

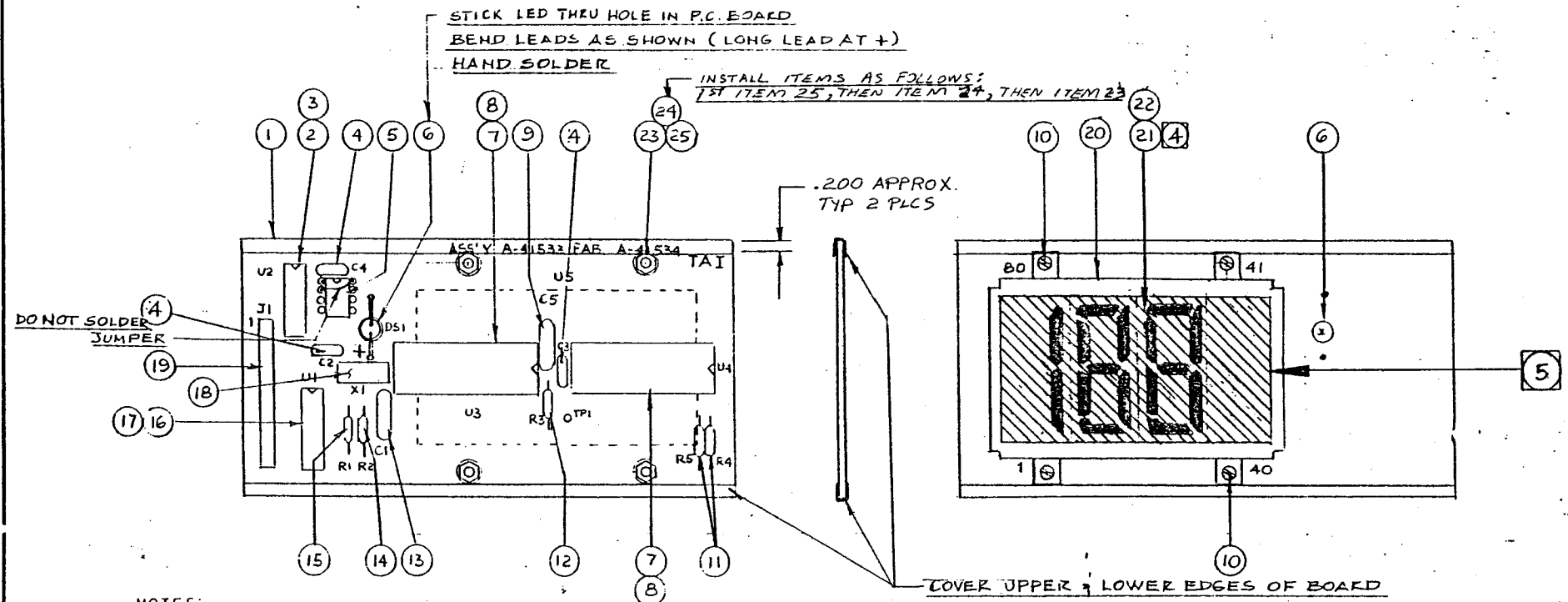
SERVICE INFORMATION
TED OXYGEN INSTRUMENTS

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

QA	ISSUE NO.	DATE	REVISION / ECO NUMBER	APP
160	1	10/7/88	INIT RELS/ECO#53-0233M	CMH



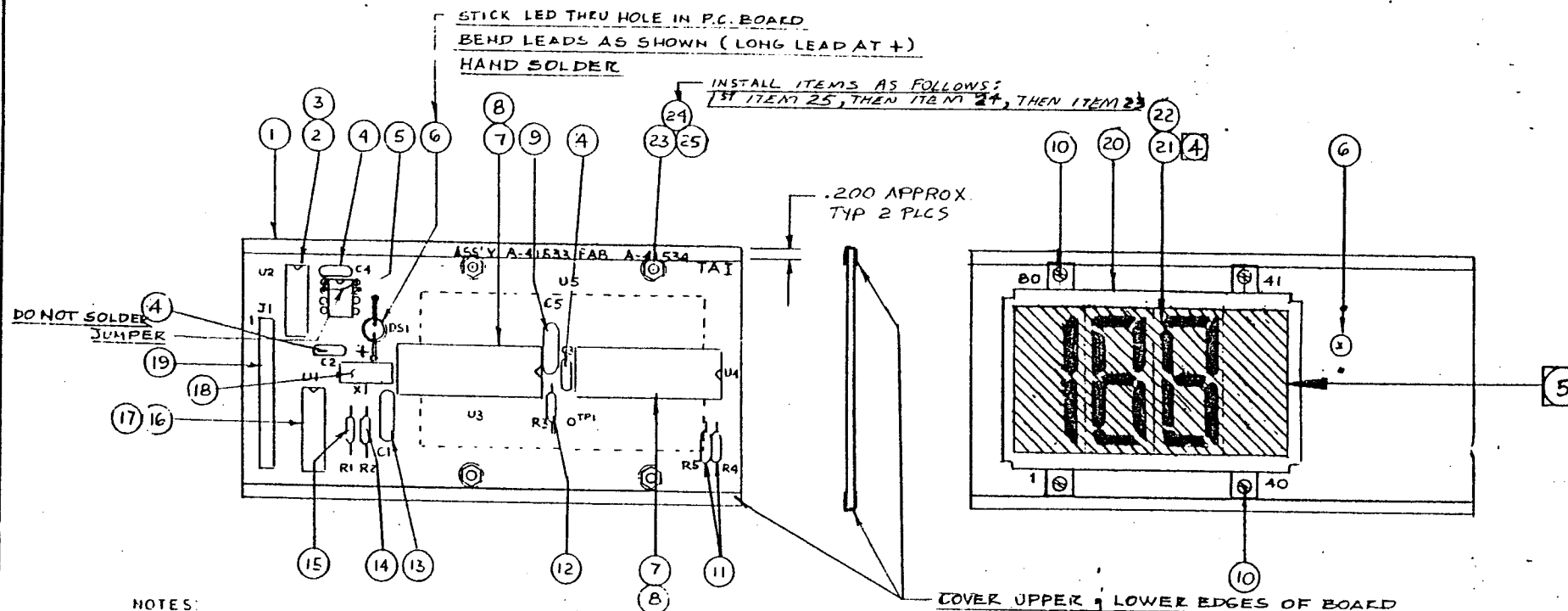
NOTES:

1. REMOVE LCD PROTECTIVE FILM BEFORE MOUNTING LCD ON BOARD.
2. VAPOR DEGREASE THE BOARDS PRIOR TO ASS'Y. CLEAN CONTACT SURFACES ON LCD DISPLAY WITH ALCOHOL & A KIM WIFE, BEING CAREFUL NOT TO SATURATE THE LCD.
3. PUT 2 STRIPS OF 1/16" THICK X 1/2" BLACK NEOPRENE CLOSED CELL SPONGE ADHESIVE (ONE SIDED) ON BACK OF LCD (ITEM 21) TO PREVENT ZEBRA STRIPES (ITEMS 22) FROM BUCKLING.
4. INSTALL LCD WITH ORIENTATION AS SHOWN.
5. MAINTAIN PROTECTIVE TAPE OVER LCD FACE DURING AND AFTER P.C. BD. ASS'Y.

QUALITY ASSURANCE
APPROVAL REQUIRED!

