SERVICE INFORMATION

TED OXYGEN INSTRUMENTS

INSTRUMENTS COVERED:

TED 200

TELEDYNE ELECTRONIC DEVICES
16830 CHESTNUT STREET
CITY OF INDUSTRY, CALIF., 91748
TELEPHONE (818) 961-9221 - (213) 283-7181
TWX: (910) 584-1887 TDYANYL COID

TED:200SERV.MAN 5/10/88

1. DESCRIPTION OF SENSOR ATTRIBUTES

1.1 General

The TED 200 uses a (J1) Mini-Micro-Fuel Cell (a galvanic sensor with a fast response time).

The output of the sensor is affected by temperature changes; an increase in temperature would, if allowed, cause an increase in sensor output and the associated inaccuracies. The sensor is protected from temperature-related problems by compensation circuits using thermistors (resistance varies with temperature change). The Micro-fuel Cell uses a probe assembly with a built-in thermistor. The Mini-Micro-Fuel Cell thermistor is located in either the cell itself or the probe assembly.

2. CIRCUIT REQUIREMENTS FOR SENSOR

2.1 MINI-MICRO-FUEL CELL.

The current from the Mini-Micro-Fuel Cell is allowed to pass through a built-in thermistor and 2 resistors, contained on a PC board, thus converting the oxygen sensor current to a voltage. This voltage is then amplified by an operation amplifier configured as a non-inverting amplifier. The output from this amplifier is then digitized by an analog to digital converter.

3. GENERAL CIRCUIT DESCRIPTION

3.1 Features

1. Sensor amplification circuit
2. Reference voltage circuit
3. Alarm circuit
4. Alarm bypass logic
5. Meter (digital)
6. Power supply

4. INDIVIDUAL CIRCUITS

4.1 Sensor Amplification Circuit

See Section 1 - Circuit Requirements for Sensors

4.2 Reference Voltage Circuit

In the TED 200, two reference voltages are required in order to precisely set the dynamic range of the analog/digital converter. These voltages are generated by precision resistive voltage division.

4.3 Alarm Circuit

In the case of the TED 200 oxygen alarms, the analog/digital converter reads the voltage at the ouput of the sensor amplification circuit. The microcomputer then calculates which voltages, from the sensor amplification circuit, should produce an alarm. The microcomputer then compares the present voltage to the calculated voltages and determines if an alarm signal is required. The analog/digital converter also reads the battery voltage, after the voltage has been divided by a resistor ladder, and activates the low battery indicator if the voltage is below a predetermined level.

4.4 Alarm Logic Circuit

The TED 200 has logic that allows the beeper to be bypassed for a set time by pressing the switch located on the unit. The logic is contained in the micro-computer program.

4.5 Meter

The TED 200 uses an integrated analog-to-digital converter that needs no adjustment. The auxilliary messages (Hi Alarm, Lo Alarm, and Lo Bat) on the LCD are driven by "exclusive or" gates in a separate IC and are enabled by a "high" to the appropriate line. In the TED 200, the LCD is driven by driver chips which are fed data from the micro-controller.

4.6 Power Supply

The TED 200 uses 4 "AA" cells which provide 6V and a common line. This 6V is regulated to 4.61V through the use of an integrated regulator circuit.

5. REPAIR/REPLACEMENT

5.1 BATTERY INSTALLATION OR REPLACEMENT

1. Turn unit off.

2. Pull open battery compartment door from left to right.

3. Remove the battery holder and take out the batteries. NOTE: Use alkaline batteries only, other kinds will give erroneous "BATT TEST" readings and reduce battery life.

4. Install 4 "AA" alkaline batteries, observing proper polarity. The use of carbon zinc batteries is not recommended.

   WARNING: If the batteries are installed improperly, damage to the circuitry may occur causing the batteries to become hot and battery life to shorten.

5. Replace battery holder.

6. Close compartment door.

5.2 SENSOR INSTALLATION OR REPLACEMENT

CAUTION: Do not scratch, puncture, or otherwise damage the sensor's membrane. Damage to the membrane will require sensor replacement. NEVER PRESS ON THE SENSING SURFACE; you might damage the sensor.

1. Remove the new Mini-Micro-Fuel Cell from its protective bag.

2. Unscrew the holder cap from the sensor holder, and remove the previous Mini-Micro-Fuel Cell.

3. Slide the pins into the holder until the base of the sensor touches the "O" ring. Do not press on the sensing surface (the center white dot) of the cell.

4. Screw the cap back onto the sensor holder.

5. Check to see that the sensor cable is plugged into the right side panel of the TED 200.

6. TROUBLESHOOTING

WARNING: THE FOLLOWING PROCEDURE SHOULD BE PERFORMED BY A QUALIFIED ELECTRONIC TECHNICIAN OR A BIOMEDICAL ENGINEER ONLY.

6.1 Watchdog Timer

The TED 200 contains a watchdog timer circuit. This timer monitors the unit for improper operation. In the event the watchdog timer detects a malfunction, the audible alarm will sound continously, the LED will be lit continuously, and the LCD will be blank. If this occurs, disconnect the batteries from the battery wires for ten (10) seconds. Reconnect the batteries (OBSERVING PROPER POLARITY) and place in the battery compartment. Turn the unit on by pressing the "ON/OFF" key once. If the condition reoccurs, replace batteries with fresh ones, as low batteries will activate this circuit. If the unit continues to alarm, remove the batteries and return the unit to TED or an Authorized Service Center.

