SERVICE INFORMATION

TED OXYGEN ALARM MONITORS

INSTRUMENTS COVERED:

TED 60
TED 80
TED 100
TED 120
TED 140
TED 160

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SERVICE MANUAL

TED OXYGEN ALARM MONITORS

TABLE OF CONTENTS

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 sensors may be useful. Suggestions are provided in the Troubleshooting section for simple cell simulator circuits. No oscilloscope or other elaborate test equipment is required.

Model TED 60 is quite different in physical appearance from other instruments in the series. Its compact appearance and economical electronic design do not conform to the unified flow of information for the overall service manual, even though the POL sensor and the theory of operation are the same. For this reason separate coverage is provided for the Model TED 60 in Section VIII.

I. DESCRIPTION OF SENSOR ATTRIBUTES

Each of the instruments uses one of two possible sensor types. These are the POL (polarographic-type) and the Micro-fuel (galvanic-type) cells.

It is important to note that the outputs of both sensor types are affected by temperature changes; an increase in temperature would, if allowed, cause an increase in sensor output and the associated inaccuracies. Both sensors are protected from temperature-related problems by compensation circuits using thermistors (resistance varies with temperature change). The POL Cell has a built-in thermistor, while the Micro-fuel Cell uses a probe assembly with a built-in thermistor.

The two sensor types differ electrically as follows:

1.1 POL Cell: <u>changes</u> an externally-applied voltage to current by reaction with oxygen

The POL Sensor is driven by an externally-applied polarizing voltage. When more oxygen is present, more current flows. The sensor also has a built-in thermistor, which is used to compensate for the change in output resulting from a change in temperature. One lead of the thermistor is connected to one of the sensor's leads. In summary, we apply a voltage to the sensor and measure the resulting current output as an indication of the amount of oxygen present.

A typical POL sensor, type T-4, requires 0.65 volts to drive it and produces 2 microamperes of current ($\pm$ 20%) for 100% oxygen.

After prolonged storage (usually two weeks or more) without a polarizing voltage, the POL Cell must be "activated" to perform as specified. Special circuitry is provided in the instruments using POL Sensors. This "activation" circuitry will apply a reverse potential of about 1.5 volts for approximately 30 seconds each time the instrument is switched on. If the output of the POL sensor drops to a stable value within half an hour after activation, then it can be calibrated; otherwise, repeat the activation cycle by switching the instrument off, then on again.

1.2 Micro-fuel Cell: <u>produces</u> a current from reaction with oxygen

The Micro-fuel Cell does not require an external voltage source; it will independently produce a current proportional to the amount of oxygen present.

A typical Micro-fuel Cell, the T-1, produces 1 milliampere of current ($\pm$ 20%) at 100% oxygen, with no driving voltage required. The T-5 and T-5A cells produce 300 microampere ($\pm$ 20%) at 100% oxygen.

II. CIRCUIT REQUIREMENTS FOR SENSORS

2.1 POL Sensor

The circuit used does four things:

1. provides the activation cycle when the analyzer is turned on
2. provides the 0.65-volt polarizing voltage
3. converts the sensor current to a voltage
4. temperature-compensates the current-to-voltage conversion

As an example, refer to the TED 80 Schematic provided in the drawings section. A reference voltage of -1.25 volts is provided by Z-1, and this is used by A-1a to provide the 0.65-volt polarizing voltage. A-1c, in conjunction with U-1 and the R-2/C-2 timing circuit, provide the activation cycle by changing the voltage of A-1a to about -1.5 volts during the first 30 seconds after turn-on.

Amplifier A-1d is the current amplifier; it has a lot of components around it that may seem confusing at first, but its operation is simple. The current provided by the cell is brought to its inverting input and through a feedback network to the output of the amplifier. As a result, the output voltage is the product of the sensor current and the feedback resistance.

The thermistor is part of the feedback network, and thus, the gain of the circuit is adjusted to compensate for the effects of temperature change on the sensor.

There is a zero offset adjustment provided by P-1 and R-11. This is used to correct for amplifier offset and the current offset of the sensor (that is, the current that flows through it in the absence of oxygen). Diode D-3 prevents any reading below zero from appearing on the display.

