FAULT FINDING ON OXYGEN MONITORS - TYPES: HUDSON 5550 AND 5552 & IVAC 1200 AND 1225.

(1) Instrument will not calibrate or reads low: Is sensor adjustment knob fully turned? (location - rear panel of 1225 & 5552, front panel of 1200 & 5550)

Fuel cell needs to be removed for the following tests - loosen two screws and gently tap the sensor holder:

Is the sensor surface wet? Has it been in ventilator line or high humidity? Water vapour can condense on to the fuel cell surface, especially if the fuel cell is facing upwards, restricting the passage of oxygen through the membrane. Cure - dry off with a soft swab, very carefully.

Is a salt deposit visible around or below the white ring on the fuel cell? Cure - remove with water and a soft swab.

Are the wire connections to the fuel cell good.

the sensor will only read 100% if 100% dry oxygen is used in a sealed container NOT incubators, etc.

(2) Instrument reads zero: Is the sensor plug in the correct way? Does the sensor work in another instrument? If so, It is obviously the moniyor which is faulty

(3) Instrument will not adjust down to 20.9%: Has sensor just been plugged in or is it a new sensor or fuel cell? They sometimes need 24 hours for good stability. After 24 hours high readings are usually caused by faulty temperature compensation circuit in holder.

(4) Instrument pointer jumps about: Are plug and sensor leads o.k.? - Hols sensor steady and shake cable. Are fuel cell connectors o.k. in the censor holder? Does the movement of the sensor cause pointer variations?
Small variations will always be present due to movement: varying the pressure on the sensor membrane but pointer should only vary 1% and always come to rest at the same place regardless of the sensor position.
Remember to check for humidity (see(1)).

(5) No reading or pointer stuck: Is fuel cell o.k. as at (1) & (2)? Is fuel cell o.k. on another Monitor? If so, return the monitor for service (usually the meter is damaged).

ELECTRICAL FAULTS.N.B. with all 1200 & 5550 check that the battery type TR 146X Duracell (PP3 or equivalent will not work)

(6) Permenent alarm: Is fuel cell working? Low alarm is usually set about 19% min. Is battery o.k.? Is sensor plug in correct way?

(7) Intermittent Alarm: Are alarms set at least 5% apart? Is low Alarm set lower than the high Alarm? Is correct battery fitted? Where is the monitor physically situated? In the presence of radio frequency interference i.e. Diathermy or Bleeps, etc.? the monitor will read correctly but alarms may sound intermittently. Cure - ensure the monitor is connected to earth by the case of an incubator or via I.V. pole with anti-static wheels. This fault usually occurs if the instrument is sitting on top of the incubator.

(8) Alarms not accurate. Medical Physics or Electronics Engineers only
Remove case - two small pressts are visible on rear chassis.
Adjust sensor to read 10%. Set low alarm to 10%.
Adjust RH preset until alarm just sounds.
Press Low alarm and adjust up and then down to 10% Alarm should sound at 10% + 1%.
The last two instructions should be carried out slowly as the alarm datection circuit is only switched on in every 15 seconds for 100 milliseconds - i.e. strobed power supply to conserve battery life.
Repeat for high Alarm using other LH preset.

CIRCUIT DESCRIPTION

Use this description in conjunction with the Block Diagrams and the Schematics.

Power Supply

The Power Supply applies voltage to the Power Saver Pulse Circuit. That Circuit generates the Vistrobe Pulse, an on-off power signal that extends battery life by eliminating the need for a continous voltage drain. The Power Saver Pulse Circuit consists of an oscillator and a one-shot. The oscillation frequency controls the sampling rate for the one-shot, which generates the Vistrobe Pulse. The oscillator has two basic frequencies, one for the alarm-off condition and one for the alarm-on condition.

Sensor Input Circuit

The electrolyte in the Sensor probe reacts with oxygen and produces an electric signal proportional to the oxygen concentration it is exposed to.

Sensor Adjustment

The signal from the sensor probe flows through the Sensor Adjustment (R-30) before reaching the Meter (M-1). The Sensor Adjustment permits calibration of the Meter and internal circuitry by allowing for adjustment of the sensor input voltage.

Low Alarm Set and Check

The Low Alarm Set (R-32) adjusts the power voltage (Vistrobe) to the Low Alarm Comparitor (IC-1B), which permits setting the level of the alarm triggering voltage. The Low Alarm Check (S-2) allows the Vistrobe voltage to be displayed on the Meter as an oxygen percentage.

High Alarm Set and Check

The High Alarm Set (R-31) and Check (S-1) function in the same manner as the Low Alarm Set and Check.

Low Alarm Comparitor

The Low Alarm Comparitor (IC-1B) compares the Sensor Input voltage with the Low Alarm Set voltage. When the Sensor voltage equals the Low Alarm voltage, the Comparitor sends a signal to the Alarm Oscillator circuit to trigger the alarm and a feedback signal to the Power Saver Circuit to increase the sampling rate of the Vistrobe.

High Alarm Comparitor

The High Alarm Comparitor (IC-1A) functions in the same manner as the Low Alarm Comparitor.