6.2 Offset Adjustment

In the event that the TED 200 fails to accept more than one new cell, or suffers an unacceptable loss in accuracy, it is possible for the user to recalibrate the unit fairly rapidly. To accomplish this, remove the batteries and disassemble the unit by unscrewing the four (4) screws located on the bottom of the unit. Slowly pull the top half of the unit off. Disconnect the ribbon cable and remove the Printed Circuit Board nearest the battery holder. Reconnect the printed circuit board (outside the unit)

to the batteries. Procede with the following steps:

1. Apply power to the board by making sure the battery pack is still installed and connected to the board.

2. Connect a 215K ohm (1%) resistor between pins 2 and 6 of the amplifier U5.

3. Jumper pin 10 to pin 2 on the connector J1.

4. With a voltage meter accurate to within ±1mV, measure the voltage between pins 5 and 6 of J1.

5. Adjust the trim pot (P1) slowly until the voltage at pin 5 is 1mV greater than that at pin 6. (If this is not possible, return unit to TAI).

6. Remove the 215K resistor and jumpered connection and put the unit back together.

NOTE: In the event these steps do not produce the desired results, return the unit to TAI.

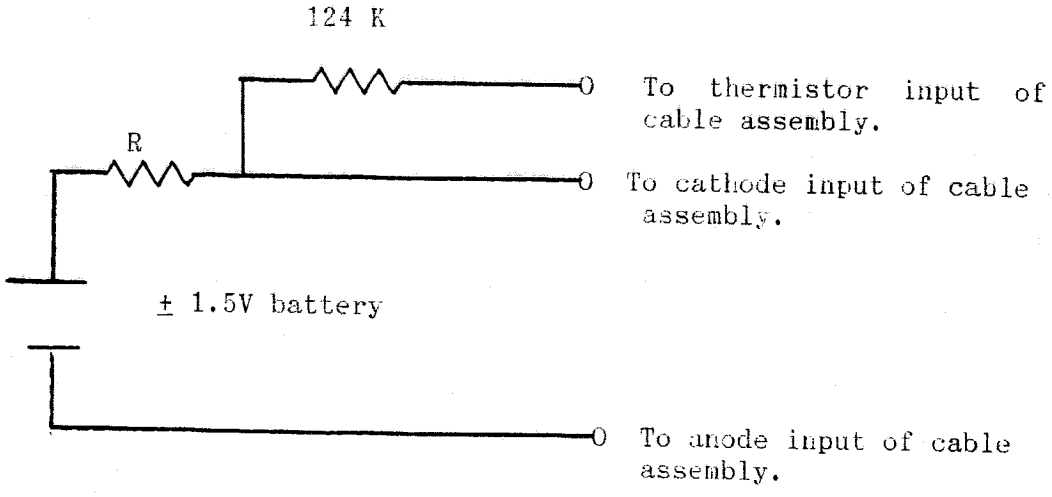
WARNING: TAMPERING WITH INTERNAL ADJUSTMENTS OR COMPONENTS, WITH THE EXCEPTION OF THE OFFSET ADJUSTMENT, MAY VOID THE INSTRUMENT WARRANTY.

7. MANUFACTURING TEST PROCEDURE(S)

The following test procedures are those actually used in our testing department. They may be helpful in providing information or suggestions about how to perform troubleshooting tests, as well, so we are including them with your service manual.

Please note that the test procedure(s) depend upon the use of a "simulator" to take the place of the measuring cell during testing of the instrument. The cell simulator can be purchased from Teledyne Electronic Devices.

Alternatively, a simple circuit, such as the one illustrated by the sketch below, can be constructed to substitute for the simulator.



R = 3.32M (21% O2)

R = 698K (100% O2)

Figure 1. Mini-Micro-Fuel Cell Simulator

TEST PROCEDURE

(Three Board System)

1. Connect a variable power supply (intially set to 6V) to the battery clip and a cell simulator via adapter to the cell probe assembly.

2. Press the "ON/OFF" key once. This key should click audibly (as should all subsequent key depressions), and the LCD should display the high and low alarm set points of 100 and 17, respectively, and should flash the message "AIR CAL" at a 1 Hz rate.

3. Set up the cell simulator so that it produces approximately 450 nA and press the "CAL" key twice. The unit should count down from 10 to 1 at a 1 Hz rate, and then display 21. At this point, the unit should flash the message "CAL IN 100%" for 5 seconds. Verify that the unit can calibrate a weak cell by first adjusting the cell simulator so that it produces .290uA and then press the "CAL" key twice. The unit should count down from 10 to 1 at a 1 Hz rate, and then display 21.

4. With the power supply set to 6V, push the "BATT TEST" key. The unit should display the message "BATTERY HOURS LEFT 999" for 5 seconds.

5. Press the "SET HI ALARM" key, and verify that the high alarm point can be adjusted by pressing the "UP" and "DOWN" arrow keys.

6. Press the "SET LO ALARM" key, and verify that the low alarm point can be adjusted by depressing the "UP" and "DOWN" arrow keys.

7. Press the "ALARM TEST" key twice. Verify that the LCD counts up from 21 to the high alarm set point, sounds the beeper and blinks the LED, and then counts back down to the low alarm set point, sounds the beeper and blinks the LED.