2.2 Micro-fuel Cell

The current from the Micro-fuel Cell is allowed to pass through a network consisting of a thermistor and two resistors within the probe assembly, and then through a Span Potentiometer in the analyzer unit. This converts the non-compensated cell current into a temperature-compensated voltage. The Span Pot is used to calibrate the sensor, and an amplifier is used to bring the voltage up to a suitable level for driving the meter and alarm circuitry.

As an example, refer to the TED 140 Schematic provided in the drawings section. The Micro-fuel Cell is shown with its compensating circuitry connected to the Span Pot. The slider of the Span Pot is connected to the non-inverting input of operational amplifier A1c, which amplifies the signal. Offset adjustment for the amplifier is provided by P-1 and R-19.

III. GENERAL CIRCUIT DESCRIPTION

Each of the analyzers in this product series contains some of the following features. Models 100 and 160 have all the named features.

The features are:

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

The chart below lists each feature and indicates the analyzers in which that feature is found. By reading down a single vertical column (for example, the TED 100), you can determine which of the features are used there. You can use the information from the chart to determine which sections of the service manual apply to the instrument you are servicing.

Section:	Used in:				
	TED 80	TED 100	TED 120	TED 140	TED 160
Sensor amplification circuit	YES	YES	NO	YES	YES
Reference voltage circuit	YES	YES	NO	YES	YES
Alarm Circuit	NO	YES	NO	YES	YES
Alarm Bypass Logic	NO	YES	NO	NO	YES
Meter (analog)	NO	NO	YES	YES	NO
Meter (digital)	YES	YES	NO	NO	YES
Power Supply	YES	YES	NO	YES	YES

IV. INDIVIDUAL CIRCUITS AND COMPONENTS

4.1 Sensor Amplification Circuit

See Section II - "CIRCUIT REQUIREMENTS FOR SENSORS".

4.2 Reference Voltage Circuit

In order to properly function, the circuits for the alarms and for the POL sensor require a reference voltage. This is provided by a band-gap reference, LM385, which acts like a very precise and stable zener diode, producing 1.25 volts (or 2.50 volts). Some circuits use an amplifier to lower the impedance of the reference and produce a 1 volt reference for other parts of the circuit. An incorrect reference voltage can be caused by a bad reference IC, by too high a resistance feeding it, or by too low a resistive load on it. A faulty reference voltage circuit or an improper reference voltage level may appear as problems with the alarm setpoints; POL sensors may receive incorrect polarizing voltages, as well.

4.3 Alarm Circuit

4.3.1 Standard Alarm Configurations

The available alarm configurations are as follows:

Type of alarm	Used in				
	TED 80	TED 100	TED 120	TED 140	TED 160
High - adjustable	NO	YES	NO	YES	YES
Low - adjustable	NO	YES	NO	YES	YES
Low - fixed at 18%	NO	YES	NO	YES	YES
Silence delay	NO	YES	NO	NO	YES
Lo Bat	YES	YES	NO	NO*	YES

* - Model 140 has a battery test switch and a meter scale for battery condition.

In every case an operational amplifier, used as a comparator, determines whether the measured parameter (oxygen level or battery voltage) is greater or less than a preset voltage. The outputs of the comparators are fed to a prescribed logic circuit, then to the alarm output devices (L.E.D., beeper, or LCD word-display element) as determined by the alarm configuration.

As an example, refer to the TED 140 Schematic in the drawings section. R7 and ZD1 produce the 1.25 volt reference. A fixed portion (0.22 volts) of the 1.25 volts is fed to A1d, which compares that voltage with the oxygen level from A1c; if that level drops below 0.22 volts, the output of A1d will go positive, turning on transistor Q1 via D3 and R17, and turning on the LED and the beeper. The LED and beeper are also turned on if either A1a or A1b are positive, which occurs if the oxygen level voltage is higher than the voltage set by P3 or lower than the voltage set by P2.

4.3.2 Optional Alarm Configurations

A Defeatable High Alarm circuit is available if specially ordered. Use of the option is indicated by the suffix "D" appended to the model number. Instruments equipped with the Defeatable Alarm Circuit can be used in applications where the sensor is exposed to 100% oxygen without triggering the high alarm, provided that the high alarm setpoint is set to 99%.