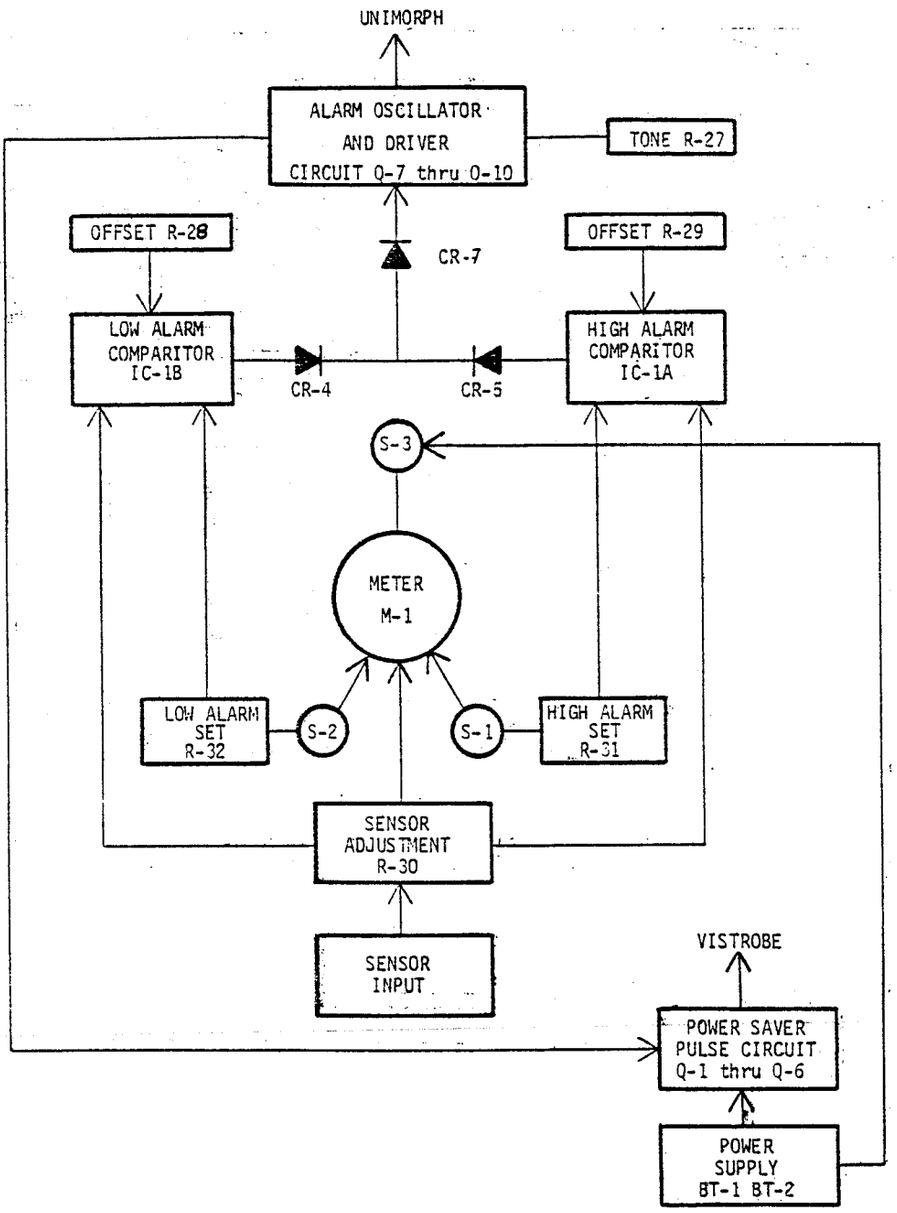
Meter

The Meter (M-1) receives input from the Sensor Adjustment (R-30) for calibration purposes. When in the Alarm Set mode, the Meter receives input from the Alarm Set potentiometers R-31 and R-32. When the Battery Check (S-3) circuit is activated, the battery voltage is shunted directly through R-24 to the Meter.

