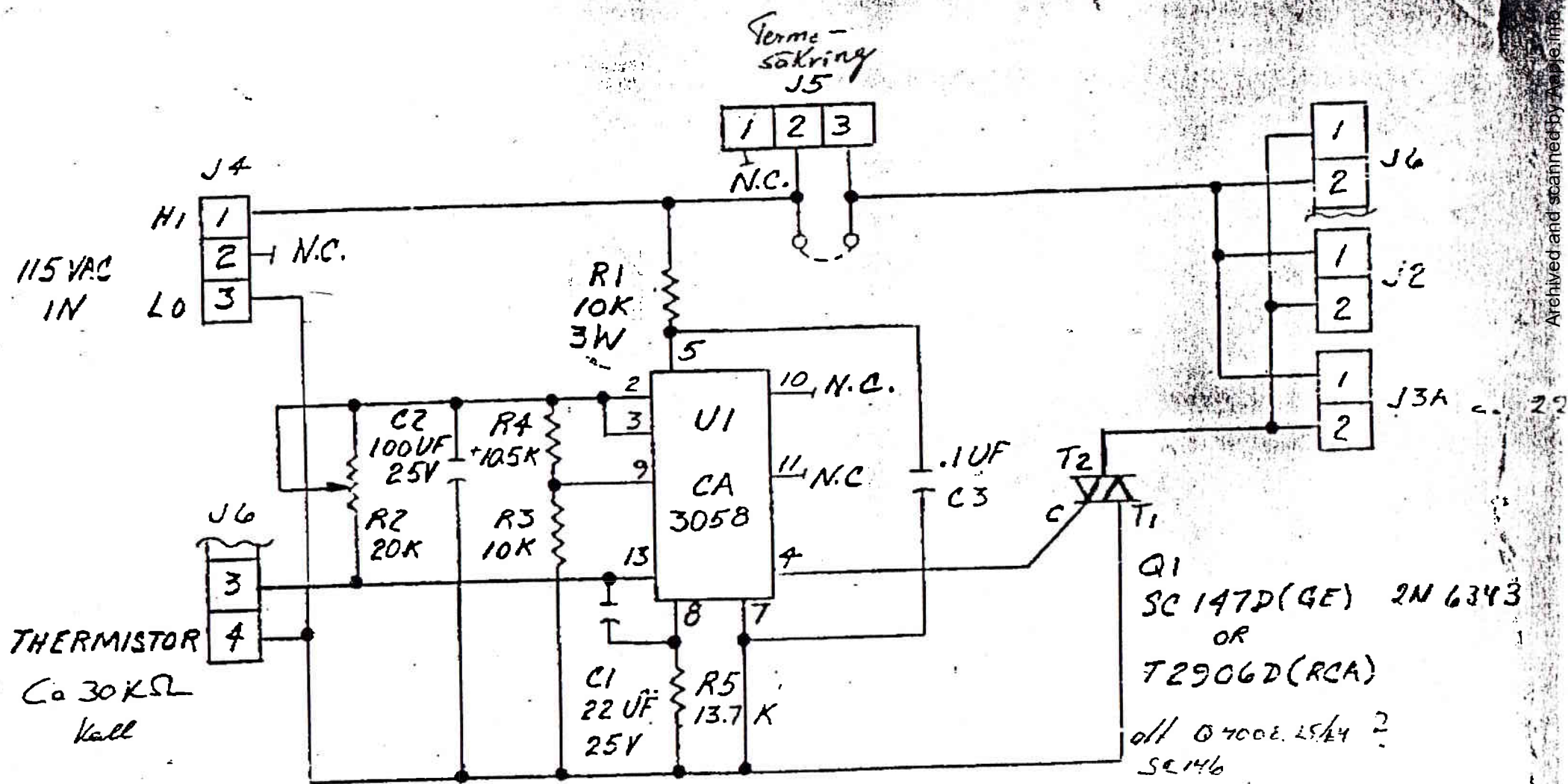
GAS PROCESSING BLOCK DIAGRAM





PROBLEM OFSINARS OFTA AU C2 EVER T2

Item	Qty.	Dwg./Part no.	
Scale			Di
Drawn by			



Item	Qty.	Dwg./Part no.	
Scale			Dr
Drawn by			



SUN ELECTRIC EUROPE B.V.

SECTION 4

DIGITAL

PROCESSING BD



SGA-9000

DIGITAL

PROCESSING BD

SECTION 04

PAGE 01

GENERAL:

THE DIGITAL PROCESSING BD IS AT THE HEART OF THE SGA-9000, AND IS RESPONSIBLE FOR THE FOLLOWING FUNCTIONS WITHIN THE TESTER:

1. SOFTWARE CONTROL OF THE TESTER
2. CONVERSION OF ANALOG SIGNALS SUITABLE FOR DIGITAL HANDLING
3. READING RPM
4. HARDWARE CONTROL OF TESTER
 - A) CAL COMMAND
 - B) PUMP
 - C) AIR SOLENOID
5. RECEIVING MANUAL/AUTO CONTROL FUNCTIONS
 - A) FRONT PANEL SWITCHES
 - B) LOW FLOW
6. ALTITUDE CORRECTION
7. PRINTER INTERFACING (OPTION)
BAUD RATE SETTING

1. SOFTWARE CONTROL

THE SGA-9000'S OPERATIONAL FLOW AND CALCULATIONS ARE BASED UPON THE SOFTWARE CONTAINED IN ITS PROM U17. THIS MANUAL IS WRITTEN AROUND SOFTWARE REVISION LEVEL 3.5.

SGA-9000

DIGITAL

PROCESSING BD

SECTION 04

PAGE 02

THE SOFTWARE CONTAINS THE FOLLOWING:

A) FUNCTIONAL FLOW PROCEDURE.

B) LOOK UP TABLES FOR ALTITUDE CORRECTION, CO₂ INTERFERENCE AND LINEARITY.

ONE OF FIVE LINEARITY CURVES MAY BE SELECTED USING THE DIP SWITCHES U1 (SEE CALIBRATION AND CHECKOUT PROCEDURE SECTION 1).

C) GAS CALCULATION FORMULAE.

2. CONVERSION OF ANALOG SIGNALS

MOST OF THE SIGNALS REQUIRED FOR MEASUREMENT ARE GENERATED BY ANALOG MEANS AND THEREFORE NEED CONVERTING INTO DIGITAL FORM BEFORE PROCESSING.

THE SIGNALS ARE AS FOLLOWS:

* = OPTION

SIGNAL	CONNECTOR	PIN
HC GAS ANA	J24	3
CO GAS ANA	J24	5
CO ₂ GAS ANA	J24	7
* O ₂ GAS ANA	J24	9



SGA-9000

DIGITAL

PROCESSING BD

SECTION 04

PAGE 03

SIGNAL	CONNECTOR	PIN
HC AGC	J24	4
CO AGC	J24	6
CO ₂ AGC	J24	8
* OIL TEMP	J30	2
+5V UNREG (MAINS IND.)	J25	5

AS THE PROCESSING BD HAS ONLY ONE A TO D CONVERTER (U28) THE ANALOG SIGNALS ARE FIRST MULTIPLEXED BY U23 AND U25.

JUMPER JP3 SHOULD BE IN POSITION A - C. THIS SELECTS THE A TO D'S 20V INPUT RANGE.

JUMPER JP4 SHOULD BE FITTED. THIS CONNECTS THE DIGITAL COMMON TO THE ANALOG COMMON.

THE A TO D CONVERSION PROCESS IS CONTROLLED VIA THE I/O AND DATA BUSES BY U22. WHEN REQUESTED THE A/D FEEDS THE DIGITAL OUTPUT ON TO THE DATA BUS. THE STATUS OF THE A TO D IS READ VIA THE DATA BUFFER U6.

SGA-9000

DIGITAL

PROCESSING BD

SECTION 04

PAGE 04

3. READING RPM (OPTION)

THE RPM SIGNAL ENTERS THE BD AT J30-3. WHEN PRESENT THIS SIGNAL CAUSES AN INTERRUPT ON THE CPU BUS WHICH TELLS THE CPU TO READ THE RPM DATA AT U6.

4. HARDWARE CONTROL

THE FOLLOWING LINES ARE ACTIVATED BY THE CPU ACCORDING TO THE SOFTWARE PROGRAM:

SIGNAL	CONNECTOR	PIN
PUMP	J31	2
AIR SOLENOID	J31	1
CAL COMMAND	J24	1

THESE SIGNALS ARE USED TO EXECUTE VARIOUS FUNCTIONS IN THE TESTER (SEE ANA PROCESS BD/AC DIST BD).

5. MANUAL/AUTO CONTROL

THE MICRO PROCESSOR BD WILL PERFORM VARIOUS FUNCTIONS ACCORDING TO THE FRONT PANEL MEMBRANE SWITCHES, THE SERVICE DIP SWITCHES (ON FRONT PANEL) AND THE LOW FLOW SWITCH.

SGA-9000

DIGITAL

PROCESSING BD

SECTION 04

PAGE 05

THE INFORMATION FROM THE FRONT PANEL MEMBRANE AND DIP SWITCHES IS FED TO THE DATA BUS AT U29. THIS INFORMATION IS READ BY THE CPU ACCORDING TO THE I/O BUS AND THE TESTER PERFORMS THE REQUIRED FUNCTION.

THE LOW FLOW SIGNAL ENTERS THE DIGITAL-PROCESSOR BD AT J56-2 AND IS READ ON TO THE DATA BUS VIA THE DATA BUFFER U6. IF THE LOW FLOW LINE GOES LOW (0V) THE PROCESSOR FORCES ALL DISPLAYS TO READ "LOF".

6. ALTITUDE CORRECTION

AS ALTITUDE INCREASES THE AIR PRESSURE DECREASES. THIS CAUSES THE MEASURED VALUE OF HC , CO + CO_2 TO DECREASE. DUE TO THE DROP IN PRESSURE IN THE GAS BENCH. IT IS THEREFORE NECESSARY TO COMPENSATE FOR THIS EFFECT.

THIS IS ACHIEVED BY ENTERING THE ALTITUDE AT WHICH THE TESTER IS SITUATED, VIA THE THUMBWHEEL SWITCH ON THE BACK PANEL (SEE ALTITUDE SETTING, SET UP PROCEDURE SECTION 1). THE ALTITUDE SWITCHES ARE CONNECTED TO THE DIGITAL-PROCESSOR BD AT J29. THE SWITCH POSITIONS ARE THEN TRANSFERED TO THE DATA BUS WHEN REQUESTED BY THE CPU VIA THE I/O BUS. THE CPU COMPENSATES THE FINAL READINGS USING A FIXED FORMULAE.



SGA-9000

DIGITAL

PROCESSING BD

SECTION 04

PAGE 06

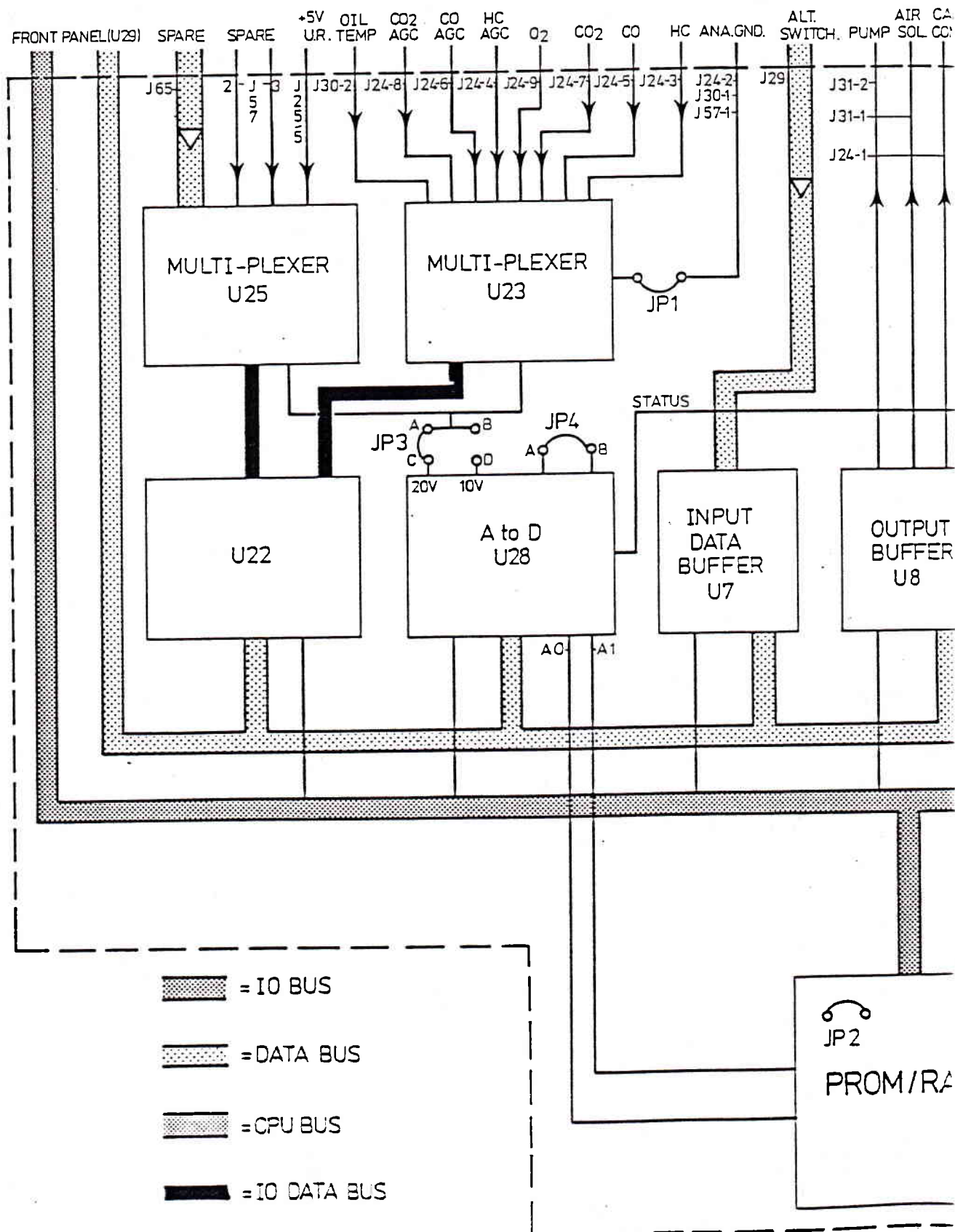
7. PRINTER INTERFACE (OPTION)

THE DIGITAL-PROCESSOR BD IS CAPABLE OF DRIVING A PRINTER VIA EITHER:

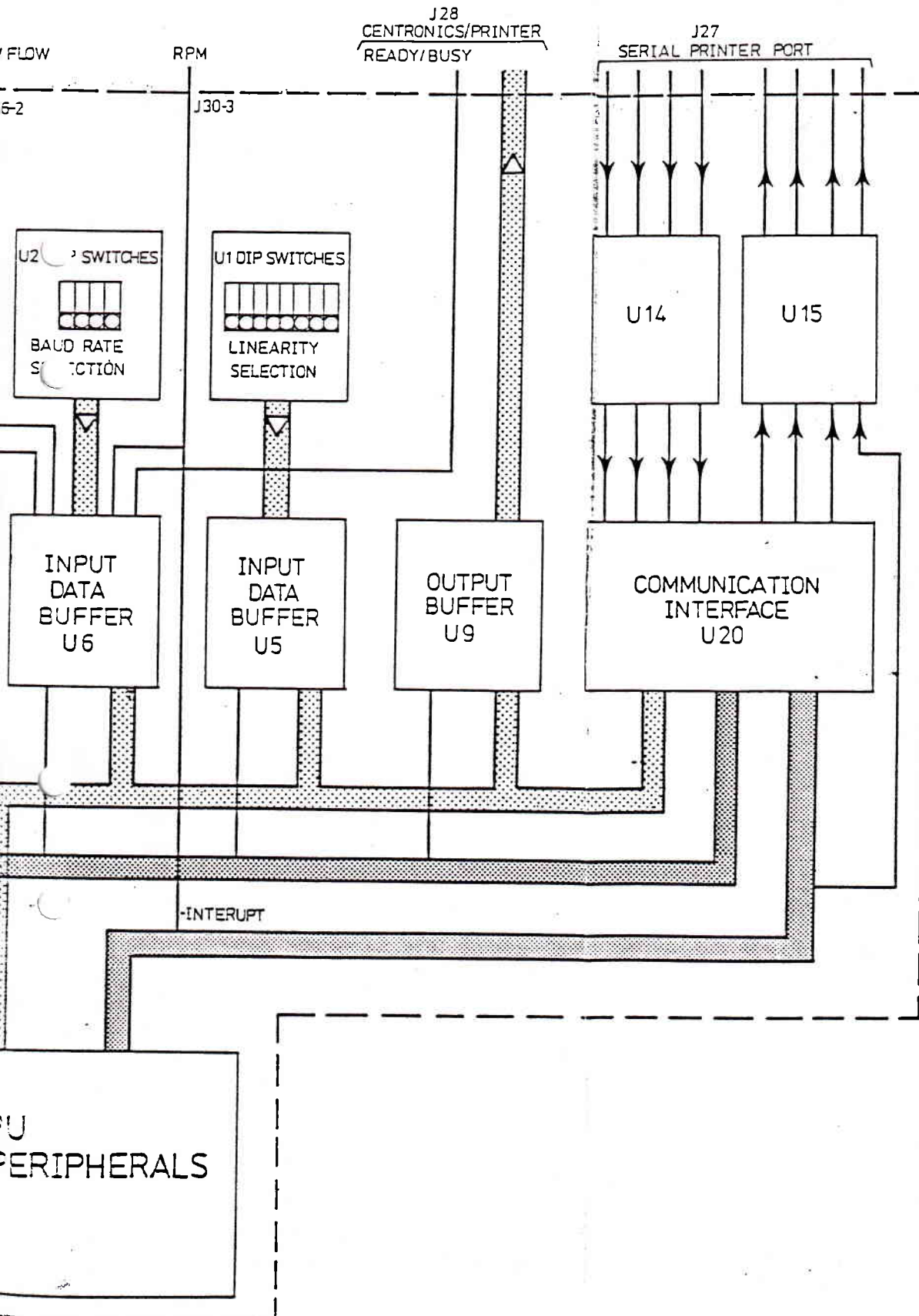
1. J27 SERIAL PORT.
2. J28 CENTRONICS (PARALLEL) PORT.

WHEN FITTED THESE PORTS ARE WIRED DIRECTLY TO THE CONNECTORS ON THE REAR PANEL. WHEN USING THE TESTER WITH A PRINTER THE APPROPRIATE BAUD RATE MUST BE SET VIA U2 DIP SWITCHES (SEE SET UP PROCEDURE SECTION 1).

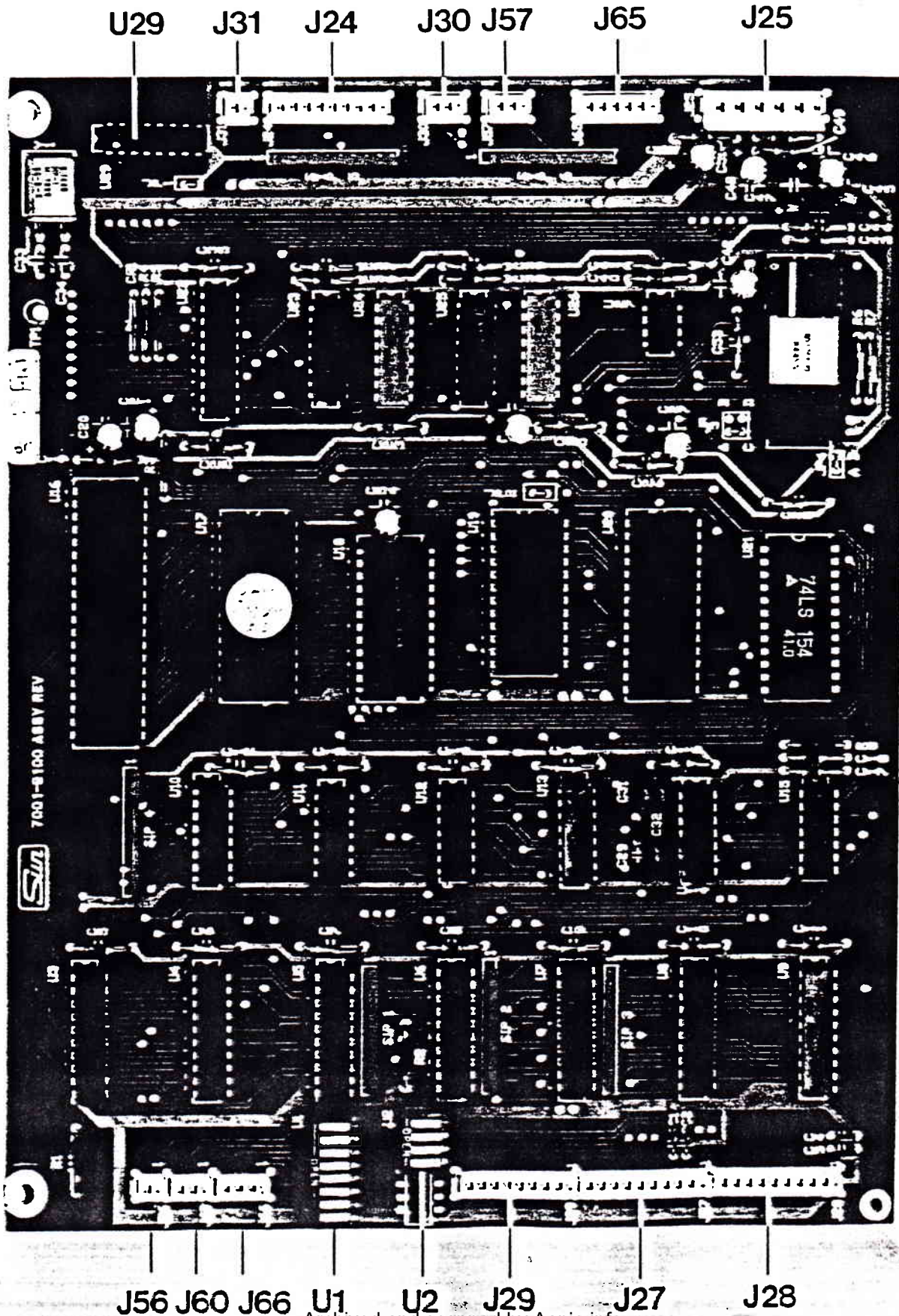
FUNCTIONAL



BLOCK DIAGRAM



DIGITAL-PROCESSOR BD



SECTION 5

CONTROLS AND

DISPLAYS

PAGES

1) CONTROLS

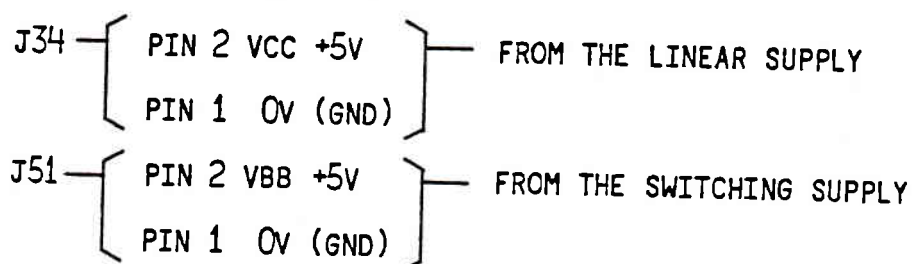
01 THRU 04

2) DISPLAYS

02 THRU 05

THE DISPLAY BD CONTAINS BOTH THE TESTER CONTROLS AND THE DIGITAL READOUTS.
FOR EASE OF DESCRIPTION THESE TWO AREA ARE COVERED SEPARATELY.

POWER FOR THE DISPLAY BD ENTERS AT:



SEE POWER SUPPLY AND DISTRIBUTION SECTION 2.

1. CONTROLS (REFER TO BLOCK DIAGRAM DISPLAY BD PART 1 CONTROLS)

THE TESTER CONTROLS COMPRISE OF THE FOLLOWINGS:

A) FRONT PANEL MEMBRANE SWITCHES. .

B) DISPLAY BD DIP SWITCHES U6.

A) FRONT PANEL MEMBRANE SWITCHES

THE FIVE FRONT PANEL MEMBRANE SWITCHES ARE CONNECTED TO THE DISPLAY BD AT J36. EACH SWITCH IS CONNECTED TO AN INPUT LINE OF THE DATA BUFFER (U3) AND A PULL UP RESISTOR. WHEN A BUTTON IS ACTIVATED THE CORRESPONDING LINE GOES LOW. THIS INFORMATION IS THEN TRANSFERRED TO THE DATA BUS ON REQUEST OF THE CPU VIA THE I/O BUS. ON RECEIVING THE DATA THE COMPUTER EXECUTES THE INSTRUCTION ACCORDING TO ITS SOFTWARE PROGRAM.

AN OPTIONAL REMOTE CONTROL MAY BE FITTED. THIS MAY BE CONNECTED TO THE DISPLAY BD AT J35 AND ACT IN PARALLEL WITH THE MEMBRANE SWITCHES (SEE SECTION 6 OPTIONS).

B) DISPLAY BD DIP SWITCHES U6

THE DISPLAY BD CONTAINS A DIP SWITCH BLOCK U6. THESE SWITCHES ENABLE THE SERVICE ENGINEER TO SELECT VARIOUS CONDITIONS WITHIN THE TESTER (FOR CONDITIONS AND SETTINGS SEE SECTION 1 SET UP/CHECKOUT AND CALIBRATION PROCEDURES). SWITCH 4 THE SERVICE MODE SWITCH (SEE SERVICE MODE FLOW DIAGRAM INTRODUCTION PAGE 06) IS, FOR EASE OF OPERATION, CONNECTED IN PARALLEL TO ANOTHER DIP SWITCH, LOCATED ON THE UPPER RIGHT HAND CORNER OF THE DISPLAY BD.

ALL THE DIP SWITCHES ARE INDIVIDUALLY CONNECTED TO THE INPUT LINES OF A DATA BUFFER (U5) AND A PULL UP RESISTOR. ANY ONE OR ANY COMBINATION OF CLOSED SWITCHES PRESENTS A BINARY CODE TO THE DATA BUFFER. THIS DATA IS TRANSFERRED TO THE DATA BUS ON REQUEST OF THE CPU VIA THE I/O BUS. ON RECEIVING THE DATA THE CPU EXECUTES THE INSTRUCTION ACCORDING TO THE SOFTWARE PROGRAM.

2. DISPLAYS (REFER TO BLOCK DIAGRAM DISPLAY BD PART 2 DISPLAYS)

THE DISPLAY BD CONTAINS SIX GROUPS(MAX) OF 7 SEGMENT DIGITAL DISPLAYS AND THE FRONT PANEL CONTROL LED'S. THE NUMBER OF GROUPS OF DISPLAYS VARIES ACCORDING TO THE NUMBER OF GASSES AND WHAT OPTIONS ARE AVAILABLE.