4.4 Alarm Logic Circuit

Models 100 and 160 have logic that allows the beeper to be bypassed for a set time by pressing the switch on the top of the unit. Refer to the schematic for models 80 and 100 in the drawings section.

Comparators A3a, A3b, and A3c can all generate alarms. A3a is the high alarm, A3b is the low alarm, and A3c is the fixed low alarm. Diodes D5, D6, D7, D10, D11, and D14 are used to "or" the outputs to the appropriate display points on the LCD and also into the circuitry that uses U1.

Integrated circuit U1 performs a number of very important functions, which are described here via the IC pin connections by which they are accessed. Pins 9 and 8 form an oscillator that is disabled by pins 1 and 2. When enabled, it causes the LED to blink via pins 3 and 4. It also fires the beeper via D13, but only upon a low output at U1 pins 11 and 10. The low condition at pins 11 and 10 exists under alarm conditions except when the pushbutton is pressed, at which time C8 is discharged (and the alarm silenced) for a set period, until C8 has charged up again.

4.5 The Meter

4.5.1 Analog Meter

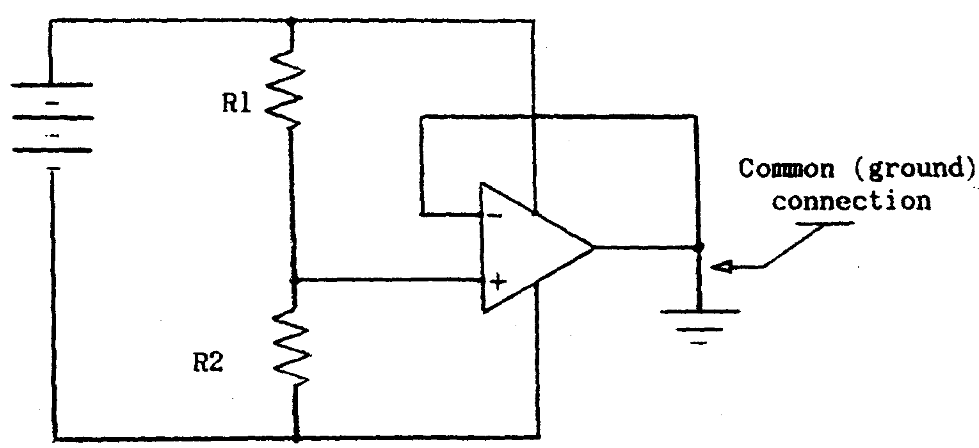
Where used, analog (pointer-and-scale-type) meters are simply driven via a trimpot from the 0-1 volt output of an operational amplifier. The meter is calibrated by first mechanically zeroing it, and then causing the voltage on it to be 1 volt, and then adjusting the series trim pot to achieve a fullscale reading.

4.5.2 Digital Meter

Digital instruments use an integrated analog-to-digital converter that needs no adjustment. The auxiliary messages (Hi Alarm, Lo Alarm, Wait, 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.

4.6 Power Supply

Power is supplied by batteries. Model TED 140 uses 4 "C" cells and provides a balanced plus and minus 3 volts (nominally) with the center connection of the batteries being the circuit reference (common or ground). The other instruments use one or two 9 volt transistor batteries and provide the common, or ground, connection by the use of an amplifier.



The output voltage of the amplifier will be the same as the voltage at the junction of R1 and R2. The amplifier is capable of supplying as much current as is needed by the rest of the circuitry.

V. TROUBLESHOOTING

The following is a general outline of the troubleshooting procedure. In practice, many steps could be skipped, according to the logic of the situation, and particular faults may require steps not mentioned.

5.1 Preliminary checks

a. Check for physical damage. Be especially aware that damage due to abuse or misuse may void the warranty for the instrument or the Micro-Fuel Cell.
b. Check the sensor: calibrate at 100% oxygen, then recheck in air; should read 21 ± 1 %.
c. Check the instrument with a good sensor.
d. Check the sensor connections.
e. Check the batteries, connections, and voltages.

5.2. Measurement circuit checks

a. Check reference voltages (if alarms or POL sensor are used).
b. Check polarizing voltages (instruments with POL sensors).
c. Check activation cycle polarizing voltages (POL sensors).
d. Check the sensor amplifier.
e. Check the span pot continuity and operation.