ITEM	PART NO.	REQ	DESCRIPTION
TOLERANCE UNLESS OTHERWISE SPECIFIED		THIS DRAWING IS THE PROPERTY OF TELEDYNE AND CONTAINS CONFIDENTIAL INFORMATION. IT IS NOT TO BE COPIED, REPRODUCED OR USED WITHOUT WRITTEN PERMISSION.	
FRAC. ± 1/64"		SCALE 1:1	
DEC. ± .005"		DATE 10-3-88	
ANGULAR ± 1/2°		MATERIAL SEE PARTS LIST	
C-41901		FINISH	
		TELEDYNE ELECTRONIC DEVICES	
		CITY OF INDUSTRY, CALIFORNIA 91748	
		ASSEMBLY	
		DISPLAY / TIMING P.C. BOARD	
		MDL. TED 200	
		(GERMAN VERSION)	
S.O.		B-47455	

D*	ISSUE NO.	DATE	REVISION / ECO NUMBER	APP
(12/1)	1	4/2/96	INIT REL	(11/1)



NOTES:

1. REMOVE LCD PROTECTIVE FILM BEFORE MOUNTING LCD ON BOARD.
2. VAPOR DEGREASE THE BOARDS PRIOR TO ASSY. CLEAN CONTACT SURFACES ON LCD DISPLAY WITH ALCOHOL & A KIM WIFE, BEING CAREFUL NOT TO SATURATE THE LCD.
3. PUT 2 STRIPS OF 1/16" THICK X 1/2" BLACK NEOPRENE CLOSED CELL SPONGE ADHESIVE (ONE SIDED) ON BACK OF LCD (ITEM 21) TO PREVENT ZEBRA STRIPES (ITEMS 22) FROM BUCKLING.
4. INSTALL LCD WITH ORIENTATION AS SHOWN.
5. MAINTAIN PROTECTIVE TAPE OVER LCD FACE DURING AND AFTER P.C. BD. ASSY.

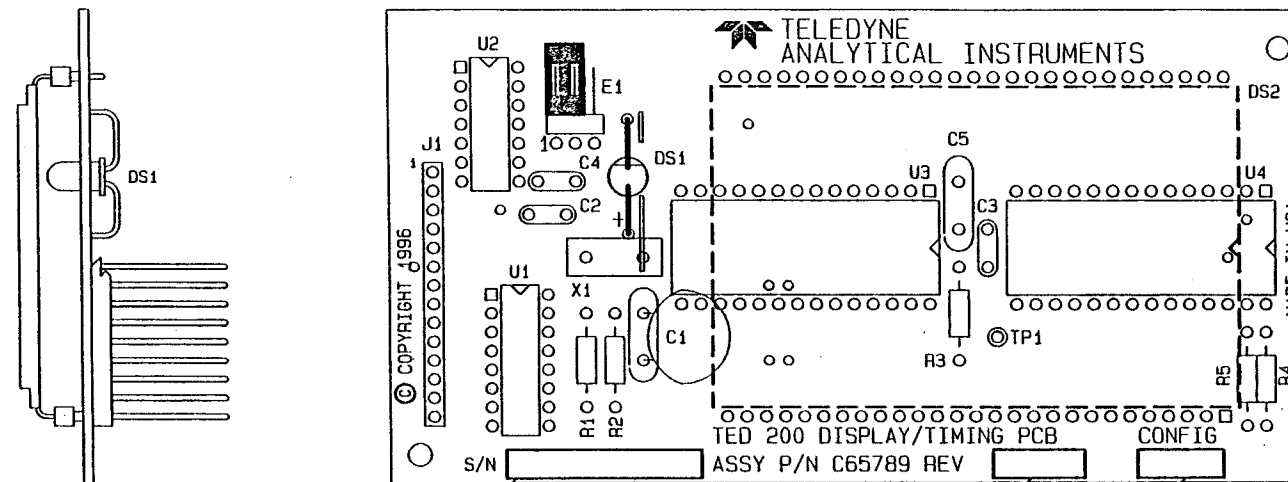
QUALITY ASSURANCE
APPROVAL REQUIRED

ITEM	PART NO.	REQ	DESCRIPTION
TOLERANCE UNLESS OTHERWISE SPECIFIED			THIS DRAWING IS THE PROPERTY OF TELEDYNE NOT TO BE COPIED, REPRODUCED OR USED WITHOUT WRITTEN PERMISSION. AND CONTAINS CONFIDENTIAL INFORMATION IF IT IS
FRAC $\pm 1/64"$ DEC $\pm .005"$ ANGULAR $\pm 1/2^\circ$			 TELEDYNE ELECTRONIC DEVICES CITY OF INDUSTRY, CALIFORNIA 91748
C-41901			SCALE 1:1 DATE 4/2/96
			MAT'L SEE PARTS LIST
ASSEMBLY			FINISH
DISPLAY / TIMING P.C. BOARD			
MDL TED 200F			DB ML ENGR (11/1) APP (11/1)
(FRENCH VERSION)			B- 50600

NOTES: UNLESS OTHERWISE SPECIFIED.

1. INTERPRET DIMENSIONS AND TOLERANCES IAW ANSI Y14.5.
2. FOR SCHEMATIC DIAGRAM SEE D-65788.
3. SOLDER IAW CONTRACT REQUIREMENTS.
4. MARK OR ENGRAVE REVISION AND SERIAL NUMBER IN AREA INDICATED.

REVISONS			
REV	DESCRIPTION	DATE	APP. BY
0	INITIAL RELEASE ECO 96-125	4/2/96	TMC
1	INCORPORATED ECO 96-540	6-24-96	A. A.
2	INCORPORATED ECO 96-1187	12/04/96	A. A.



5. MARK CONFIGURATION "E", "F" OR "G" PERMANENT AND LEGIBLE, E= ENGLISH VERSION, F= FRENCH VERSION OR G= GERMAN VERSION IN AREA INDICATED.
6. IF PRESENT, REMOVE LCD PROTECTIVE FILM BEFORE MOUNTING LCD ON BOARD. SAVE THE FILM TO REUSE AFTER THE LCD HAS BEEN INSTALLED ON THE PCB.
7. INSTALL SOCKETS FOR LCD ON SOLDER SIDE (BACK) OF PCB.
8. INSTALL LCD, IN SOCKETS, WITH ORIENTATION AS SHOWN ON SOLDER SIDE OF PCB, AFTER ALL SOLDERING OF COMPONENTS IS COMPLETE.
9. REPLACE THE PROTECTIVE FILM OVER LCD FACE AFTER THE LCD IS INSTALLED ON THE PCB.
10. INSTALL DS1 AS SHOWN WITH LONG LEAD AT (+).
11. TRIM ALL COMPONENT LEADS AFTER SOLDERING.
12. INSTALL SHUNT JUMPER ON E1 PINS 1 AND 2.
13. BEND C1 DOWN AS FLAT AS POSSIBLE TO PCB TO AVOID INTERFERENCE WITH SHIELDING PLATE.