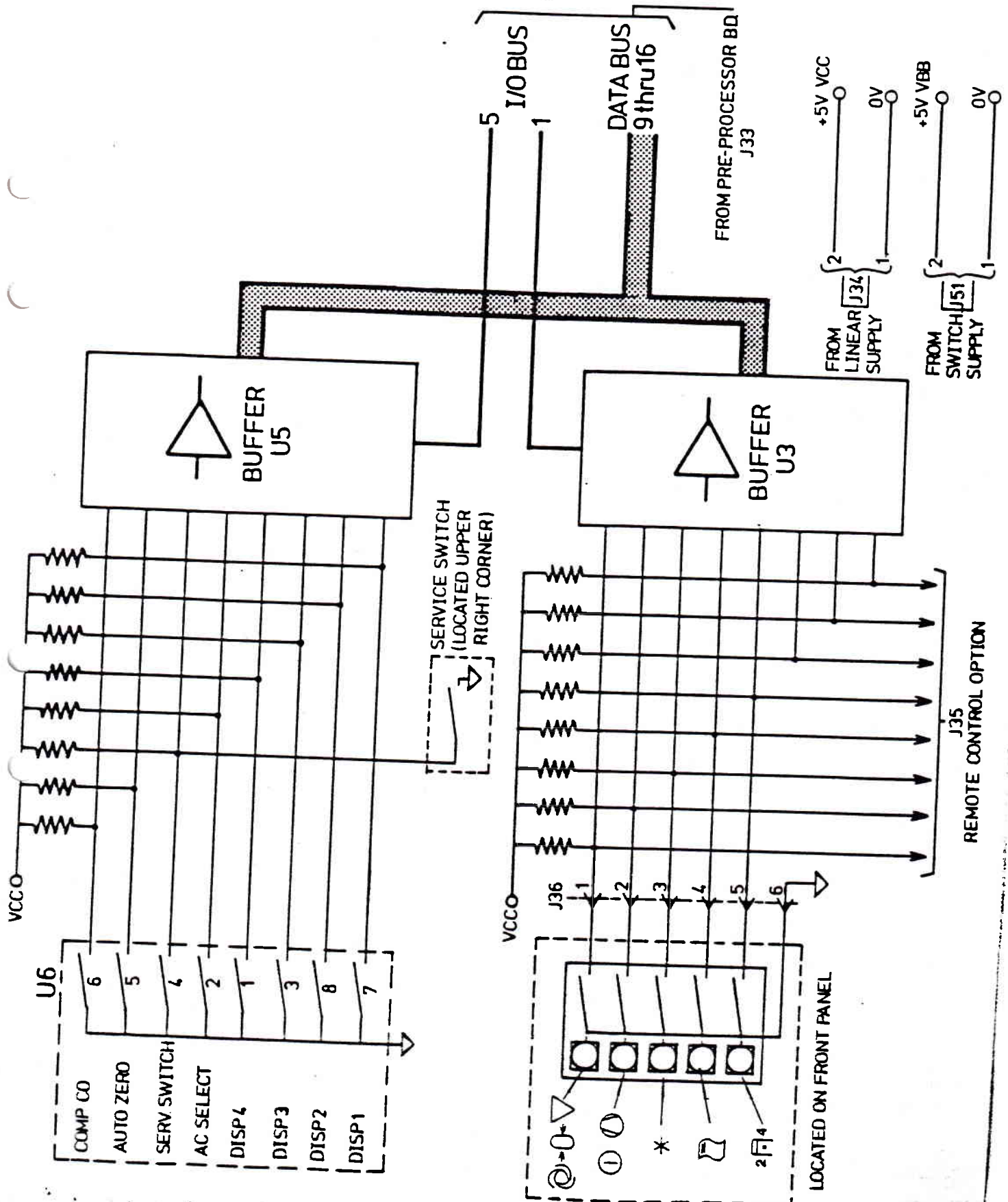
SGA-9000
CONTROLS AND
DISPLAYS
SECTION 05
PAGE 03

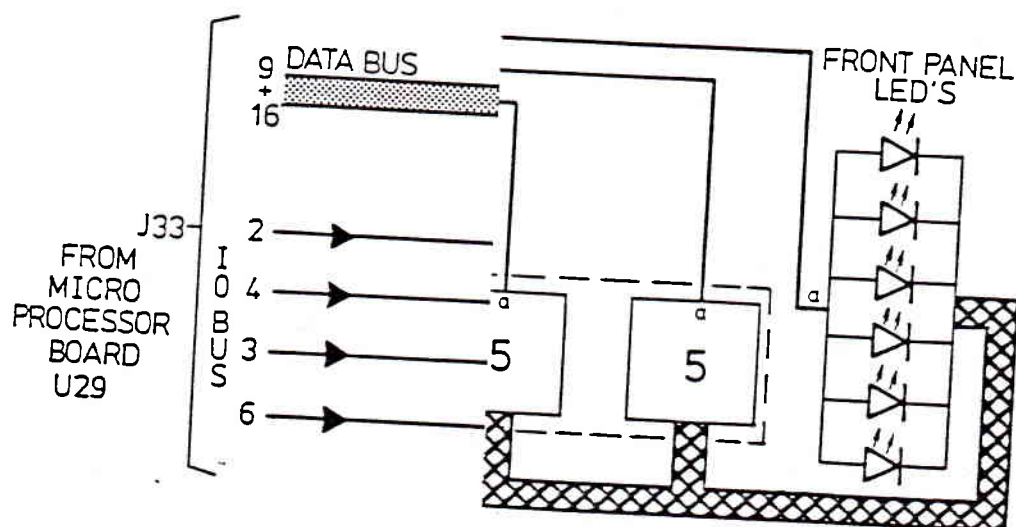
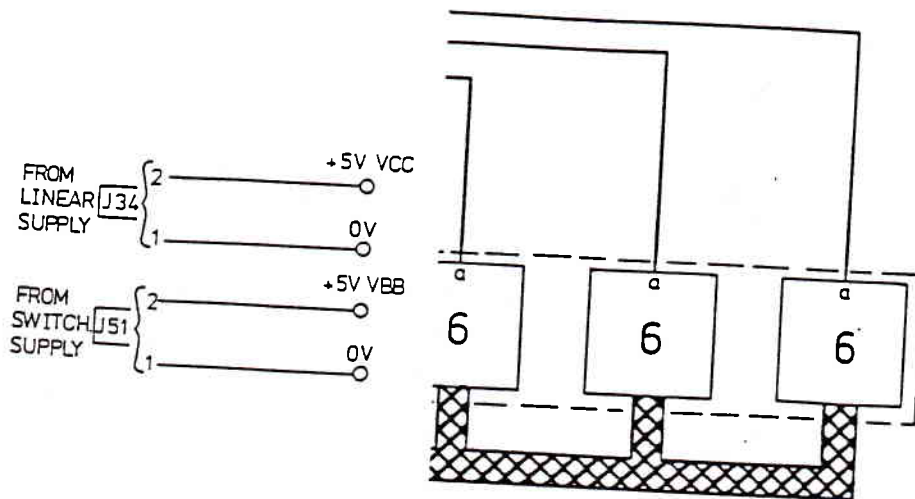
THE DISPLAY BD USES A SYSTEM OF MULTIPLEXING TO DRIVE ALL THE DISPLAYS. THIS ALLOWS THE USE OF A COMMON DATA BUS IN THE FOLLOWING MANNER:

DATA ARRIVES AT J33 PINS 9 TO 16. THIS DATA IS THEN EITHER LATCHED INTO U4, U2 OR U1 ACCORDING TO WHICH I/O LINE IS ACTIVATED. AFTER LATCHING THE THREE DECODERS, U24, U23 AND U20 RECEIVE DATA. THIS DATA IS DECODED AND ON THE INSTRUCTION OF AN I/O LINE ALL THREE DECODERS STROBE THEIR APPROPRIATE DISPLAY BY SWITCHING THE ANODES. THE LATCH CONTAINING THE NEW DATA WILL UPDATE ITS STROBED DISPLAY. THE OTHER LATCHES WILL REPEAT THE DATA THAT WAS ENTERED ON THE PREVIOUS CYCLES. THE WHOLE CYCLE IS THEN REPEATED UPDATING ONE OF THE REMAIN LATCHES. WHEN THIS CYCLE HAS BEEN REPEATED FOR ALL THREE LATCHES IT STARTS AGAIN WITH THE INITIAL LATCH. THIS METHOD ALLOWS ALL THE DISPLAYS TO BE UPDATED SEQUENTIALLY. THE SPEED OF CYCLING IS TOO FAST FOR THE HUMAN EYE TO DETECT THE STROBE EFFECT. U12, U17 AND U9 DECODE THE DATA LINES TO MAKE THE INFORMATION SUITABLE FOR DISPLAY.

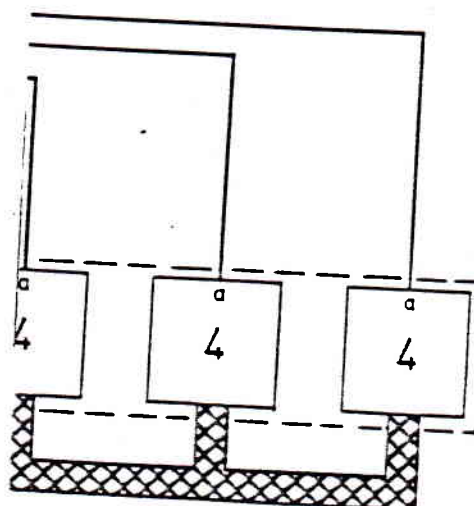
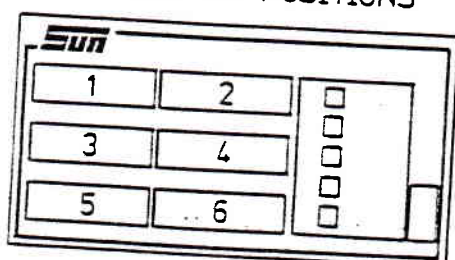
BY VARYING THE TIMING SEQUENCE OF THE I/O LINES IT IS POSSIBLE TO SHOW DATA IN VARIOUS GROUPS OF DISPLAYS. FOR EXAMPLE YOU MAY SHOW THE CO DATA IN GROUP 1 AND CO₂ IN GROUP 3, OR IF REQUIRED CO IN GROUP 3 AND CO₂ IN GROUP 1. THIS ALLOWS THE SERVICE ENGINEER TO CHOOSE WHICH WINDOW TO DISPLAY WHICH READINGS. THIS SELECTION IS MADE USING DIP SWITCHES 1, 3, 8 AND 7 ON U6 SITUATED ON THE DISPLAY BD (FOR SETTINGS SEE SECTION 1 SET UP/CHECKOUT AND CALIBRATION PROCEDURES).

FUNCTIONAL BLOCK DIAGRAM
DISPLAY BOARD PART 1 CONTROLS





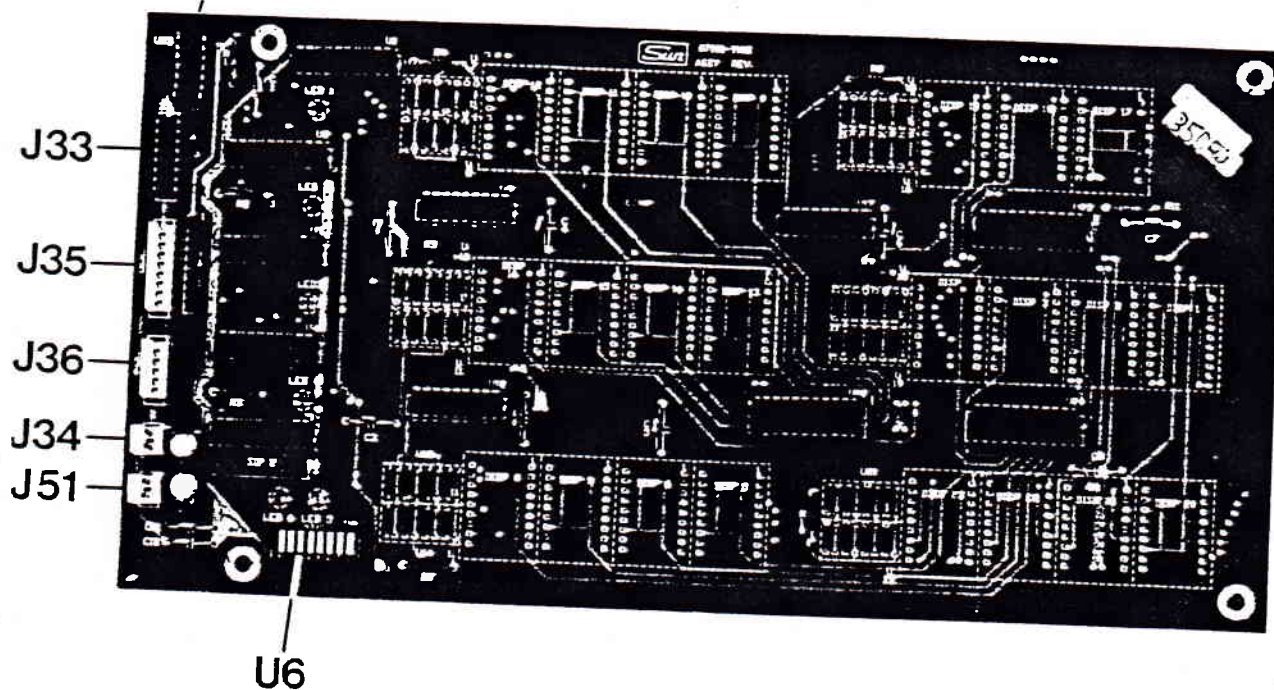
KEY TO DISPLAY POSITIONS



SGA-9000
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SECTION 05
PAGE 06

DISPLAY BD

SERVICE SWITCH





SUN ELECTRIC EUROPE B.V.

SECTION 6

OPTIONS

	PAGE
1. O ₂	01 THRU 07
2. PRINTER	08 THRU 11
3. REMOTE CONTROL	11
4. RPM	} 12 THRU 18
5. OIL TEMPERATURE	

SGA-9000

OPTIONS

SECTION 06

PAGE 01

GENERAL

A VARIETY OF OPTIONS ARE AVAILABLE FOR THE SGA-9000 GAS ANALYSER. THESE OPTIONS COME IN THE FORM OF KITS THAT MUST BE FITTED BY THE SERVICE ENGINEER. THE FOLLOWING SECTION GIVES THE INFORMATION NECESSARY TO FIT AND MAINTAIN THESE OPTIONS.

1. O₂ KIT NO. 9100-060

CONTENTS:

GENERAL

- A) MEASUREMENT SPECIFICATION
- B) KIT CONTENTS
- C) INSTALLATION INSTRUCTIONS
- D) FUNCTIONAL DESCRIPTION
- E) FUNCTIONAL BLOCK DIAGRAM
- F) CALIBRATION PROCEDURE

GENERAL

THE O₂ OPTION ENABLES THE TESTER TO DETERMINE THE PERCENTAGE OF OXYGEN IN THE CARS EXHAUST.

A) MEASUREMENT SPECIFICATION:

RANGE 0.0 TO 40.0%.

DISPLAY RESOLUTION 00.1.

MEASUREMENT RESOLUTION 0.1% @ SEA LEVEL.

SGA-9000

OPTIONS

SECTION 06

PAGE 02

B) KIT CONTENTS:

ITEM	PART NUMBER
1. O ₂ SENSOR	SUN-7049-0004
2. O ₂ MOUNTING ASSY	SGA-9200- 456
3. O ₂ WIRE HARNESS ASSY	SGA-9200- 477
4. LIGHT BAR (HLMP 2685)	SGA-4812- 010
5. 7 SEGMENT DISPLAYS (DLO 3900F)	SGA-4812- 013
6. 8 WIDE DARLINGTON DRIVER (ULN 2803A)	SGA-3101- 155
7. LATCH SOURCE DRIVER (UCN 4815A)	SGA-3101- 149
8. TRISTATE OCTAL LATCH (74LS373N)	SGA-3101- 144
9. DUAL OP-AMP (LF353N)	SGA-3101- 118
10. BUSHING (O ₂ OPENING)	SGA-2809- 032
11. O ₂ SCREENED SYMBOL	
12. SCREWS VARIOUS	
13. INSTALLATION INSTRUCTIONS	REF-9300710

C) INSTALLATION INSTRUCTIONS:

STEP 1: REMOVE MAIN COVER.

STEP 2: REMOVE FRONT PANEL ASSY.

STEP 3: REMOVE DISPLAY P.C.B. FROM FRONT PANEL ASSY.

STEP 4: INSTALL THE LIGHT BARS (ITEM 4) INTO SOCKETS U7 AND U8 ON THE
DISPLAY BD.

STEP 5: INSTALL THE SEVEN SEGMENT DISPLAYS (ITEM 5) INTO SOCKETS DISP.
9, 10, 11 AND 12.

STEP 6: ATTACH THE O₂ SCREENED SYMBOL TO THE APPROPRIATE WINDOW OF THE FRONT PANEL.

STEP 7: MOUNT THE DISPLAY BD BACK ON THE FRONT PANEL.

STEP 8: INSTALL THE FOLLOWING ITEMS ON THE REAR OF THE DISPLAY BD.:

ITEM		LOCATION
8	TRISTATE OCTAL LATCH	U 1
7	LATCH SOURCE DRIVER	U20
6	8 WIDE DARLINGTON DRIVER	U 9

NOTE: CHECK ALL I.C.'S ARE INSTALLED SO THAT THE DETENT CONFORMS WITH THE DISPLAY BD SILK SCREENING.

STEP 9: RE-MOUNT THE FRONT PANEL ASSY.

STEP 10: REMOVE THE ANALOG PROCESSING BD.

STEP 11: INSTALL THE DUAL OP-AMP (ITEM 9) IN SOCKET U15.

NOTE: CHECK THE OP-AMP IS INSTALLED SO THAT THE DETENT CONFORMS WITH THE ANALOG PROCESSING BD SILK SCREENING.

STEP 12: CONNECT ONE END OF THE O₂ WIRING HARNESS (ITEM 3) TO J44 ON THE ANALOG PROCESSING BD ENSURING THE LOCKING DEVICE LOCATES CORRECTLY.

STEP 13: REMOVE THE PLUG IN THE REAR OF THE TESTER AND RUN THE O₂ WIRING HARNESS THROUGH THE HOLE. REPLACE THE ANALOG PROCESSING BD.

STEP 14: FIT THE O₂ BUSH IN THE HOLE ON THE REAR OF THE TESTER.

STEP 15: REMOVE THE PLATE HOLDING THE GAS DISCHARGE PORT ON THE REAR OF THE TESTER. PULL THE TUBE OUT A FEW CENTIMETERS AND DISCONNECT THE DISCHARGE PORT.

STEP 16: CONNECT THE TUBE TO THE NYLON FITTING ON THE O₂ MOUNTING ASSY (ITEM 2) AND SECURE THE O₂ MOUNTING ASSY TO THE REAR OF THE TESTER USING THE SCREWS SUPPLIED.

STEP 17: MOUNT THE O₂ TRANSDUCER ELEMENT ON THE MOUNTING ASSY AND CONNECT THE O₂ WIRING HARNESS.

STEP 18: REPLACE AND SECURE TESTER MAIN COVER.

D) FUNCTIONAL DESCRIPTION:

THE O₂ OPTION COMPRISES OF:

- I) O₂ TRANSDUCER ELEMENT.
- II) ANALOG PROCESSING CIRCUITRY.
- III) A TO D CONVERSION AND DISPLAY.

I) O₂ TRANSDUCER ELEMENT:

DESCRIPTION:

THE O₂ TRANSDUCER ELEMENT IS THE GALVANIC TYPE, AND CONSISTS OF A GOLD CATHODE AND LEAD ANODE CONTAINED IN A SEALED POLYETHYLENE CYLINDER FILLED WITH A LIQUID ELECTROLYTE. THIS SENSOR IS DESIGNED TO BE INSENSITIVE TO POSITION. THE SENSOR LIFE SHOULD EXCEED ONE YEAR IN A 45-50% OXYGEN ENVIRONMENT. THE SENSOR IS DISPOSABLE AND SHOULD BE REPLACED WHEN ITS LIFE HAS EXPIRED.

PRINCIPLE OF OPERATION:

WHEN OXYGEN DIFFUSES THROUGH THE MEMBRANE IN THE SENSOR IT SETS UP A CHEMICAL REACTION BETWEEN THE ELECTRODES AND THE ELECTROLYTE. THIS CAUSES A CURRENT TO BE GENERATED.

THE CURRENT IS PROPORTIONAL TO THE AMOUNT OF OXYGEN IN THE SAMPLE, AND IS INTERNALLY TEMPERATURE COMPENSATED. THE SENSOR IS SITUATED AT THE END OF THE PNEUMATIC FLOW OF THE TESTER (FIG 1).

FIG 1

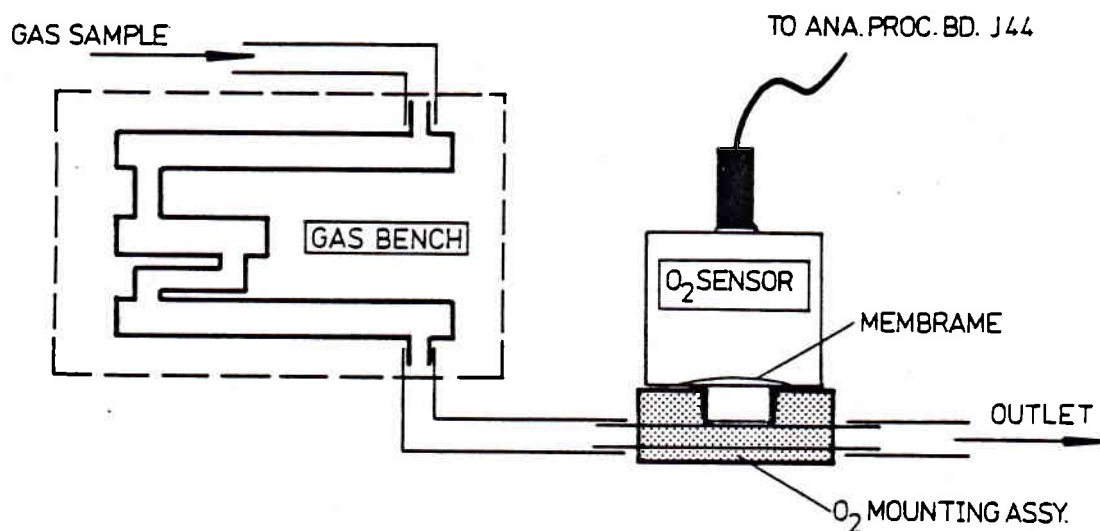
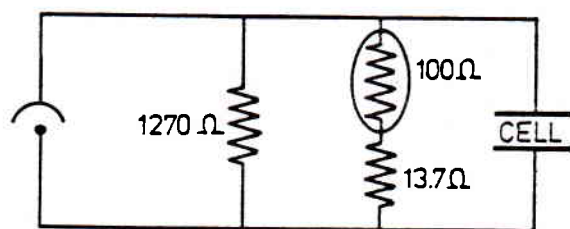


FIG 2



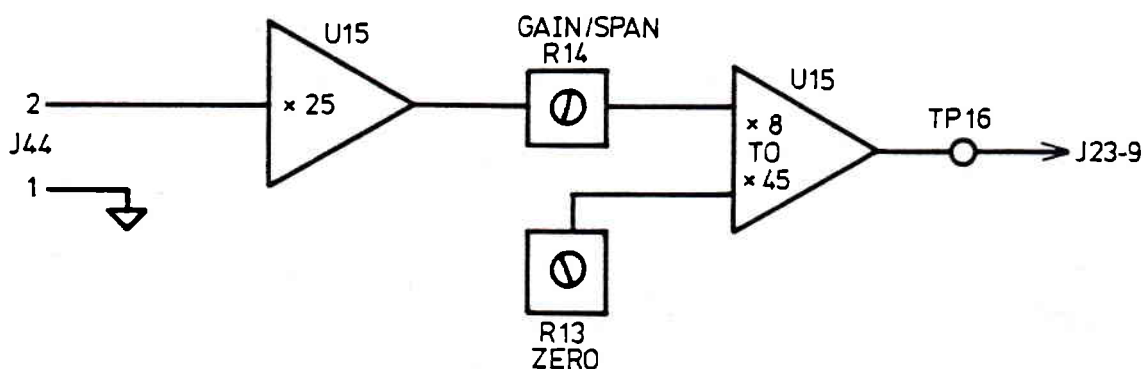
OUTPUT 5 - 17 MV @ 20% O₂.

THE OUTPUT OF THE O₂ SENSOR IS CONNECTED TO J44 PINS 1 + 2 ON THE ANALOG PROCESSING BD VIA THE O₂ WIRING HARNESS.

II) ANALOG PROCESSING:

THE ANALOG PROCESSING CIRCUITRY FOR THE O₂ OPTION IS CONTAINED ON THE ANALOG PROCESSING BD. THIS CIRCUITRY AMPLIFIES THE O₂ SENSOR SIGNAL AND ALLOWS FOR A ZERO AND GAIN (SPAN) SET CONTROLS:

THE O₂ SENSOR SIGNAL ENTERS THE PROCESSING BD AT J44 PINS 1 + 2 AND IS DC COUPLED TO ONE HALF OF A DUAL OP-AMP. THE SIGNAL IS AMPLIFIED AND FED TO THE SECOND HALF OF THE OP-AMP VIA A VARIABLE RESISTOR R14. THIS POTENTIOMETER ALLOWS FOR THE OVERAL GAIN SETTING OF THE CIRCUIT. THE SECOND HALF OF THE OP-AMP FURTHER AMPLIFIES THE SIGNAL AND ALLOWS THE OUTPUT AT TP16 TO BE OFFSET. THIS OFFSET ACTS AS A ZERO WHEN NO OXYGEN IS PRESENT. THE PROCESSED OXYGEN SIGNAL IS OUTPUTTED TO THE DIGITAL PROCESSING BD AT J23-9.



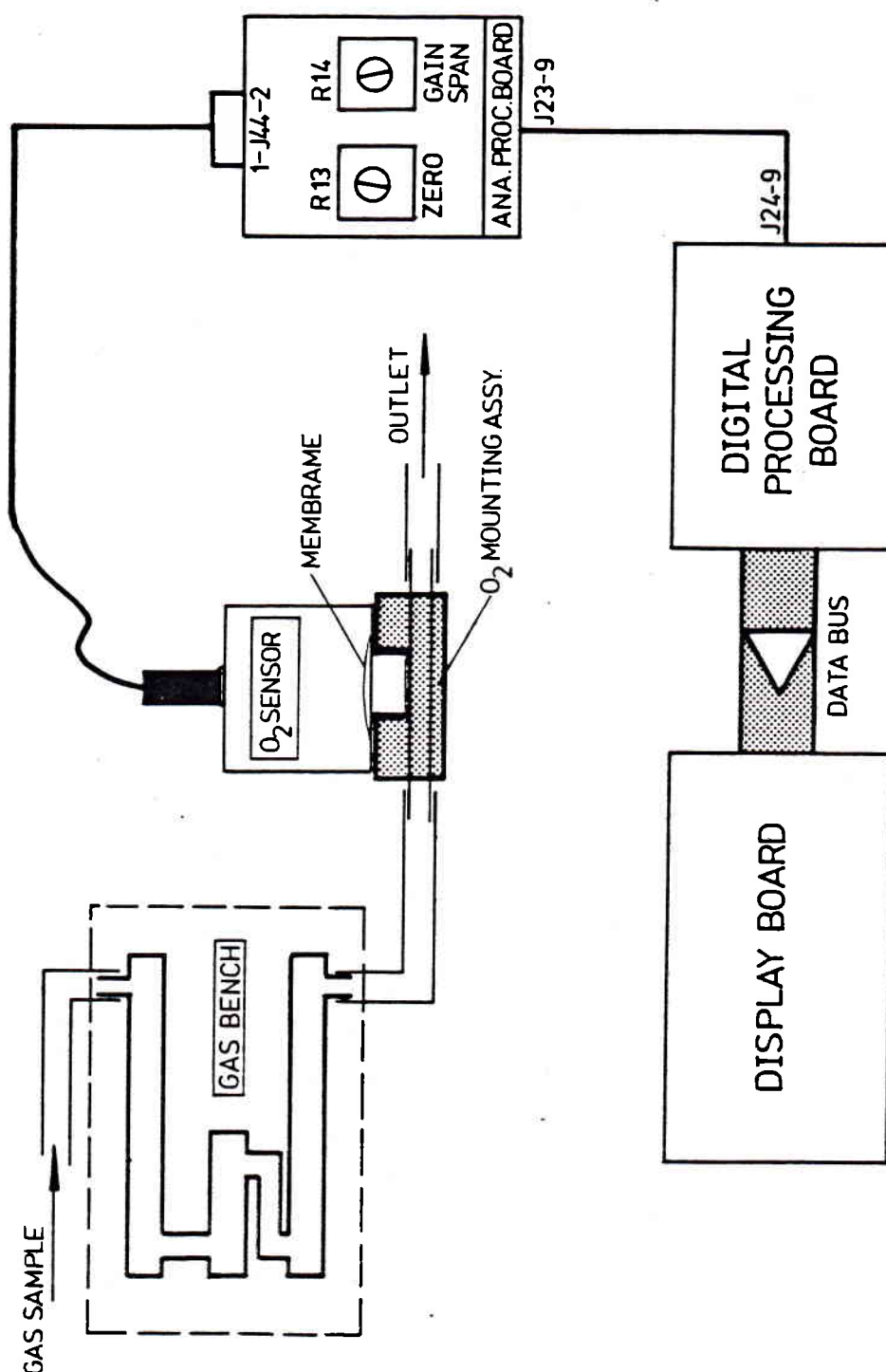
III) A TO D CONVERSION AND DISPLAY:

THE PROCESSED ANALOG SIGNAL ENTERS THE DIGITAL PROCESSING BD AT J24-9.

THE SIGNAL IS THEN MULTIPLEXED INTO THE A TO D CONVERTER WITH THE REST OF THE TESTERS ANALOG SIGNALS TO BE MEASURED. (SEE SECTION 4 AND 5 FOR

FURTHER DESCRIPTIONS OF PROCESSING AND DISPLAY.)

E. FUNCTIONAL BLOCK DIAGRAM



F) CALIBRATION PROCEDURE:

FOR CALIBRATION PROCEDURE SEE SECTION 1.3 CALIBRATION.



2. PRINTER KIT NO. 9100-061

CONTENTS:

GENERAL

- A) KIT CONTENTS
- B) INSTALLATION INSTRUCTIONS
- C) BAUD RATE SETTING
- D) PRINTER TYPE
- E) FUNCTIONAL BLOCK DIAGRAM

GENERAL

TO INCREASE THE FLEXIBILITY OF THE SGA-9000 BY MAKING A HARD COPY RECORD OF MEASUREMENTS, A KIT HAS BEEN MADE AVAILABLE TO ALLOW THE CONNECTION OF EITHER A PARALLEL (CENTRONICS) OR SERIAL (RS 232C) TYPE PRINTER.

A) KIT CONTENTS:

<u>ITEM</u>	<u>PART NUMBER</u>
1. HARNESS PARALLEL OUTPUT (CENTRONICS)	9200475
2. HARNESS SERIAL OUTPUT (RS 232c)	9200476
3. COVER PLATE FOR I/O OPTION	2511-019
4. SCREWS 4	
5. TIE WRAPS	
6. TRISTATE OCTAL LATCH (SN74LS373N)	SGA 3101-144
7. RS 232C DRIVER (MC1488P)	
8. INSTALLATION INSTRUCTIONS	REF 9300709



B) INSTALLATION INSTRUCTIONS:

STEP 1: REMOVE MAIN COVER.

STEP 2: REMOVE I/O BLANKING PLATE LOCATED BELOW THE LEFT SIDE OF THE
FILTER BOWL ASSY.

STEP 3: REMOVE DIGITAL PROCESSING BD.

STEP 4: FIT THE SOCKETS TO THE REAR OF THE TESTER RUNNING THE WIRES
UNDER ANALOG PROCESSING BD PARTITION.

STEP 5: CONNECT THE PLUGS P28 AND P27 TO THEIR CORRESPONDING SOCKETS
ON THE DIGITAL PROCESSING BD.

STEP 6: CHECK IF I.C. SOCKETS U15 AND U9 ARE EMPTY:

IF EMPTY:

FIT THE SN 74LS373N IN U9

AND FIT THE MC 1488P IN U15.

NOTE: CHECK THE I.C.'S ARE INSTALLED SO THAT THE DETENT
CONFORMS TO THE PROCESSING BD SILK SCREEN.

IF FULL:

DISCARD THE SUPPLIED I.C.'S.

STEP 7: REPLACE THE DIGITAL PROCESSING BD.

C) BAUD RATE SETTING:

THE TESTERS BAUD RATE MUST BE SET TO MATCH THE BAUD RATE OF THE PRINTER IT IS TO BE USED WITH. THIS IS DONE VIA THE DIP SWITCHES U2 ON THE DIGITAL PROCESSING BD.

THE FOLLOWING BAUD RATES ARE AVAILABLE:

110
150
300
600
1200
2400
4800
9600

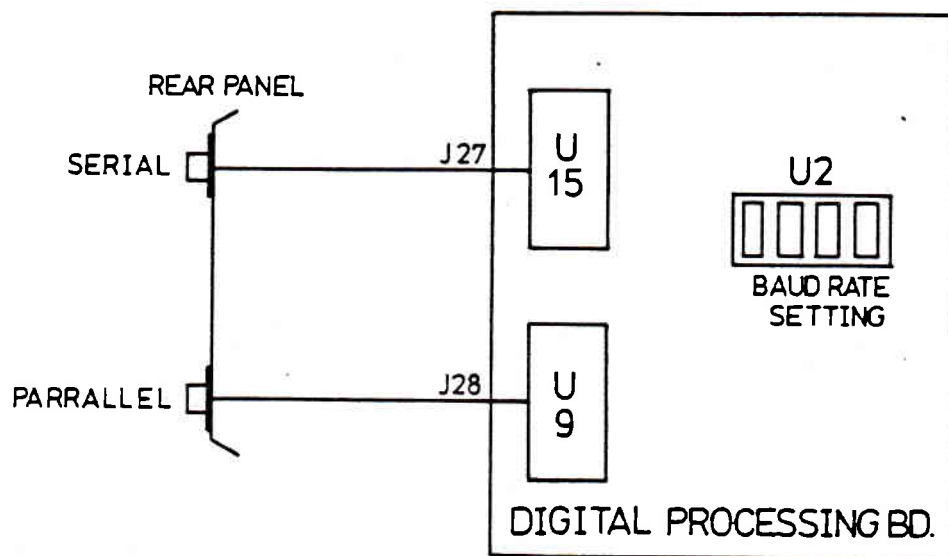
FOR BAUD RATE SETTING SEE SECTION 1.1 SET UP.