8. With the LCD reading 21%, set the low alarm to a value above 21. The alarm should sound and the LCD should flash. Verify that the "ALARM SILENCE" key is working by pressing once. Five seconds after pressing this key, the LCD should begin counting down from 30 to 1 in the lower right hand corner of the display. NOTE: While the LED continues to flash, the beeper should not beep while the unit is counting from 30.

9. Verify the linearity of the unit by adjusting the cell simulator so that the current it produces corresponds to 100% (i.e., divide the 21% calibration current by .21 to determine the current). Once the LCD has stabilized, the unit should read a number between 96 and 104. If the number is not in this range, refer to section 4.2 - Offset Adjustment. If the number is within this range, press the "CAL" key twice. The unit should display the message "CAL IN 100%" and count from 15 to 1, at a 1 Hz rate, and then display 100.

10. Verify that the watchdog timer circuit is functioning by removing the jumper (in a socket) which resides on the display and timing board when the unit is in its normal operating mode (i.e., displaying O_2 concentration). Tie pin 8 of the socket to ground. After 5 to 15 seconds from the removal of the jumper, the LCD should go blank, the beeper should sound continuously, and the LED should light up and remain lit indefinitely. When the test is completed, remove the ground connection at pin 8 of the socket and replace the jumper.

11. Verify that the hardware shutdown circuit is functioning by applying approximately 6V to the unit with a power supply. With the unit on, turn the voltage down to 5V. The unit should turn off. NOTE: Shortly thereafter, the LED and buzzer <u>may</u> or <u>may not</u> turn on. This is normal.

SUPPLEMENT TO
TED 200 INSTRUCTION MANUAL
TROUBLE SHOOTING

3/06/89

The TED 200 is supplied with a variety of built-in safety features which prevent the instrument's use when a fault or incorrect calibration procedure is detected. When a unit repeatedly displays "recal air", "recal in 100%", "replace sensor", alarms continuously, or refuses to turn on, it may be an indication of an erroneous calibration, an expired sensor, an intermittant or faulty connection in the sensor holder or a low battery condition. To determine where the difficulty lies, please use the following procedure.

1. With the unit in the off condition install the sensor (section III of instruction manual). If the sensor is already in place remove it and inspect sensor and sensor holder contacts for corrosion. If corrosion is observed replace the component with a known good one and proceed to step 2.

2. With the unit in the off condition allow the instrument to sit for 15 minutes. This allows the sensor to stabilize.

3. Turn the unit on. If the unit refuses to turn on or immediately goes into alarm, the batteries are too low for the unit to function or are improperly installed. Replace batteries with new ones paying special attention to proper battery polarity.

4. Perform an air calibration as described in section III.4 in the instruction manual. Note: It is very important that air calibration be performed <u>every time</u> a sensor or sensor holder is installed on a unit. The microprocessor in the TED 200 cannot perform its task properly without this data.

5. Push battery test. If batteries are low, replace with new ones.

6. If the TED 200 calibrates correctly in air, proceed with the calibration procedures in the instruction manual for 100% O2 calibration. If the unit flashes "recal in 100%" or "replace sensor" after a second attempt to calibrate, proceed to step 7.

7. The flashing display may indicate a faulty holder connection, or a non-functioning sensor. The following procedures will locate the defective component:

A. Replace the sensor holder assembly with a known functioning one and insert original sensor. Recalibrate in air following steps 2 thru 4. If "recal air" or "replace sensor" indication still persists, the sensor is inoperable and requires replacement. If the unit accepts calibration, proceed to step 8.

B. Sensor holders may display an intermittent condition making it more difficult to locate the fault. Using a known working sensor, install it in the suspect holder leaving the cap off. Proceed with the calibration procedures outlined in 2 thru 4. If the unit continues to display "recal air" or "replace sensor", the sensor holder has an open circuit and should be replaced. If the unit accepts the calibration, proceed to step 8.

8. PARTS LIST FOR TED-200

	PART#	DESCRIPTION
A-	176	ALARM
A-	34717	ADAPTER PLATE
A-	36872	PROBE CLIP
A-	41524	CONTROLLER PCB
A-	41529	ANALOG PCB
A-	41533	DISPLAY & TIMING PCB
B-	56	BATTERY CLIP WITH LEADS
B-	330	BUMPER FEET
B-	384	BATTERY HOLDER
B-	385	BATTERY STACK
B-	39620	PROBE ASSEMBLY
C-	360	10 pF CAPACITOR
C-	386	.047 MICRO CAPACITOR
C-	394	1500 uF CAPACITOR
C-	460	.1 uF CAPACITOR
C-	460	.1 MICRO 100V 10% CAPACITOR
C-	775	1 MICRO CAPACITOR
C-	989	DUPONT-BERG FEMALE CONNECTOR
C-	990	FEMALE CONNECTOR
C-	991	500 kHz CRYSTAL
C-	993	20 pF 100V 19% CAPACITOR
C-	994	680 uF CAPACITOR
C-	996	MALE CONNECTOR
C-	997	RIBBON CABLE
C-	1036	4 mHz CRYSTAL
D-	62	DIODE, IN4148
H-	229	HEADER
H-	239	90 DEG. HEADER
H-	240	HANDLE
I-	91	INTEGRATED CIRCUIT
I-	123	INTEGRATED CIRCUIT
I-	124	INTEGRATED CIRCUIT
I-	125	INTEGRATED CIRCUIT
I-	126	INTEGRATED CIRCUIT
I-	127	INTEGRATED CIRCUIT
I-	128	INTEGRATED CIRCUIT
I-	129	INTEGRATED CIRCUIT
I-	130	INTEGRATED CIRCUIT
I-	131	REG VOLT
J-	23	PHONE JACK
L-	185	LCD
L-	189	LED
P-	538	50k TRIM POT
R-	207	1M 1/4 W 5% RESISTOR
R-	211	8.2k 1/4 W 5% RESISTOR
R-	307	100k 1/4 W 5% RESISTOR
R-	311	10k 1/8 W 1% RESISTOR
R-	318	10 M 1/8 W 1% RESISTOR