QUALITY ASSURANCE
APPROVAL REQUIRED



WARNING: ANTISTATIC HANDLING PROCEDURES
ARE REQUIRED IN ASSEMBLY OF THIS PCB.
REF. A29573

DO NOT SCALE DIM		DO NOT SCALE DIM	
TOLERANCE UNLESS OTHERWISE SPECIFIED: ANGULAR ± 1/2°		TOLERANCE UNLESS OTHERWISE SPECIFIED: ANGULAR ± 1/2°	
LINEAR { .XX = ± .03 .XXX = ± .010		LINEAR { .XX = ± .03 .XXX = ± .010	
SIGNATURES	DATE	TITLE	SCALE
N/	DRFT: T.MCINTYRE	1/9/96	2:1
P/	CHK:		STN C-41533
I/	APPR: T.MCINTYRE	4/22/96	SHEET 1 OF 1
F/	ENGR:		
Q/	S.O.:		
REFERENCE	CAD ID C65790-0.PCB	MATL. SEE SEPARATE PARTS LIST	REV 2

PAGE
1 OF 1

REVISION NO. 2

ECO NO. 96-1187

A.A.
12/04/76

[illegible]

CAD ID: B4152417

 **Teledyne Analytical Instruments**
A business unit of Teledyne Electronic Technologies

PARTS LIST

DRAWING NUMBER

B-41524

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MODEL/SERIES: TED 200

DRAWING TITLE: ASSEMBLY,
CONTROLLER P.C. BOARD16) ECO#95-317
5/15/95V.M.
Cruz

INC. ECO#96-1272

17) 1/29/97

ITEM No.	QUANTITY								T.A.I. PART NUMBER	SCHEMATIC REFERENCE	DESCRIPTION
	A	B	C	D	E	F	G	H			
1.	1								B-41525		P.C. BOARD FAB. DETAIL
2.	7								H 239	J1	HEADER, 90°, SAMTEC 025" SQUARE TERMINAL STRIP TSW-114-08-S-D-RA
3.	5								C 460	C1,C3,C4,C6,C7	CAPACITOR, .1MF, 100V, 10%
4.	1								I 128	U1	I.C. #ADC 0808CCN A/D CONVERTER
5.	1								S 776	U1	SOCKET, LOW PROFILE DIP, 28 PIN
6.	1								I 130	U3	I.C. #74HC20 DUAL AND GATE
7.	3								S 207	U3,U4,U5	SOCKET, DIP 14PIN
8.	1								C 989	J2	F. CONNECTOR DUPONT-BERG #66950-010
9.	1								S 647	U6	SOCKET, 16 PIN
10.	1								R 407	R11	RESISTOR, 3.3M, 1%, 1/4W
11.	1								I 129	U4	I.C. #74HC02N QUAD OR GATE
12.	1								I 91	U5	I.C. #74HC14N HEX SCHMITT INV.
13.	3								R 207	R1,R6,R10	RESISTOR, 1M, 1/4W, 5%
14.	1								R 441	R7	RESISTOR, 499Ω, 1/8W, 1%
15.	1								C 990	J3	FEM. CONNECTOR, DUPONT-BERG #66950-014
									C 1030	X1	CRYSTAL, 4MHZ



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PARTS LIST

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REV.
17

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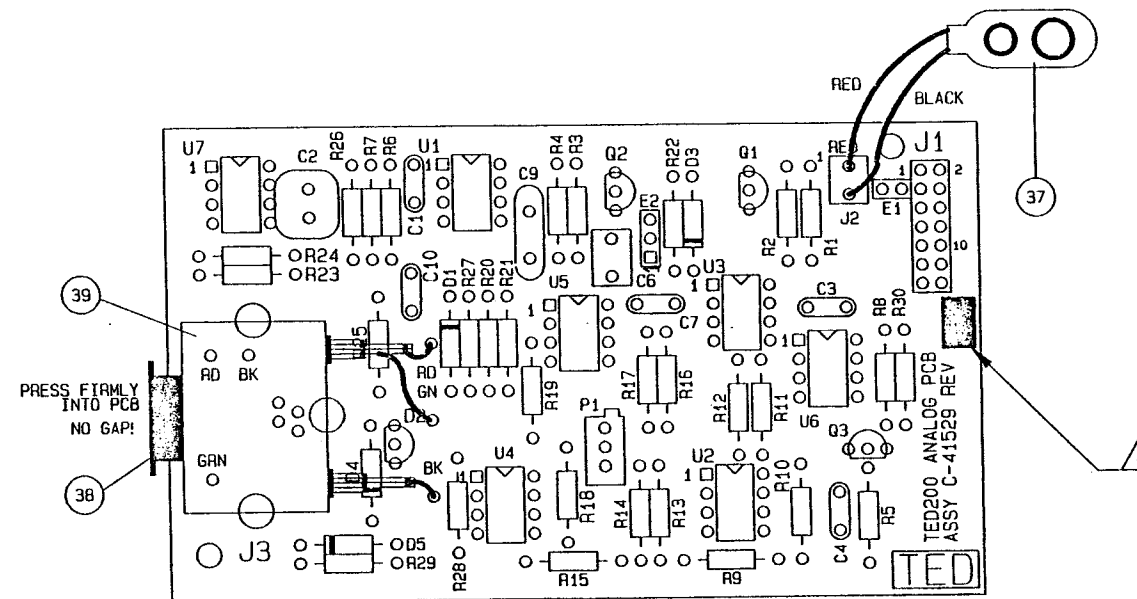
[illegible]

NOTES: UNLESS OTHERWISE SPECIFIED.

1. INTERPRET DIMENSIONS AND TOLERANCES IAW ANSI Y14.5.
2. FOR SCHEMATIC DIAGRAM SEE B41912
3. SOLDER IAW CONTRACT REQUIREMENTS.

4. MARK REVISION NUMBER PERMANENT AND LEGIBLE
IN AREA INDICATED.

REVISIONS				
REV	DESCRIPTION	DATE	APP.	REV.
14	INCORPORATED ECO 96-664	8-8	C.C.	TMC
15	INCORPORATED ECO 96-1194	11/22/16		TMC



WARNING: ANTISTATIC HANDLING PROCEDURES
ARE REQUIRED IN ASSEMBLY OF THIS PCB.
REF. A29573

DO NOT SCALE DIM		TOLERANCE UNLESS OTHERWISE SPECIFIED: ANGULAR = 1/2°		TELEDYNE ANALYTICAL INSTRUMENTS	
LINEAR { .X = .1 .XX = .03 .XXX = .010		TITLE		A BUSINESS UNIT OF TELEDYNE ELECTRONIC TECHNOLOGIES	
SIGNATURES		DATE		SCALE 2:1	
DRFT: T. MCINTYRE		11/24/08		PCB ASSEMBLY	
CHK:				TED 200	
APP'X:				REGULATOR & E/I BD.	
ENGR:				SHEET 1 OF 1	
S.O.				REV	
REFERENCE		C41530 B.PCB		15	

TELEDYNE ANALYTICAL INSTRUMENTS PARTS LIST										DATABASE FILE NAME P4152915.WK2	DRAWING NUMBER C-41529	PAGE 1 of 3
MODEL / SERIES: TED-200										DATE 11/21/96	REVISION NUMBER: 15	APPROVED
DRAWING TITLE: ANALOG PCB										ECO: 96-1194		
ITE	QUANTITY								TAI PART NUMBER	SCHEMATIC REFERENCE B-41912	ITEM DESCRIPTION	MANUFACTURER PART NUMBERS [Or Equivalents]
NO.	A	B	C	D	E	F	G	H				
1	1								I 131	U1	IC LOW POWER POSITIVE VOLTAGE RE	MAXIM ICL7663ACPA
2	6								I 126	U2 U3 U4 U5 U6 U7	IC OP AMP MICROPOWER PROGRAMMA	PMI OP-22EZ
3	1								R1054	D2	IC VOLT. REF. 2.5V 3% @ 20uA-20mA	NATIONAL LM385Z-2.5 (TO-92)
4	2								T 841	Q2 Q3	TRANS. PNP SAT. SW. 12V 80mA TO-92	MOTOROLA MPS3640
5	1								T 842	Q1	TRANSISTOR NPN GP 30V 800mA TO-92	MOTOROLA MPS2222
6	2								D 62	D4 D5	DIODE 200mA 200V GENERAL PURPOSE	1N4148
7	1								S 89	D3	DIODE 1A 400V RECTIFIER	1N4004
8	1								Z 25	D1	DIODE ZENER 130V 20% @950uA	1N988
9	1								C 388	C1	CAPACITOR 0.047uF 10% 100V CERAMIC	CK06BX473K
10	3								C 775	C2 C7 C10	CAPACITOR 1.0uF 10% 50V POLYESTER	WIMA MKS2/1uF/10%/50V
11	1								C 383	C9	CAPACITOR 1.0uF 20% 50V CERAMIC	KEMET C330-C-105M-5U5CA
12	3								R 307	R1 R29 R30	RES 100K Ohm 5% 0.25W CF	ROEDERSTEIN SK2 SERIES
13	1								R 475	R2	RES 47K Ohm 5% 0.25W CF	ROEDERSTEIN SK2 SERIES
14	1								R 311	R3	RES 10K Ohm 1% 0.125W MF	RN55D1002F
15	1								R 442	R4	RES 9.53K Ohm 1% 0.125W MF	RN55D9531F
16	1								R 423	R5	RES 15K Ohm 1% 0.125W MF	RN55D1502F