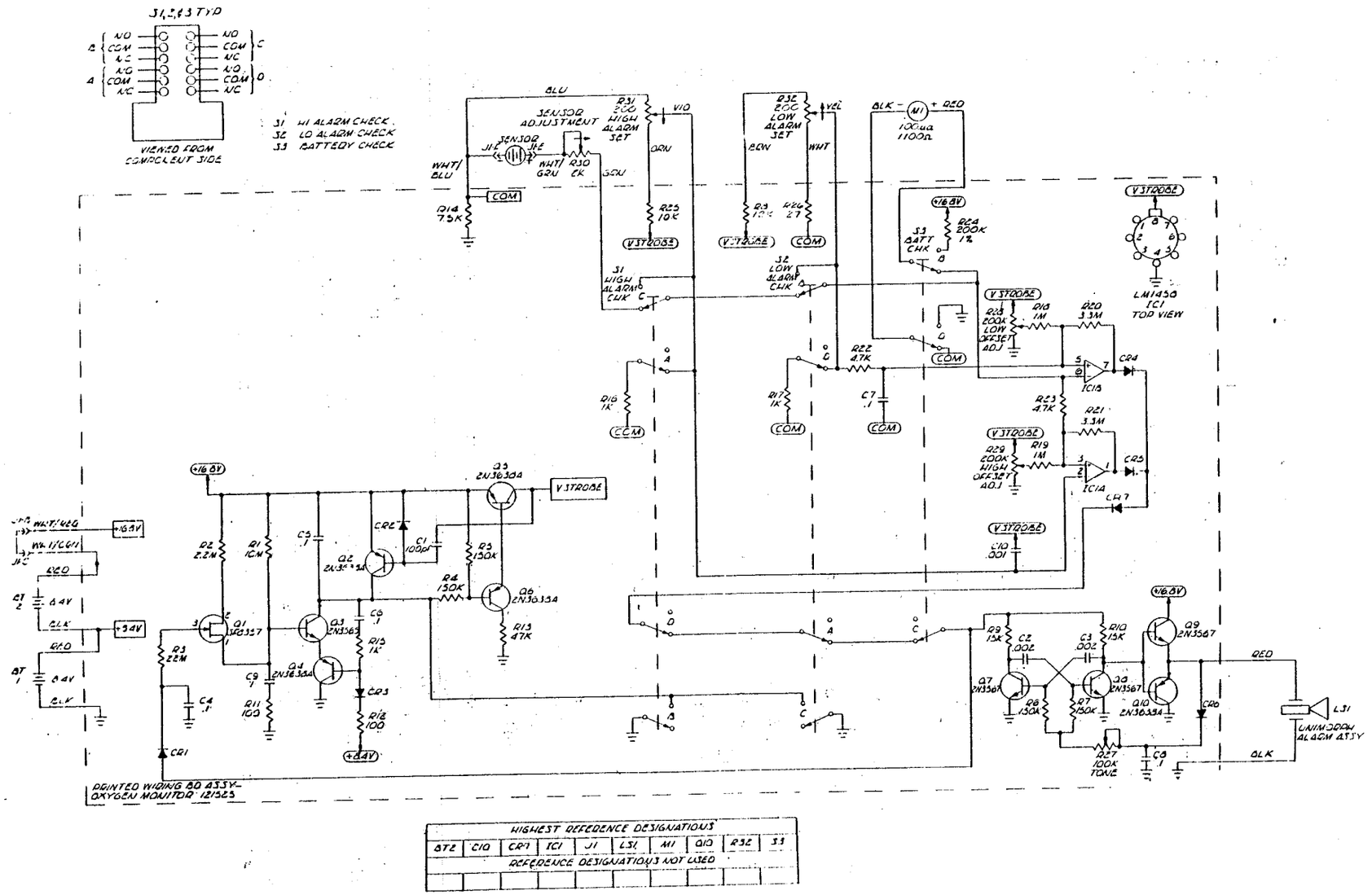
Alarm Oscillator and Driver Circuit

The Alarm Oscillator and Driver Circuit (Q7 to Q10) is triggered by pulses from one of the Comparitor circuits when the Sensor Input voltage equals the Alarm Set voltage in a Comparitor. The Oscillator (Q7 and Q8) converts those pulses into an oscillating signal. That signal is amplified in the Driver (Q9 and Q10) to a level sufficient to power the Unimorph Alarm (LS1), which converts the signal into a high-pitched sound wave. When in the Alarm mode, a signal is fed back to the Power Saver Pulse circuit. That signal triggers a quicker pulsing mode in the Power Circuit so the alarm will sound at a faster rate.