98368

QA	ISSUE NO.	DATE	REVISION / ECO NUMBER	APP
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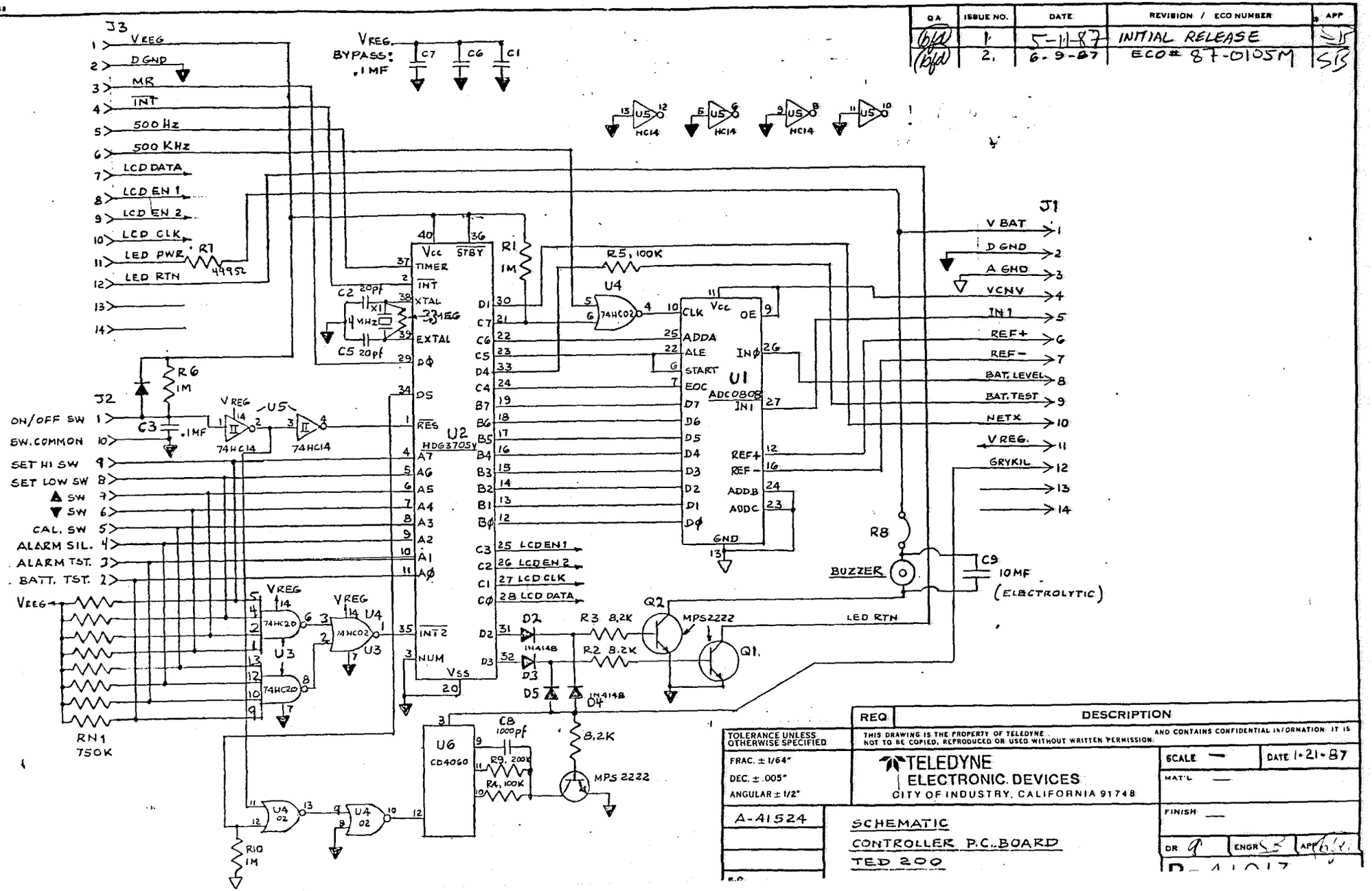
bfd	2.	6-9-87	ECO# 87-0105M	SS



REQ	DESCRIPTION

TOLERANCE UNLESS OTHERWISE SPECIFIED
FRAC. ± 1/64"
DEC. ± .005"
ANGULAR ± 1/2"