5.3. Alarm circuit checks (Models TED 100, 140, 160)

a. Check the alarm pots for continuity and operation.
b. Check the voltages at the inputs of the comparators.
c. Check the comparator input/output match. If the positive input is of greater magnitude than the negative input, the output voltage should be positive; if the positive input is smaller than the negative input, then the output voltage should be negative.
d. Check the voltage at each end of the setpoint potentiometer. Check the voltage at the slider to be sure that it corresponds with the physical setting.
e. If all else checks OK, test the logic circuit. (Sect 4.4)
f. If no problems are found with the alarm circuit, and yet the LED does not light or the beeper does not beep, then test or replace the LED or beeper, as necessary.

5.4. Meter circuit checks

a. Check the meter connections
b. Check the continuity between the main circuit and the meter.
c. Check the meter response to changes in input signal.
d. Check the word-messages of digital meters by simulating the conditions which would activate them. For example, check the "WAIT" message just after the instrument is turned on; check the alarm messages by adjusting the setpoints until the instrument is in an alarm condition; check the "LO BAT" message by deliberately providing the instrument with insufficient battery voltage.

VI. REPAIR / REPLACEMENT

CAUTION:

IC'S ARE SUSCEPTIBLE TO DAMAGE FROM STATIC ELECTRICITY. GROUND YOURSELF AND YOUR SOLDERING IRON BEFORE WORKING ON THE UNIT. WEAR NATURAL FIBERS - NO NYLON OR POLYESTER!

DO NOT TOUCH THE CIRCUIT BOARDS WITH YOUR FINGERS. CONTAMINATION FROM BODY SALTS OR OILS MAY AFFECT THE ACCURACY OF THE INSTRUMENT.

<u>Battery Requirements</u>

Models TED 80, 100, and 160:	Two standard 9-volt batteries
Model TED 120:	None
Model TED 140:	Four Size "C" batteries

6.1 Battery installation or replacement

<u>Models TED 80 and TED 100</u>

1. Place the power switch in the off position.
2. Open the instrument by unscrewing the two screws on the face, and gently pull out the front cover assembly and bottom plate. Be careful that you don't pull wires loose.
3. Place two 9V batteries in the battery compartments at the rear of the assembly, and place the battery clips on each battery.
4. To close the instrument, carefully slide the assembly back into position; replace the two screws on the front.

<u>Models 140 and 160</u>

1. Place the power switch in the OFF position.
2. Move. the sliding back panel to the right to expose the battery compartment.
3. Remove old batteries, if present.
4. Install the correct batteries, observing proper polarity.
5. Close the sliding back panel.

6.2 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.

Micro-fuel Cell

1. Remove the new Micro-fuel cell from its protective bag. Carefully remove the shorting clip FROM THE MEMBRANE SIDE FIRST, so that you don't damage the membrane.

2. Unscrew the holder cap from the sensor holder, and remove the previous Micro-fuel Cell, if one is present.

3. Place the new Micro-fuel Cell inside the sensor holder with the cell's membrane surface facing outward, and the electrical contacts facing inward.

4. Screw the cap back onto the sensor holder.

5. Check to see that the sensor cable is plugged into its receptacle at the analyzer.

Polarographic Sensor

1. Before removing the new sensor from its protective bag, check the freeze indicator; if it shows that the sensor has been subjected to freezing temperatures (the colored bead will have burst, and the color spread), then the sensor should be returned to the factory, unopened if possible, for warranty replacement.

2. Remove the old sensor (if any) from the sensor holder.

3. Gently insert the Polarographic Sensor into the probe assembly, then rotate it until the pins "click" into alignment position.

4. Use the lip around the top of the sensor cap as a pushing surface to fully insert the sensor into the probe sockets. **DO NOT** press on the sensing surface of the sensor.

5. Insert the probe assembly plug into the rear jack.

6.3 Disassembly

Models TED 80 and TED 100

Open the instrument by unscrewing the two screws on the face, and gently pull out the front cover assembly and bottom plate. The electronic circuitry and components are now accessible.