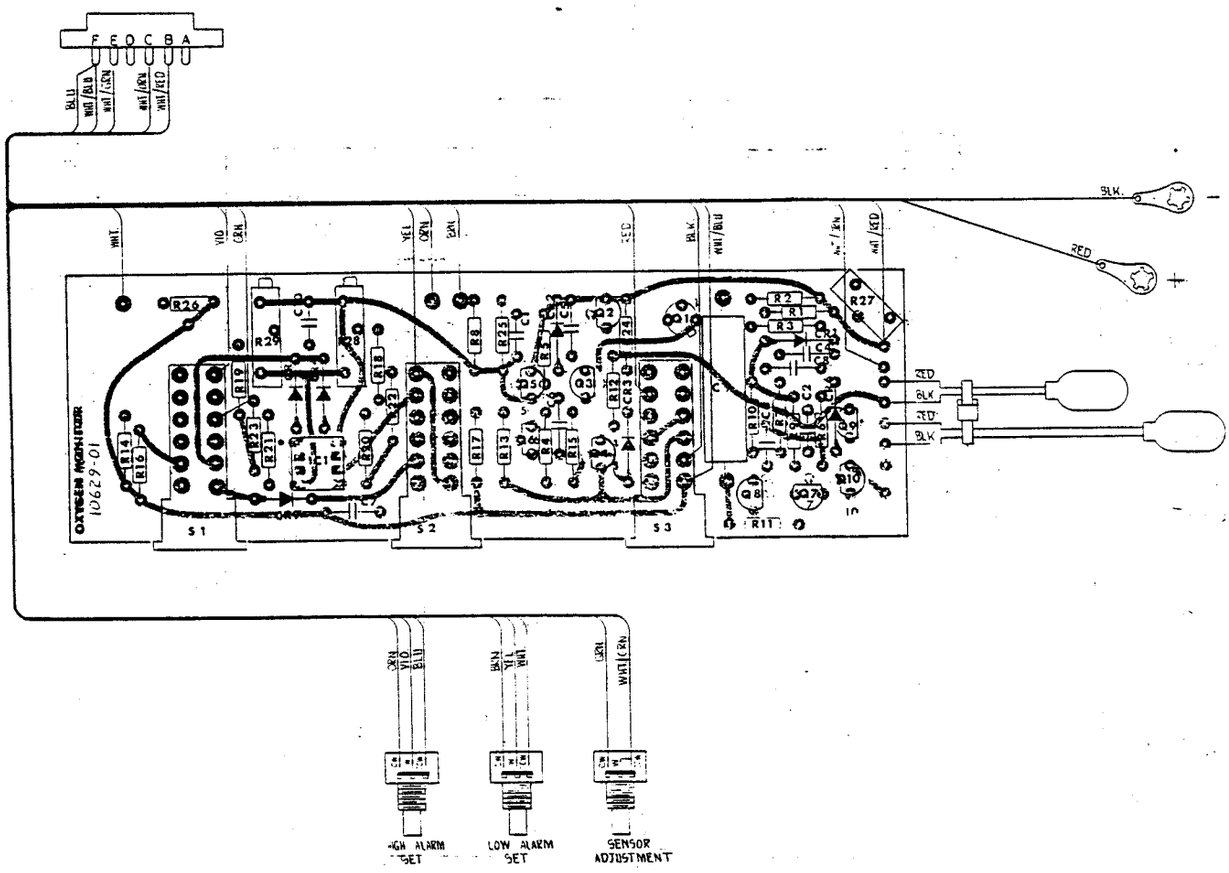
BLOCK DIAGRAM



S-1: HIGH ALARM CHECK
S-2: LOW ALARM CHECK
S-3: BATTERY CHECK



HIGHEST REFERENCE DESIGNATIONS									
BT2	C10	CR7	IC1	J1	LS1	M1	Q10	R32	S3
REFERENCE DESIGNATIONS NOT USED									



CIRCUIT BOARD ASSEMBLY

CALIBRATION

Equipment Required: 1) Millivolt Source
2) Voltmeter

I. Pre-Calibration

(Refer to Troubleshooting chart for possible causes if a procedure does not check out correctly).

A) Zero the needle on the Meter by turning the adjustment screw below the Meter face.

B) Check the linearity of the Meter by applying 10V, in series with a 100K 1% resistor, directly to the Meter. The needle should indicate 100% ± 2% (1 division). Apply 9V; the needle should indicate 90% ± 2% (1 division). Each 1V decrease should lower the Meter reading 10%. Remove the voltage source from the Meter.

C) Short pins B and C in the Sensor connector at the back of the unit.

D) Check the Battery condition by pushing the Battery Check switch on the front of the unit and noting the indication on the Meter. Replace the Batteries if necessary.

E) Check the Low Alarm range by pushing the Low Alarm Check switch and turning the Set Knob below it. With the Set Knob at the left stop, the Meter needle should indicate less than 20%. Turn the Knob to the right stop; the needle should sweep smoothly to the right and should indicate more than 94%.

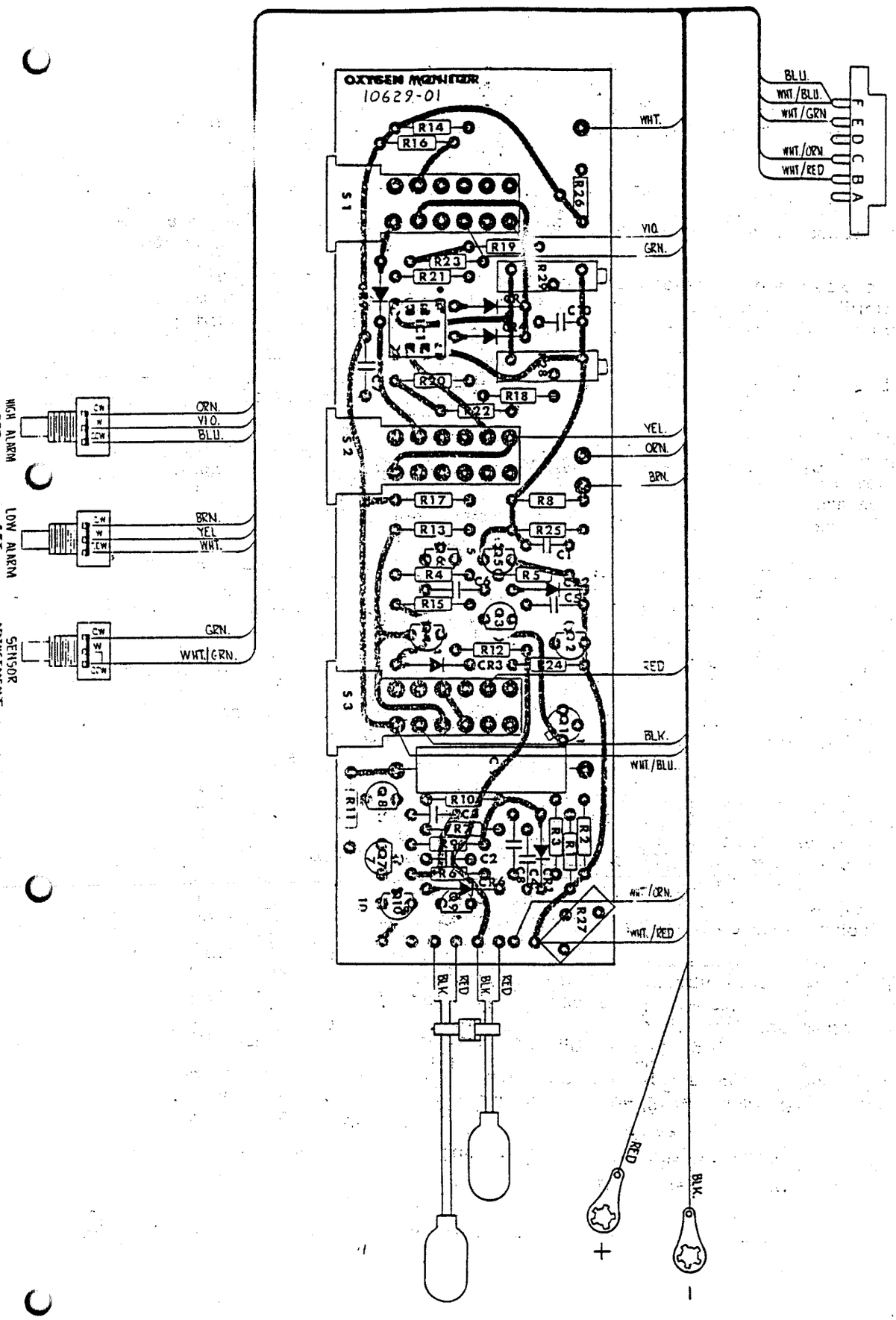
F) Check the High Alarm range by pushing the High Alarm Check switch and turning the Set Knob below it. With the Set Knob at the left stop, the Meter needle should indicate less than 20%. Turn the knob to the right stop; the needle should sweep smoothly to the right and indicate more than 100%.