TELEDYNE
ELECTRONIC DEVICES
CITY OF INDUSTRY, CALIFORNIA 91748

SCALE —
DATE 1-21-87
MAT'L —
FINISH —
DR 9
ENGR SS
APP

A-41524

SCHEMATIC
CONTROLLER P.C. BOARD
TED 200

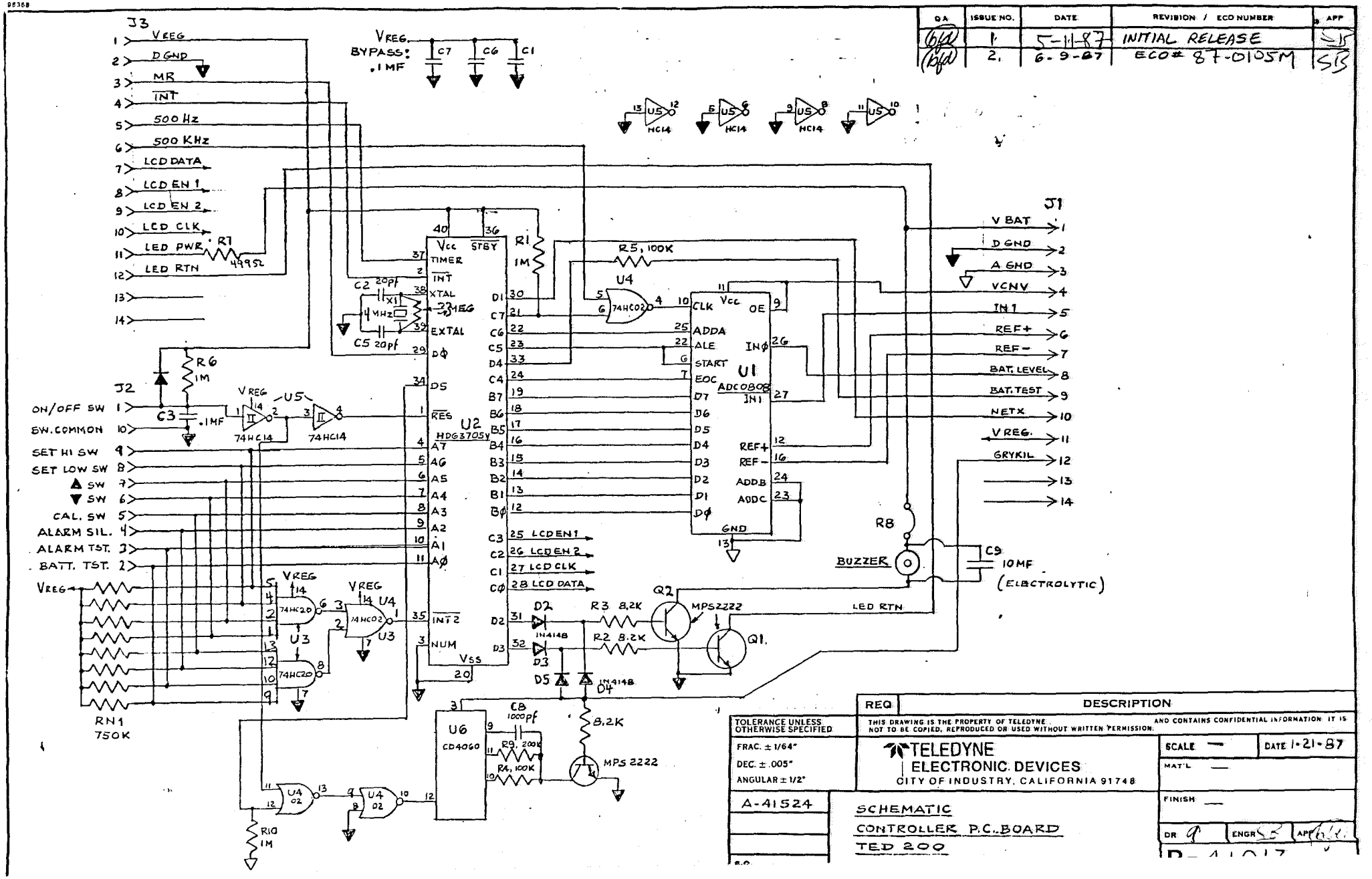
D-41017

PARTS LIST FOR TED-200 (Con't)

	PART#	DESCRIPTION
R-	371	30k 1/8 W 1% RESISTOR
R-	407	3.3M 1/8 W 1% RESISTOR
R-	423	15k 1/8 W 1% RESISTOR
R-	436	2.7 1/8 W 1% RESISTOR
R-	441	499 1/8 W 1% RESISTOR
R-	475	47k 1/4 W 5% RESISTOR
R-	484	210k 1/8 W 1% RESISTOR
R-	490	82.5k 1/8 W 1% RESISTOR
R-	512	200K RESISTOR
R-	514	1M 1/8 W 1% RESISTOR
R-	636	715 OHMS 1/8 W 1% RESISTOR
R-	679	10M 1/8 W 1% RESISTOR
R-	754	402k 1/8 W 1% RESISTOR
R-	780	196k 1/8 W 1% RESISTOR
R-	1054	ZENER DIODE
R-	1219	1.5M 1/8 W 1% RESISTOR
R-	1221	100k 1/8 W .1% RESISTOR
R-	1222	750k RESISTOR NETWORK
R-	1226	542k 1/8 W 25% RESISTOR
R-	1227	576k 1/8W .25% RESISTOR
R-	1228	523k 1/8 W .25% RESISTOR
R-	1229	493k 1/8W .25% RESISTOR
R-	1230	2.26M 1/8W 1% RESISTOR
R-	1242	437k 1/8 W .25% RESISTOR
S-	89	DIODE
S-	183	16 PIN DIP SOCKET
S-	207	14 PIN DIP SOCKET
S-	208	8 PIN DIP SOCKET
S-	642	40 PIN DIP SOCKET
S-	647	16 PIN SOCKET
S-	776	28 PIN DIP SOCKET
T-	841	TRANSISTOR
T-	842	TRANSISTOR
Z-	25	DIODE
Z-	35	ZEBRA STRIPE CONNECTOR