Models TED 120, TED 140, and TED 160

Remove the four screws at the corners of the underside of the instrument, then pull the top cover up and away from the electronics.

MANUFACTURING TEST PROCEDURES

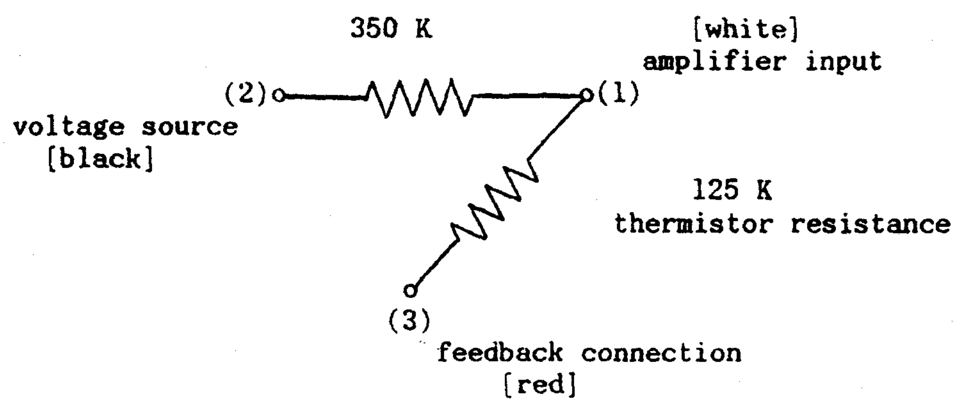
The following test procedures are those actually used in our testing department. They may be helpful in providing information or suggestions about how to perform troubleshooting tests, as well, so we are including them with your service manual.

Please note that the test procedures 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.

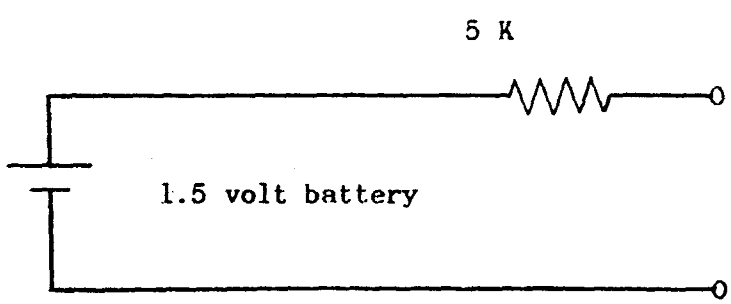
Alternatively, a simple circuit, such as the ones illustrated by the two sketches below, can be constructed to substitute for the simulator.

POL Sensor Simulator

Numbers (1), (2), and (3) correspond to the sensor connections shown in the instrument schematics, and the colors in brackets indicate the colors of the POL sensor wires.



Micro-fuel Cell Simulator



TEST PROCEDURE

MODELS TED-80 AND TED-100

1. Connect the 9V battery to the battery terminals, and switch on the instrument. Connect a current meter across the power switch terminals. Switch off the instrument. The current reading should be below 1 mA. Switch the instrument on again and remove the current meter.

2. Connect the DVM negative lead to pt. #5 (ground) on the main PC Board and the positive lead to pt. #7. The DVM should indicate +4.5 V, or half the battery voltage.

3. Connect DVM positive to pt. #9. DVM should read -4.5 V, or half the battery voltage.

4. Connect DVM positive lead to pt. #2; DVM should read 2.00 $\pm$.02 V.

5. Short D3 and set the calibrate control fully clockwise. Adjust P1 until the displau indicates "- 01". (Note: There is no minus sign to indicate negative readings; counter-clockwise adjustment of P1 reduces the reading.) Remove the short from D3.

6. Switch off the instrument, install a new C-4 sensor, wait 60 seconds, then switch it on again. The display will show the numbers "00" and the word "WAIT".

7. Connect the DVM between ground (pt. #5) and pt. #8. The DVM should read approximately -1.5 V for the first 20 $\pm$5 sec., then +660 $\pm$20 mV.

8. After the 20 sec. time interval, display will read fullscale. After a short time (1-2 minutes) the reading will decrease, and stabilize within 3 min. The "WAIT" indicator will blank at this time.