G) Apply 100mV to pins E (positive lead) and F (negative lead) of the Sensor connector at the back of the unit.

H) Check the Sensor Adjustment range by turning the Sensor Adjustment Knob on the front of the unit. Start with the Knob at the left stop, then turn it fully to the right stop. The Meter needle should sweep smoothly at least 40 divisions (80%) across the Meter.

I) Check the Low Alarm sound point by pressing the Low Alarm Check switch and adjusting the Low Alarm Set Knob so the Meter needle indicates 40%. Then turn the Sensor Adjustment Knob until the alarm sounds, which should be at 40% ± 2% (1 division). If the alarm sounds within tolerance, turn the Sensor Adjustment Knob until the needle indicates 50%. If the alarm does not sound within tolerance, calibrate R-28 per Calibration steps II-C, D and E.

J) Check the High Alarm sound point by pressing the High Alarm Check Switch and adjusting the High Alarm Set Knob so the needle indicates 60%. Then turn the Sensor Adjustment Knob clockwise until the


OXYGEN MONITOR
10629-01
WHT.
VIO.
GRN.
YEL.
ORN.
BRN.
RED
BLK.
WHT/BLU.
WHT/ORN.
WHT/RED
BLU.
WHT/BLU.
WHT/GRN
WHT/ORN
WHT/RED
F E D C B A
HIGH ALARM
ORN.
VIO.
BLU.
LOW ALARM
BRN.
YEL.
WHT.
SENSOR
GRN.
WHT/GRN.
BLK.
RED
BLK.
RED
RED
BLK.
+
-

alarm sounds, which should be at 60% ± 2% (1 division). If the alarm does not sound within tolerance, calibrate R-29 per Calibration steps II-F, G and H.

II. Calibration

(Refer to Troubleshooting chart for possible causes if a procedure does not check out correctly.)

A) Short pins B and C in the Sensor connector at the back of the unit. Turn the High Alarm Set Knob and the Sensor Adjustment Knob fully clockwise and the Low Alarm Set Knob fully counterclockwise.

B) Apply 80 ± 5mV to pins E (positive lead) and F (negative lead) of the Sensor connector.

C) Adjust the Low Alarm set point by pressing the Low Alarm Check switch and turning the Set Knob until the Meter needle indicates 40%. Then turn the Sensor Adjustment Knob until the alarm sounds. If the alarm sounds at 40%, go on to step F. If the alarm sounds at less than 40%, adjust trim pot R-28 clockwise; if the alarm sounds at more than 40%, adjust R-28 counterclockwise.

D) Return the Sensor Adjustment Knob to its right stop, then turn it counterclockwise again to find the new Low Alarm sound point. If still not sounding at 40%, readjust R-28 as indicated above. Continue the process in steps C and D until the Low Alarm sounds at 40%. Then turn the Sensor Adjustment Knob until Meter needle indicates 50%.

E) Recheck that the Low Alarm set point is still at 40% by pressing the Low Alarm Check switch and noting the Meter reading. If not at 40%, repeat steps C and D.

F) Adjust the High Alarm set point by pressing the High Alarm Check switch and turning the Set Knob until the Meter needle indicates 60%. Then turn the Sensor Adjustment knob clockwise until the alarm sounds. If the alarm sounds at 60%, go on to step I. If the alarm sounds at less than 60%, adjust trim pot R-29 clockwise; if the alarm sounds at more than 60%, turn the Sensor Adjustment knob until the needle indicates 50% and adjust R-29 counterclockwise.

G) Turn the Sensor Adjustment knob clockwise again to find the new High Alarm sound point. If still not sounding at 60%, readjust R-29 as indicated above. Continue the process in steps F and G until the High Alarm sounds at 60%. Then, turn the Sensor Adjustment knob until the Meter needle indicates 50%.

H) Recheck that the High Alarm set point is still at 60% by pressing the High Alarm Check switch and noting the Meter reading. If not at 60%, repeat steps F and G.

I) Set the alarm tone adjustment R-27 to the desired level.

TROUBLESHOOTING

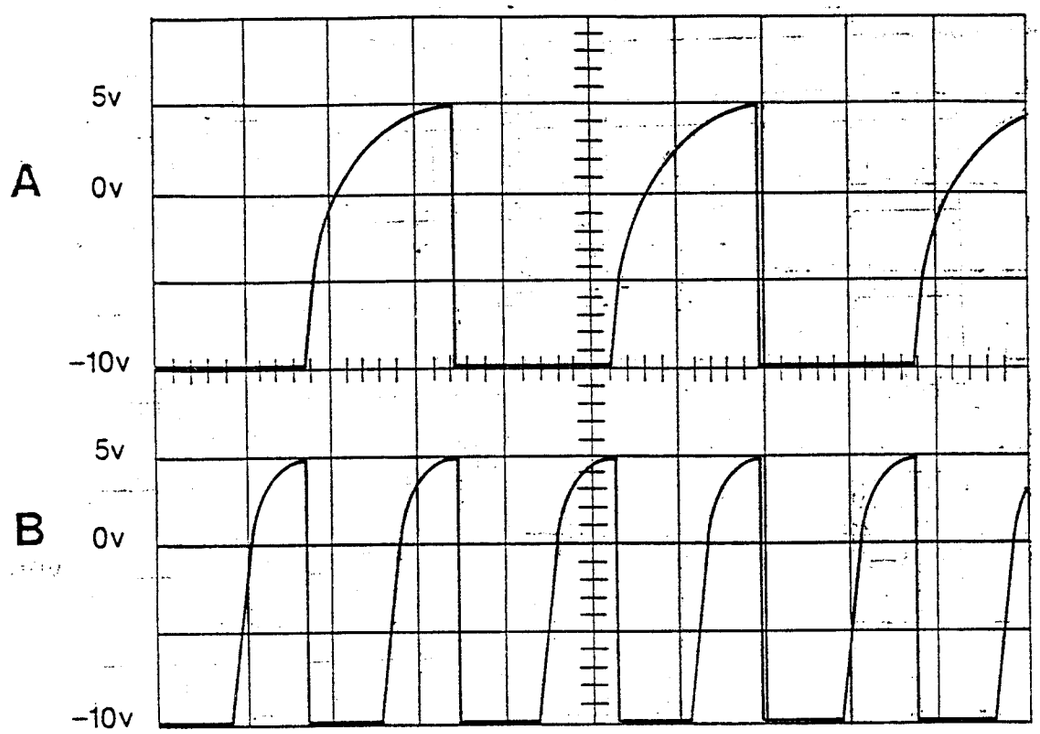
Use in conjunction with Pre-Calibration and Calibration procedures.