TELEDYNE ANALYTICAL INSTRUMENTS										DATABASE FILE NAME	DRAWING NUMBER	PAGE
PARTS LIST										P4152915.WK2	C-41529	2 of 3
MODEL / SERIES: TED-200										DATE	REVISION NUMBER: 15	APPROVED
DRAWING TITLE: ANALOG PCB										11/21/96	ECO: 96-1194	SEE PAGE 1
ITEM	QUANTITY								TAI PART NUMBER	SCHEMATIC REFERENCE	ITEM DESCRIPTION	MANUFACTURER PART NUMBERS [Or Equivalents]
NO.	A	B	C	D	E	F	G	H				
17	1								R 484	R6	RES 210K Ohm 1% 0.125W MF	RN55D2103F
18	1								R1613	R7	RES 542K Ohm .25% 0.125W MF 50PPM	PRECISION RESISTIVE GP1/4 SERIES
19	3								R 679	R8 R17 R22	RES 10M Ohm 1% 0.125W CERMET	ALLEN BRADLEY CC1005F
20	2								R1611	R9 R23	RES 523K Ohm .25% 0.125W MF 50PPM	PRECISION RESISTIVE GP1/4 SERIES
21	2								R1609	R10 R12	RES 100K Ohm .1% 0.125W MF 50PPM	RN55C1003B
22	1								R1608	R11	RES 437K Ohm .25% 0.125W MF 50PPM	PRECISION RESISTIVE GP1/4 SERIES
23	1								R 754	R13	RES 402K Ohm 1% 0.125W MF	ROEDERSTEIN MK2 SERIES
24	2								R1612	R14 R24	RES 493K Ohm .25% 0.125W MF 50PPM	PRECISION RESISTIVE GP1/4 SERIES
25	1								R1219	R15	RES 1.5M Ohm 1% 0.125W MF	ROEDERSTEIN MK2 SERIES
26	1								R 490	R16	RES 82.5K Ohm 1% 0.125W MF	RN55D8252F
27	1								R1230	R18	RES 2.26M Ohm 1% 0.125W MF	ROEDERSTEIN MK2 SERIES
28	1								R1610	R19	RES 576K Ohm .25% 0.125W MF 50PPM	PRECISION RESISTIVE GP1/4 SERIES
29	1								R 514	R21	RES 1M Ohm 1% 0.125W MF	ROEDERSTEIN MK2 SERIES
30	1								R 780	R25	RES 196K Ohm 1% 0.125W MF	RN55D1963F
31	1								R 407	R26	RES 3.3M Ohm 1% 0.125W MF	ROEDERSTEIN MK2 SERIES
32	1								R 371	R27	RES 30.1K Ohm 1% 0.125W MF	RN55D3012F

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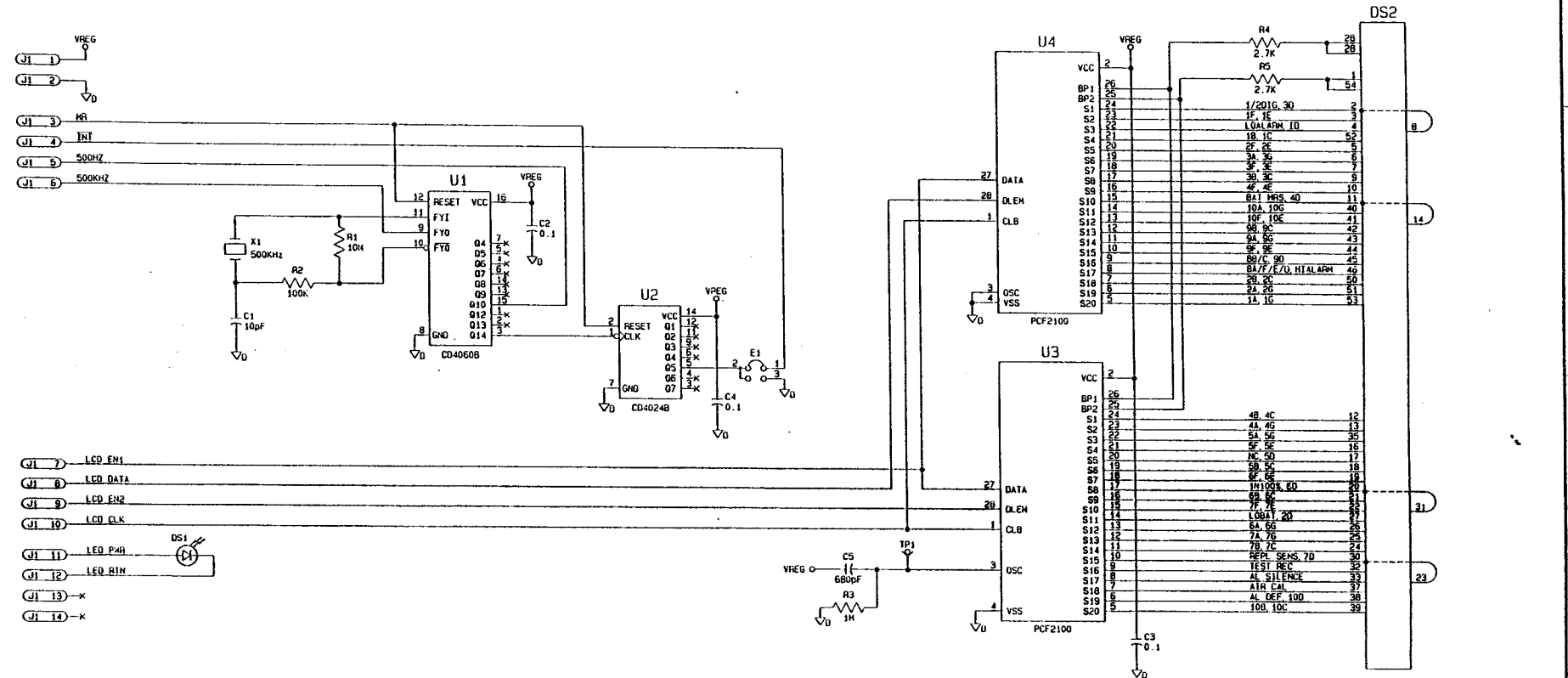
NOTES: UNLESS OTHERWISE SPECIFIED

1. PREPARED IAW DOCUMENTS LISTED:
GRAPHIC SYMBOLS: ANSI Y32.2
REFERENCE DESIGNATORS: ANSI Y32.16
DEFINITIONS OF ENGR DWGS: ANSI Y14.15