9. REFERENCE DRAWINGS

Schematic - Display & Timing	B-41914
Schematic - Controller	B-41913
Schematic - Analog	B-41912
Final Assembly	C-41901



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TELEDYNE
ELECTRONIC DEVICES
CITY OF INDUSTRY, CALIFORNIA 91748

SCALE —
DATE 1-21-87
MAT'L —
FINISH —
DR 9
ENGR SS
APP

A-41524

SCHEMATIC
CONTROLLER P.C. BOARD
TED 200

D-41017

98358

QA	ISSUE NO	DATE	REVISION / ECO NUMBER	APP
	4	12-22-87	ECO 87 NO-0250M	SB

QA	ISSUE NO.	DATE	REVISION / ECO NUMBER	APP
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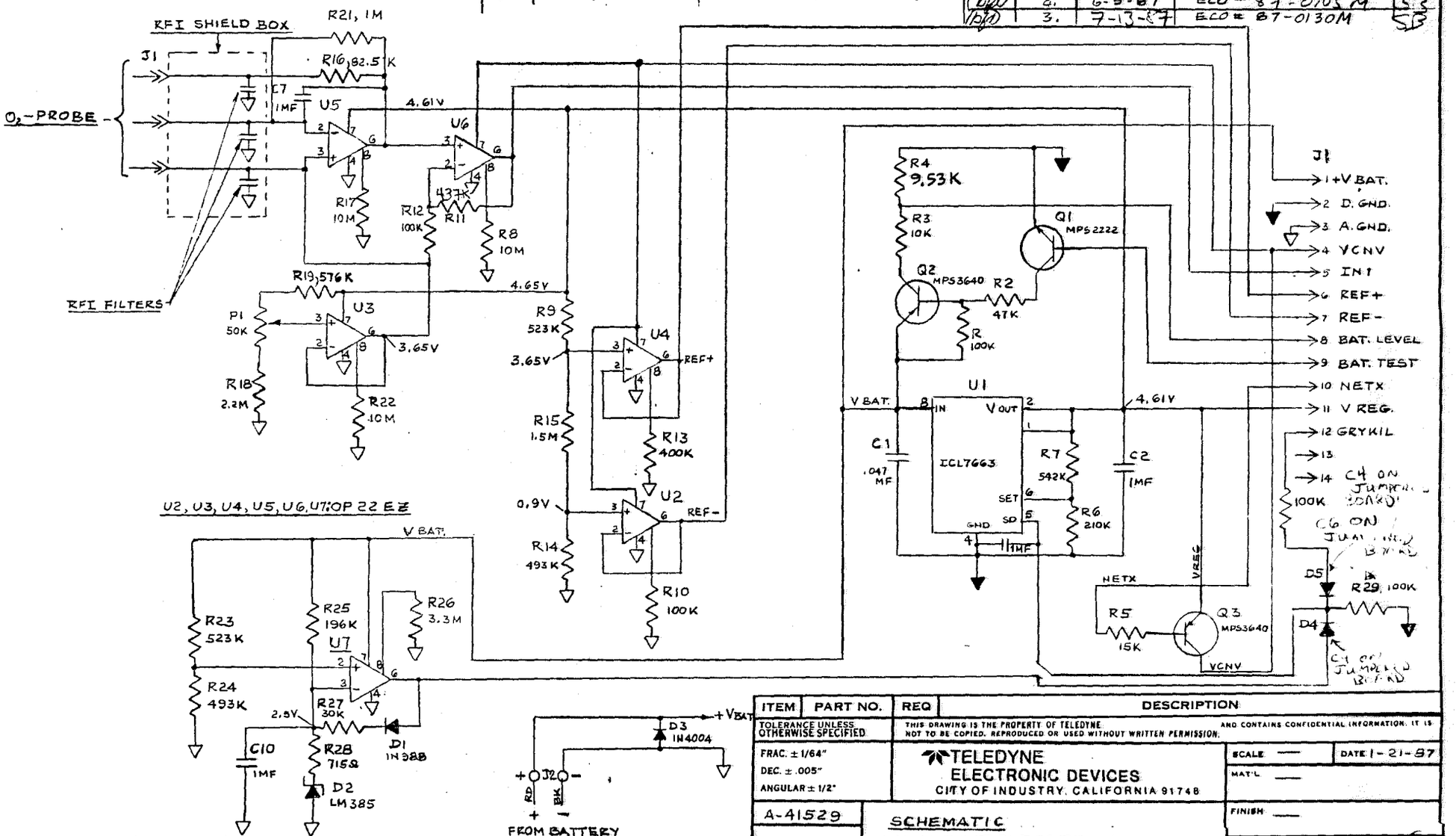
	2.	6-9-87	ECO # 87-0105M	SB
	3.	7-13-87	ECO # 87-0130M	SB



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TELEDYNE
ELECTRONIC DEVICES
CITY OF INDUSTRY, CALIFORNIA 91748

SCALE —
DATE 1-21-87
MAT'L —
FINISH —

A-41529

SCHEMATIC
ANALOG P.C. BOARD

SERVICE INFORMATION

TED OXYGEN INSTRUMENTS

INSTRUMENTS COVERED:

TED 200

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TED:200SERV.MAN 5/10/88

TED 200 SERVICE MANUAL

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LIST OF FIGURES

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INTRODUCTION

This manual is intended to provide service information to help qualified personnel service the TED line of oxygen analyzers. The ability to read and follow schematics is assumed, as is basic knowledge of the functions and characteristics of operational amplifiers.