(Refer to Circuit Board drawings for part locations)

Condition	Possible Causes
1. Meter sticks or won't zero.	Meter
2. Unit cannot be calibrated.	Fuel cell
3. Unit non-linear (per Step I-B).	Meter, fuel cell
4. Low alarm range insufficient (per step I-E).	Incorrect value for R-8
5. High alarm range insufficient (per step I-F).	Incorrect value for R-25
6. Alarm fails to sound within set tolerances (per steps I-I or I-J).	Q-1, CR-4, CR-5, CR-7, Alarm oscillator and driver circuit, IC-1, Unimorph, power saver circuit, R-28 (see steps II-C, D and E), R-29 (see steps II-F, G and H)
7. Alarm sounds when unit is in a no-alarm condition.	IC-1, power saver circuit, contamination to circuit board (such as battery acid, saline solution, etc.)
8. Alarm not loud enough.	Unimorph, alarm oscillator and driver circuit, R-27 requires adjustment (see step II-I)
9. Meter needle fluctuates more than 1 division during alarm mode.	IC-1
10. Duration of alarm and/or rate.	Q-1, Q-3, Q-4, CR-1, C-4, C-9. R-1, R-2, R-3, R-11, C-5
11. Low alarm set point cannot be calibrated (per steps II-C, D and E).	IC-1, R-18, R-20, CR-4, CR-5, CR-7, power saver circuit
12. High alarm set point cannot be calibrated (per steps II-F, G and H).	IC-1, R-19, R-21, CR-4, CR-5, CR-7, power saver circuit
13. Battery drains too quickly.	Power saver circuit

NOTE: A damaged push switch could cause one or more of the above symptoms.

WAVEFORM SPECIFICATIONS



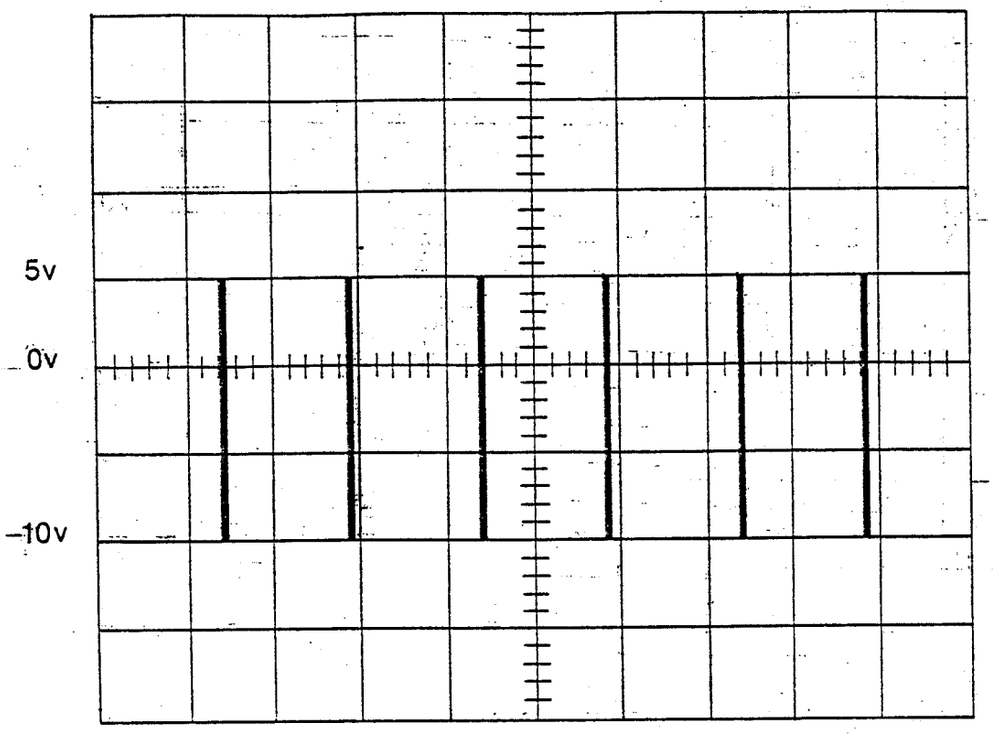
Signal Description

Signal	Location	Specifications	Comments
A. Oscillator Output	Q-8 Collector	Freq 1.4 KHz ± 10%	Lowest tone adjustment
B. Oscillator Output	Q-8 Collector	Freq 2.8 KHz ± 10%	Highest tone adjustment
C.			