2. FOR ASSEMBLY SEE C-65789.

3. RESISTANCE VALUES ARE IN OHMS, 1/8W, +/- 1%.

4. CAPACITANCE VALUES ARE IN MICROFARADS, 50V, +/- 10%.



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REV	DATE	BY	DATE	BY	SCALE
1	11/19/81	1	11/19/81	1	NONE
SCHEMATIC DIAGRAM			TED 200		
DISPLAY / TIMING PCB			B-41914		
REV 1			1 OF 1		
D-65788			REV 1		

 Teledyne Analytical Instruments
A business unit of Teledyne Electronic Technologies

DRAWING NUMBER

C-41901

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PARTS LIST

ITEM No.	QUANTITY								T.A.I. PART NUMBER	DESCRIPTION
	A	B	C	D	E	F	G	H		
12.	2	3	2	2	3		3	3	LL 80	LOCKWASHER #6 EXTERNAL TOOTH
13.	1	2	1	1	2		2	2	NN 48	NUT, HEX 6-32
14.	-	-	-	1	-		-	1	A-50602	BACK PANEL SILKSCREEN DETAIL
↑	-	-	1	-	-		1	-	A-46234	" " "
↓	1	-	-	-	1		-	-	A-42003	" " "
↓	-	1	-	-	-		-	-	A-55013	" " "
15.	1	1	1	1	1		1	1	B 384	BATTERY BOX
16.	1	1	1	1	1		1	1	A-63416	BATTERY HOLDER
17.	1	1	1	1	1		1	1	CC 5	CABLE CLAMP (STRAIN RELIEF)
18.	1	1	1	1	1		1	1	C 997	(CYPRESS) RIBBON 4" LONG CABLE, FUJITSU # FCN-70TJ014-AU/C ORDER #LA3001 4" BETWEEN CONN.
19.	1	1	1	1	1		1	1	C-41529	P.C. BOARD ASSEMBLY, ANALOG
20.	2	2	2	2	2		2	2	SS 271	SCREW, FLAT HEAD, 4-40 x 1/4"
21.	4	4	4	4	4		4	4	B 330	BUMPER
22.	4	4	4	4	4		4	4	SS 272	SCREW, BINDER HEAD, 4-40 x 1 3/4" LG
23.	-	1	-	-	1		1	1	CP 1253	CLIP, PROBE
24.	1	1	-	-	1		-	-	A-41151	FCC LABEL
25.	1	-	1	1	1		1	1	A-37030	LABEL, SERIAL No.
26.	-	1	-	-	-		-	-	A-55011	" "
27.	1	-	1	1	-		-	-	A 181	T-ADAPTER (NOT SHOWN) INCLUDED IN
28.	4	4	4	4	4		4	4	B 99	BATTERY (NOT SHOWN) SHIPPING BOX

Teledyne Analytical Instruments
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PARTS LIST

ITEM No.	QUANTITY								T.A.I. PART NUMBER	DESCRIPTION
	A	B	C	D	E	F	G	H		
29.	2	2	2	2	2		2	2	-----	SCREW, BINDER HEAD, 4-40 x 1/2"
30.	2	2	2	2	2		2	2	-----	NUT, HEX, 6-32
31.	1	1	1	1	1		1	1	A 176	ALARM
32.	.01	.01	.01	.01	.01		.01	.01	L 146	TORQUE SEAL INSPECTOR'S LACQUER
33.	1	1	1	1	1		1	1	-----	TIE WRAP
34.										
35.	2	2	2	2	2		2	2	S 823	SPACER, H.H. SMITH #9031, 3/16 O.V. 2-56 x 916" LG
36.	4	4	4	4	4		4	4	-----	SCREW, BINDER HEAD, 2-56 x 1/4"
37.	4	4	4	4	4		4	4	-----	LOCKWASHER #2 EXTERNAL TOOTH
38.	1	-	-	-	-		-	-	A-45581	LABEL, CSA
39.	-	-	1	-	-		1	-	L 201	LABEL, GS/TUV
40.	A/R	A/R	A/R	A/R	A/R		A/R	A/R	-----	FOAM, BUBBER 4" x 3/4" x 1/8"
41.	-	1	-	-	1		1	1	C 885	CABLE
42.	-	1	-	-	1		1	1	A 268	T-ADAPTER (NOT SHOWN)
43.	-	-	-	-	1		-	-	A-52978	LABEL, CSA
44.	1	1	1	1	1		1	1	BB 192	BOX WITH FOAM
45.	1	-	1	1	1		1	1	LL 124	LABEL, BOX
46.	1	-	-	-	-		-	-	MC41901A	OPERATING MANUAL
47.	-	-	1	-	-		-	-	MC41901C	" "
				1			-	-	MC41901D	" "

 Teledyne Analytical Instruments
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DRAWING NUMBER

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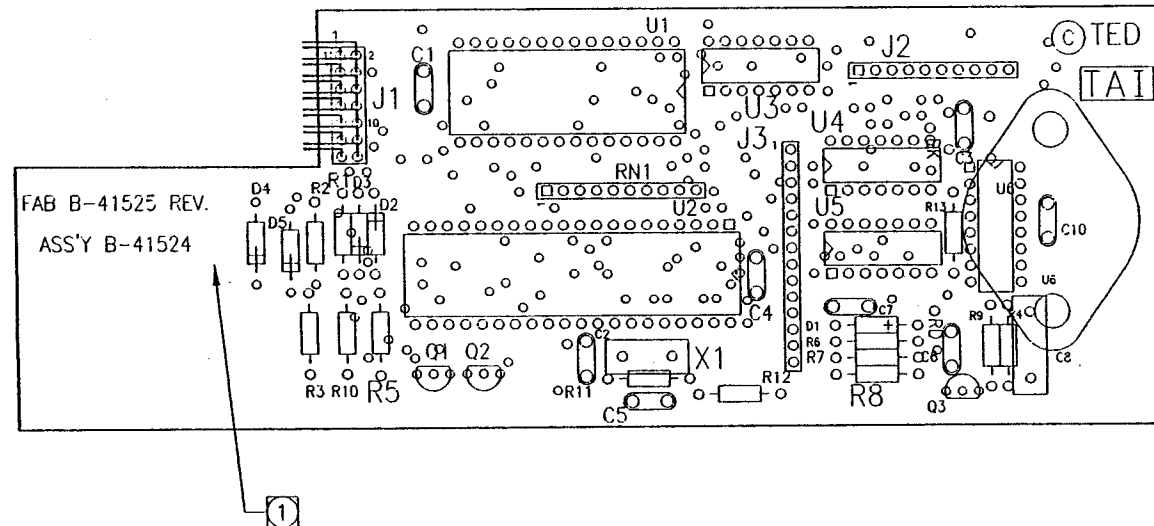
PARTS LIST

ITEM No.	QUANTITY								T.A.I. PART NUMBER	DESCRIPTION
	A	B	C	D	E	F	G	H		
49.	-	-	-	-	1		-	-	MC41901E	OPERATING MANUAL
50.	-	-	-	-	-		1	-	MC41901G	" "
51.	-	-	-	-	-		-	1	MC41901H	" "
52.	-	1	-	-	-		-	-	MC41901B	" "
53.	-	1	-	-	-		-	-	A-57342	LABEL BOX, SUPPLIED BY CUSTOMER
54.	1	1	1	1	1		1	1	C-65964	SHIELD, PROTECTIVE FAB DETAIL
55.	1	1	1	1	1		1	1	C-65965	BARRIER, FAB DETAIL
56.										
57.	1	1	1	1	1		1	1	A-65849	LABEL, CE DETAIL
58.	1	1	1	1	1		1	1	B-65899F	LABEL, MODEL AND CLASS
59.	1	1	1	1	1		1	1	C-66775	COVER, BATTERY HOUSING
60.	1	1	1	1	1		1	1	B-67216	ISOLATOR, SOLDER TAILS
61.	1	1	1	1	1		1	1	C-67215	ISOLATOR, COMPONENT SIDE
62.										
63.										
64.					Ref				C41901E-RS	ROUTE SHEET
65.					Ref				C41901E.SOE	SEQUENCE OF EVENTS
66.	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	B-41912	SCHEMATIC - ANALOG BOARD
67.	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	B-41913	SCHEMATIC - CONTROLLER BOARD
68.	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref	B-41914	SCHEMATIC - DISPLAY / TIMING BOARD

NOTES: UNLESS OTHERWISE SPECIFIED.