ON COMPLETION OF BAUD RATE SETTING REPLACE TESTER COVER. THE BAUD RATE MAY BE OBSERVED IN THE CO₂ WINDOW DURING TESTER STATUS CHECK (SEE OPERATING FLOW DIAGRAM, INTRODUCTION).

D) PRINTER TYPE:

ALL PRINTERS FITTED WITH SERIAL OR PARALLEL PORTS MAY BE USED WITH THE SGA-9000. IT SHOULD BE NOTED HOWEVER THAT NO PRINTER CABLE IS SUPPLIED WITH THE OPTION KIT AND THIS MUST BE PURCHASED SEPARATELY.

E) FUNCTIONAL BLOCK DIAGRAM:



3. REMOTE CONTROL

THIS OPTION IS TO BE RELEASED AT A LATER DATE.

4. RPM

KIT NO. 7009E9311-22

5. OIL TEMP

NOTE: THESE OPTIONS ARE NOT AVAILABLE SEPARATELY.

CONTENTS:

GENERAL

- A) KIT CONTENTS
- B) INSTALLATION INSTRUCTIONS
- C) FUNCTIONAL DESCRIPTION
- D) FUNCTIONAL BLOCK DIAGRAM
- E) CALIBRATION PROCEDURES

GENERAL

THE RPM/OIL TEMP OPTION ALLOWS THE OPERATOR TO MEASURE THE EXHAUST GASSES OF A CAR UNDER KNOWN ENGINE CONDITIONS. THIS ENABLES HIM TO TEST CARS MORE ACCURATELY AGAINST MANUFACTURES SPECIFICATIONS AND DIAGNOSE POSSIBLE ENGINE PROBLEMS.

A) KIT CONTENTS:

ITEM

PART NUMBER

- | | |
|---------------------------------------|--------------|
| 1. RPM/OIL TEMP PCB | 7001E9310-21 |
| 2. RPM/OIL TEMP CONNECTOR PLATE ASSY | 7009E9311-21 |
| 3. WIRING HARNESS W 14 | 7076E9310-77 |
| 4. WIRING HARNESS W 22 | 7076E9310-76 |
| 5. STAND OFFS | SGA 2801-059 |
| 6. LIGHT BARS (HLMP 2685) | SGA 4812-010 |
| 7. SEVEN SEGMENT DISPLAYS (DLO 3900F) | SGA 4812-013 |

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<u>ITEM</u>	<u>PART NUMBER</u>
8. TRISTATE OCTAL LATCH (74LS373N)	SGA 3101-144
9. LATCH SOURCE DRIVER (UCN 4815A)	SGA 3101-149
10. 8 WIDE DARLINGTON DRIVER (ULN 2803A)	SGA 3101-155
11. RED TRIGGER LEAD	6004-0262-000
12. RED TRIGGER CLAMP	0507-0006-000
13. OIL TEMP PROBE	6004E9004-0
14. INSTALLATION INSTRUCTIONS	0692E9305-01

B) INSTALLATION INSTRUCTIONS:**STEP 1:** REMOVE MAIN COVER.**STEP 2:** REMOVE RPM/OIL TEMP BLANKING PLATE LOCATED BELOW THE RIGHT SIDE OF THE FILTER BOWL ASSY.**STEP 3:** MOUNT THE RPM/OIL TEMP CONNECTOR PLATE ASSY (ITEM 2) IN PLACE OF THE REMOVED BLANKING PLATE. ENSURE THAT IT MAKES A GOOD CHASSIS GROUND CONTACT WITH THE TESTER.**STEP 4:** RUN THE CABLES W 30 AND W 31 THROUGH THE OPENING PROVIDED INTO THE CENTRAL PCB PARTITION OF THE TESTER.**STEP 5:** MOUNT THE TWO STAND OFF'S (ITEM 5) IN THE HOLES PROVIDED ADJACENT TO THE REAR OF THE ANALOG PROCESSING BD.**STEP 6:** CONNECT P 63 AND P 64 FROM THE CONNECTOR PLATE ASSEMBLY TO J 63 AND J 64 RESPECTIVELY ON THE RPM/OIL TEMP PCB (ITEM 1).**STEP 7:** LOCATE THE BOTTOM OF THE PCB IN THE RAIL PROVIDED AND SNAP THE TOP ONTO THE STAND OFF'S.**STEP 8:** REMOVE THE TESTER FRONT PANEL.

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STEP 9: CONNECT THE P 37 END OF WIRING HARNESS W 22 TO J 37 ON THE RPM/OIL TEMP PCB.

STEP 10: RUN W 22 BETWEEN THE DIGITAL AND ANALOG PROCESSING BOARDS. CONNECT THE P 30 END TO J 30 LOCATED ON THE FRONT EDGE OF THE DIGITAL PROCESSING BD.

STEP 11: CONNECT THE P 53 END OF WIRING HARNESS W 14 TO J 53 ON THE RPM/OIL TEMP PCB.

STEP 12: RUN W 14 BETWEEN THE DIGITAL AND ANALOG PROCESSING BDS. AND AND ROUND TO THE LINEAR POWER SUPPLY, CONNECT THE P 52 END TO J 52 LOCATED ON THE TOP RIGHT HAND SIDE OF THE LINEAR SUPPLY.

STEP 13: REMOVE THE DISPLAY BD FROM THE FRONT PANEL.

STEP 14: INSTALL THE LIGHT BARS ITEM 6 INTO SOCKETS U 10, U 11, U 13 AND U 14 OF THE DISPLAY BD.

STEP 15: INSTALL THE SEVEN SEGMENT DISPLAYS ITEM 7 INTO SOCKETS DISP. 5, 6, 7, 8, 13, 14, 15 AND 16 ON THE DISPLAY BD.

STEP 16: ATTACH THE OIL TEMP AND RPM SCREENED SYMBOLS TO THE APPROPRIATE WINDOWS OF THE FRONT PANEL.

STEP 17: MOUNT THE DISPLAY BD BACK ON THE FRONT PANEL.

STEP 18: CHECK AND IF NECESSARY INSTALL THE FOLLOWING IC'S IN THEIR RESPECTIVE SOCKETS ON THE REAR OF THE DISPLAY BD.

<u>ITEM</u>		<u>LOCATION</u>
9	LATCH SOURCE DRIVER	U 20 + U 24
10	8 WIDE DARLINGTON DRIVER	U 9 + U 12
8	TRI-STATE OCTAL LATCH	U 1 + U 4

NOTE: CHECK ALL IC'S ARE INSTALLED SO THAT THE DETENT CONFORMS WITH THE DISPLAY BD SILK SCREENING.

STEP 19: REMOUNT THE FRONT PANEL ASSY.

STEP 20: RE-FIT MAIN COVER.

C) FUNCTIONAL DESCRIPTION:

I. RPM

RPM IS DERIVED FROM THE RED TRIGGER PICK-UP THAT IS CONNECTED TO A CYLINDER SPARK PLUG LEAD OF THE ENGINE UNDER TEST.

THE TIGGER PICK-UP IS CONNECTED TO THE REAR OF THE TESTER AT J 68, WHERE IT IS SECURELY EARTHED AND SUPPRESSED AGAINST UNWANTED ENGINE INTERFERENCE. THE TRIGGER SIGNAL IS FED TO THE RPM/OIL TEMP BD AT J 64, IT IS THEN RUNG UP IN A TUNED CIRCUIT, WHICH IS MATCHED TO THE INDUCTANCE OF THE TRIGGER CLAMP. THE OUTPUT OF THE TUNED CIRCUIT IS FED TO A COMPARATOR, WHERE ONLY SIGNALS GREATER THAN 190 MV GENERATE AN OUTPUT, THIS ENSURES THAT PICK-UP FROM OTHER CYLINDERS, DO NOT GENERATE SPURIOUS PULSES. THE OUTPUT OF THE COMPARATOR IS THEN FILTERED TO REMOVE HIGH FREQUENCY OSCILLATIONS. THE FALLING EDGE OF THE FILTERED PULSE IS USED TO TRIGGER THE FIRST OF TWO MONOSTABLES. THE SECOND MONOSTABLE IS TRIGGERED FROM THE RISING EDGE OF THE FIRST, THIS ENSURES THAT THE SECOND MONO CANNOT BE RE-TRIGGERED BEFORE THE FIRST MONO RESETS. THIS SET UP FURTHER PROHIBITS THE POSSIBILITY OF PRODUCING SPURIOUS PULSES. THE Q AND $\bar{Q}$ OUTPUTS OF THE SECOND MONO ARE THEN BUFFERED. THE POSITIVE OR NEGATIVE PULSE OUTPUT MAY THEN BE SELECTED BY W 1 FOR OUTPUT AT J 37-3.



NOTE: W 1 POSITION B-B (NEGATIVE PULSE).

THE NEGATIVE PULSES AT J 37 ARE FED TO THE DIGITAL PROCESSING BD AT J 30-3 WHERE THEY PRESENT AN INTERRUPT ON THE CPU BUS. THIS INTERRUPT INFORMS THE CPU THAT RPM DATA IS AVAILABLE FOR READING AT DATA BUFFER U6. THE DIGITAL PROC BD THEN DISPLAYS THIS INFORMATION AT THE APPROPRIATE SLOT IN THE NORMAL MANNER (SEE SECTIONS 4 AND 5). THE CPU WILL AUTOMATICALLY COMPENSATE FOR 2 OR 4 CYCLE ENGINES ACCORDING TO THE POSITION OF THE 2/4 CYCLE FRONT PANEL SWITCH.

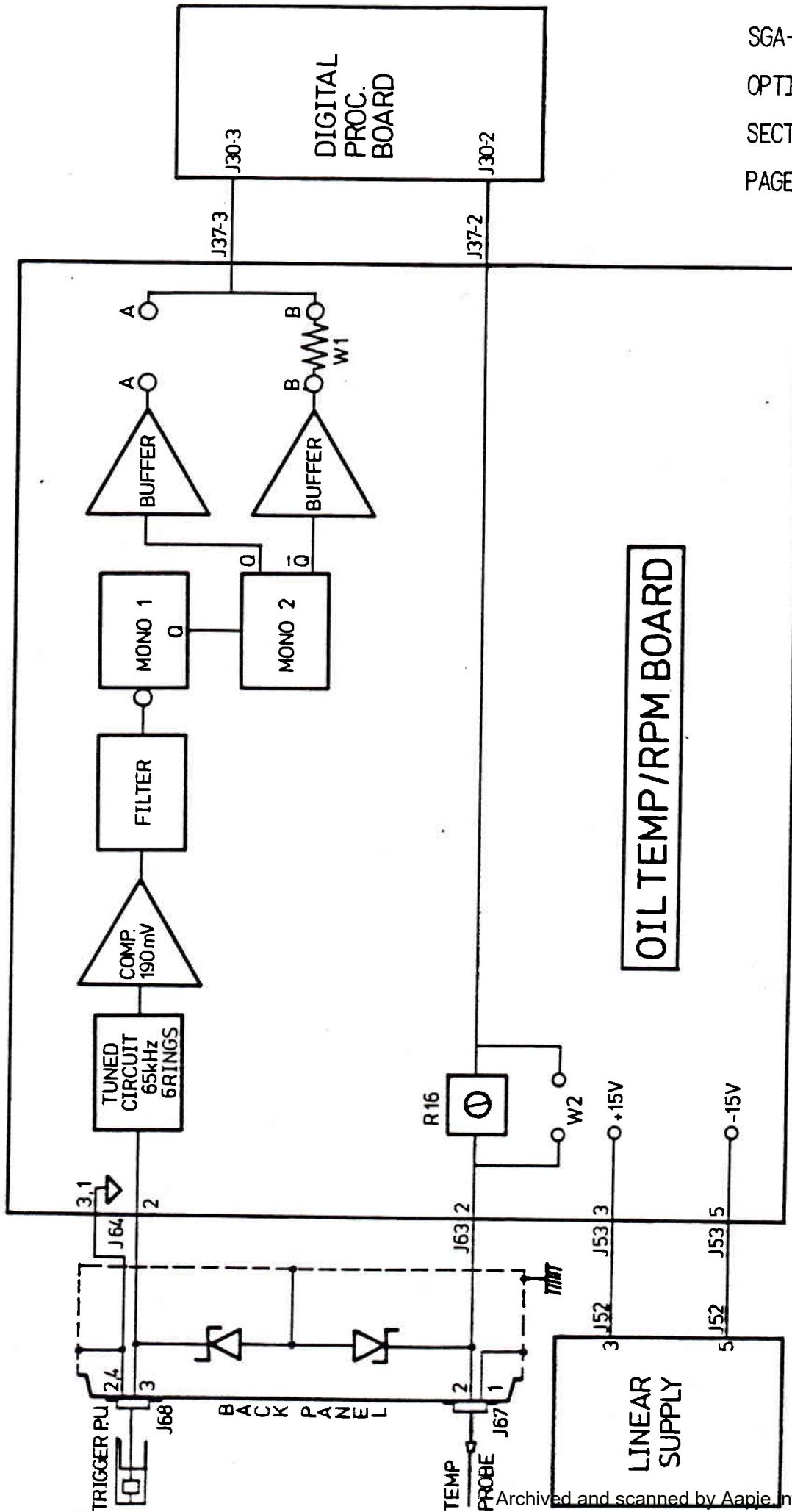
II. OIL TEMP

OIL TEMPERATURE IS OBTAINED USING A THERMISTOR SITUATED IN THE END OF THE OIL TEMP PROBE. THE TEMP PROBE IS CONNECTED TO THE REAR OF THE TESTER AT J 67, WHERE IT IS SECURELY EARTHED AND SUPPRESSED AGAINST UNWANTED ENGINE INTERFERENCE.

THE RPM/OIL TEMP BD RECEIVES THE THERMISTOR INFORMATION AT J 63-2. THE CIRCUITRY ON THE PCB CONVERTS THE RESISTANCE INTO A CORRESPONDING DC VOLTAGE. THIS VOLTAGE MAY BE CALIBRATED BY R16. THE RESULTING ANALOG VOLTAGE IS OUTPUTTED AT J 37-2 TO THE DIGITAL PROCESSING BD J 30-2. THE DIGITAL PROCESSING BD HANDLES THE SIGNAL AS ONE OF ITS ANALOG INPUTS (SEE SECTION 4).

D. FUNCTIONAL BLOCK DIAGRAM

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SGA-9000

OPTIONS

SECTION 06

PAGE 18

E. CALIBRATION PROCEDURES

RPM: THE RPM CANNOT BE CALIBRATED.

OIL TEMP:

IMMERSE THE END OF THE OIL TEMP PROBE IN BOILING WATER. ADJUST R 16 UNTIL THE TESTER READS 100° C.

IF BOILING WATER IS NOT AVAILABLE ADJUST R 16 UNTIL THE TEMPERATURE DISPLAYED MATCHES THE AMBIENT TEMPERATURE IN WHICH THE PROBE IS SITUATED.



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SECTION 7

TROUBLESHOOTING

GUIDE



INTRODUCTION

THIS TROUBLESHOOTING GUIDE HAS BEEN DESIGNED TO ASSIST THE SERVICE ENGINEER IN LOCATING AND REPAIRING FAULTS THAT OCCUR IN THE FIELD. IT IS THEREFORE ASSUMED THAT THE TESTER HAS FUNCTIONED CORRECTLY PRIOR TO THE FAULT APPEARING.

IMPORTANT: BEFORE FOLLOWING THIS GUIDE IT MUST FIRST BE ASCERTAINED AS TO WHETHER THE POWER SUPPLIES ARE FUNCTIONING CORRECTLY. TO CHECK AND IF NECESSARY REPAIR THESE SUPPLIES SEE SECTION 2 POWER SUPPLY AND DISTRIBUTION.

FOR SIMPLICITY THE TROUBLESHOOTING GUIDE HAS BEEN SUB-DIVIDED INTO MAIN FAULT SYMPTOMS, AS ILLUSTRATED ON PAGE 02. FOR EACH SYMPTOM THERE IS A FLOW DIAGRAM THAT SUGGESTS A COURSE OF ACTION. THAT COMBINED WITH THE INFORMATION FOUND IN THE SECTION(S) COVERING THAT AREA, WILL ENABLE THE SERVICE ENGINEER TO MAKE THE REPAIR. IT MAY BE POSSIBLE WHEN HAVING MORE THAN ONE FAULT TO COMBINE THE INFORMATION GIVEN, THEREBY ELIMINATING POSSIBLE CAUSES.

NOTE: THIS SECTION IS ONLY A GUIDE AND MUST BE USED IN CONJUNCTION WITH THE INFORMATION GIVEN IN THE REST OF THE MANUAL.