Scope Settings

	Vertical	Horizontal
A.	5v/div	SWEEP RATE — .2ms/div
B.	5v/div	SYNC. — Positive edge
C.		

WAVEFORM SPECIFICATIONS



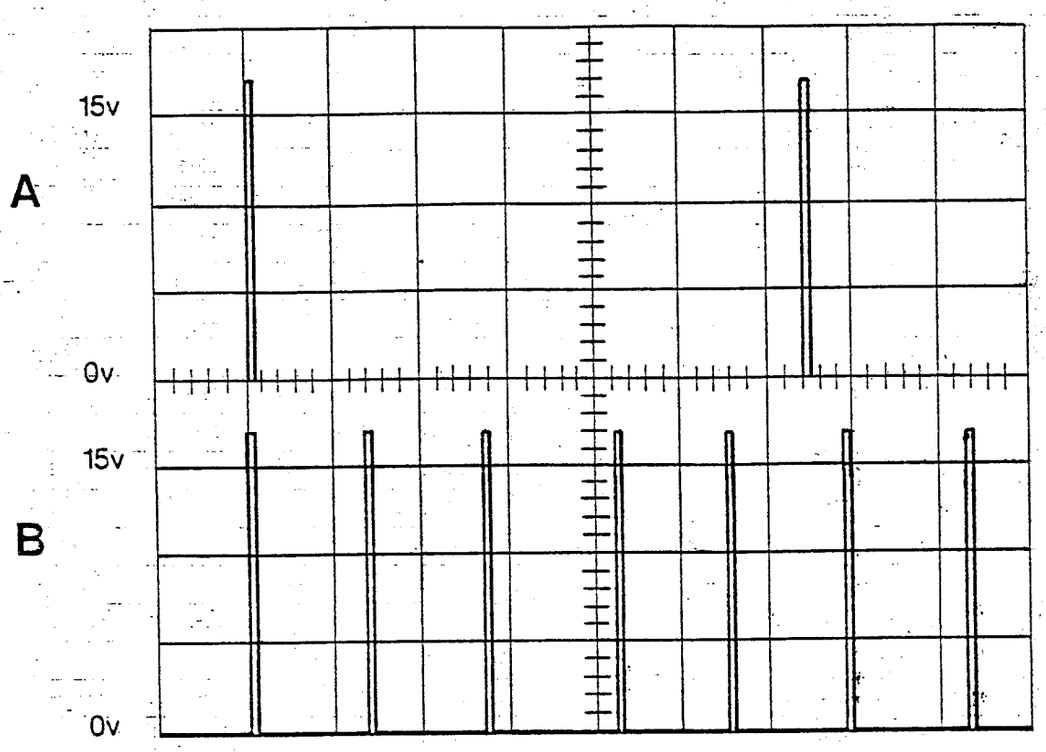
Signal Description

Signal	Location	Specifications	Comments
A. Alarm Output	Q-9 or Q-10 Emitter	pulse width 60ms ± 30% RATE; every 1.4 sec ± 30%	

Scope Settings

	Vertical	Horizontal
A.	5v/div	SWEEP RATE — 1s/div
		SYNC. — Positive edge

WAVEFORM SPECIFICATIONS



Signal Description

	Signal	Location	Specifications	Comments
A.	Vistrobe	0-5 Collector	Pulse Width 62ms ± 6ms Rep Rate 6.4 sec ± 10%	Alarm not Activated
B.	Vistrobe	0-5 Collector	Pulse Width 62ms ± 6ms Rep Rate 1.4 sec ± 10%	Alarm Activated

Scope Settings

	Vertical	Horizontal
A.	5v/div	SWEEP RATE — 1s/div
B.	5v/div	SYNC. — Positive edge of A
C.		