① MARK REVISION, PERMANENT AND LEGIBLE IN AREA INDICATED.

REVISIONS				
REV	DESCRIPTION	DATE	APP.	REV. BY
16	INC. ECO# 95-317	5/15/96	VMC	M.V.
17	INC. ECO# 96-1272	11/29/97	VMC	M.V.



APPLY MASKING TAPE TO BOTH SIDES OF
CIRCUIT BOARD AFTER WAVE SOLDERING
(TOP EDGE ONLY).

ITEM		QTY	PART No.	DESCRIPTION		
BILL OF MATERIAL						
DO NOT SCALE DWG			THIS DRAWING IS THE PROPERTY OF TELEDYNE ANALYTICAL INSTRUMENTS AND CONTAINS CONFIDENTIAL INFORMATION. IT IS NOT TO BE COPIED, REPRODUCED OR USED WITHOUT WRITTEN PERMISSION			
TOLERANCE UNLESS OTHERWISE SPECIFIED: ANGULAR $\pm 1/2^\circ$			 Teledyne Analytical Instruments A business unit of Teledyne Electronic Technologies CITY OF INDUSTRY, CALIFORNIA 91748			
LINEAR $\begin{matrix} .X & = & \pm .1 \\ .XX & = & \pm .02 \\ .XXX & = & \pm .010 \end{matrix}$						
S/ B-41913	SIGNATURES		DATE	TITLE P.C. BOARD ASSEMBLY CONTROLLER MODEL TED 200		
N/	DRFT: <i>Marley</i>	12/20/96	SCALE			----
I/	CHK: JOHN C. REYES	1/7/97	SIM			
P/	APPR:		SHEET			1 OF 1
O/	ENGR: VICTOR M. CRUZ					
F/	S.O.:					
REFERENCE	CAD I.D. B4152417		MATL.	** SEE SEPARATE PARTS LIST **	DWG NO. B-41524	REV 17

TED 200 SERVICE MANUAL

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TED 200

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

5. Meter (digital)
6. Power supply

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.

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 output 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 auxiliary 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 continuously, 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 battery wires for ten (10) seconds. Reconnect the batteries (OBSERVING PROPER POLARITY) and disconnect the unit from the 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. Proceed with the following steps:

1. Apply power to the board by making sure the battery pack is still
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 $\pm 1\text{mV}$, measure the voltage between pins 5 and 6 of J1.
5. Adjust the trim pot (P1) slowly until the voltage at pin 5 is 4mV 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.

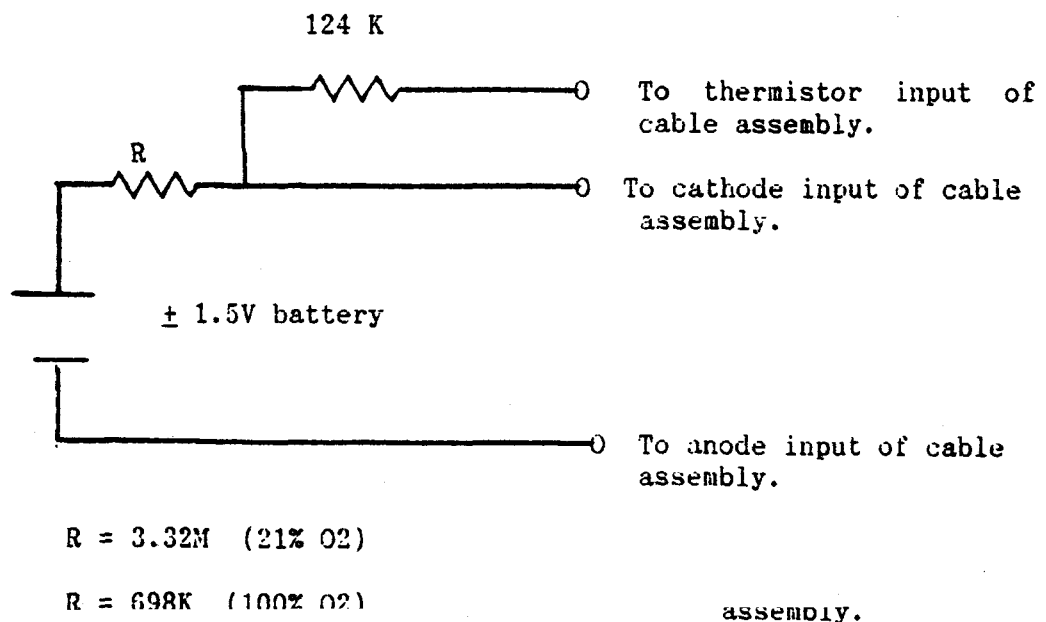


Figure 1. Mini-Micro-Fuel Cell Simulator

TEST PROCEDURE

(Three Board System)

1. Connect a variable power supply (initially 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. ~~be adjusted by pressing the UP and DOWN arrow keys.~~
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 hardware shutdown circuit is functioning by removing the jumper (pin 8 socket), which connects to the supply and turning on the unit when the unit is in its normal operating mode (i.e., displaying O₂ 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 may or may not turn on. This is normal.

SUPPLEMENT TO
TED 200 INSTRUCTION MANUAL
TROUBLE SHOOTING

3/06/89

The TED 20

SUPPLEMENT TO

3/06/89

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 intermittent 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 every time 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 sensor, or a~~ non-functioning sensor. The following procedures will locate the defective sensor. 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. With the sensor holder cap removed gently rock the sensor from side to side 1-2 mm from its seated position. Do not twist the sensor. If the oxygen reading remains constant gently pull on the sensor cable where it enters the back of the sensor holder and at the instrument case. If the reading fluctuates there is a faulty connection in the sensor holder assembly and it should be replaced.

9. If none of the above procedures locate the fault, the instrument along with its sensor holder should be returned to the factory for repair.

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 mF 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 mF 25V 100V 19% CAPACITOR
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