9. After a stable low reading is achieved, and using gases or a POL sensor simulator, introduce 100% oxygen. Set the CALIBRATE control for a display reading of 100.

10. Place the sensor in air (or adjust the simulator to simulate 20.9%); the reading should stabilize at 21 $\pm$1 %. Readjust P1, if necessary, to bring the reading to within these limits.

NOTE: PERFORM STEPS 11, 12, AND 13 FOR MODEL TED-100 ONLY. FOR TED-80, SKIP TO STEP 14.

11. TED-100 ONLY: Set the HIGH limit to read 30% and the LOW limit to read 25%. Offset the CALIBRATE control so that the display reads above 30%. The HIGH warning (HI ALARM) should be shown on the display and the light should flash. The beeper should beep 1 pulse per second. Press the SILENCE pushbutton to verify that the audible alarm only stops for about 30 seconds. Alarming should occur within ± digit of the setpoint.

12. TED 100 ONLY: Turn the SPAN control until the meter reads below 25%; LOW warning should appear on the meter within ±1 digit of the setpoint, and the light should flash.

13. TED 100 ONLY: Set the LOW limit to 10%. Slowly adjust the CALIBRATE control to lower the meter reading; the LOW warning should appear at 18% ±1%.

14. Remove the sensor (or POL simulator).

15. Disconnect the batteries and connect a variable power supply between the battery leads. Vary the supply voltage from 9V to 6.5V. The LO BAT indicator should appear at 6.5 ±.2 V.

TEST PROCEDURE

MODEL TED-120

1. Be sure that the meter reads zero; adjust the mechanical meter zero, if necessary.

2. Connect the probe assembly. Set the Micro-fuel Cell simulator selector switch to the C-1 position; connect the simulator to the probe assembly (positive lead to the outer spring contact, negative lead to the center spring contact).

3. Simulate 100% oxygen and adjust the CALIBRATE control until the meter reads 100.

4. Simulate 20.9% oxygen. The meter needle should coincide with the red CAL mark on the meter scale. Readjust the mechanical meter zero until the needle points exactly to the CAL mark.

TEST PROCEDURE

MODEL TED-140

1. Prior to supplying power to the unit, be certain that the pointer of the readout meter points exactly to zero. Adjust the mechanical zero of the meter if necessary.

2. Slide open the battery panel at the rear of the instrument, and install four size C alkaline batteries, observing proper polarity as shown. Place the power switch in the ON position.

3. Adjust trimmer P-1 on the PC Board until the meter reads exactly zero.

4. Connect the probe assembly. Set the Micro-fuel Cell simulator to a 70 microampere output with the selector switch in the A-3 position and the attenuator in the CAL position. Connect the simulator to the probe assembly (positive lead to the outer spring contact and the negative lead to the center spring contact).

5. Set the attenuator of the simulator to 100 %. Adjust the CALIBRATE control of the test unit until the meter reads 100.

6. Set the attenuator of the simulator to CAL (21%). The meter needle should coincide with the red CAL mark on the meter scale. Readjust the mechanical meter zero until the needle points exactly to the CAL mark.

7. Set the HIGH limit to read 30% and the LOW limit to read 25%. Offset the CALIBRATE control so that the display reads above 30%. The HIGH warning (HI ALARM) should be shown on the display and the light should flash. The audible alarm should sound, as well. Alarming should occur within ± digit of the HI ALARM setpoint.

8. Turn the CALIBRATE control until the meter reads below 25%; LOW warning should appear on the meter within ±1 digit of the setpoint, and the audible and visual alarms should energize.

9. Set the LOW limit to 10%. Slowly adjust the CALIBRATE control to lower the meter reading; the LOW warning should appear at 18% ±1%. The audible and visual alarms should energize.

10. Turn the unit off and replace the two batteries in the positive half of the power supply with a variable DC power supply. Place a capacitor (300 to 600 mfd.) across the power supply to lower the source impedance.

11. Turn the unit on and vary the supply voltage from 3 volts to 1.8 volts while holding the power switch in the BAT TEST position. The pointer of the meter should cross the BATTERY REPLACE mark when the supply voltage is 2.0 ±0.1 volts.