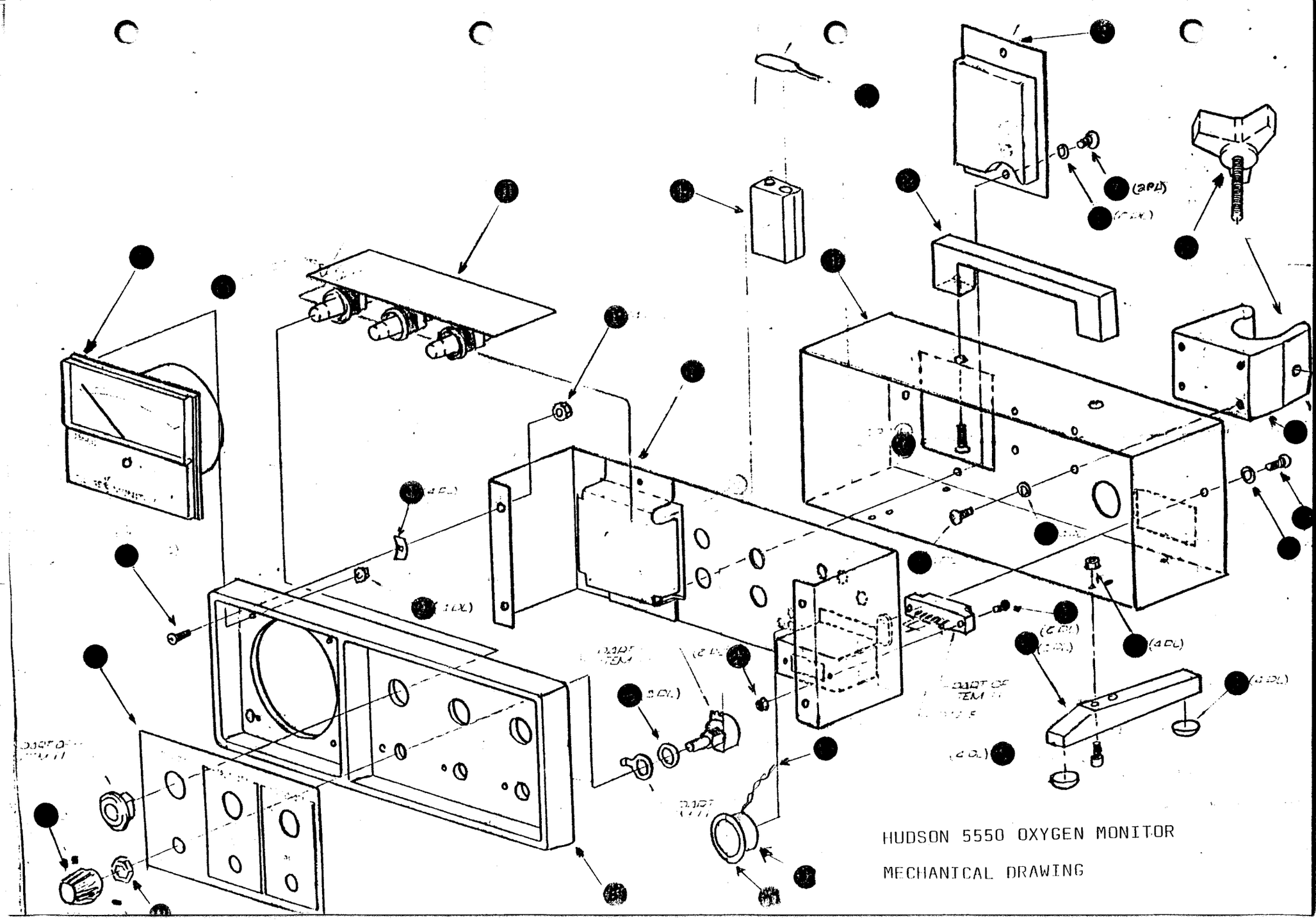
PARTS LIST

REFERENCE NUMBER	HUDSON DATA NUMBER	DESCRIPTION	QUANTITY	MANUFACTURER	MANUFACTURER NUMBER
	10288-01	SCREW - F.H.M.S., 4-40 X 3/16	2	VARIOUS	
	50314	SENSOR TEE	1	HUDSON	
	50315	SENSOR COVER	1	HUDSON	
	50902	SCREEN	1	HUDSON	
	50908	SENSOR HOUSING	1	HUDSON	
		SENSOR HOUSING ASSEMBLY (only) 50908			
	10290-01	CONNECTOR ASSEMBLY	1	HUDSON	
	10295-01	CHASSIS BOARD ASSEMBLY	1	HUDSON	
	10549-01	CABLE FASTENER	1	VARIOUS	
	50317	SENSOR HOUSING	1	HUDSON	
		SENSOR CONNECTOR ASSEMBLY (only) 10290-01			
	10291-01	CORD, RETRACTABLE	1	HUDSON	
	10292-01	PLASTIC CONNECTOR SHELL TOP	1	HUDSON	
	10293-01	PLASTIC CONNECTOR SHELL BOTTOM	1	HUDSON	
	10294-02	BOARD-PRINTED CIRCUIT	1	HUDSON	
	10549-01	CABLE FASTENER	1	VARIOUS	
		CHASSIS BOARD ASSEMBLY (only) 10295-01			
	10296-01	RESISTOR 59K, 1W, 1%	1	CORNING	RN55D
	10297-01	THERMISTOR, 196.5K	1	CAL-R	M-704-747
	10298-02	TUBING-SHRINK 1/8"	1	VARIOUS	
	10299-01	CHASSIS BOARD SUB-ASSEMBLY	1	HUDSON	

* ALTERNATES: 11K, 12K, 13K, 15K

** ALTERNATES: 10K, 11K, 13K, 15K

ALTERNATES: Replace R8 and R25 with Resistors of equal value.



HUDSON 5550 OXYGEN MONITOR

MECHANICAL DRAWING

PARTS LIST, HUDSON 5550.

REF NOS	PT. NOS	DESCRIPTION
1	10603-01	Foot
2	10587-01	Screw Cap 8-32x½"
4	10585-01	Washer Flat 3/8 S-C
5	10555-01	Casting Machined Oxygen Monitor
6	10596-01	Knob
7	10561-01	Panel Control
8	10584-01	Screw Mach. 6-32x3/8"
9	10566-01	Meter 5550
10	10012-01	Nut, Hex 3/8-32x9/16 Fltx3/32 Thick
11	illegible	Board Ass'y
12	10325-01	Nut, Kep 6-32 S-C
13	10560-01	Bracket Ass'y
15	10018-01	Battery MN1604
17	10576-01	Nut Kep 8-32 S-C
18		Loctite
19		Cover Ass'y Battery
25	10580-01	Screw Mach 8-32x3/8"
26	10578-01	Washer, Int. Thd., No 8 S-C Lock
27		Seal, Silicone
28	10123-01	Nut, Kep 4-40 S-C
29	10614-01	Clamp Ass'y Pole Mount (5550)
31	10573-01	Cover Silk Screened Oxygen Monitor
32	10604-01	Unimorph Ass'y
33	10579-01	Screw Mach 4-40x½
34	10589-01	Screw Mach 10-32x3/8
35	10581-01	Washer Int. Thd. No 10 S-C Lock
38	10551-01	Bumper (10114)
39	10553-01	Knob, Blk. 1/4-20 Stud x 2" lg.
42	10552-01	Clip, Speed
43	10557-01	Handle
44	10588-01	Screw Mach 10-32x½