The only equipment required in troubleshooting the analyzer is a digital voltmeter; however, means of simulating the sensor may be useful. Suggestions are provided in the Manufacturing Test Procedure Section for a simple cell simulator circuit. No oscilloscope or other elaborate test equipment is required.

4.3 Alarm Circuit

In the case of the TED 200 oxygen alarms, the analog/digital converter reads the voltage at the ouput of the sensor amplification circuit. The microcomputer then calculates which voltages, from the sensor amplification circuit, should produce an alarm. The microcomputer then compares the present voltage to the calculated voltages and determines if an alarm signal is required. The analog/digital converter also reads the battery voltage, after the voltage has been divided by a resistor ladder, and activates the low battery indicator if the voltage is below a predetermined level.

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2. Unscrew the holder cap from the sensor holder, and remove the previous Mini-Micro-Fuel Cell.

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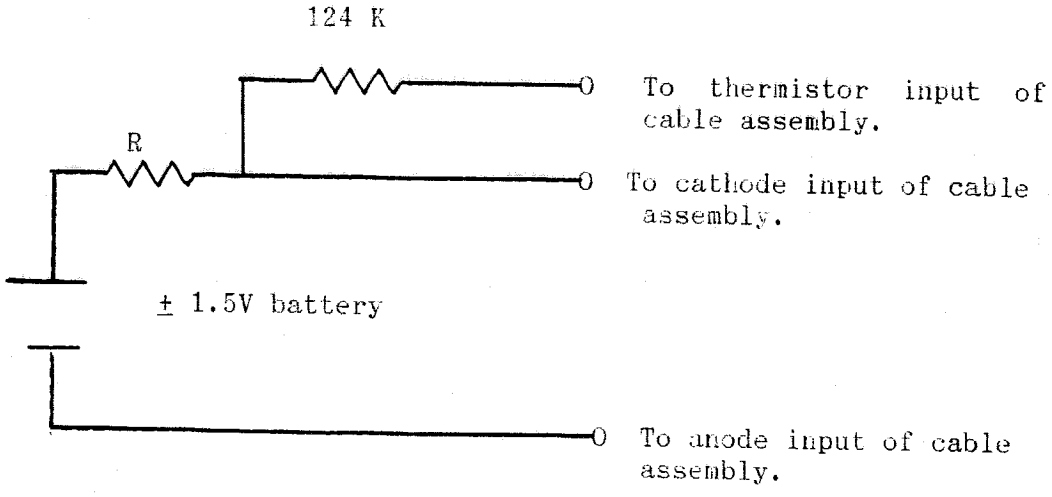

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(Three Board System)

1. Connect a variable power supply (intially set to 6V) to the battery clip and a cell simulator via adapter to the cell probe assembly.

2. Press the "ON/OFF" key once. This key should click audibly (as should all subsequent key depressions), and the LCD should display the high and low alarm set points of 100 and 17, respectively, and should flash the message "AIR CAL" at a 1 Hz rate.

3. Set up the cell simulator so that it produces approximately 450 nA and press the "CAL" key twice. The unit should count down from 10 to 1 at a 1 Hz rate, and then display 21. At this point, the unit should flash the message "CAL IN 100%" for 5 seconds. Verify that the unit can calibrate a weak cell by first adjusting the cell simulator so that it produces .290uA and then press the "CAL" key twice. The unit should count down from 10 to 1 at a 1 Hz rate, and then display 21.

4. With the power supply set to 6V, push the "BATT TEST" key. The unit should display the message "BATTERY HOURS LEFT 999" for 5 seconds.

5. Press the "SET HI ALARM" key, and verify that the high alarm point can be adjusted by pressing the "UP" and "DOWN" arrow keys.

6. Press the "SET LO ALARM" key, and verify that the low alarm point can be adjusted by depressing the "UP" and "DOWN" arrow keys.

7. Press the "ALARM TEST" key twice. Verify that the LCD counts up from 21 to the high alarm set point, sounds the beeper and blinks the LED, and then counts back down to the low alarm set point, sounds the beeper and blinks the LED.

8. With the LCD reading 21%, set the low alarm to a value above 21. The alarm should sound and the LCD should flash. Verify that the "ALARM SILENCE" key is working by pressing once. Five seconds after pressing this key, the LCD should begin counting down from 30 to 1 in the lower right hand corner of the display. NOTE: While the LED continues to flash, the beeper should not beep while the unit is counting from 30.

9. Verify the linearity of the unit by adjusting the cell simulator so that the current it produces corresponds to 100% (i.e., divide the 21% calibration current by .21 to determine the current). Once the LCD has stabilized, the unit should read a number between 96 and 104. If the number is not in this range, refer to section 4.2 - Offset Adjustment. If the number is within this range, press the "CAL" key twice. The unit should display the message "CAL IN 100%" and count from 15 to 1, at a 1 Hz rate, and then display 100.