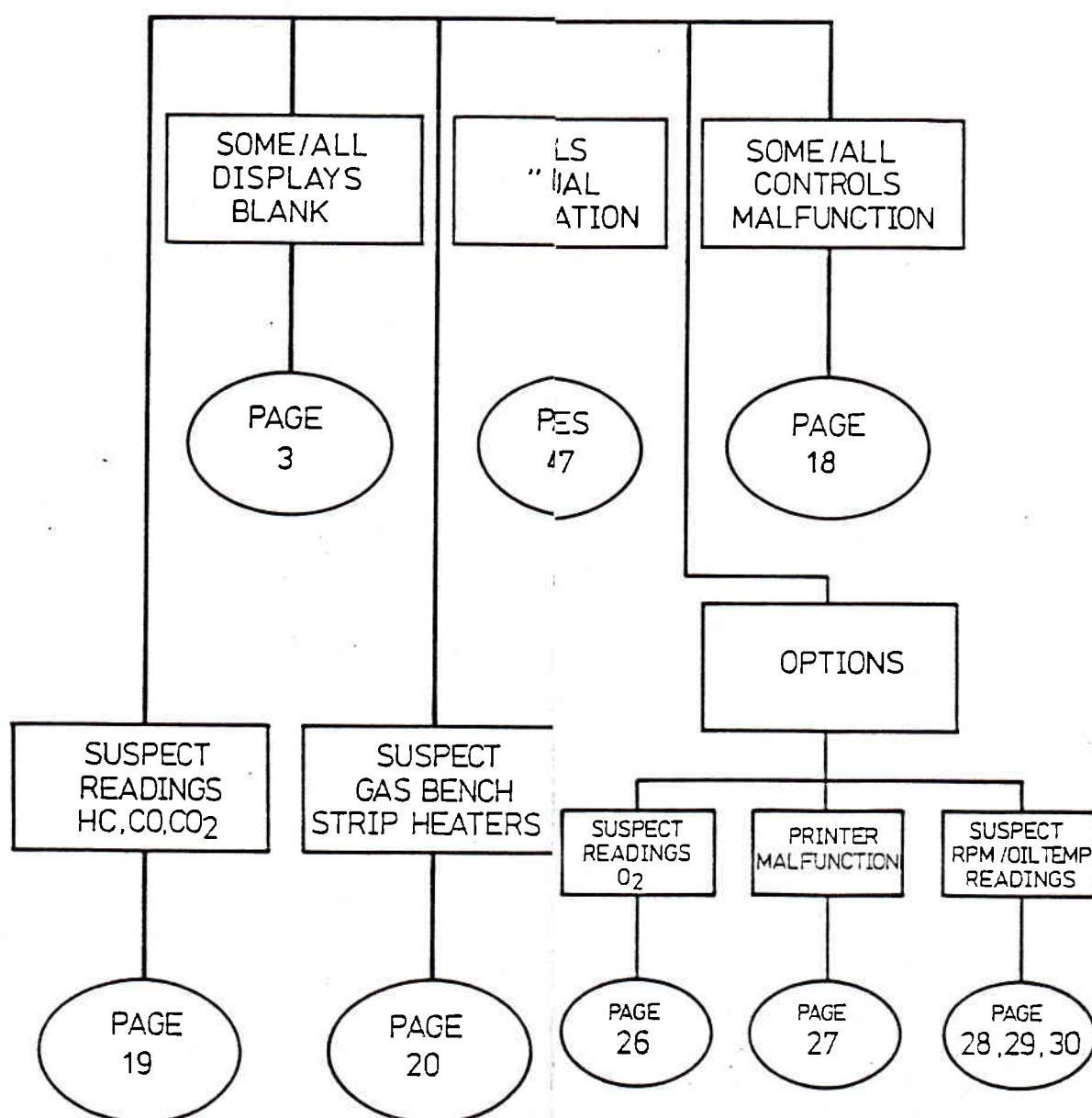
SGA-9000

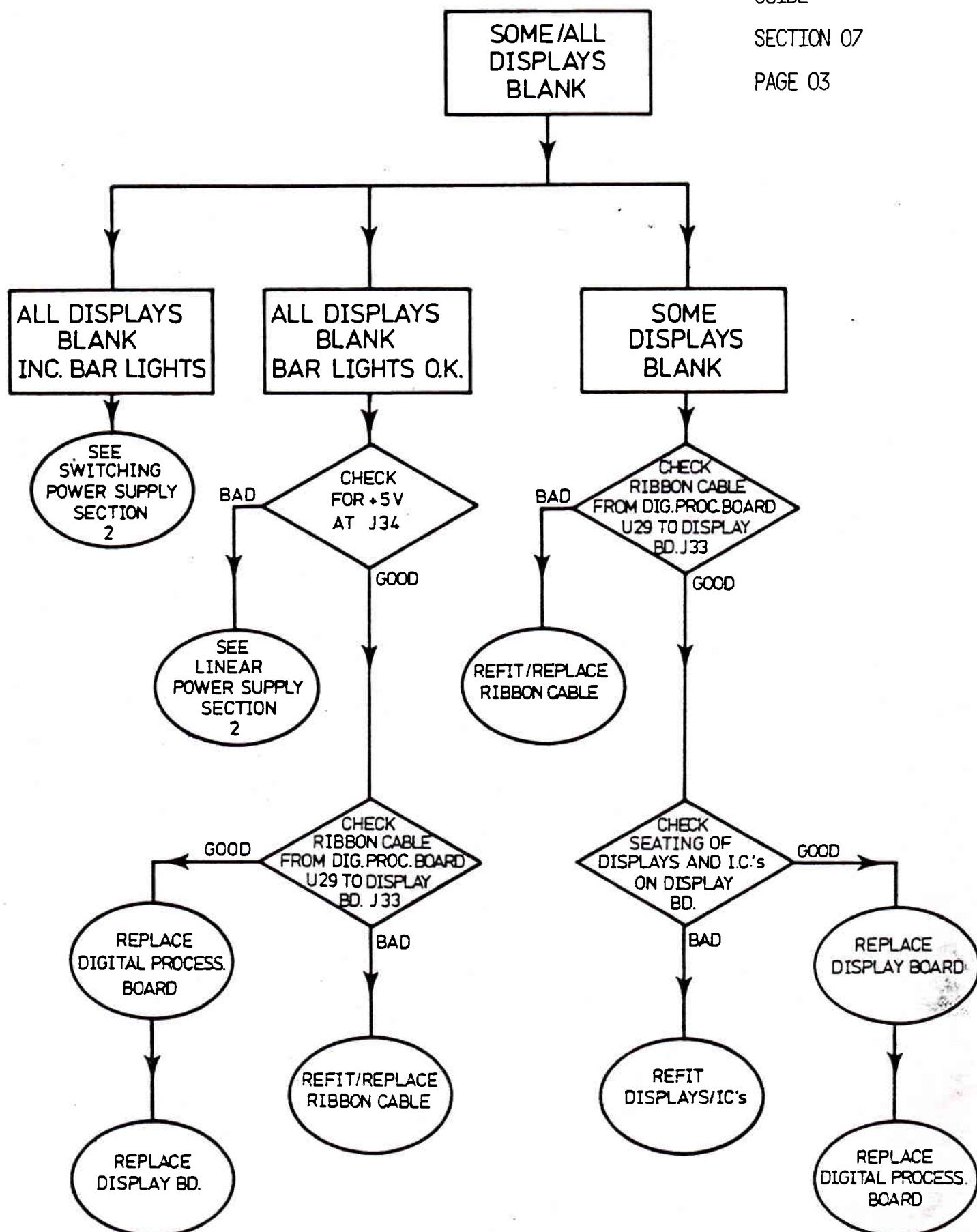
TROUBLESHOOTING

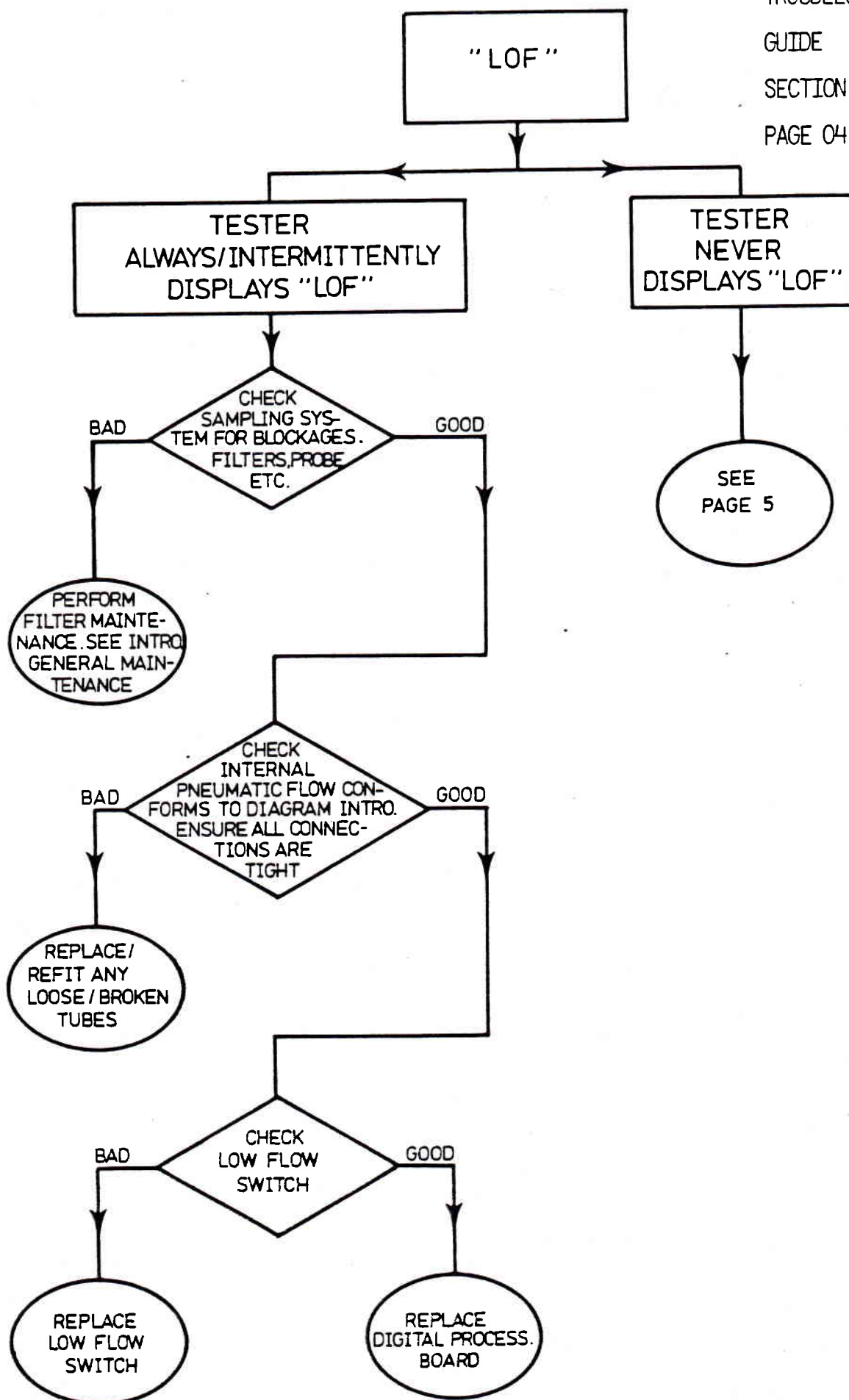
GUIDE

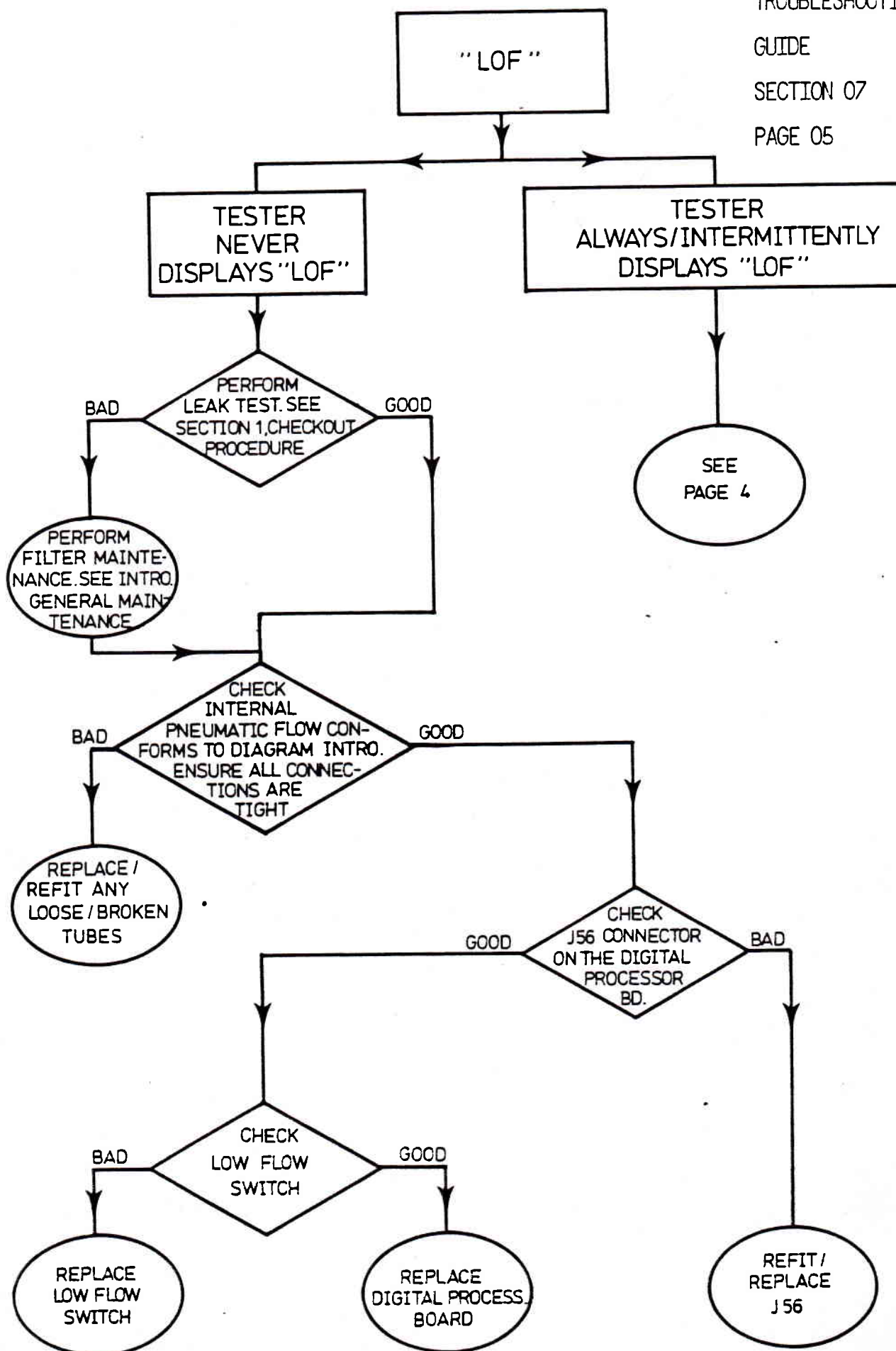
SECTION 07

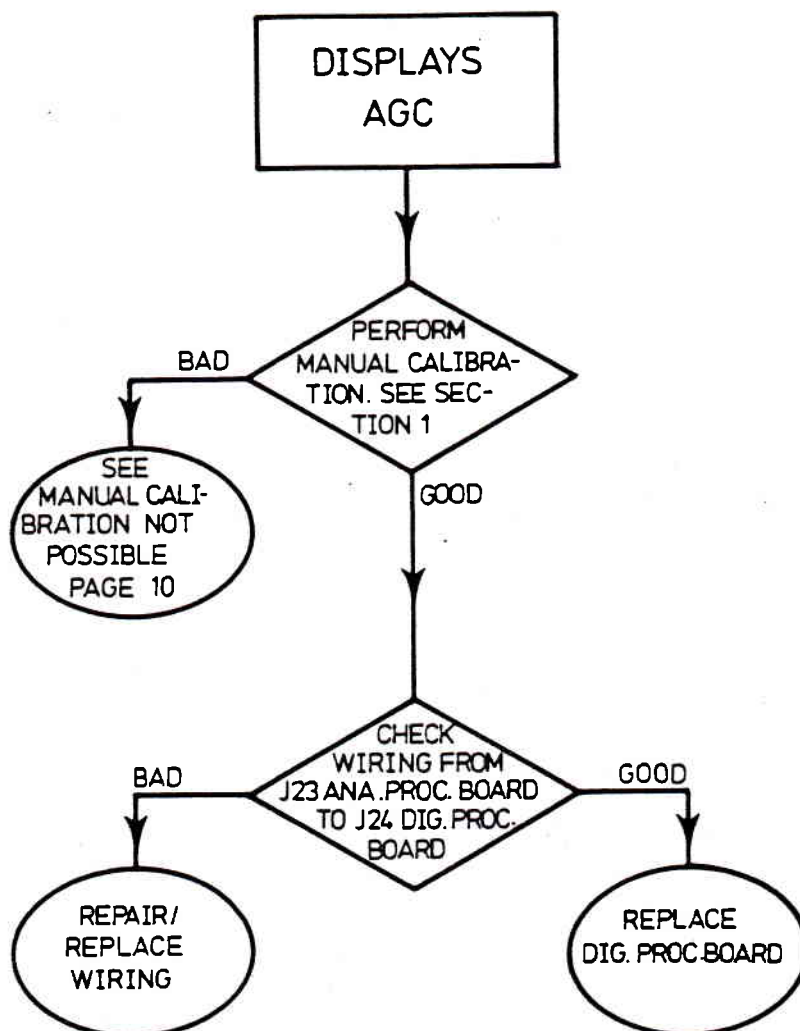
PAGE 02









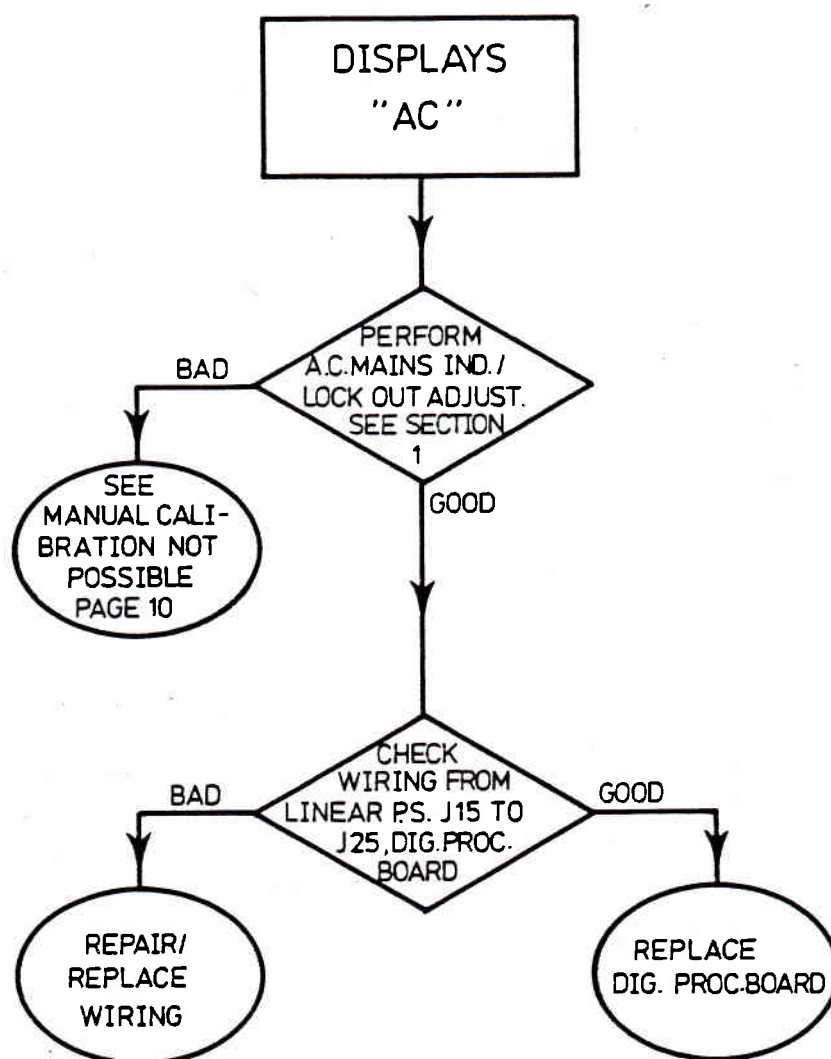


NOTE: IF THE TRIGGER CHANNEL DISPLAYS "AGC" THEN ALL GAS CHANNELS WILL DISPLAY "AGC".

TRIGGER CHANNELS ARE:

HC ON (HC, CO, CO₂) AND (HC, CO) BENCHES.

CO ON (CO, CO₂) BENCHES.



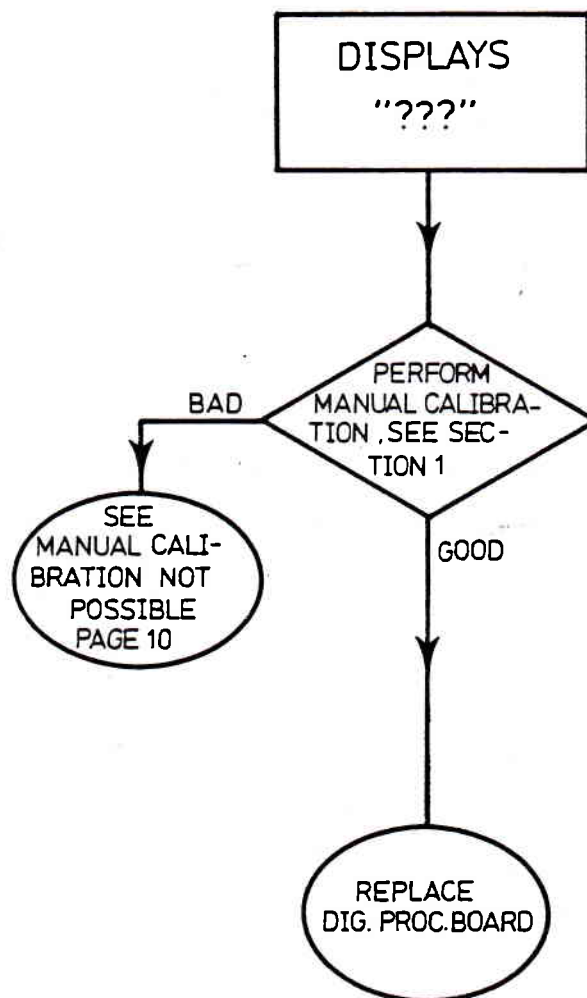
SGA-9000

TROUBLESHOOTING

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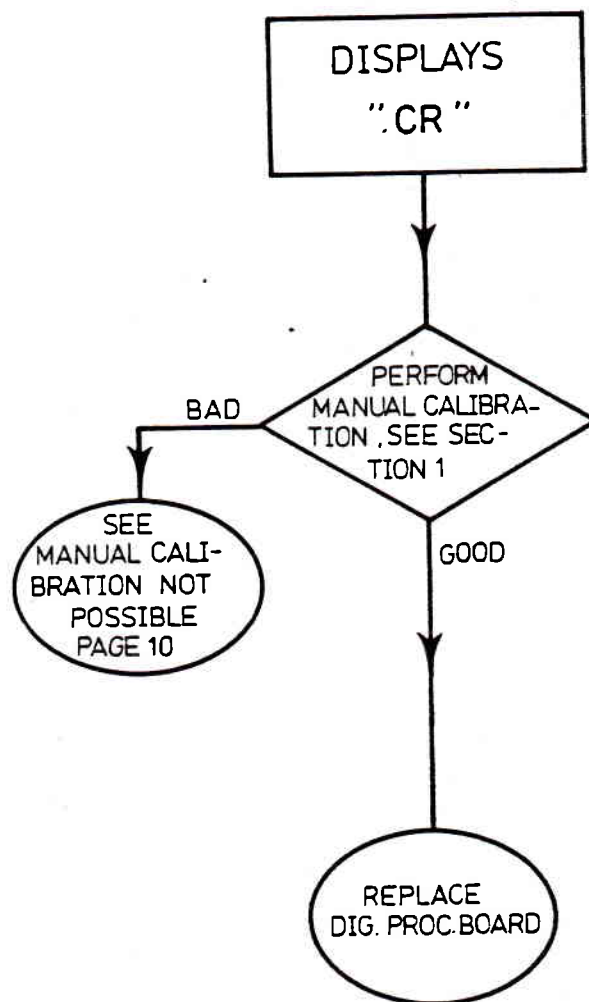
SGA-9000

TROUBLESHOOTING

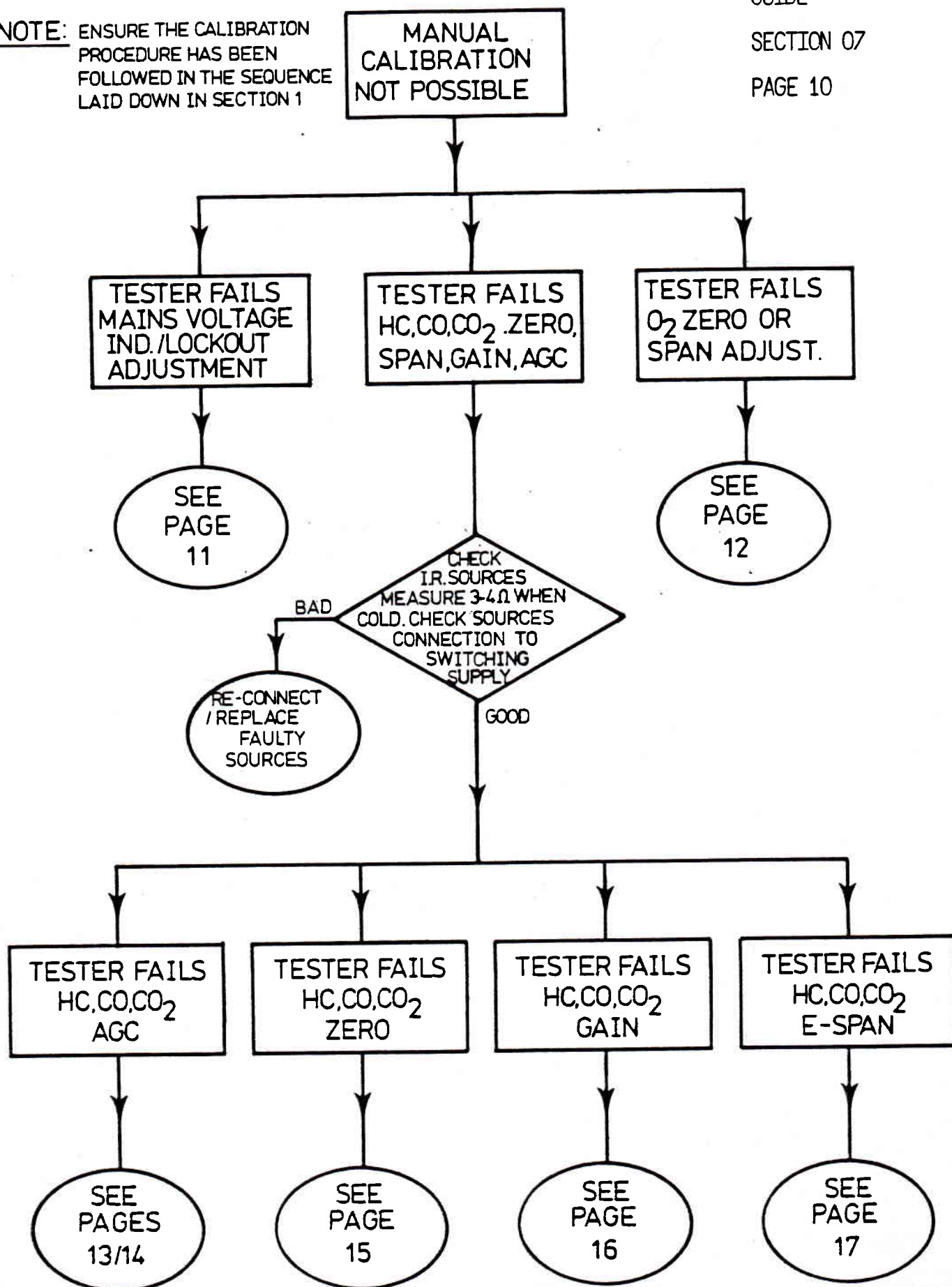
GUIDE

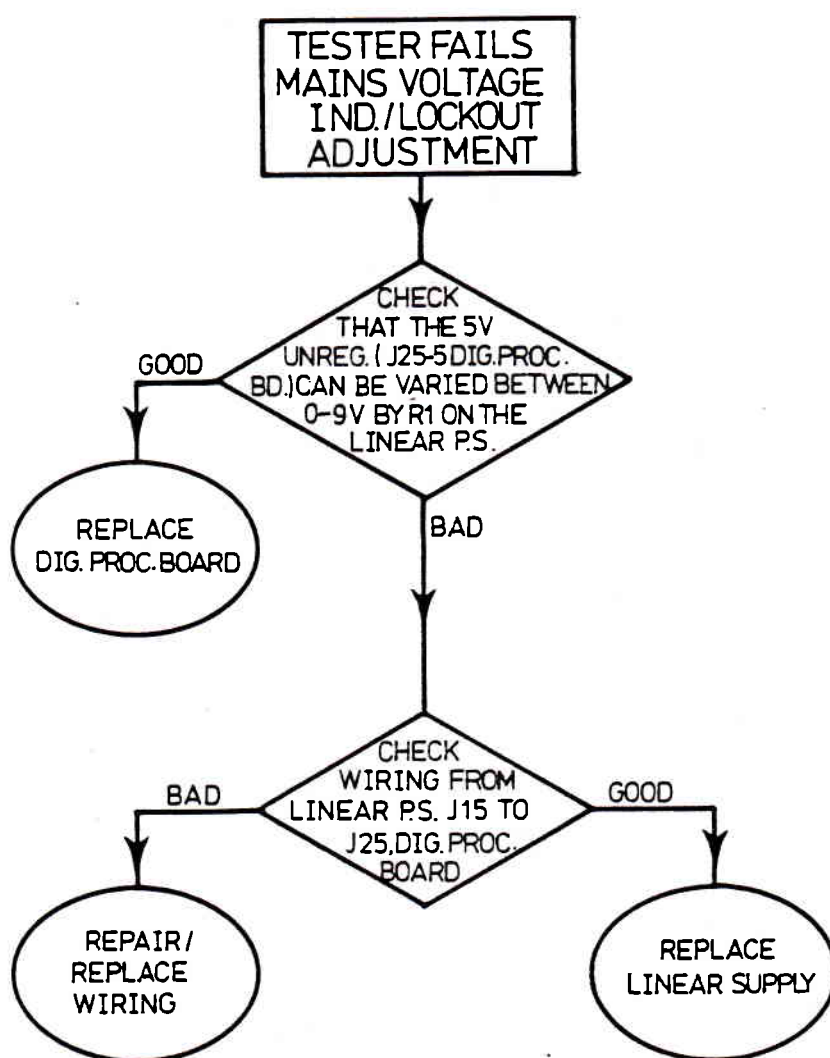
SECTION 07

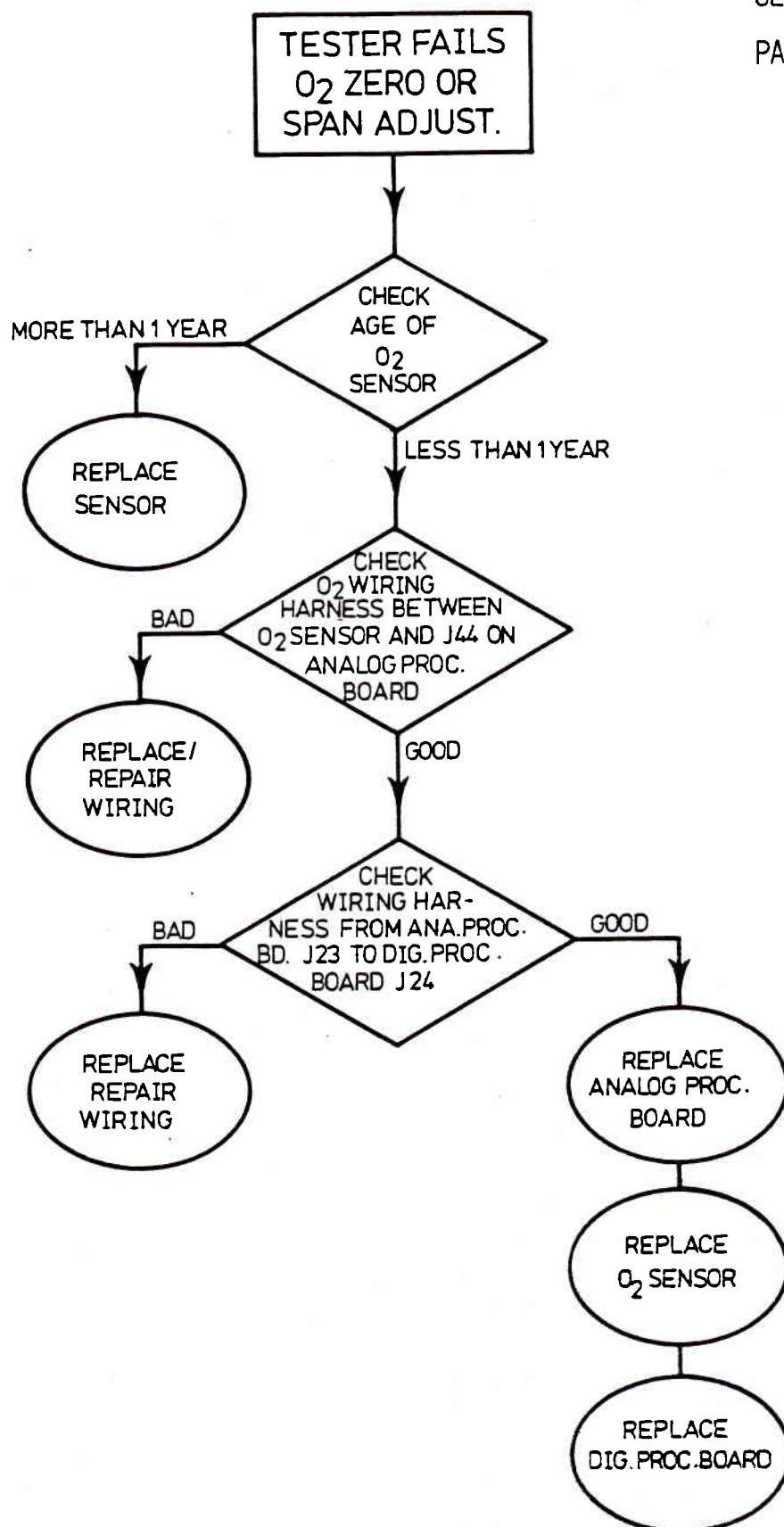
PAGE 09



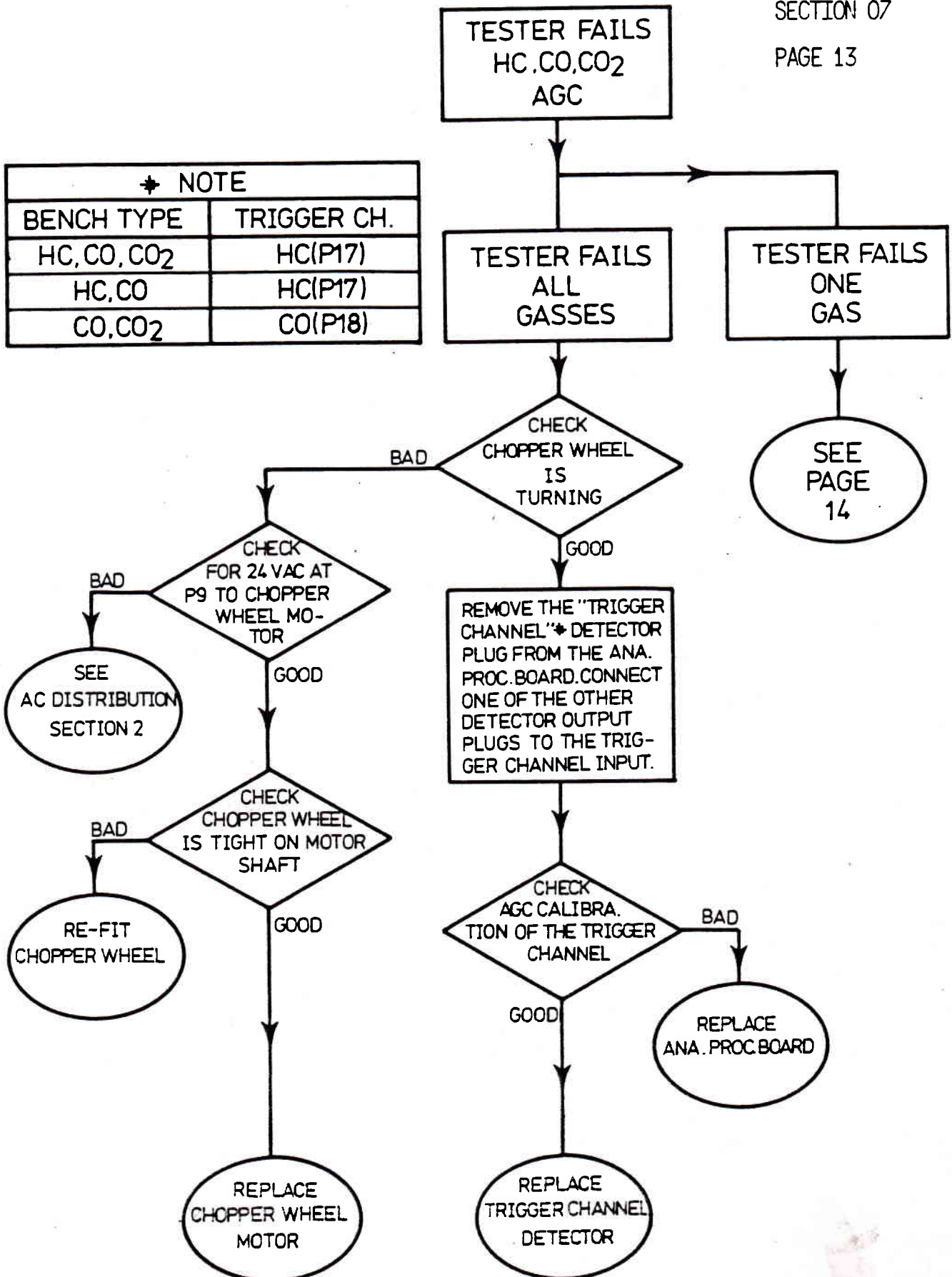
NOTE: ENSURE THE CALIBRATION PROCEDURE HAS BEEN FOLLOWED IN THE SEQUENCE LAID DOWN IN SECTION 1