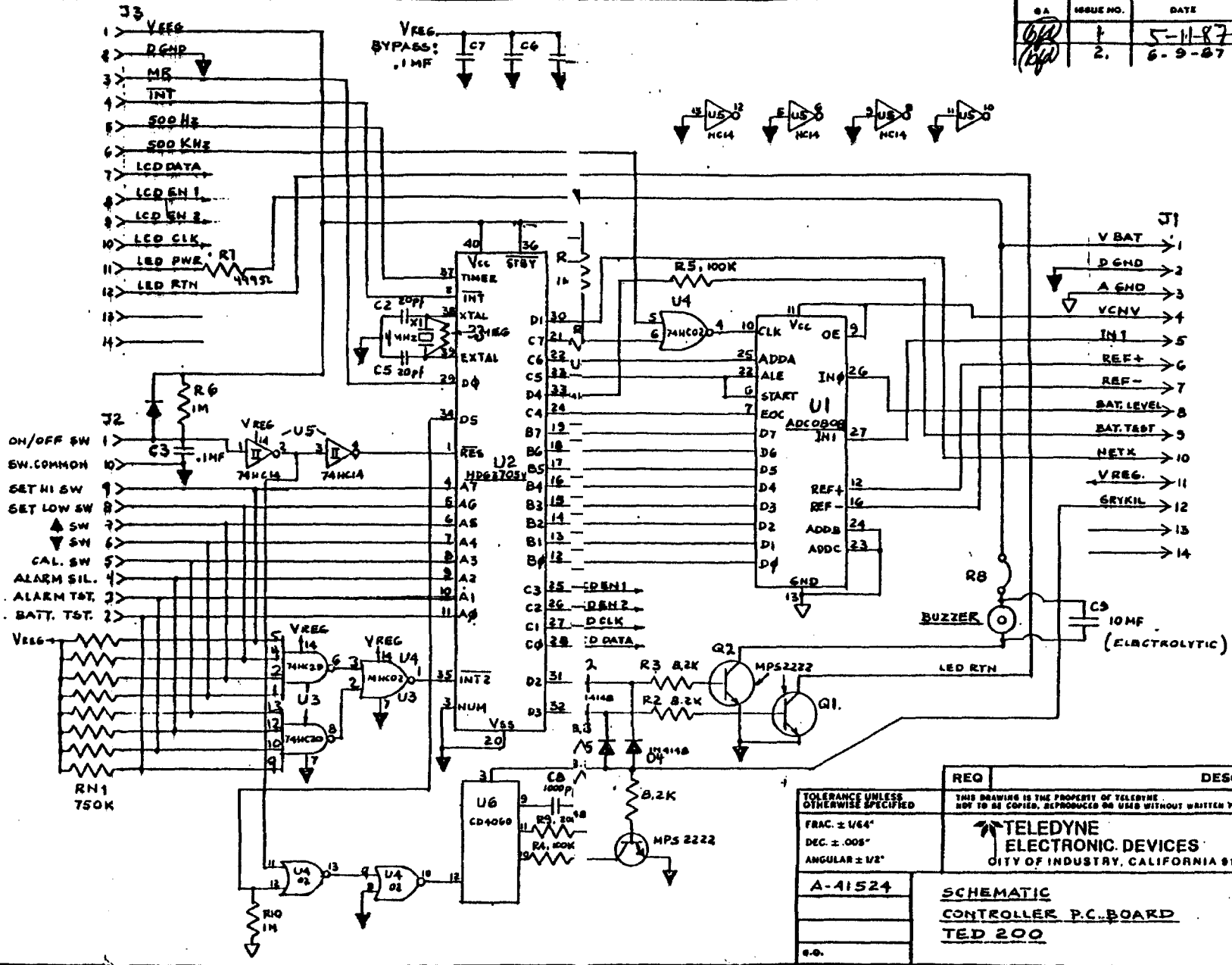
PARTS LIST FOR TED-200 (Con't)

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	4.20M 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

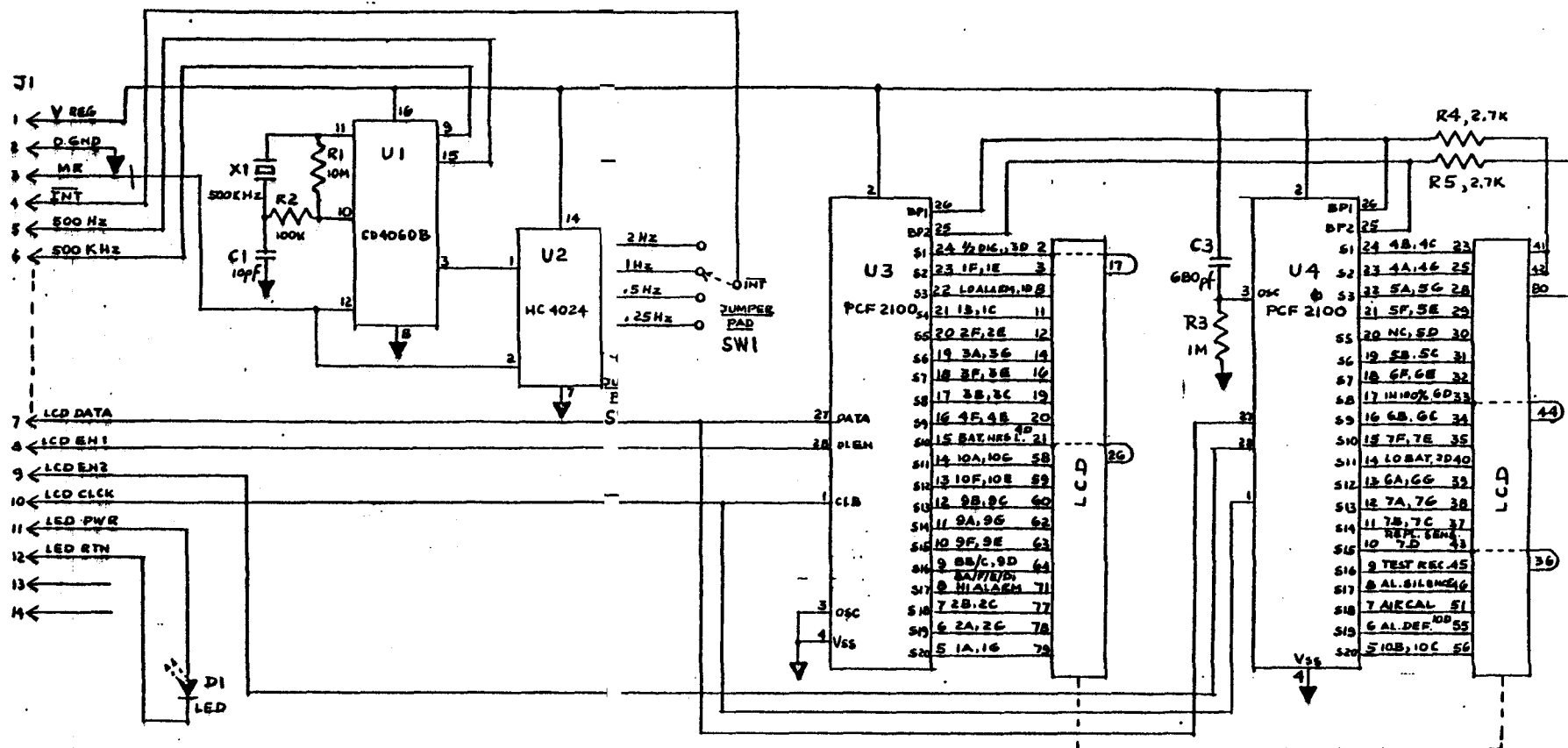
Schematic - Display & Timing	B-41914
Schematic - Controller	B-41913
Schematic - Analog	B-41912
Final Assembly	C-41901