10. Verify that the watchdog timer circuit is functioning by removing the jumper (in a socket) which resides on the display and timing board when the unit is in its normal operating mode (i.e., displaying O_2 concentration). Tie pin 8 of the socket to ground. After 5 to 15 seconds from the removal of the jumper, the LCD should go blank, the beeper should sound continuously, and the LED should light up and remain lit indefinitely. When the test is completed, remove the ground connection at pin 8 of the socket and replace the jumper.

11. Verify that the hardware shutdown circuit is functioning by applying approximately 6V to the unit with a power supply. With the unit on, turn the voltage down to 5V. The unit should turn off. NOTE: Shortly thereafter, the LED and buzzer <u>may</u> or <u>may not</u> turn on. This is normal.

SUPPLEMENT TO
TED 200 INSTRUCTION MANUAL
TROUBLE SHOOTING

3/06/89

The TED 200 is supplied with a variety of built-in safety features which prevent the instrument's use when a fault or incorrect calibration procedure is detected. When a unit repeatedly displays "recal air", "recal in 100%", "replace sensor", alarms continuously, or refuses to turn on, it may be an indication of an erroneous calibration, an expired sensor, an intermittant or faulty connection in the sensor holder or a low battery condition. To determine where the difficulty lies, please use the following procedure.

1. With the unit in the off condition install the sensor (section III of instruction manual). If the sensor is already in place remove it and inspect sensor and sensor holder contacts for corrosion. If corrosion is observed replace the component with a known good one and proceed to step 2.

2. With the unit in the off condition allow the instrument to sit for 15 minutes. This allows the sensor to stabilize.

3. Turn the unit on. If the unit refuses to turn on or immediately goes into alarm, the batteries are too low for the unit to function or are improperly installed. Replace batteries with new ones paying special attention to proper battery polarity.

4. Perform an air calibration as described in section III.4 in the instruction manual. Note: It is very important that air calibration be performed <u>every time</u> a sensor or sensor holder is installed on a unit. The microprocessor in the TED 200 cannot perform its task properly without this data.

5. Push battery test. If batteries are low, replace with new ones.

6. If the TED 200 calibrates correctly in air, proceed with the calibration procedures in the instruction manual for 100% O2 calibration. If the unit flashes "recal in 100%" or "replace sensor" after a second attempt to calibrate, proceed to step 7.

7. The flashing display may indicate a faulty holder connection, or a non-functioning sensor. The following procedures will locate the defective component:

A. Replace the sensor holder assembly with a known functioning one and insert original sensor. Recalibrate in air following steps 2 thru 4. If "recal air" or "replace sensor" indication still persists, the sensor is inoperable and requires replacement. If the unit accepts calibration, proceed to step 8.

B. Sensor holders may display an intermittent condition making it more difficult to locate the fault. Using a known working sensor, install it in the suspect holder leaving the cap off. Proceed with the calibration procedures outlined in 2 thru 4. If the unit continues to display "recal air" or "replace sensor", the sensor holder has an open circuit and should be replaced. If the unit accepts the calibration, proceed to step 8.

8. PARTS LIST FOR TED-200

	PART#	DESCRIPTION
A-	176	ALARM
A-	34717	ADAPTER PLATE
A-	36872	PROBE CLIP
A-	41524	CONTROLLER PCB
A-	41529	ANALOG PCB
A-	41533	DISPLAY & TIMING PCB
B-	56	BATTERY CLIP WITH LEADS
B-	330	BUMPER FEET
B-	384	BATTERY HOLDER
B-	385	BATTERY STACK
B-	39620	PROBE ASSEMBLY
C-	360	10 pF CAPACITOR
C-	386	.047 MICRO CAPACITOR
C-	394	1500 uF CAPACITOR
C-	460	.1 uF CAPACITOR
C-	460	.1 MICRO 100V 10% CAPACITOR
C-	775	1 MICRO CAPACITOR
C-	989	DUPONT-BERG FEMALE CONNECTOR
C-	990	FEMALE CONNECTOR
C-	991	500 kHz CRYSTAL
C-	993	20 pF 100V 19% CAPACITOR
C-	994	680 uF CAPACITOR
C-	996	MALE CONNECTOR
C-	997	RIBBON CABLE
C-	1036	4 mHz CRYSTAL
D-	62	DIODE, IN4148
H-	229	HEADER
H-	239	90 DEG. HEADER
H-	240	HANDLE
I-	91	INTEGRATED CIRCUIT
I-	123	INTEGRATED CIRCUIT
I-	124	INTEGRATED CIRCUIT
I-	125	INTEGRATED CIRCUIT
I-	126	INTEGRATED CIRCUIT
I-	127	INTEGRATED CIRCUIT
I-	128	INTEGRATED CIRCUIT
I-	129	INTEGRATED CIRCUIT
I-	130	INTEGRATED CIRCUIT
I-	131	REG VOLT
J-	23	PHONE JACK
L-	185	LCD
L-	189	LED
P-	538	50k TRIM POT
R-	207	1M 1/4 W 5% RESISTOR
R-	211	8.2k 1/4 W 5% RESISTOR
R-	307	100k 1/4 W 5% RESISTOR
R-	311	10k 1/8 W 1% RESISTOR
R-	318	10 M 1/8 W 1% RESISTOR