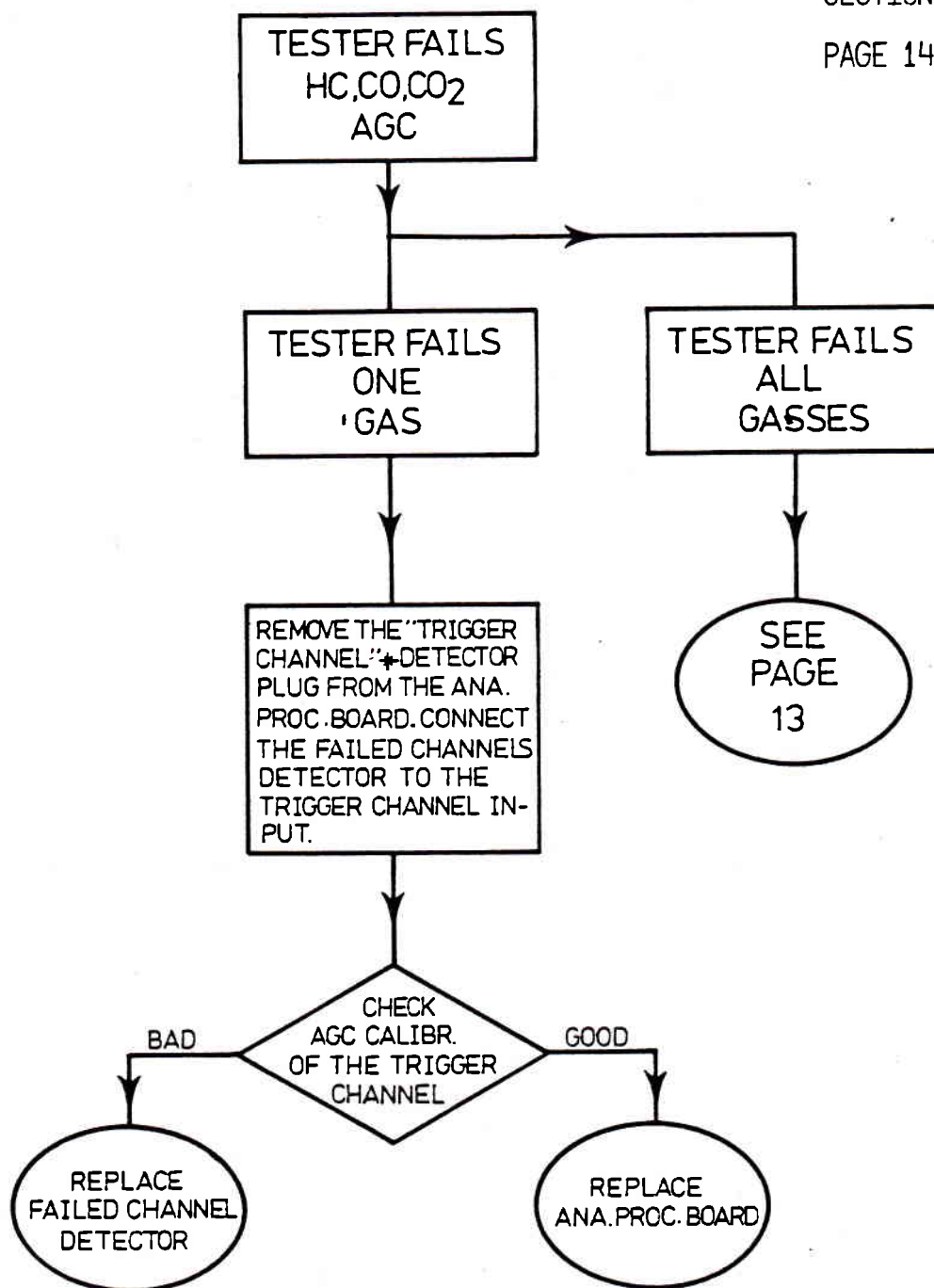




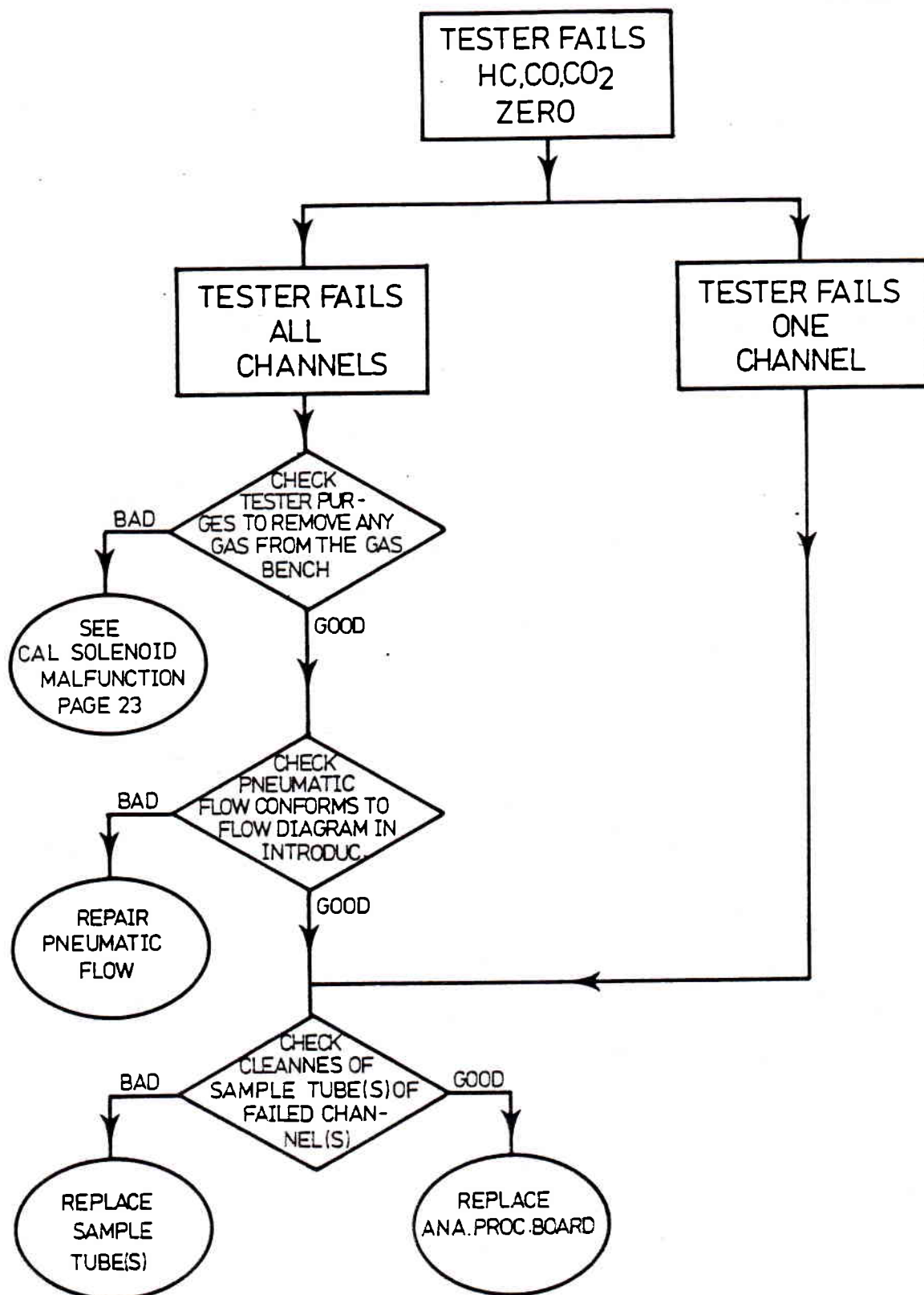


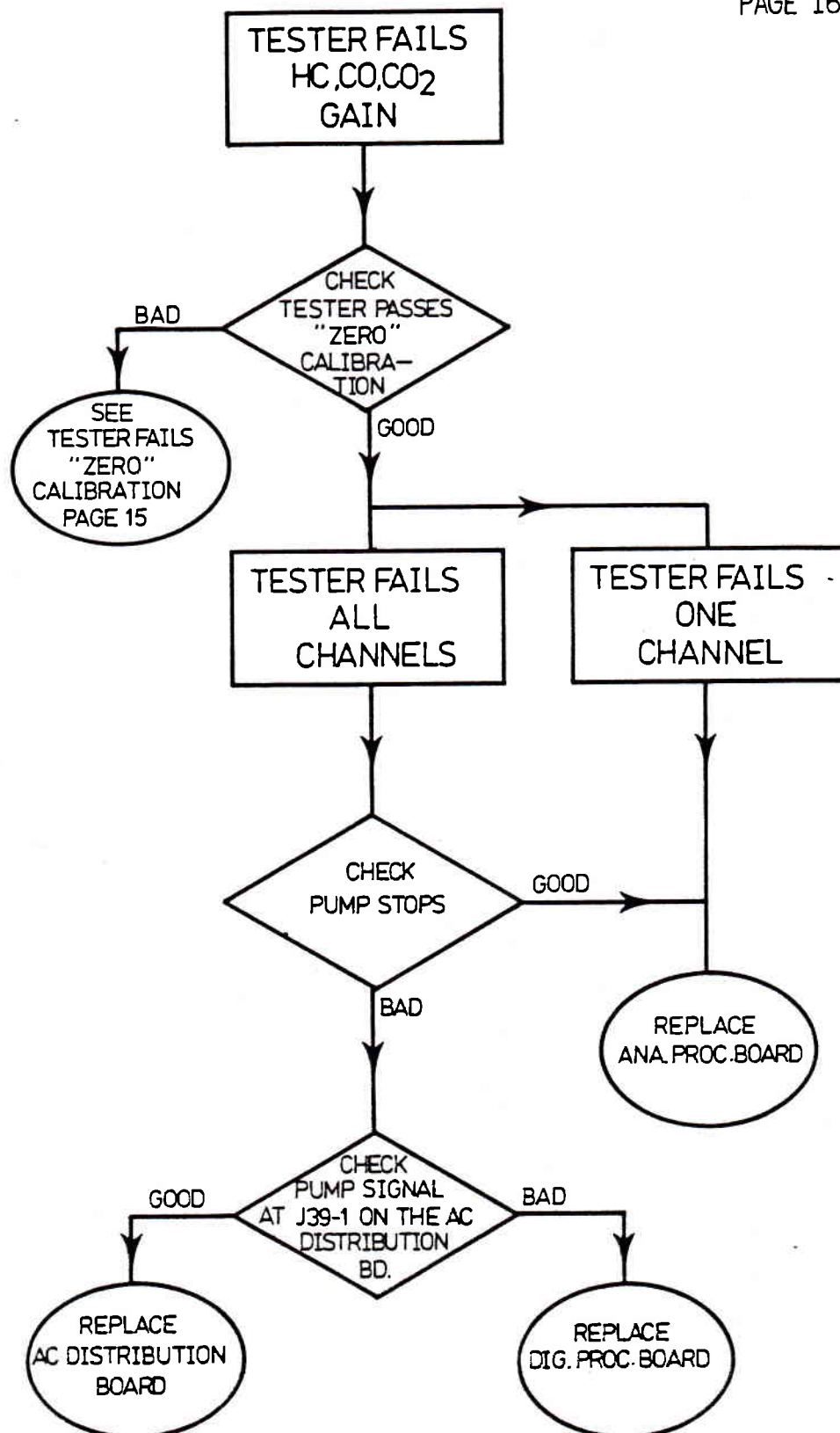
* NOTE	
BENCH TYPE	TRIGGER CH.
HC, CO, CO ₂	HC(P17)
HC, CO	HC(P17)
CO, CO ₂	CO(P18)

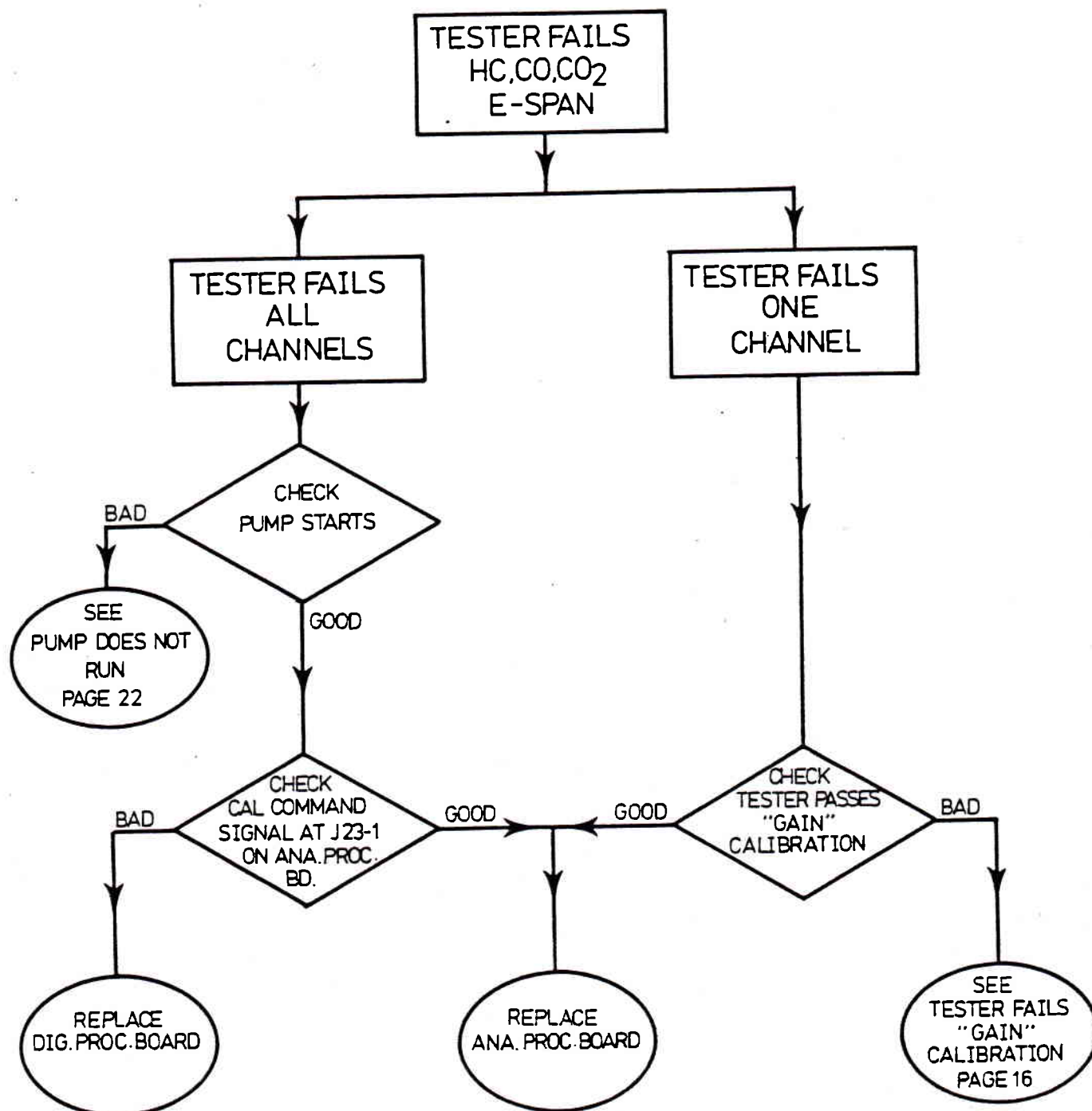


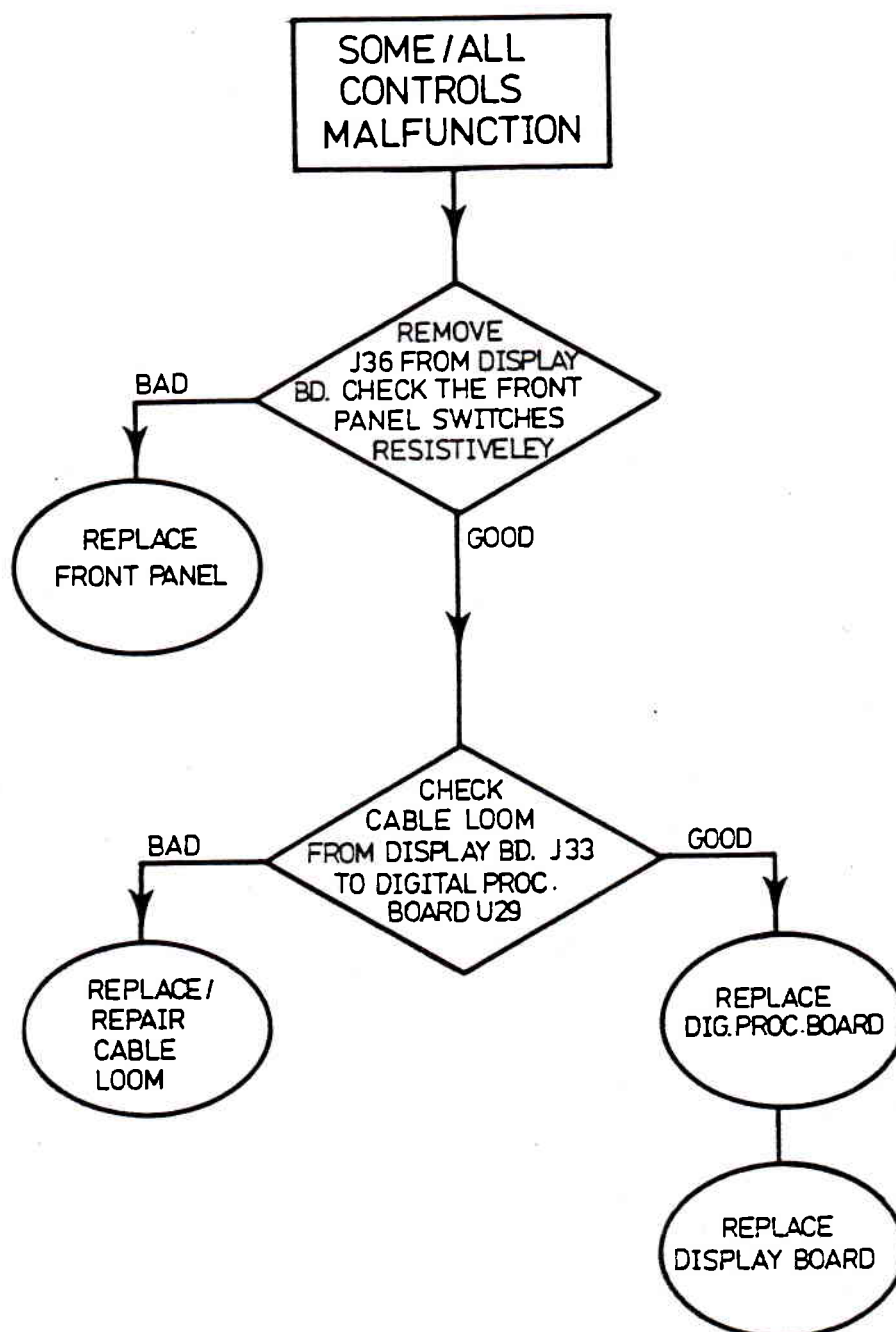


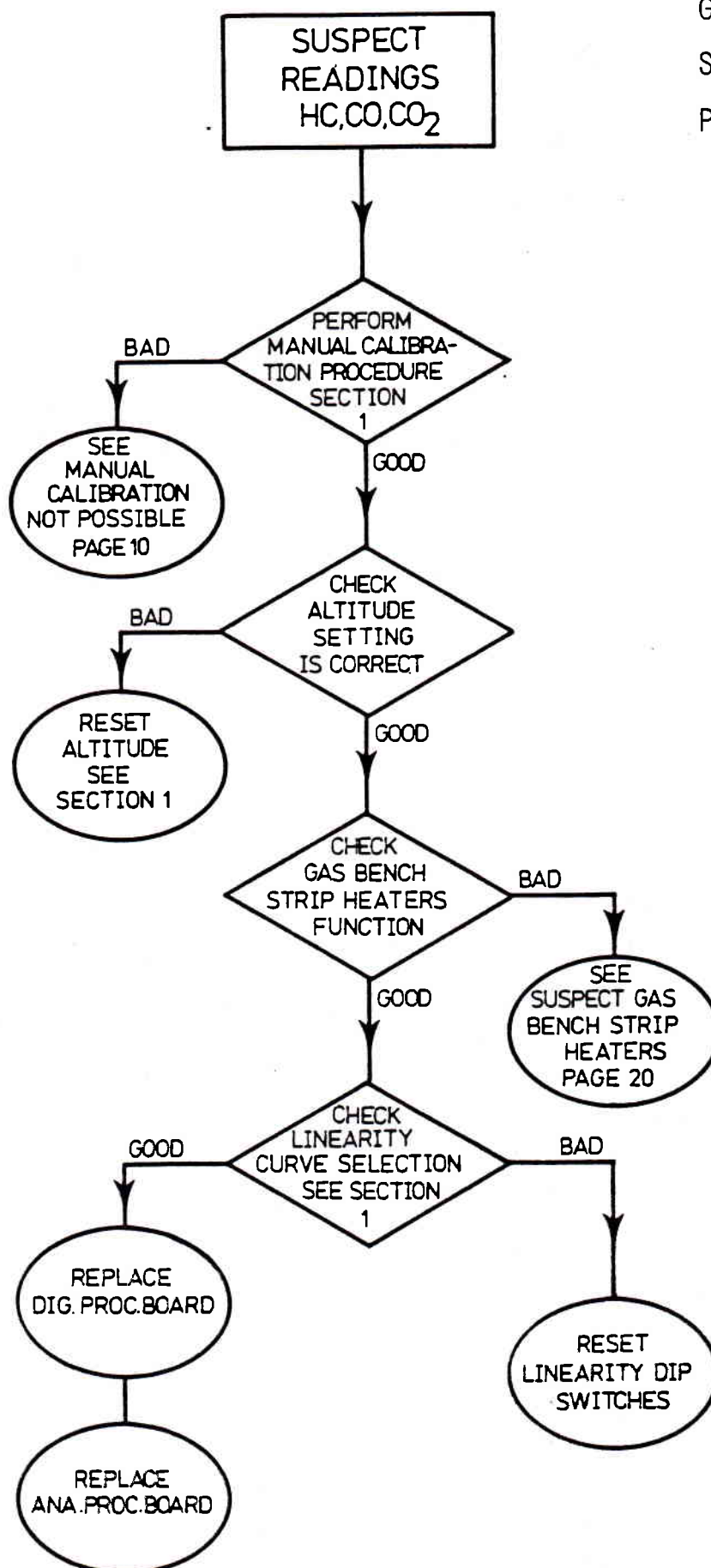
* NOTE	
BENCH TYPE	TRIGGER CH.
HC,CO,CO2	HC(P17)
HC,CO	HC(P17)
CO,CO2	CO(P18)