TEST PROCEDURE

MODEL TED-160

1. Connect a 9V battery to the battery terminals, and switch on the instrument. Connect a current meter across the power switch terminals. Switch off the instrument. The current reading should be below 1 mA. Switch the instrument on again and remove the current meter.

2. Connect the DVM negative lead to pt. #5 (ground) on the main PC Board and the positive lead to pt. #7. The DVM should indicate +4.5 V, or half the battery voltage.

3. Connect DVM positive to pt. #9. DVM should read -4.5 V, or half the battery voltage.

4. Connect DVM positive lead to pt. #2; DVM should read 2.00 $\pm$.02 V.

5. Adjust trimmer P-1 on the PC Board until the meter reads exactly zero.

6. Connect the probe assembly. Set the Micro-fuel Cell simulator to a 70 microampere output with the selector switch in the A-3 position and the attenuator in the CAL position. Connect the simulator to the probe assembly (positive lead to the outer spring contact and the negative lead to the center spring contact).

7. Set the attenuator of the simulator to 100 %. Adjust the CALIBRATE control of the test unit so that the voltage out of A3a at pin 16 is 2.000 volts. The display should read 100 $\pm$1.

8. Check the "SIG OUT" voltage; it should be 100 $\pm$2 millivolts.

9. Set the attenuator of the simulator to CAL (21%). The display should read 21 $\pm$1.

10. Set the HIGH limit to read 30% and the LOW limit to read 25%. Offset the CALIBRATE control so that the display reads above 30%. The HIGH warning (HI ALARM) should be shown on the display and the light should flash. The audible alarm should sound, as well. Press the silence pushbutton, and the audible alarm should silence for 30 $\pm$10 seconds. Alarming should occur within $\pm$ digit of the HI ALARM setpoint.

11. Turn the CALIBRATE control until the meter reads below 25%; LOW warning should appear on the meter within $\pm$1 digit of the setpoint, and the audible and visual alarms should energize.

12. Set the LOW limit to 10%. Slowly adjust the CALIBRATE control to lower the meter reading; the LOW warning should appear at 18% $\pm$1%. The audible and visual alarms should energize.

13. Disconnect the battery and connect a variable power supply between the battery leads. Vary the supply voltage from 9 volts to 6.5 volts. At 6.5 $\pm$.2 volts, the LO BAT indicator should appear.

VIII. SPECIAL INSTRUCTIONS FOR MODEL TED-60

Refer to the TED 60 drawings at the rear of the service manual.

The TED 60 uses a POL-type sensor. Refer to Sections I and II for sensor information.

At the top end of the instrument are located the power switch and the span control.

Although the span control resembles a pushbutton, it is actually a small potentiometer which can be adjusted , when the sensor is exposed to air or span gas, to cause the LCD meter to read the oxygen concentration of air or of the span gas. To adjust the span control, gently turn it with your finger tip.

The power switch has three positions: OFF (center position); ON (rocked to the right); and "*" (rocked to the left). The OFF and ON positions are self-explanatory. The "*" position initiates the activation cycle for the POL sensor (see Sections I and II). After the sensor has been stored for long periods of time (usually two weeks or more) without a polarizing voltage, start the instrument in the "*" position. After the meter reading has stabilized to a correct value, place the switch in the "ON" position and proceed with normal operation. For normal starting, when activation is not required, start the instrument in the ON position to avoid having to wait for the activation cycle to complete.

The electronics circuit contains four integrated circuit amplifiers, all of which are IC # UA776. If a problem is suspected in any of the IC circuits, a convenient and economical troubleshooting procedure would be to replace all four IC's with new ones.

Other troubleshooting steps would involve checking the instrument with a sensor and battery that are known to be good. Replacement of the good sensor with the original one will indicate if the original sensor is faulty: span the instrument on 100% oxygen, then check it again with the sensor exposed to air. A faulty sensor will probably not indicate the correct oxygen concentration of air (20.9%). The meter indication should be 21 $\pm$ 1 %

To replace the battery, simply open the cover at the back of the instrument, then replace the battery and reclose the cover.

Refer to Section 6.2 for details concerning sensor replacement.

To gain access to the electronics, disassemble the unit by removing the four case screws in the back cover.