QA	ISSUE NO.	DATE	REVISION / ECO NUMBER	APP
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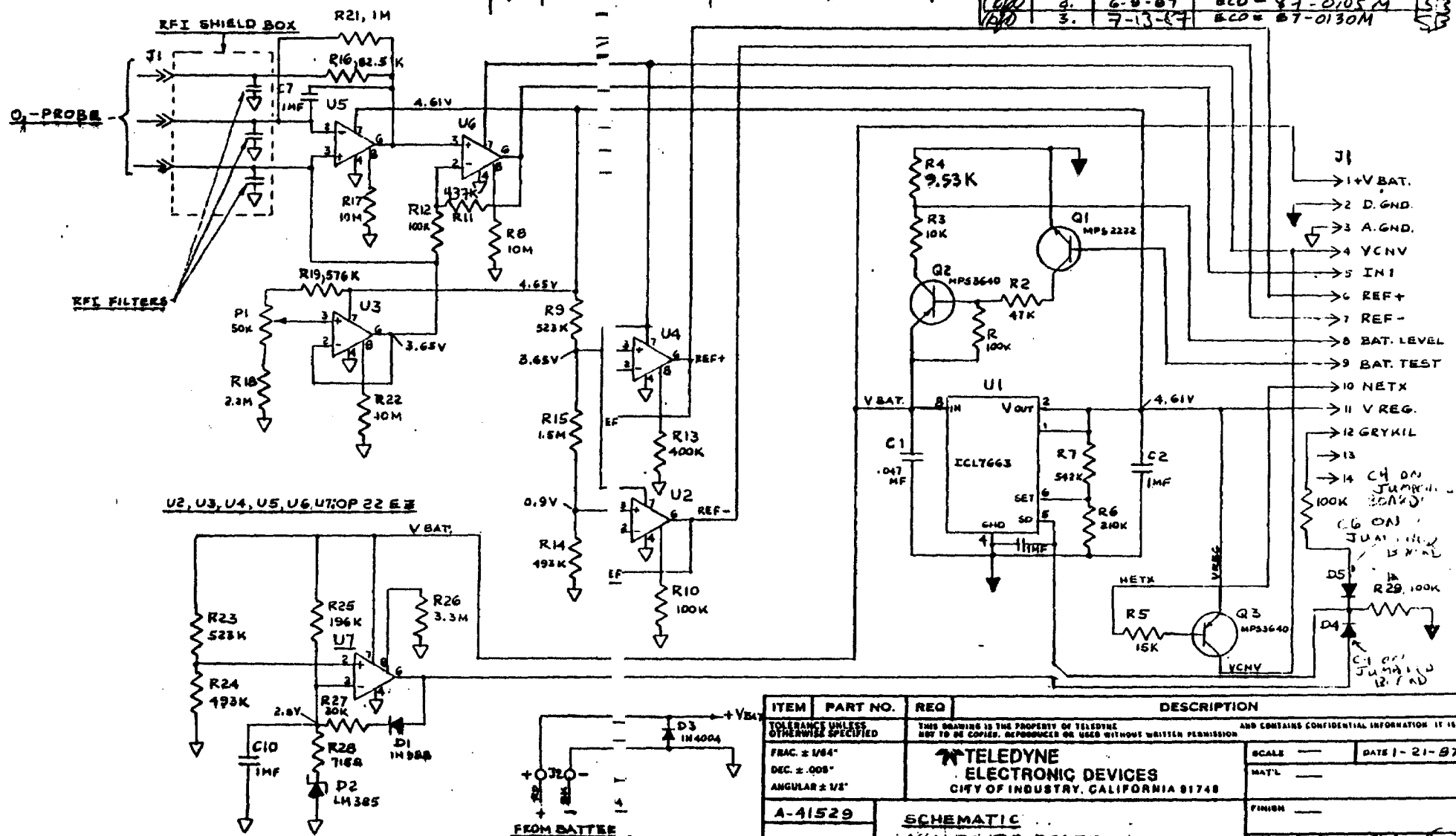


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ANGULAR $\pm$ 1/2"	FINISH —
A-41524	TELEDYNE ELECTRONIC DEVICES CITY OF INDUSTRY, CALIFORNIA 91748
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	DR 9 ENGRS APP 1/1
	B-41913

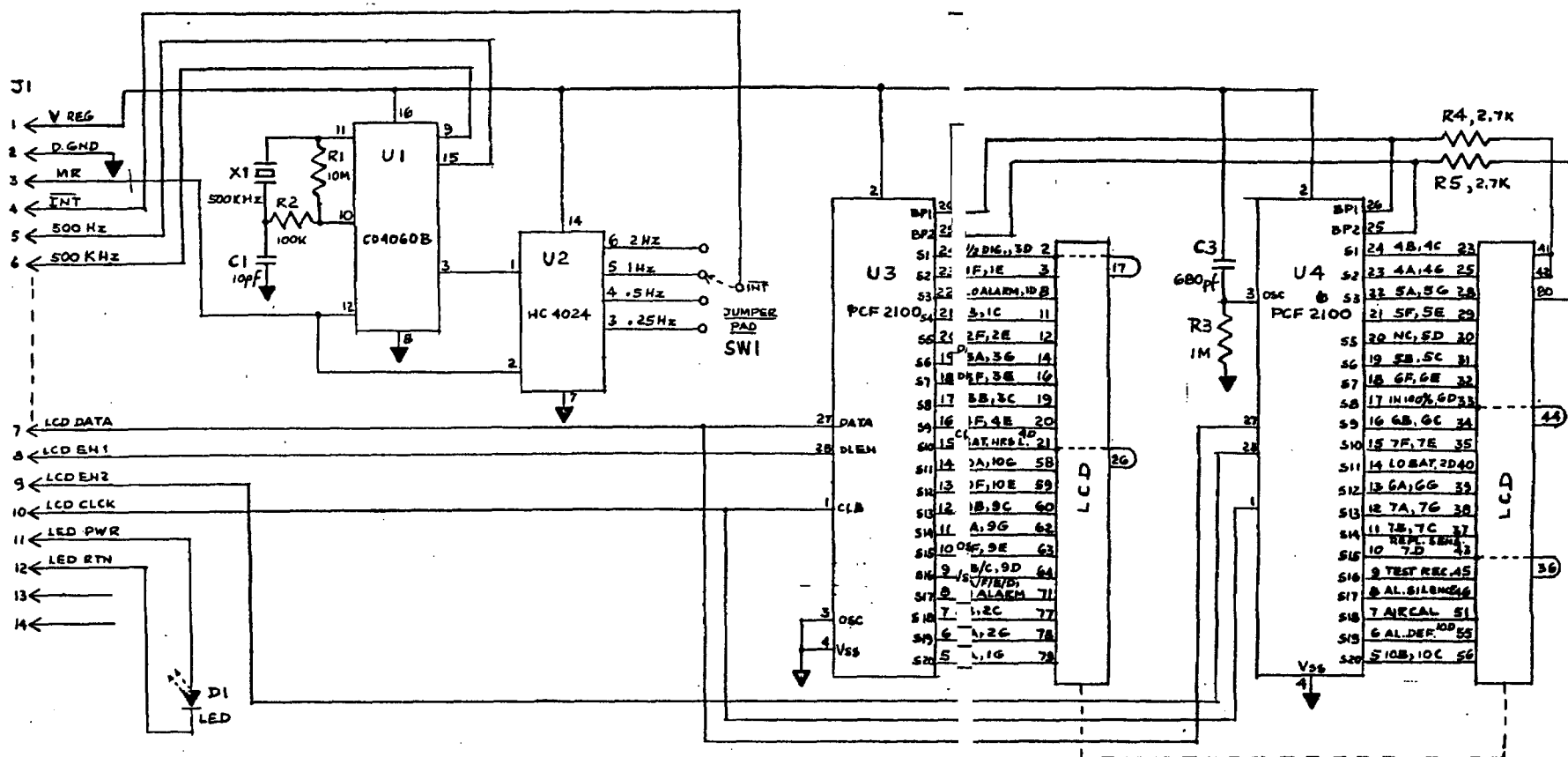
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VBP	1	5-11-87	INIT RELS	SB



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DEC. ± .005"			MATL —
ANGULAR ± 1/2°			FINISH —
B-41533	SCHEMATIC		DR <i>GP</i> <i>SB</i> APP <i>E/H</i>
	DISPLAY/TIMING P.C. BOARD		
	TED 200		
S.O.			B-41914



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A-41529		SCHEMATIC ANALOG P.C. BOARD TED 200		FINISH —		
S.O.				DR 	CHECK  APP. 	



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ANGULAR ± 1/2				FINISH ———
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