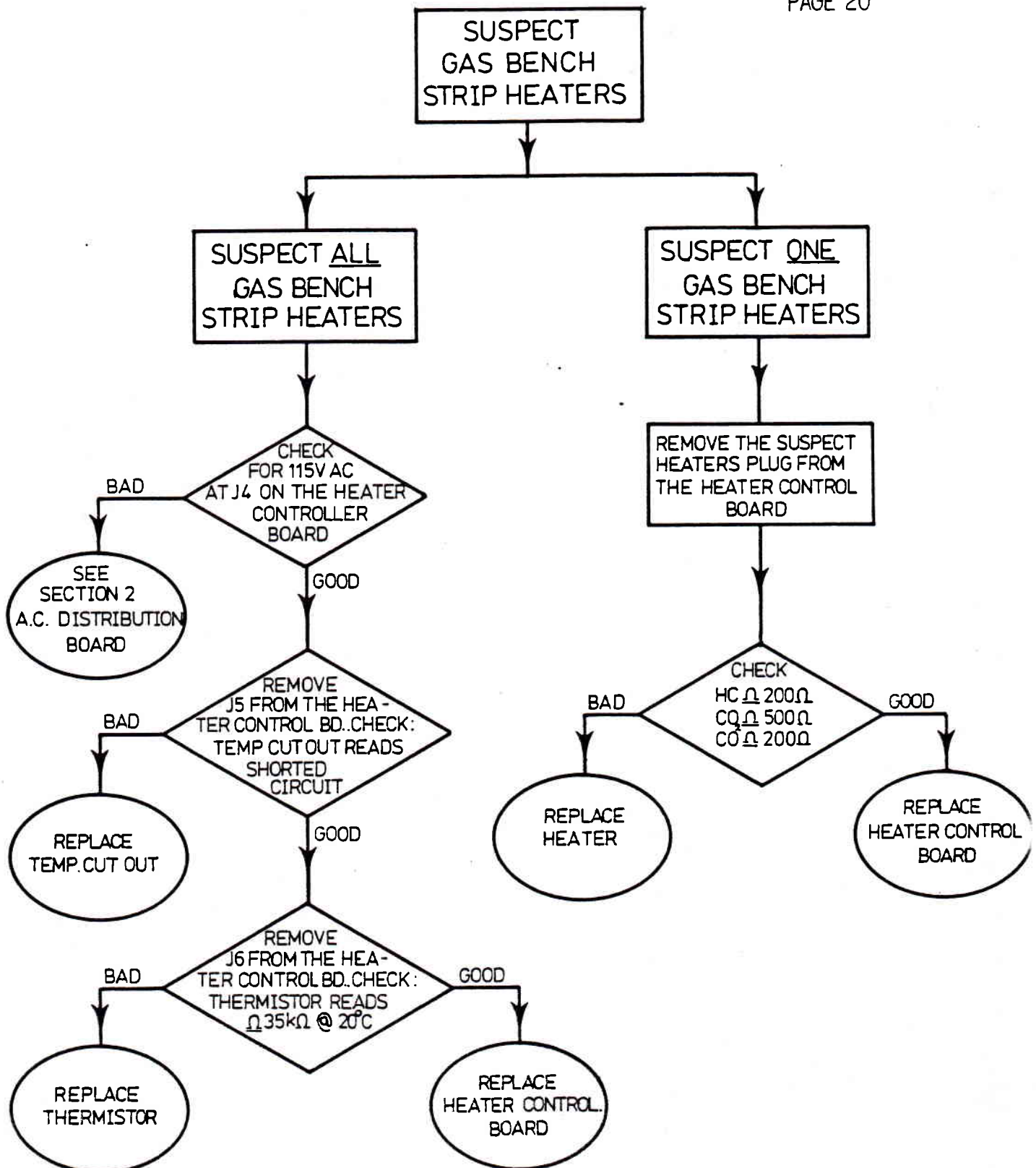


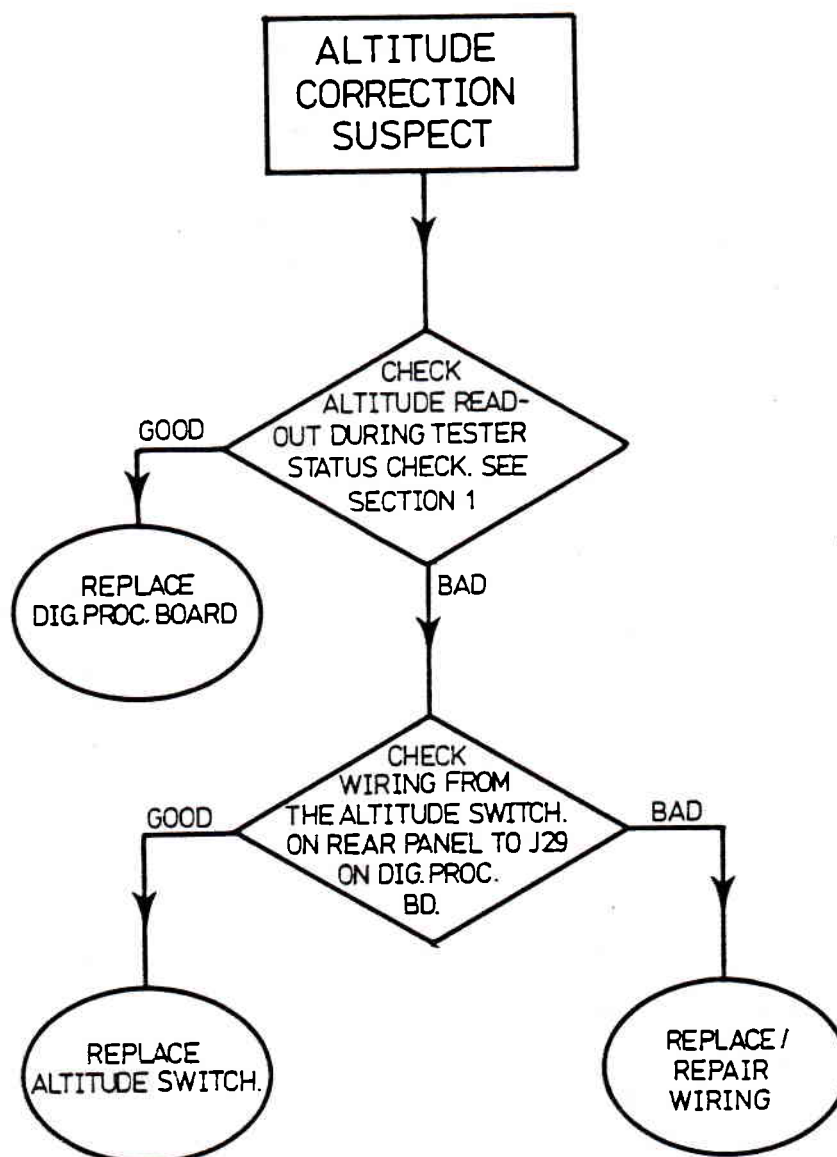


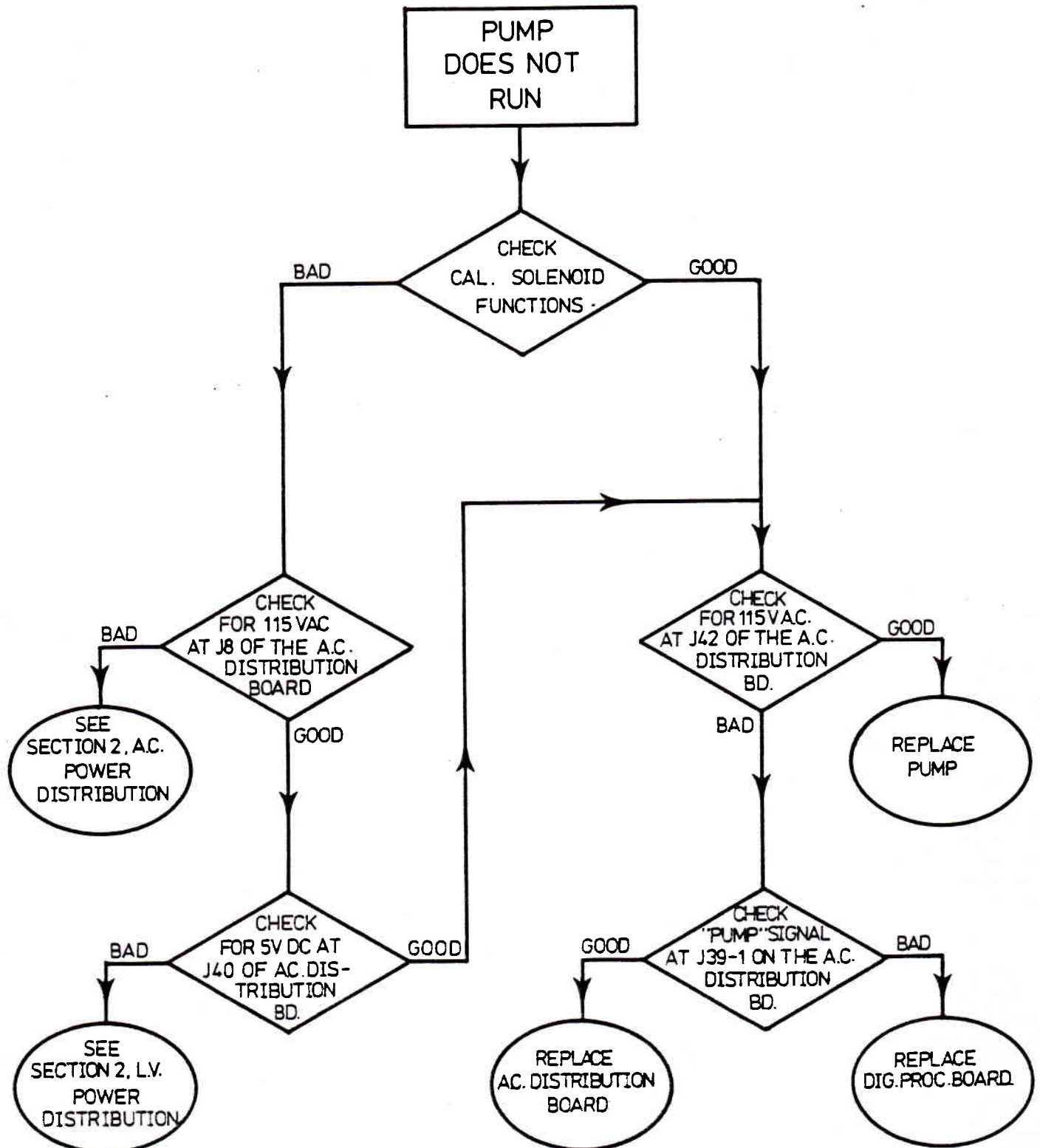


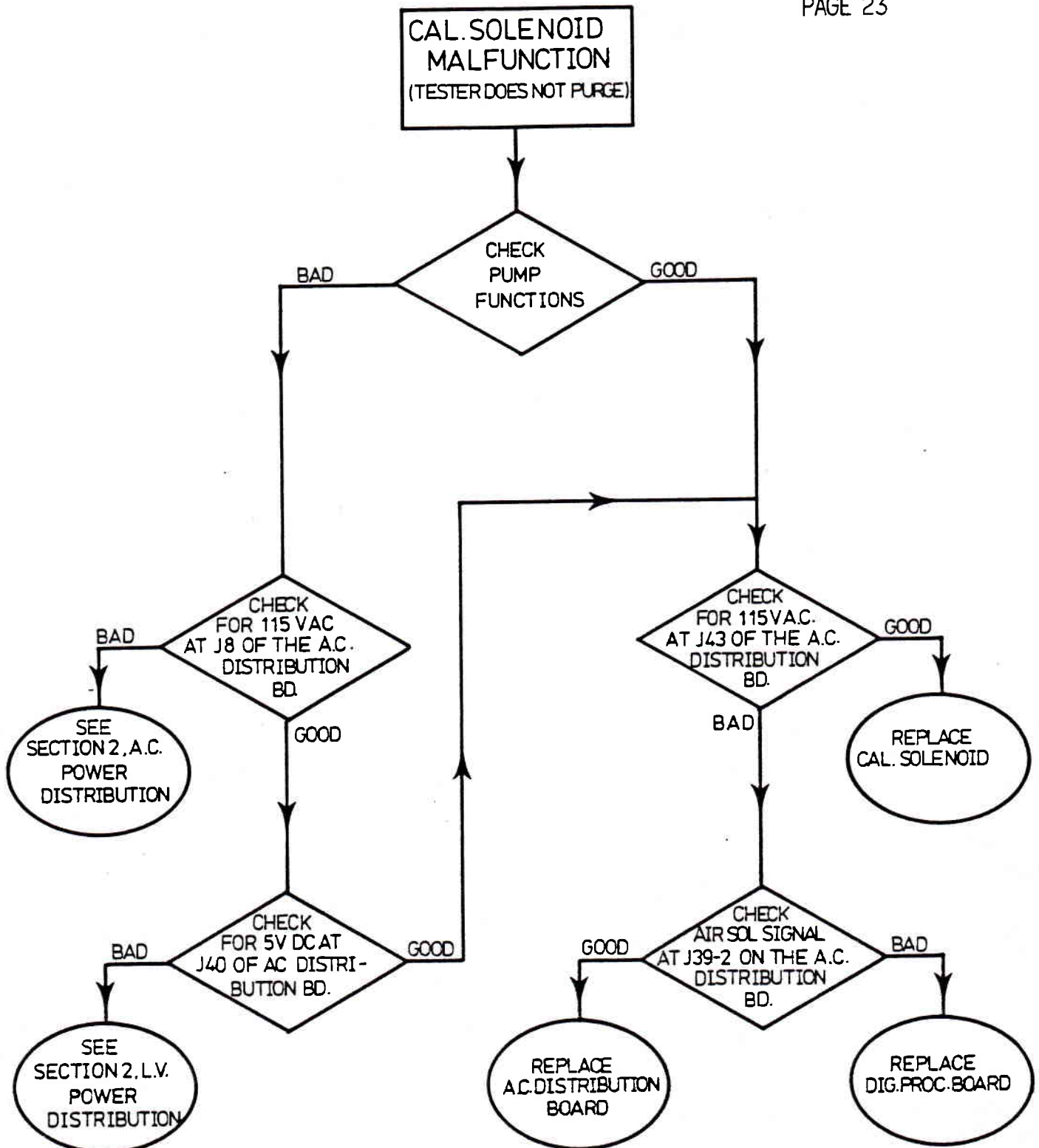


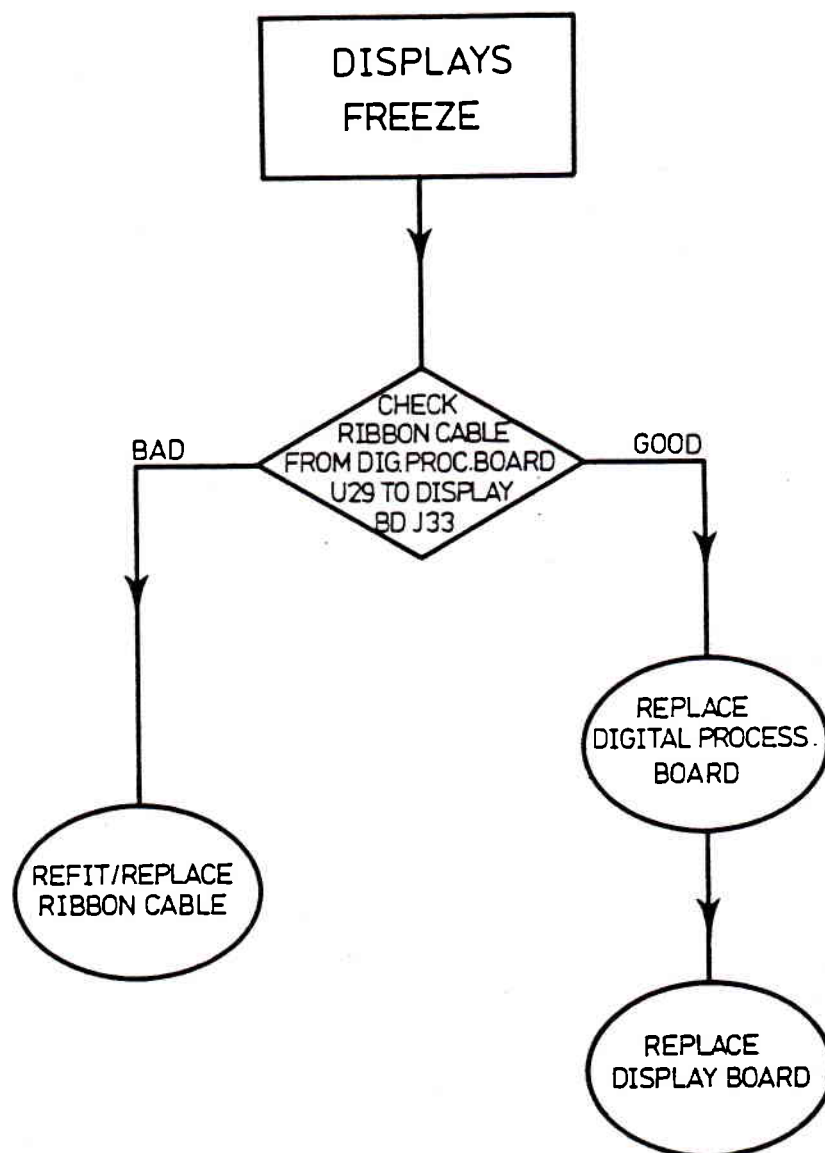


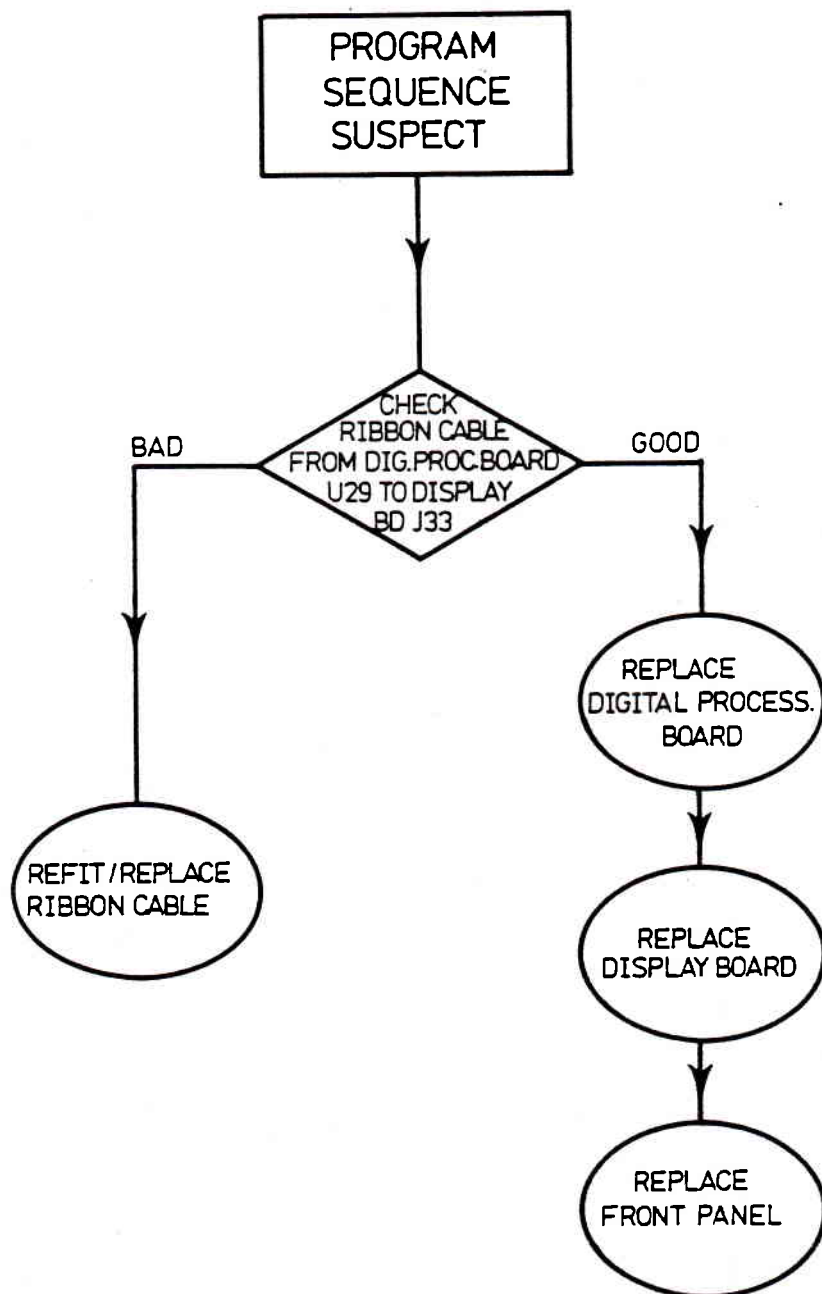


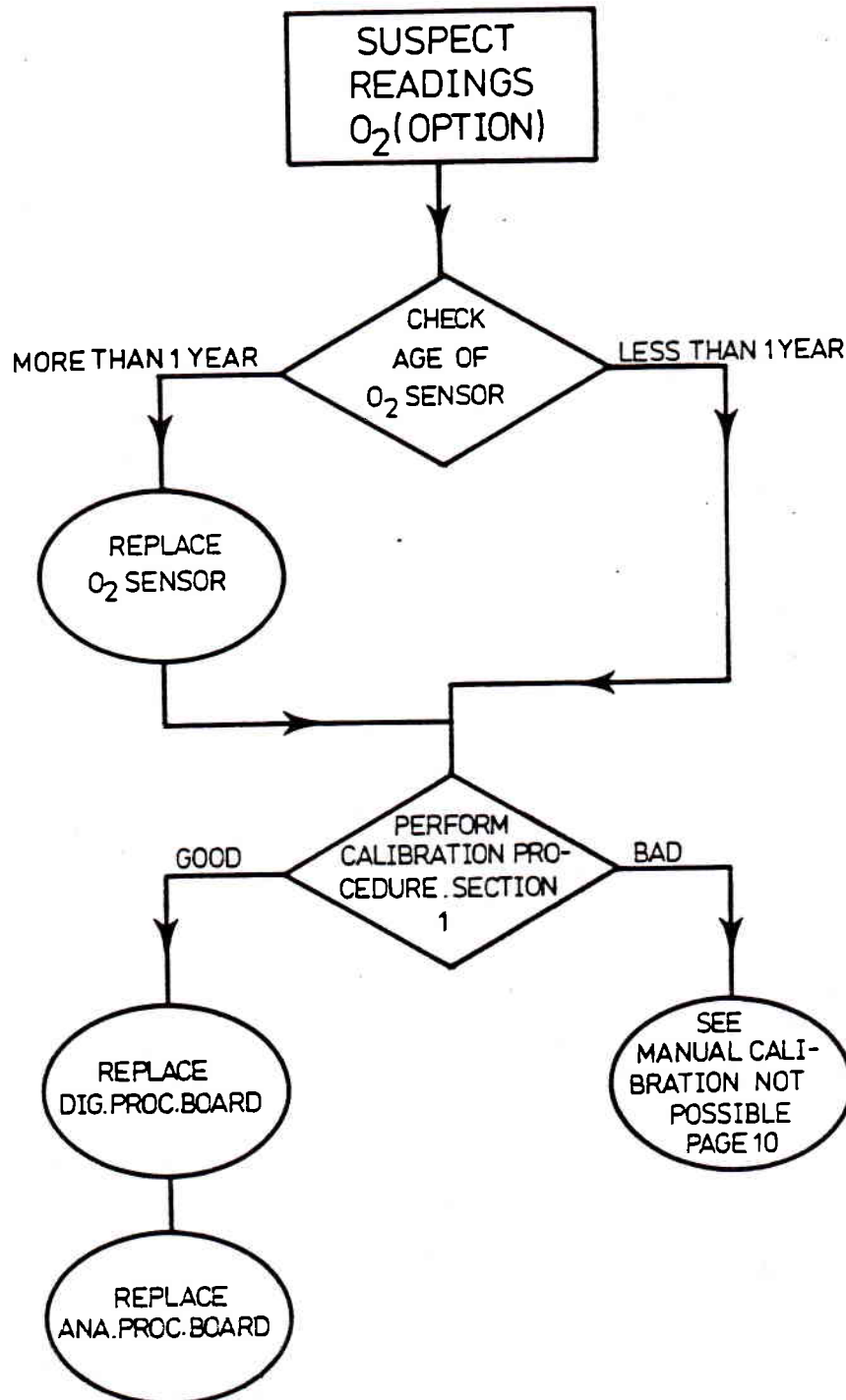


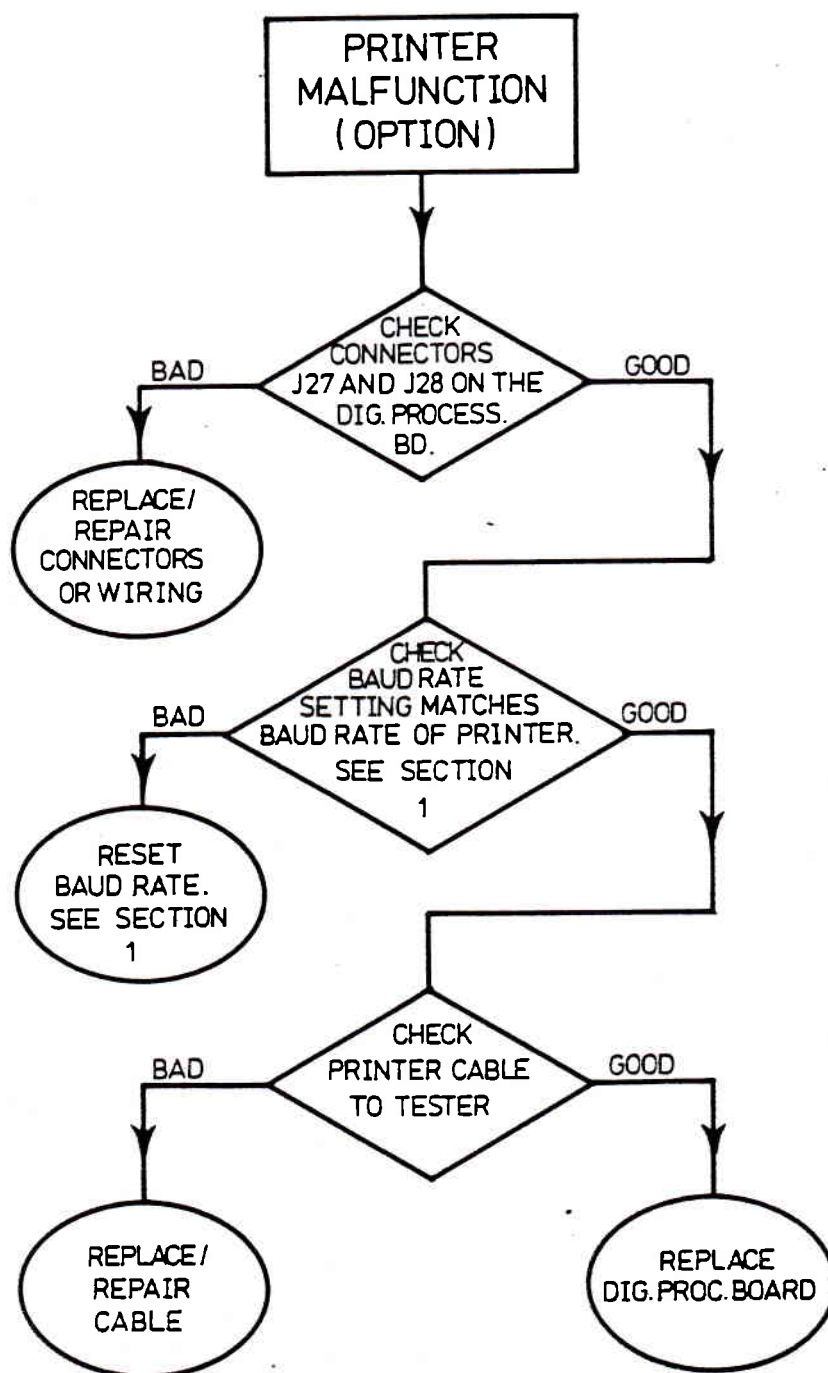


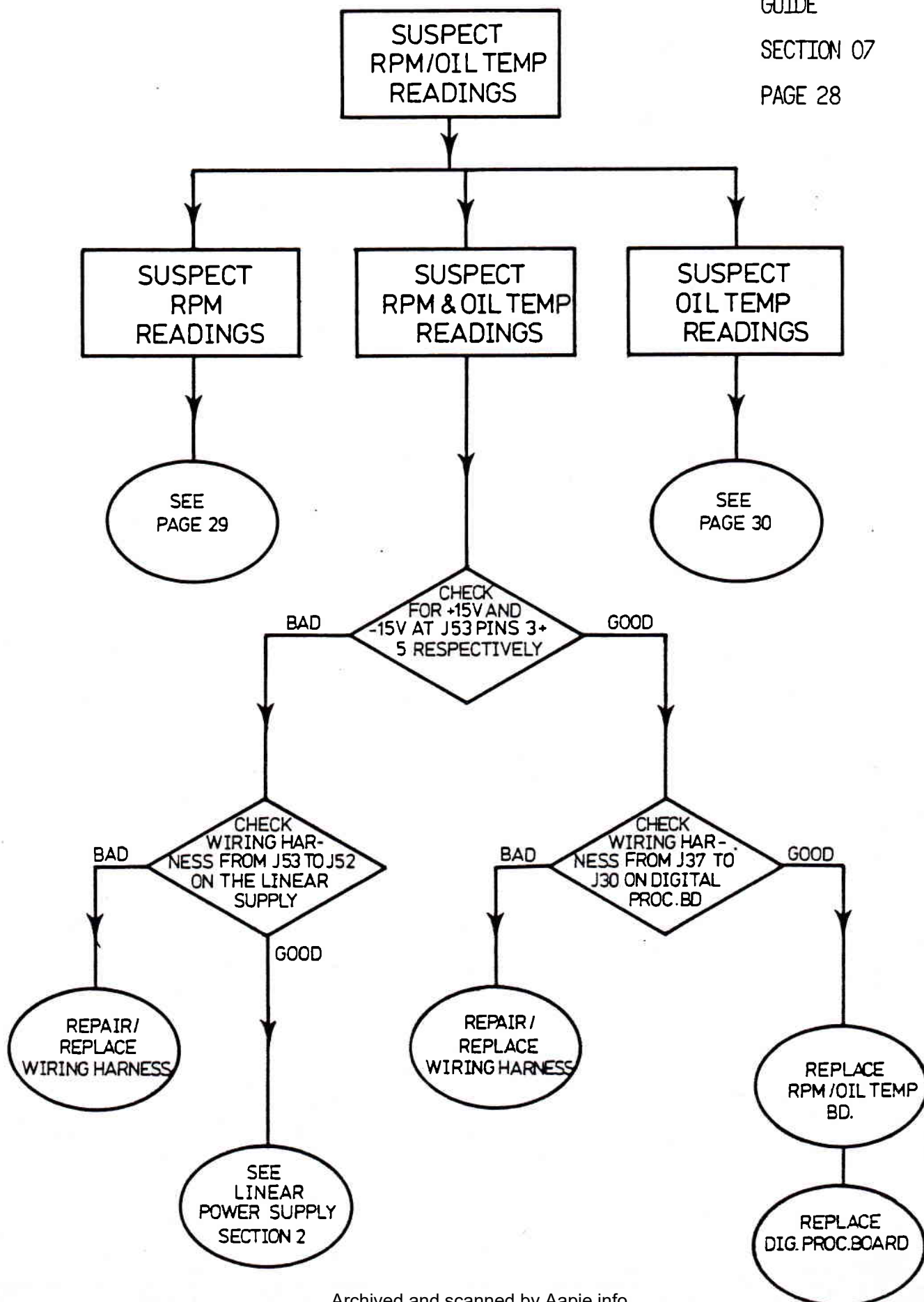


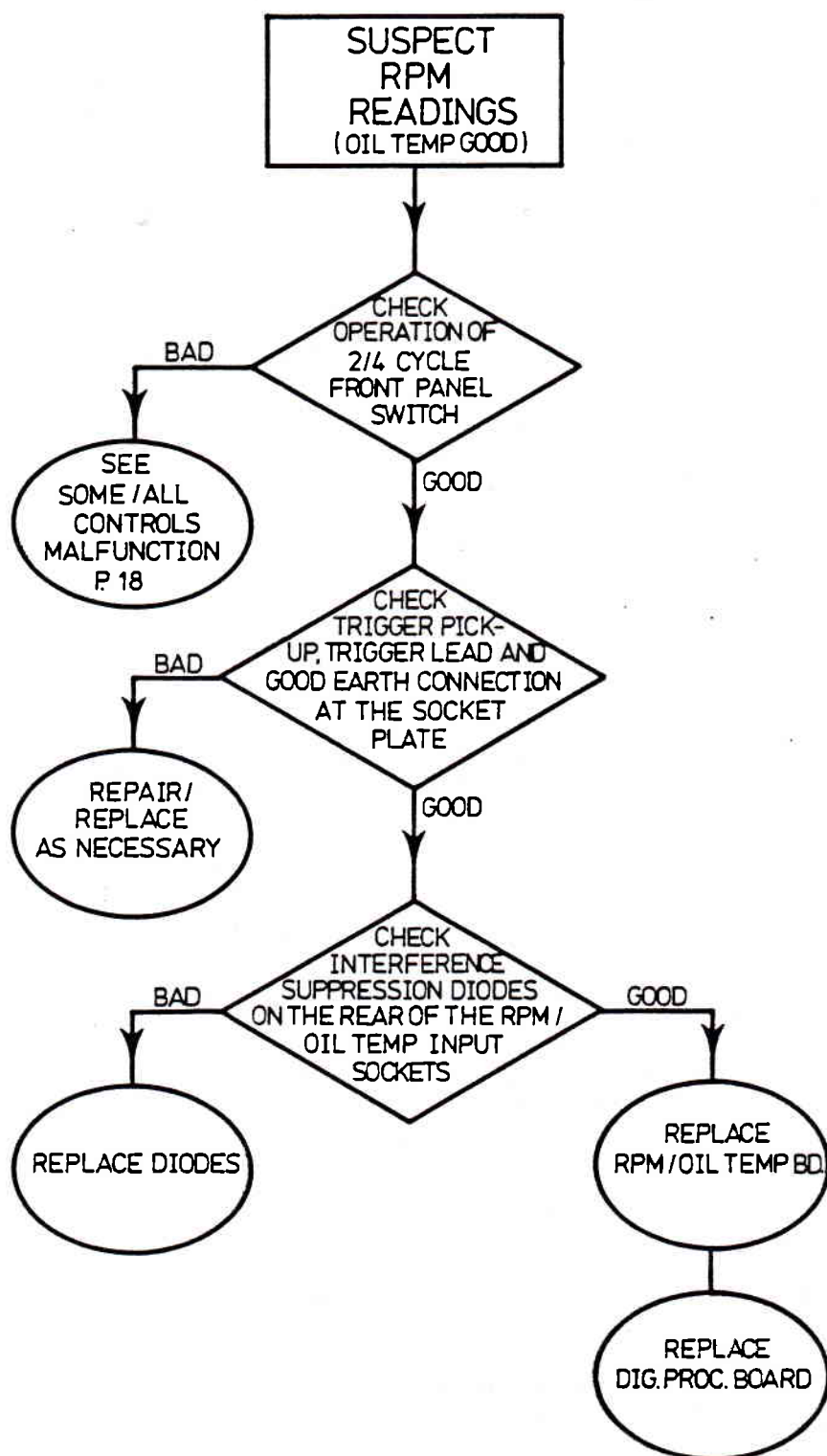


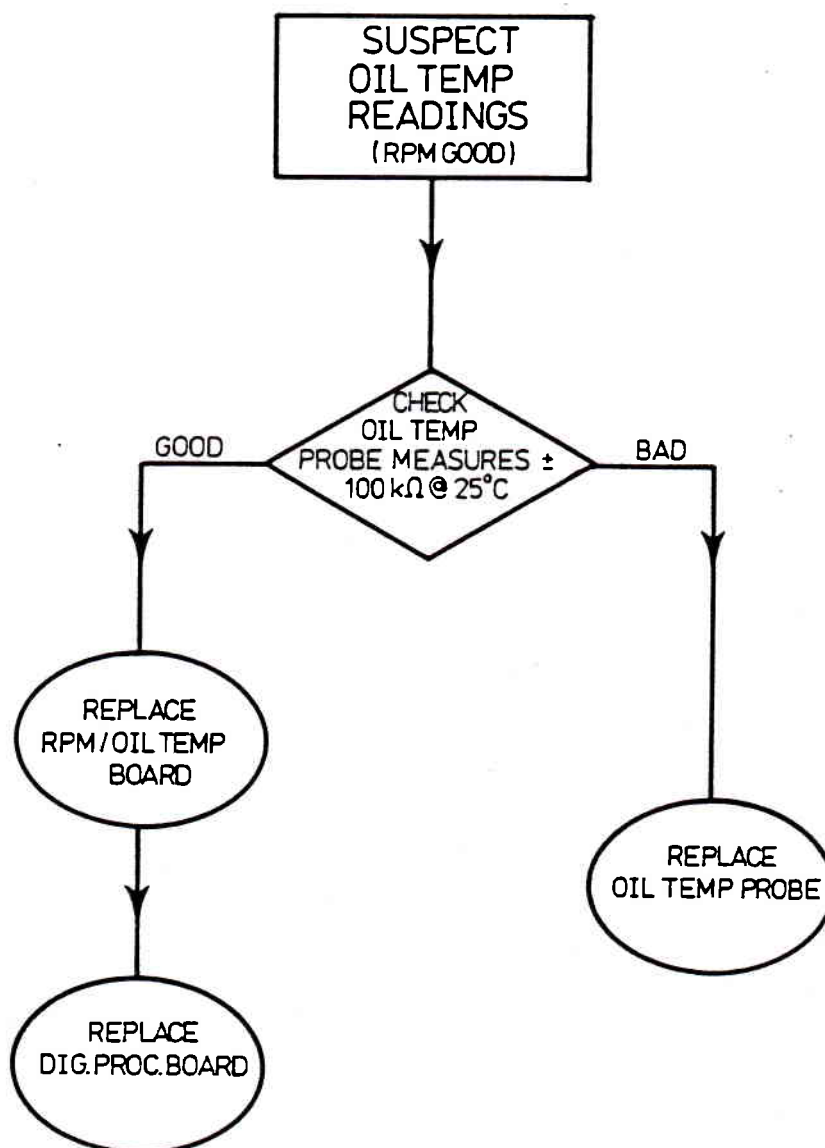














SUN ELECTRIC EUROPE B.V.

SECTION 8

PARTS & ACCESSORIES

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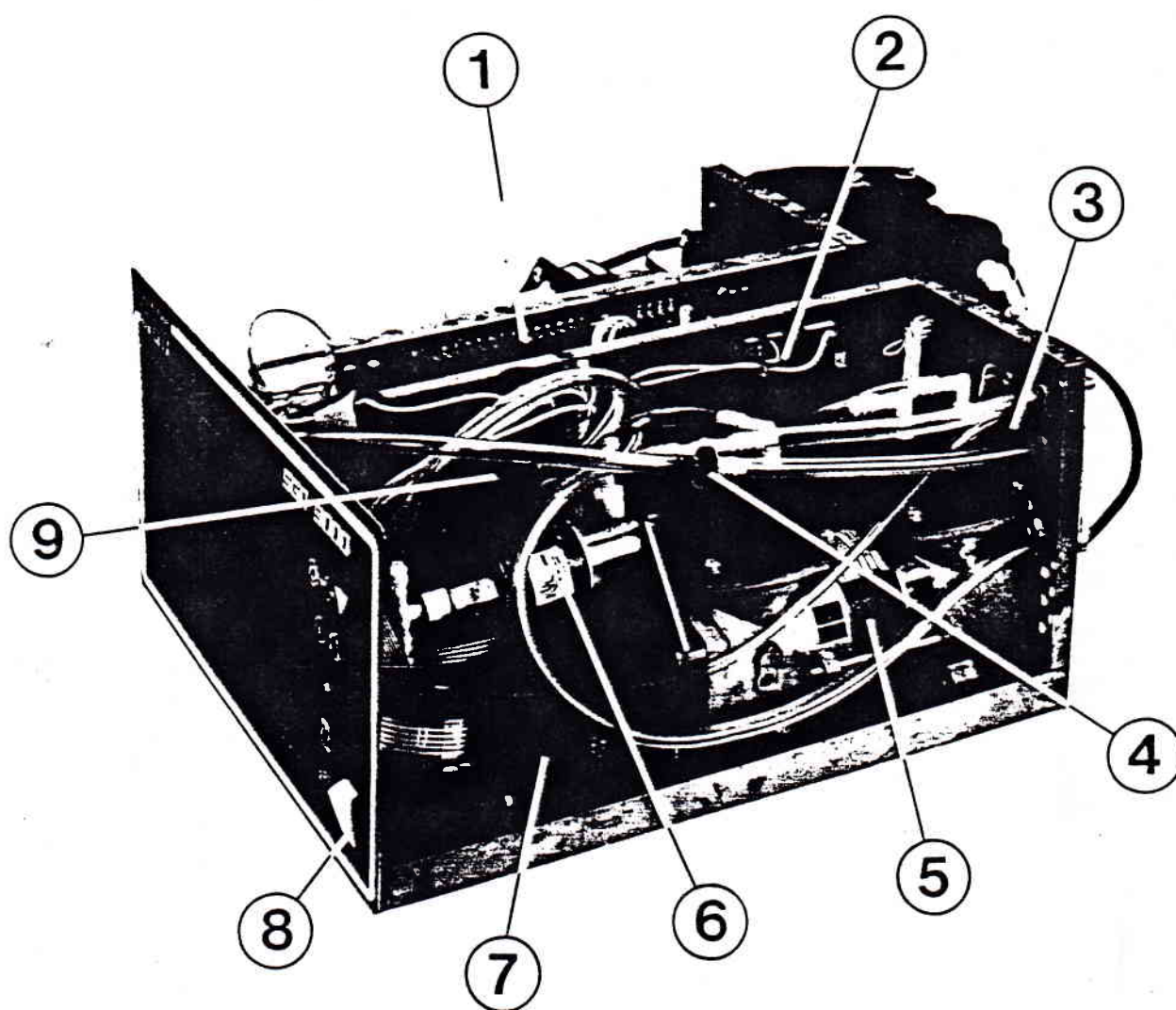
PARTS &

ACCESSORIES

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SGA-9000 INSIDE VIEW (RIGHT)



ITEM

1
2
3
4
5
6
7
8
9

DESCRIPTION

ANALOG PROCESSING BOARD (3 GAS)
A.C. DISTRIBUTION BOARD
PRESSURE SWITCH
NON-RETURN VALVE
PUMP ASSY
SOLENOID SUB-ASSY
SWITCHING POWER SUPPLY
MAINS SWITCH (220 V)
LINEAR POWER SUPPLY

PART NUMBER

SGA 9200-429
SGA 9200-433
SGA 5115-003
SGA 2821-197
SGA 9200-480
SGA 9200-481
SGA 9200-455
SGA 5103-022
SGA 9200-432

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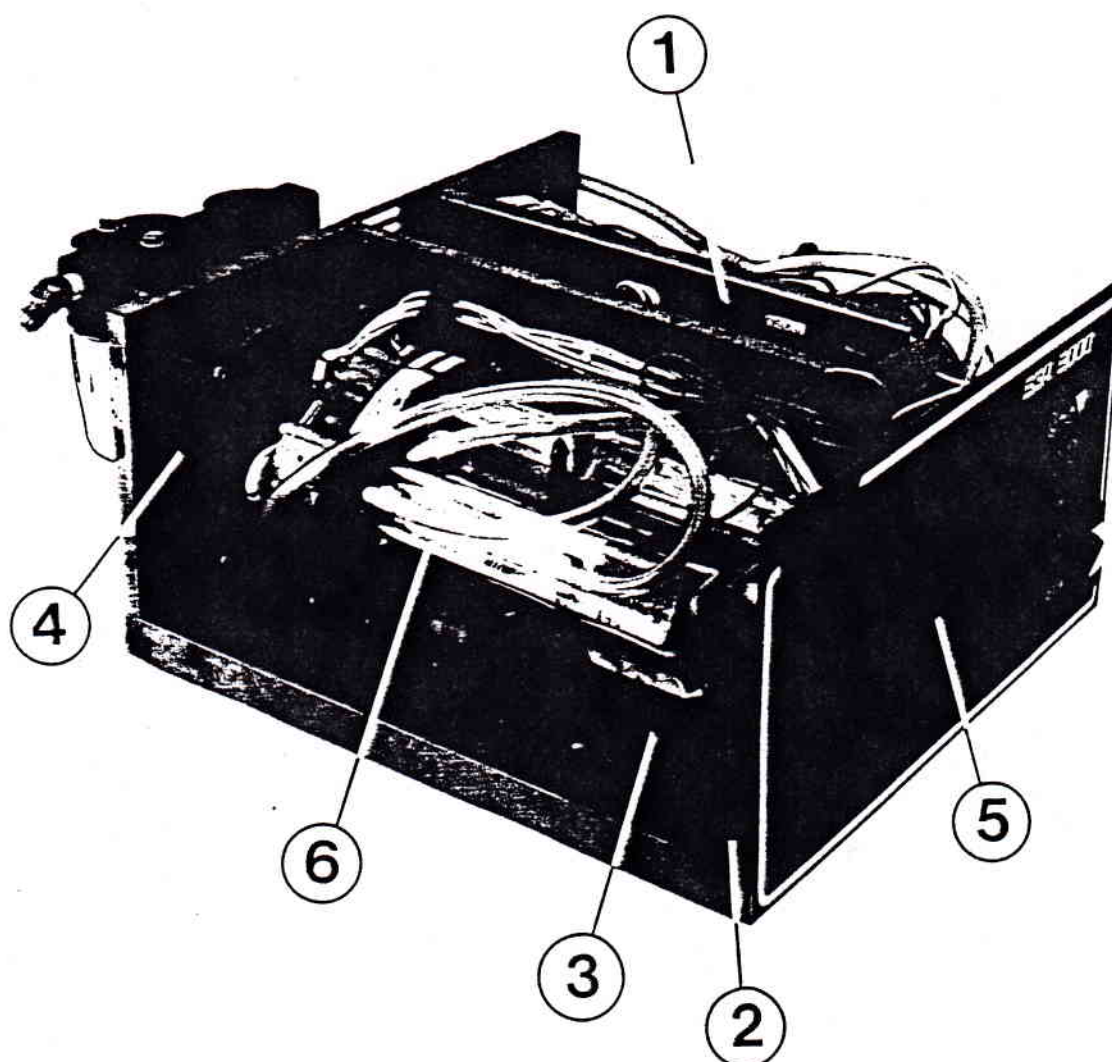
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PAGE 02

SGA-9000 INSIDE VIEW (LEFT)



<u>ITEM</u>	<u>DESCRIPTION</u>	<u>PART NUMBER</u>
1	DIGITAL-PROCESSOR BOARD	SGA 9200-604
2	DISPLAY BOARD	SGA 9200-430
3	MAINS TRANSFORMER (EUROPE)	SGA 9200-450
4	ETRI FAN (COOLING)	SGA 2602-012
5	FRONT PANEL (WITHOUT P.C.B.)	SGA 1702-026
6	GAS BENCH (3 GAS)	SGA 9200-441

SGA-9000

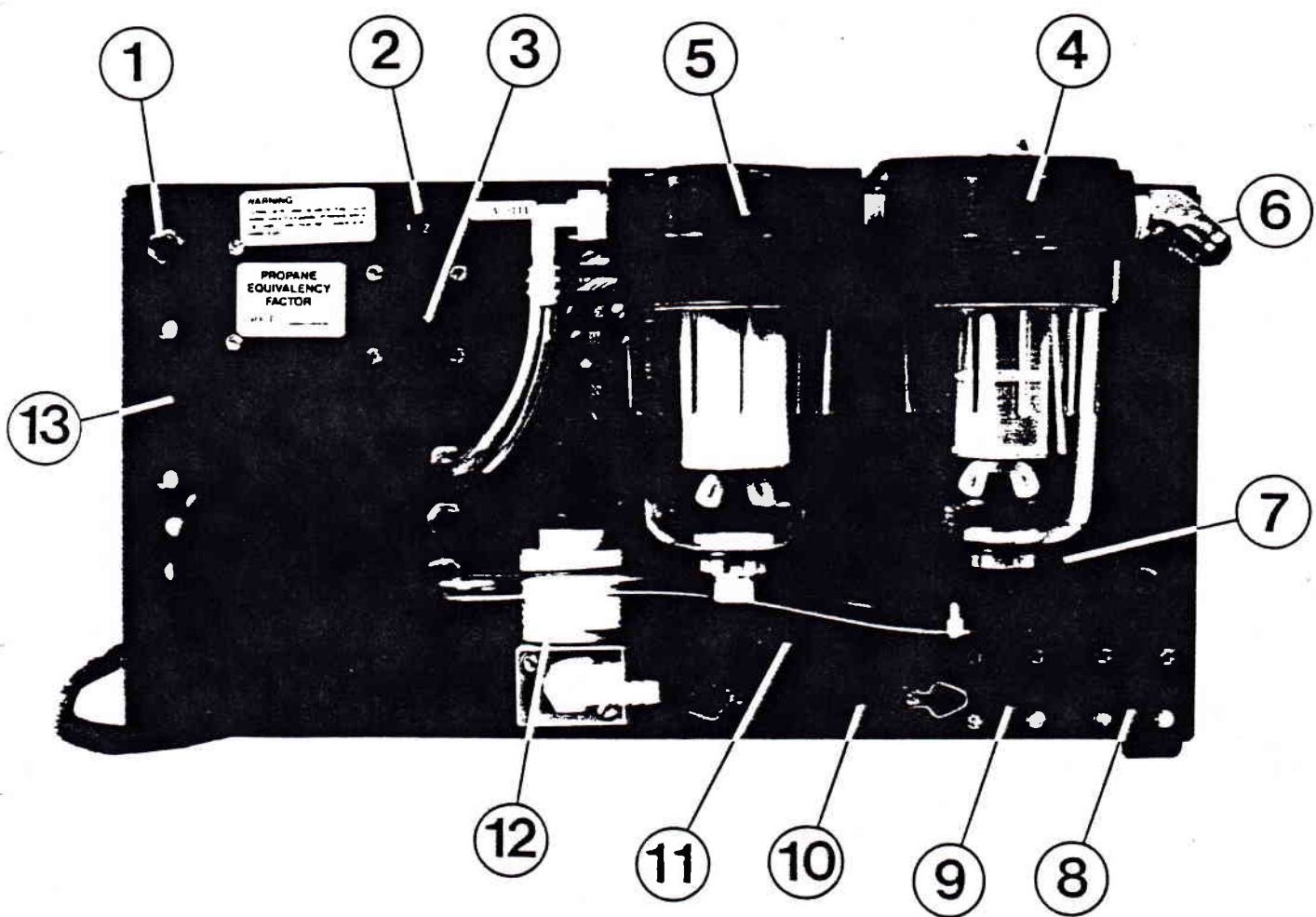
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SGA-9000 BACK VIEW



ITEM

DESCRIPTION

PART NUMBER

1	CAL INLET	--
2	ALTITUDE THUMBWHEEL	SGA 5103- 020
3	CONNECTOR, REMOTE CONTROL	--
4	FILTER ASSY, PRIMARY	SUN 0301-0115
5	FILTER ASSY, SECONDARY	SUN 0301-0116
6	EXHAUST GAS INLET	--
7	ASPIRATOR ASSY	SUN 7054-0075
8	OIL TEMP SOCKET	} OPTION KIT NO. 7009E9311-22
9	RPM SOCKET	
10	SERIAL PRINTER PORT	} OPTION KIT NO. 9100-061
11	PARALLEL PRINTER PORT	
12	DETECTOR CELL, 02	SUN 7049-004
13	FLOW-METER (NOT SHOWN)	SGA 9200- 576

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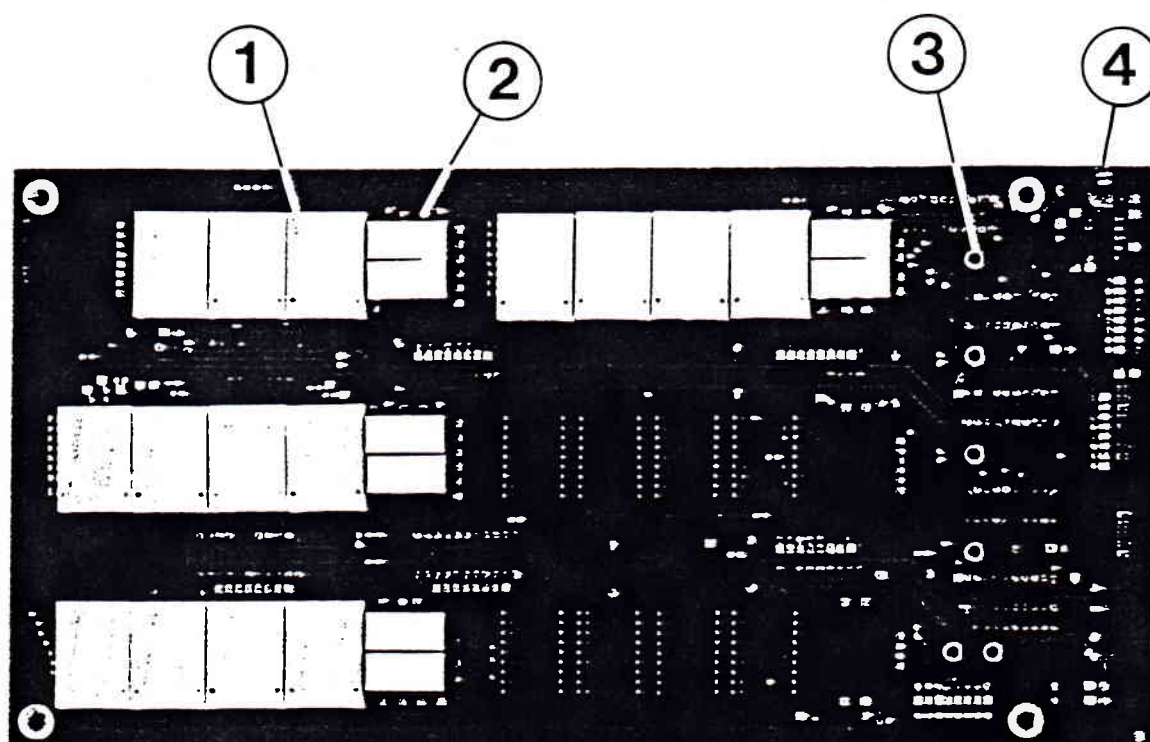
PARTS &

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PAGE 04

FRONT PANEL (DISPLAY) BOARD



<u>ITEM</u>	<u>DESCRIPTION</u>	<u>PART NUMBER</u>
1	7 SEGMENT DISPLAY	SGA 4812-013
2	LIGHT BAR	SGA 4812-010
3	CONTROL PANEL LED	SGA 4812-012
4	"SERVICE" DIP SWITCH	SGA 5103-024

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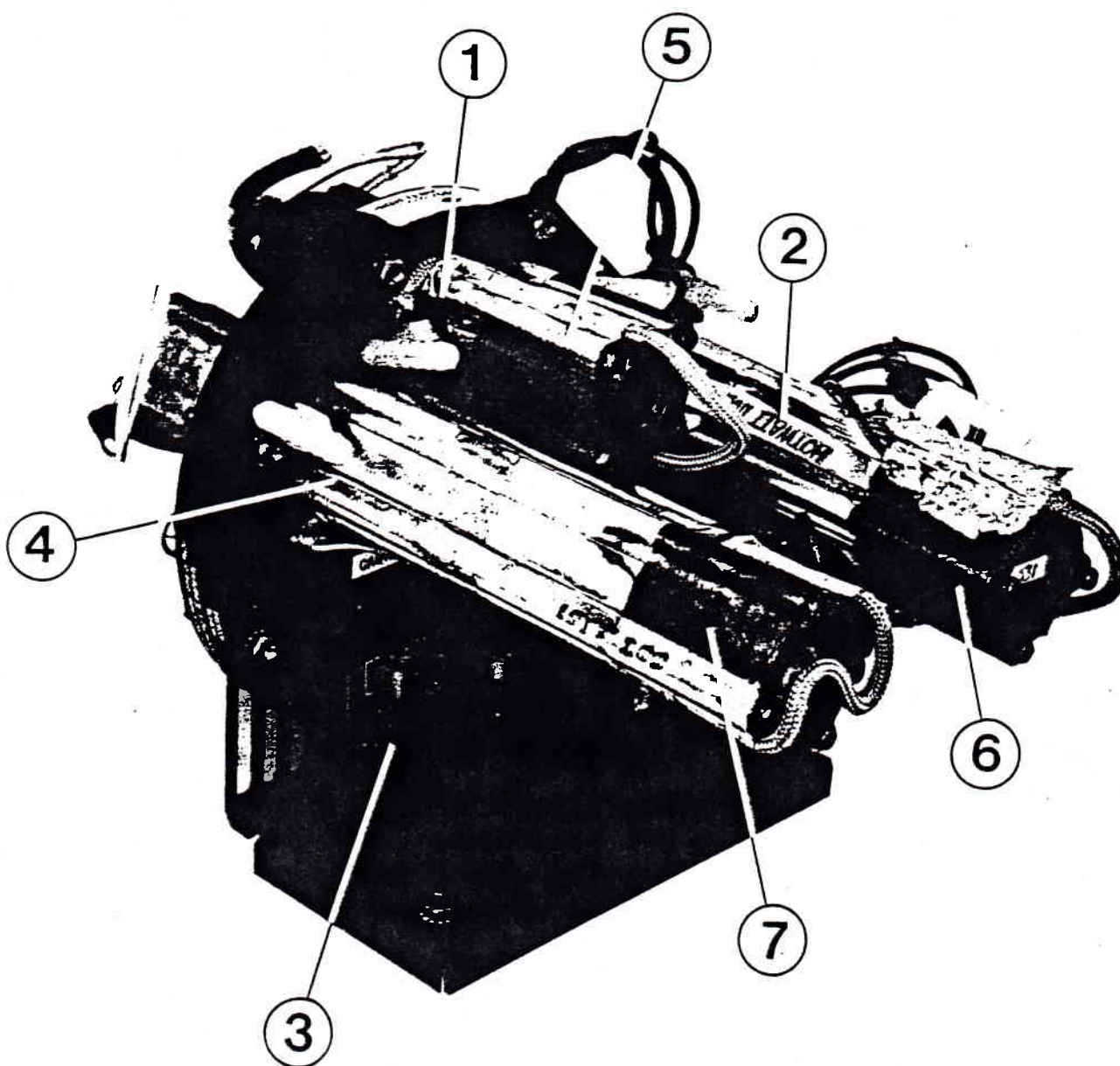
PARTS &

ACCESSORIES

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PAGE 05

I.R. GAS BENCH (DETECTOR SIDE)



ITEM

DESCRIPTION

PART NUMBER

SAMPLE TUBE ASSY (CO₂)
 SAMPLE TUBE ASSY (HC)
 HEATER CONTROLLER BD
 SAMPLE TUBE ASSY (CO)
 DETECTOR ASSY (CO₂)
 DETECTOR ASSY (HC)
 DETECTOR ASSY (CO)

SGA 9200-183
 SGA 9200-542
 SGA 9200-572
 SGA 9200-543
 SGA 9200-457
 SGA 9200-159
 SGA 9200-449

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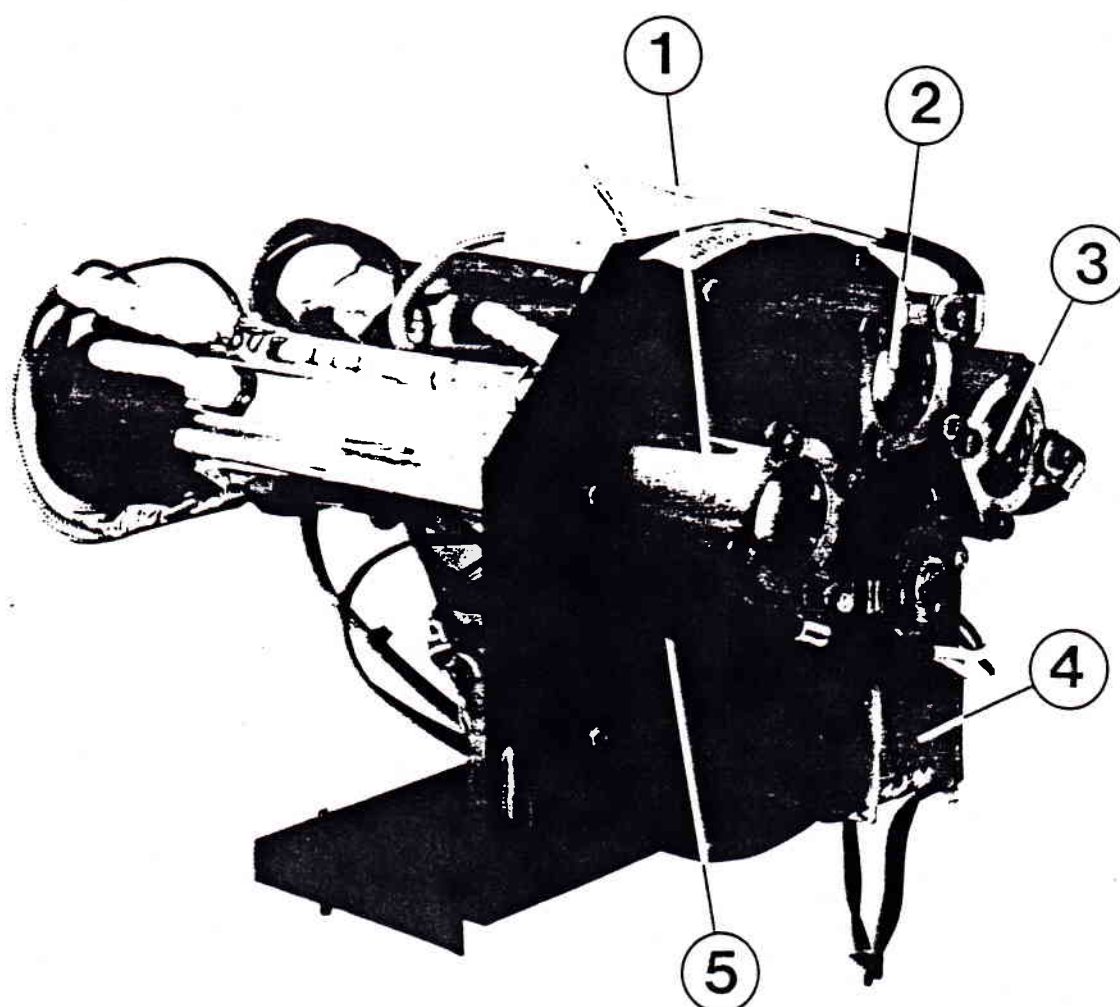
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I.R. GAS BENCH (SOURCE SIDE)



<u>ITEM</u>	<u>DESCRIPTION</u>	<u>PART NUMBER</u>
1	SOURCE ASSY (HC)	SGA 9200-310B
2	SOURCE ASSY (CO ₂)	SGA 9200-318B
3	SOURCE ASSY (CO)	SGA 9200-310B
4	CHOPPER WHEEL MOTOR ASSY	SGA 9200-188
5	CHOPPER WHEEL & HUB ASSY	SGA 9200-020

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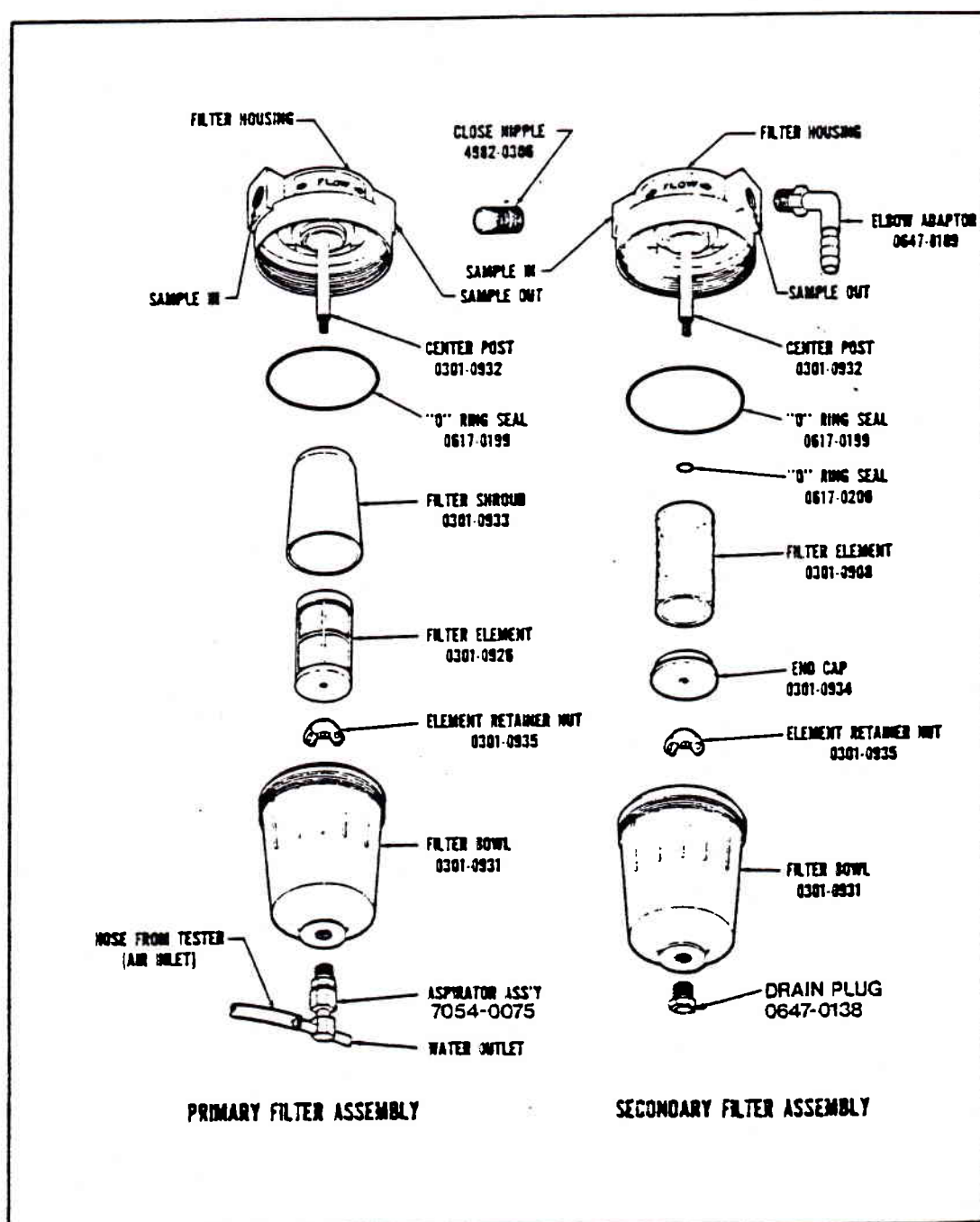
PARTS &

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SAMPLE FILTER ASSEMBLIES



SGA-9000

PARTS &

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RECOMMENDED SPARE PARTS FOR THE SGA-9000

QTY REQ./10 UNITS	DESCRIPTION	PART NUMBER
	<u>METALWORK</u>	
--	CHASSIS WELD ASSY	SGA 2509-243
--	COVER	SGA 2509-242
--	COVER, TOP WINDOW	SGA 2511-018
1	FRONT PANEL ASSY	SGA 1702-026
	<u>GAS BENCH</u>	
1	BENCH ASSY, CO-HC-CO ₂	SGA 9200-441
1	BENCH ASSY, CO-HC	SGA 9200-490
1	BENCH ASSY, CO-CO ₂	SGA 9200-489
1	CHOPPER WHEEL & HUB ASSY	SGA 9200-020
1	CHOPPER MOTOR ASSY	SGA 9200-188
2	SOURCE & HARNESS ASSY, CO-HC	SGA 9200-310B
2	SOURCE & HARNESS ASSY, CO ₂	SGA 9200-318B
1	10 CM GAS CEL ASSY, CO	SGA 9200-543
1	10 CM GAS CEL ASSY, HC	SGA 9200-542
1	1 1/4 CM GAS CEL ASSY, CO ₂	SGA 9200-183
2	DETECTOR CELL & HARNESS ASSY, CO	SGA 9200-449
2	DETECTOR CELL & HARNESS ASSY, HC	SGA 9200-159
2	DETECTOR CELL & HARNESS ASSY, CO ₂	SGA 9200-457
5	O-RING	SGA 7007-020



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QTY REQ./10 UNITS	DESCRIPTION	PART NUMBER
2	O-RING	SGA 7007-008
2	HEATER UNIT ASSY, 60 W	SGA 9200-267
2	HEATER UNIT ASSY, 26 W	SGA 9200-268
2	HEATER-THERMISTOR UNIT ASSY	SGA 9200-269
2	THERMISTOR 30 KOHMS	SGA 5302-005
2	THERMAL CUT-OUT ASSY	SGA 9200-281
1 ROLL	TAPE, ALUMINIUM FOIL, 3 M	SGA 1605-002
4	SHOCK BUMPER, BENCH MTG	SGA 2801-057
<u>MISCELLANEOUS ELECTRICAL</u>		
2	LINE FILTER ASSY	SGA 9200-466
2	POWER SWITCH	SGA 5103-022
1	LIGHT BAR	SGA 4812-010
5	7 SEGMENT DISPLAY	SGA 4812-013
1	TRANSFORMER ASSY, EUROPE	SGA 9200-450
1	PUMP ASSY, THOMAS	SGA 9200-480
1	RELAY (FOR SOLENOID)	SGA 4504-008
3	DETECTOR CELL O ₂	SUN 7049-004
1	ETRI FAN	SGA 2602-012
2	PRESSURE SWITCH	SGA 5115-003
1	BCD THUMBWHEEL (ALTITUDE)	SGA 5103-020
1	POWER CABLE, EUROPE	SGA 9200-579

SGA-9000

PARTS &

ACCESSORIES

SECTION 08

PAGE 10

QTY REQ./10 UNITS	DESCRIPTION	PART NUMBER
	<u>PRINTED CIRCUIT BOARDS</u>	
1	FRONT PANEL (DISPLAY) BOARD	SGA 9200-430
1	A.C. DISTRIBUTION BOARD	SGA 9200-433
1	HEATER CONTROLLER BD	SGA 9200-572
1	LINEAR POWER SUPPLY ASSY	SGA 9200-432
1	SWITCHING POWER SUPPLY ASSY	SGA 9200-455
1	DIGITAL-PROCESSOR BOARD ASSY	SGA 9200-604
1	ANALOG PROCESSING BD ASSY CO-HC	SGA 9200-498
1	ANALOG PROCESSING BD ASSY CO-CO ₂	SGA 9200-497
1	ANALOG PROCESSING BD ASSY CO-HC-CO ₂	SGA 9200-429
1	SNAP-IN CARD GUIDE, E 750	SGA 2801-064
1	SNAP-IN CARD GUIDE, E 900	SGA 2801-066
1	SNAP-IN CARD GUIDE, E 300	SGA 2801-065
5	STAND-OFF P.C. BOARD MTG	SGA 2801-059
	<u>PNEUMATIC PARTS</u>	
1	SOLENOID SUB ASSY	SGA 9200-481
2	CHECK VALVE	SGA 2821-197
1	FLOW METER ASSY	SGA 9200-576
2	AIR FILTER	SGA 1605-003
1	FILTER ASSY, PRIMARY	SUN 0301-0115
1	FILTER ASSY, SECONDARY	SUN 0301-0116



SUN ELECTRIC EUROPE B.V.

SGA-9000

PARTS &

ACCESSORIES

SECTION 08

PAGE 11

QTY REQ./10 UNITS	DESCRIPTION	PART NUMBER
2	FILTER BOWL	SUN 0301-0931
5	FILTER O-RING	SUN 0617-0199
10	FILTER ELEMENT, NYLON	SUN 0301-0926
50	FILTER ELEMENT, PAPER	SUN 0301-0908
3	ASPIRATOR	SUN 7054-0075
1	EXHAUST HOSE <i>Gummi</i>	SUN 3988-0202
1	EXHAUST PROBE <i>Metall</i>	SUN 7009-0511



SUN ELECTRIC EUROPE B.V.

SECTION 9

SOFTWARE REVISIONS

SGA-9000

SOFTWARE

REVISIONS

SECTION 09

PAGE 01

GENERAL

THIS SERVICE/REPAIR MANUAL HAS BEEN WRITTEN AROUND SOFTWARE REVISION LEVEL:

3.5

THIS SECTION WILL CONTAIN ALL THE INFORMATION NECESSARY FOR THE SERVICE ENGINEER TO MAINTAIN ANY TESTER WITH A LATER REVISION LEVEL (3.6 ➔).

TO CHECK THE SOFTWARE REVISION LEVEL ENTER THE TESTER STATUS CHECK BY PRESSING THE * BUTTON DURING THE WARM UP PERIOD. THE REVISION LEVEL WILL BE DISPLAYED IN THE O₂ SLOT. IF THE O₂ OPTION IS NOT FITTED THE SOFTWARE REVISION LEVEL MAY BE READ ON THE BACK OF U17 ON THE DIGITAL-PROCESSOR BD.

SHOULD ANY TESTER BE FOUND TO CONTAIN AN EARLIER REVISION LEVEL THAN 3.5 (← 3.4) IT MUST BE REPLACED WITH THE 3.5 REVISION.

3.5 REVISION LEVEL IS AVAILABLE ON REQUEST FROM EURO SPARES AMSTERDAM.



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SECTION 10

SERVICE BULLETINS



PAGE 01

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PAGE 02

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TECHNICAL SERVICES

SUN ELECTRIC EUROPE B.V.

SERVICE BULLETIN NO.: 256

JULY 1990

PAGE 1 OF 1

**SLOW UPDATE OF SGA-9000 DISPLAY AFTER INSTALLATION
OF LAMBDA KIT OR SPECIAL PRINTER SOFTWARE**

SGA-9000

After the installation of the LAMBDA kit (7009E9310-27) and following the Installation and Check-out procedure 0692E9306-26, the update of the display takes place only every 3 seconds.

This problem was also noticed when the special printer software (in order to print in the middle of the paper) was installed.

This problem is caused by wrong dip-switch settings of U-2 located on the digital processor board, used for the Baud Rate Selection.

The dip-switch setting is not fixed by the factory.

To get an acceptable refresh rate of the display, the baud rate should be set to at least 1200 Baud, but preferably as high as 9600 Baud.

Refer to the SGA-9000 Service Manual section 1 page 04, & section 4 page 08.

THE FOLLOWING BAUD RATES ARE SELECTED BY SETTING U2 AS FOLLOWS:

BAUD RATE	U2 SETTING			
	S1	S2	S3	S4
110	C	C	C	N/U
150	C	C	0	N/U
300	C	0	C	N/U
600	C	0	0	N/U
1200	0	C	C	N/U
2400	0	C	0	N/U
4800	0	0	C	N/U
9600	0	0	0	N/U

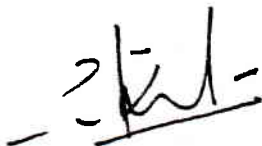
0 = OPEN

C = CLOSED

N/U = NOT USED

THE BAUD RATE SELECTED MAY BE MONITORED IN THE TESTER STATUS CHECK. (SEE OPERATING FLOW DIAGRAM INTRODUCTION PAGE 04.)


G.A. Heyning


P. Tan

NOTE: INSERT THIS PAGE IN RELATED SECTION OF SUN REPAIR MANUAL

ref.: h. lubbers 9006

0692E9305-01 INSTALLATION INSTRUCTIONS RPM/OIL TEMPERATURE KIT 7009E9313-993. CALIBRATION AND CHECK OUT PROCEDURE

- 3.1 Connect the RPM and TEMP leads to the corresponding connectors on the rear panel of the SGA-9000.
- 3.2 Immerse the end of the oil temperature probe in boiling water.
- 3.3 Wait until the temperature reading on the front panel stabilizes and adjust R26 on the RPM/OIL PCB for 100 °C.
- 3.4 The RPM circuit does not require calibration.
- 3.5 Reassemble the top cover to the chassis.
- 3.6 Connect the red trigger clamp to an engine or ignition simulator and check for correct and stable readings at various engine speeds.
- Perform the check out procedure -as described in section 1, page 11 to 15 of the service manual.

= = = This completes the calibration and check out = = =

0692E9305-01 INSTALLATION INSTRUCTIONS RPM/OIL TEMPERATURE KIT 7009E9313-99

- 2.11 Solder a 100 nF capacitor (item 1.17) across pin 1 and pin 3 of J30 located on the front edge of the digital board.
- 2.12 Solder a 100 nF capacitor (item 1.17) between pin 8 and pin ¹⁰~~20~~ of U16, ~~using heatshrink sleeving (item 1.18) as required.~~
- 2.13 Relocate the digital board and snap the top onto the stand-off's.
- 2.14 Relocate the bottom of the rpm/oil temp pcb (item 1.1) in the rail provided and snap the top onto the stand-off's.
- 2.15 Run W22 between the digital and analog boards. Connect the P30 end to J30 located on the front edge of the digital board. (discard P30/P54 if present between J30 and the linear power supply)
- 2.16 Run W14 between the digital and analog processing boards and round to the linear power supply. Connect the P52 end to J52 located on the top right hand side of the linear power supply.
- 2.17 Remove the display board from the front panel.
- 2.18 Install the (4) light bars (item 1.6) into sockets U10, U11, U13 and U14 of the display board.
- 2.19 Install the (8) seven segment displays (item 1.7) into the sockets for display 5, 6, 7, 8, 13, 14, 15 and 16 on the display board. If necessary, cut 2 mm. from all pins to match height with the other displays.
- 2.20 Attach the oil temp and rpm screened symbols (items 1.15 and 1.16) to the appropriate windows on the back of the front panel.
- 2.21 Relocate and fasten the display board on the front panel.
- 2.22 Install the following ic's in their respective sockets on the rear of the display board where necessary.

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>LOCATION</u>
1.9	latch source driver	U20 and U24
1.10	8 wide darlington driver	U9 and U12
1.8	tri-state octal latch	U1 and U4

- 2.23 Check and correct the settings of the eight dip switch positions (U6) on the display board. Details are explained in section 01, page 07 of the service manual. (U6 switches 1-3-5-6-7-8 are normally closed)
- 2.24 Reassemble the front panel assembly.

NOTE: Care must be taken in reassembling the front panel to the chassis. The exhaust line from the CO cell to the exhaust port on the back panel must be positioned above the transformer and in a "free" position. do not pinch the line between the transformer and the display board.

= = = This completes the installation = = =

0692E9305-01 INSTALLATION INSTRUCTIONS RPM/OIL TEMPERATURE KIT 7009E9313-991. KIT CONTENTS

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>QTY</u>	<u>PART NUMBER</u>
1.1	RPM/OIL TEMP PCB	1	7001E9311-28
1.2	RPM/OIL TEMP CONNECTOR PLATE ASSY	1	7009E9313-98
1.3	WIRING HARNESS W14 (P52-P53)	1	7076E9312-98
1.4	WIRING HARNESS W22 (P30-P37)	1	7076E9312-99
1.5	STAND-OFF (SGA 2801-059)	2	0536-0510-003
1.6	LIGHT BAR (HLMP 2685)(SGA 4812-010)	4	7096S4111
1.7	SEVEN SEGMENT DISPLAYS (DLO 3900F)(SGA 4812-013)	8	7096S4112
1.8	TRISTATE OCTAL LATCH (74LS373N)(SGA 3101-144)	2	0773-7373
1.9	LATCH SOURCE DRIVER (UCN5815A)(SGA 3101-149)	2	7096S2124
1.10	8 WIDE DARLINGTON DRIVER(ULN 2803A)(SGA 3101-155)	2	0773-0318
1.11	TRIGGER LEAD	1	6004E9310-38
1.12	RED TRIGGER CLAMP	1	7096E4055-81
1.13	OIL TEMP PROBE	1	6004E9310-37
1.14	INSTALLATION INSTRUCTIONS	1	0692E9305-01
1.15	STICKER OIL TEMP	1	4600E9307-74
1.16	STICKER RPM	1	4600E9307-75
1.17	CAPACITOR 100 NF	2	7096E1080-13
1.18	HEATSHRINK SLEEVE 50 x 1.6 MM	1	3-565-523
1.19	SCREW 4-40 UNC x 3/8"	4	0404-0069
1.20	INT. LOCKWASHER	2	0400-0400-203

2. INSTALLATION INSTRUCTIONS

- 2.1 Remove main cover.
- 2.2 Remove and discard the rpm/oil temp blanking plate, located below the right side of the filter bowl assy.
- 2.3 Mount the rpm/oil temp connector plate assy (item 1.2) in place of the removed blanking plate. Note that the green/yellow ground lead is located near the left side of the chassis. Bolt the ground lead to the fan -using the two lockwashers (item 1.20) to ensure proper grounding.
- 2.4 Run the cables P63 and P64 through the opening provided into the central pcb partition of the tester.
- 2.5 Mount the two stand-off's (item 1.5) in the holes provided adjacent to the rear of the analog processing pcb.
- 2.6 Connect P63 and P64 from the connector plate assy to J63 and J64/J65 respectively on the rpm/oil temp pcb (item 1.1)
- 2.7 Connect the P53 end of wiring W14 to J53 on the rpm/oil temp pcb.
- 2.8 Connect the P37 end of wiring W22 to J37 on the rpm/oil temp pcb.
- 2.9 Remove the tester front panel.
- 2.10 Move the digital board partly upwards.

3. CHECK-OUT PROCEDURE:

- 3.1** TURN THE UNIT ON AND CHECK THE DC VOLTAGE ON J65 BETWEEN PIN 6 (GROUND) AND PIN 5 (V-In) FOR THE FOLLOWING LEVELS (+/-1V)

SWITCH POSITION:	0	1	2	3	4
J65 PIN 5-6 VOLTS:	0,0	2,5	5,0	7,5	10

- 3.2** CLOSE THE COVER OF THE UNIT AND SET THE FUEL TYPE SWITCH IN POSITION 0 (TEMP).

- 3.3** CHECK THAT THE GAS READINGS AGREE WITH THE READINGS FOUND BEFORE INSTALLATION OF THE LAMBDA KIT (RE. PAGE 1 OF 4)

NOTE:

IF CO₂ = 0 THE LAMBDA DISPLAY WILL READ "OF" (OVER FLOW)
IF O₂ >10% THE LAMBDA DISPLAY WILL READ "OF" (OVER FLOW)

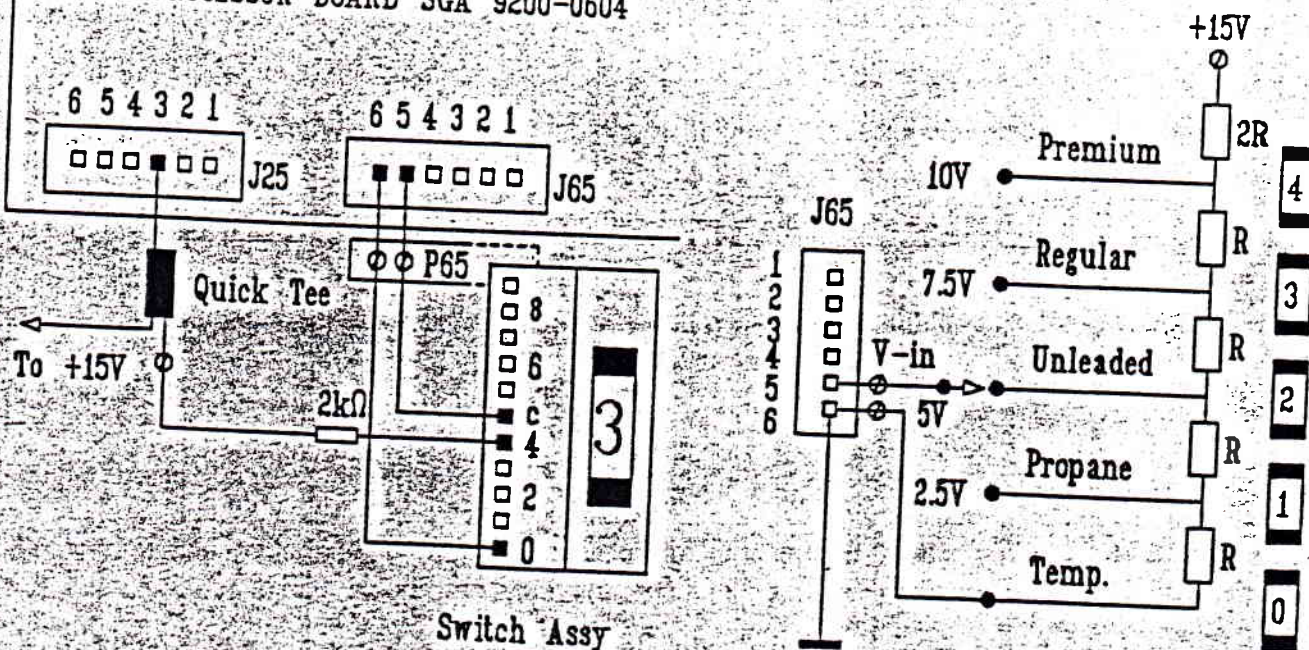
THIS COMPLETES THE CHECK-OUT PROCEDURE

=====

- 2.10 REMOVE THE DIGITAL PROCESSOR BOARD FROM THE SNAP-ON STAND-OFF'S AND CAREFULLY SQUEEZE THE BOARD IN A POSITION TO REACH CONNECTOR J25 AND J65.
- 2.11 REPLACE THE EEPROM IN LOCATION U17 BY THE NEW VERSION C.6. (ITEM 1.3)
- 2.12 REFER TO THE SCHEMATIC BELOW AND CONNECT THE WIRES COMING FROM THE SWITCH ASSEMBLY AS FOLLOWS:
- 2.13 -CONNECT P65 FROM THE SWITCH ASSY TO J65 ON THE DIGITAL PROCESSOR BOARD.
- 2.14 -ATTACH THE +15V WIRE (WITH THE 2k Ω) BY MEANS OF THE QUICK TEE CONNECTOR (ITEM 1.2) TO THE WIRE COMING FROM J25 PIN 3.
- 2.15 RELOCATE THE DIGITAL PROCESSOR BOARD AND SNAP THE TOP ONTO THE STAND-OFF'S.
- 2.16 REASSEMBLE THE FRONT PANEL ASSY, TAKING CARE NOT TO PINCH WIRES BETWEEN THE DISPLAY BOARD AND THE TRANSFORMER.

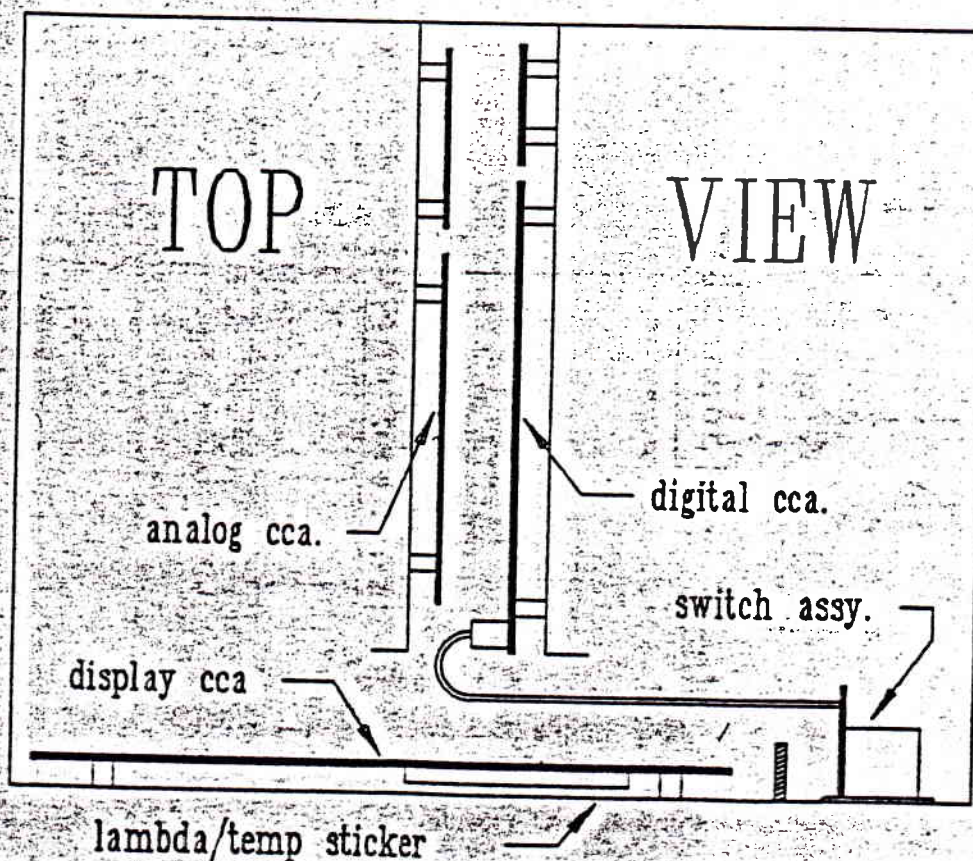
THIS COMPLETES THE INSTALLATION PROCEDURE

DIGITAL PROCESSOR BOARD SGA 9200-0604



2. INSTALLATION INSTRUCTIONS:

- 2.1 REMOVE MAIN COVER.
- 2.2 REMOVE THE FRONT PANEL.
- 2.3 REMOVE THE DISPLAY BOARD FROM THE FRONT PANEL.
- 2.4 REMOVE AND DISCARD THE TEMPERATURE SYMBOL FROM THE BACK OF THE FRONT PANEL.
- 2.5 ATTACH THE NEW LAMBDA/TEMP STICKER (ITEM 1.4) TO THE APPROPRIATE WINDOW ON THE BACK OF THE FRONT PANEL.
- 2.6 REASSEMBLE THE DISPLAY BOARD ON THE FRONT PANEL.
- 2.7 ON THE FRONT PANEL LOCATE THE SQUARE HOLE FOR THE SWITCH ASSEMBLY ABOVE THE MAINS SWITCH. WITH A SHARP KNIFE CAREFULLY REMOVE THE RED FOIL THAT COVERS THE SQUARE HOLE.
- 2.8 ATTACH THE TEXT PLATE (ITEM 1.5) ONTO THE FRONT SIDE OF THE FRONT PANEL AS SHOWN.
- 2.9 GLUE THE SWITCH ASSEMBLY INTO THE SQUARE HOLE ON THE FRONT PANEL, USING A GLUE SUCH AS "LOCTITE 415 SUPER BONDER".



INSTALLATION/CHECK-OUT PROCEDURE 0692E9306-26

LAMBDA KIT 7009E9315-27

**** NOT APPLICABLE FOR THE FRENCH SGA9000 (CO-CORRIGÉ) ****

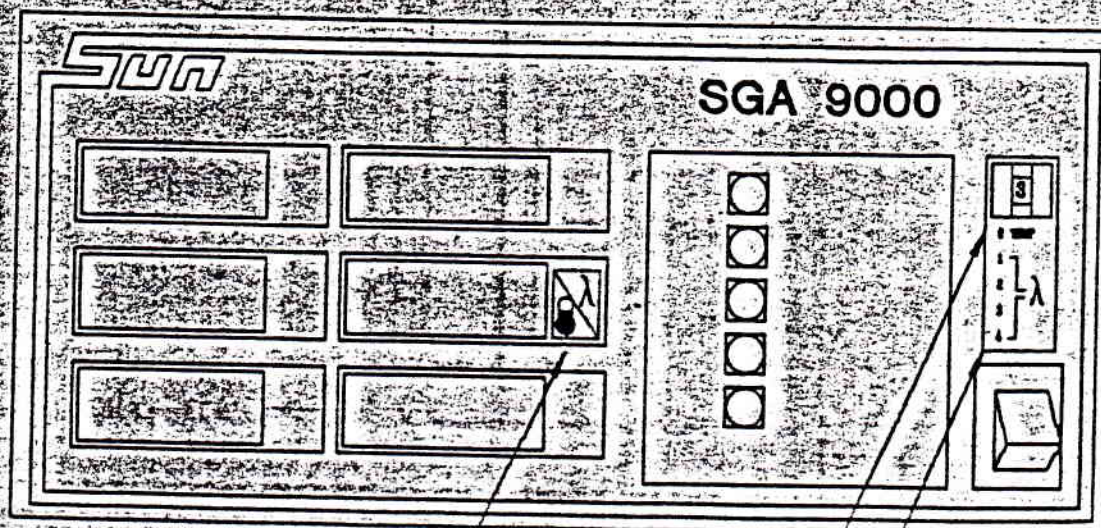
1. KIT CONTENTS:

<u>ITEM</u>	<u>DESCRIPTION</u>	<u>QTY</u>	<u>PARTNUMBER</u>
1.1	SWITCH ASSEMBLY	1	7009E9315-26
1.2	CONNECTOR, QUICK TEE	1	7096E3055-63
1.3	EPROM, VERSION C.6 OR HIGHER	1	0703E0610-01
1.4	STICKER, LAMBDA/OIL TEMP.	1	4600E9309-22
1.5	TEXT PLATE, FUEL TYPES	1	1243E9301-09
1.6	INSTALLATION INSTRUCTIONS	1	0692E9306-26

NOTES:

BEFORE YOU START TO INSTALL THIS LAMBDA KIT:

- MAKE SURE THAT THE UNIT IS A 4-GAS ANALYZER (CO/CO₂/HC/O₂).
- MAKE SURE THAT THE RPM/OIL TEMPERATURE KIT IS INSTALLED, SINCE THE LAMBDA KIT MAKES USE OF THE RPM/TEMP DISPLAY.
- CHECK AND CALIBRATE THE UNIT PROPERLY (RE. PAGE 4, STEP 3.3)



lambda/temp sticker

switch assy

text plate

RELEASE OF THE INSTALLATION/CHECK-OUT PROCEDURE 0692E9306-26
FOR THE LAMBDA KIT 7009E9315-27
(NOT APPLICABLE FOR THE FRENCH SGA-9000)

NOVEMBER 1989

PAGE 1 OF 1

FOR THE INSTALLATION OF THE LAMBDA KIT IN AN SGA-9000, AN
INSTALLATION/CHECK-OUT PROCEDURE WILL BE PART OF EACH LAMBDA KIT.

ONE COPY OF THIS INSTALLATION/CHECK-OUT PROCEDURE WILL BE MAILED TO THE
SERVICE MANAGERS FOR REFERENCE.

THE SGA-9000 MUST HAVE THE FOLLOWING OPTIONS INCORPORATED:

- ALL 4 GAS OPTIONS (CO, CO₂, HC AND O₂)
- THE RPM/OIL TEMPERATURE KIT

NOTE:

THE REQUIRED GLUE (TO FIT THE SWITCH ONTO THE FRONT PANEL) IS
NOT INCLUDED IN THE LAMBDA KIT.


G.A. Heyning


P. Tan

Reference: ERN 378

SUN

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TRECOMMENDED SPARE PARTS LIST
FOR THE SGA-9000PAGE 1 OF 5
JULY 1985

ATTACHED, PLEASE FIND THE UPDATED RECOMMENDED SPARE PARTS LIST FOR THE
SGA-9000.

DISCARD ALL PREVIOUS SGA-9000 RECOMMENDED SPARE PARTS LISTS FROM YOUR FILE AND
INSERT THIS UPDATED LIST IN ITS PLACE.

WHEN ORDERING SGA-9000 PARTS, YOU MUST ALWAYS INDICATE THE PART NUMBER IN FULL
DETAIL, FOR EXAMPLE:

DESCRIPTIONPART NO.

COVER

SGA 2509-242

ASPIRATOR

SUN 7054-0075


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TRECOMMENDED SPARE PARTS LIST
FOR THE SGA-9000PAGE: 2 OF 5
JULY 1985

<u>DESCRIPTION</u>	<u>PART NUMBER</u>	<u>QTY/10 UNITS</u>
CHASSIS WELD ASSY	SGA 2509-243	-
COVER	SGA 2509-242	-
COVER, TOP WINDOW	SGA 2511-018	-
FRONT PANEL ASSY	SGA 1702-026	1
BENCH ASSY, CO-HC-CO2	SGA 9200-441	1
BENCH ASSY, CO-HC	SGA 9200-490	1
BENCH ASSY, CO-CO2	SGA 9200-489	1
CHOPPER WHEEL & HUB ASSY	SGA 9200-020	1
CHOPPER MOTOR ASSY	SGA 9200-188	1
SOURCE & HARNESS ASSY, CO-HC	SGA 9200-310 B	2
SOURCE & HARNESS ASSY, CO2	SGA 9200-318 B	2
10 CM GAS CELL ASSY, CO	SGA 9200-543	1
10 CM CELL ASSY, HC	SGA 9200-542	1
1-1/4 CM GAS CELL ASSY, CO2	SGA 9200-183	1
DETECTOR CELL & HARNESS ASSY, CO	SGA 9200-449	2
DETECTOR CELL & HARNESS ASSY, HC	SGA 9200-159	2
DETECTOR CELL & HARNESS ASSY, CO2	SGA 9200-457	2
O-RING	SGA 7007-020	5

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TRECOMMENDED SPARE PARTS LIST
FOR THE SGA-9000PAGE 3 OF 5
JULY 1985

<u>DESCRIPTION</u>	<u>PART NUMBER</u>	<u>QTY/10 UNITS</u>
HEATER UNIT ASSY, 60W	SGA 9200-267	2
HEATER UNIT ASSY, 26W	SGA 9200-268	2
HEATER-THERMISTOR UNIT ASSY	SGA 9200-269	2
THERMISTOR 30K OHMS	SGA 5302-005	2
THERMAL CUT-OUT ASSY	SGA 9200-281	2
TAPE, ALUMINIUM FOIL-3M	SGA 1605-002	1 ROLL
SHOCK BUMPER, BENCH MTG	SGA 2801-057	4
POWER SWITCH	SGA 5103-022	2
LIGHT BAR	SGA 4812-010	1
7 SEGMENT DISPLAY	SGA 4812-013	5
LABEL, INTERNATIONAL SYMBOLS	SGA 7009-205	1 SHEET
FRONT PANEL BOARD ASSY	SGA 9200-430	1
A.C. DISTRIBUTION BOARD	SGA 9200-433	1
HEATER CONTROL BOARD ASSY	SGA 9200-572	1
LINEAR POWER SUPPLY ASSY	SGA 9200-432	1
SWITCHING POWER SUPPLY ASSY	SGA 9200-455	1
MICRO PROCESSOR BOARD ASSY	SGA 9200-604	1
ANALOG PROCESSING BOARD ASSY, CO-HC	SGA 9200-498	1

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TRECOMMENDED SPARE PARTS LIST
FOR THE SGA-9000PAGE 4 OF 5
JULY 1985

<u>DESCRIPTION</u>	<u>PART NUMBER</u>	<u>QTY/10 UNITS</u>
ANALOG PROCESSING BOARD ASSY, CO-CO2	SGA 9200-497	1
ANALOG PROCESSING BOARD ASSY, CO-HC-CO2	SGA 9200-429	1
SNAP-IN CARD GUIDE, E750	SGA 2801-064	1
SNAP-IN CARD GUIDE, E900	SGA 2801-066	1
SNAP-IN CARD GUIDE, E300	SGA 2801-065	1
STAND-OFF, P.C. BOARD MTG	SGA 2801-059	5
TRANSFORMER ASSY, EUROPE	SGA 9200-450	1
PUMP ASSY, THOMAS	SGA 9200-480	1
SOLENOID SUB ASSY	SGA 9200-481	1
RELAY	SGA 4504-008	1
CHECK VALVE	SGA 2821-197	2
LINE FILTER ASSY	SGA 9200-466	2
PRESSURE SWITCH	SGA 5115-003	2
FLOW METER ASSY	SGA 9200-576	1
AIR FILTER	SGA 1605-003	2
ENTRI FAN	SGA 2602-012	1
BUMPER, BLACK-3M	SGA 1401-004	4
RIBBON CABLE, HARNESS	SGA 9200-478	1

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TRECOMMENDED SPARE PARTS LIST
FOR THE SGA-9000

<u>DESCRIPTION</u>	<u>PART NUMBER</u>	<u>QTY/10 UNTS</u>
POWER CABLE, EUROPE	SGA 9200-579	1
BCD THUMBWHEEL	SGA 5103-020	1
DETECTOR CELL, O2	SUN 7049-004	3
FILTER ASSY, PRIMARY	SUN 0301-0115	1
FILTER ASSY, SECONDARY	SUN 0301-0116	1
FILTER BOWL	SUN 0301-0931	2
FILTER O-RING	SUN 0617-0199	5
FILTER ELEMENT, NYLON	SUN 0301-0926	10
FILTER ELEMENT, PAPER	SUN 0301-0908	50
ASPIRATOR	SUN 7054-0075	3
EXHAUST HOSE	SUN 3988-0202	1
EXHAUST PROBE	SUN 7009-0511	1

NOTE: WHEN ORDERING SGA-9000 PARTS YOU MUST ALWAYS INDICATE
THE PART NUMBERS IN FULL DETAIL, FOR EXAMPLE:
COVER: SGA 2509-242 OR ASPIRATOR: SUN 7054-0075.

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9100060

O2 Option Kit Assembly

Sequence of Assembly

1. Remove the main chassis cover by unfastening (10) 2803-195 #6-32 x 3/8" Lg. Slotted Hex Washer Hd. Screws and (2) 9200578 #6-32 x 3/8" Lg. Fillister Hd. Screws. DO NOT DISCARD.
2. Remove the Front Panel Assembly off the main chassis, by unfastening (3) 2803-191 #8-32 x 3/8" Lg. screws and (3) #8 Internal Toothlock washers.
3. After the Front Panel has been detached, remove the Front Panel P.C. Board off the Front Panel sub-plate.
4. Install light bars (HLMP-3900) onto the P.C. Board display row no. 2 (U7 & U8).
5. Install the 7-segment displays (HDSP-3900) onto the P.C. Board display row no. 2 (DISP. 9,10,11,12).
6. After sequence 4 & 5 have been completed, attached the P.C. Board back to the Front Panel sub-plate.
7. On the rear of the P.C. Board, install the following items:
 - Tri-State Octal Latch (74LS373N) to U1
 - Latch Source Driver (UCN4815A) to U20
 - 8 Wide Darlington Drive (ULN2803A) to U9

Take care to install these components so the detent on the package matches the indicated component detent on the silkscreen.
8. Install the Front Panel Assembly back to the main chassis with respective hardware screws and washers.
9. Detach the Analog Processing Board Assembly off its P.C. Board stand-offs.
10. Lift this board up and install the Dual Op Amp (LF353N) to U15. Again, take care to match the package detent with P.C. Board silkscreen.
11. Take the O2 Wire Harness sub-assembly (9200477) and connect the MTA connector to J44 of the Analog Processing Board. Take care to correctly mate locking mechanism.
12. After sequence 10 & 11 have been completed, the Analog Processing Board must be installed back to the P.C. Board stand-offs.
13. On the main chassis rear panel assembly; remove and discard the O2 plate by unfastening (2) #6-32 x 1/4" Lg. screws (2803-189). After the plate has been detached, pull this plate until the hose is out 2" inches from the main chassis rear panel.
14. Disconnect hose from the bulkhead fitting (brass) mounted on the O2 plate. Discard O2 plate & fitting. Connect hose to O2 Mounting assembly's (9200456) straight nylon fitting.

Sequence of Assembly (cont.)

15. The O₂ Mounting Assembly is now ready to be installed with (2) #6-32 x 1-1/4" Lg. screws (2E03-193).
16. Remove the existing hole plug, located above the O₂ Mounting Block.
17. Route the O₂ Wire Harness Assembly (9200477) from the Analog Processing Board (J44) through this harness bushing (2809-032).
18. Install O₂ Transducer Element (SUN #7049-0004) onto the O₂ Mounting Block and P48 (part of 9200477) must connect to the element.
19. Install the main cover back to main chassis and fasten with proper hardware.