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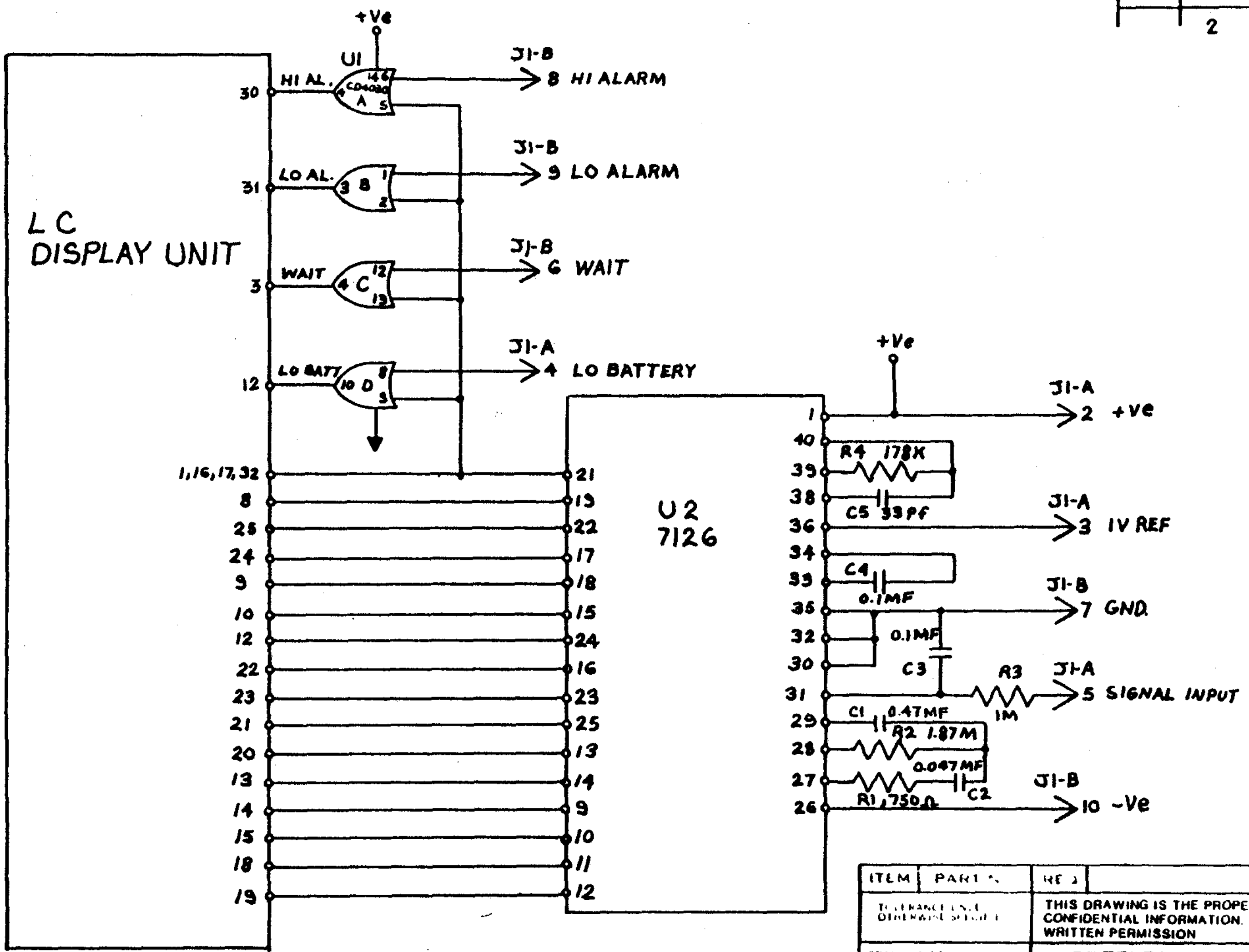

SEE C-30661 MAIN P.C BD SCH.
P.C. BD ASS'Y: C-30171

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TELEDYNE ELECTRONIC DEVICES
CITY OF INDUSTRY CALIFORNIA 91748

SCALE — DATE 3-22-84
MAT'L —
FINISH —
DR ENGR APP

S.O.

MDL. TED 100
MEDICAL O_2 ANALYZER
LCD P.C. BD. SCHEMATIC

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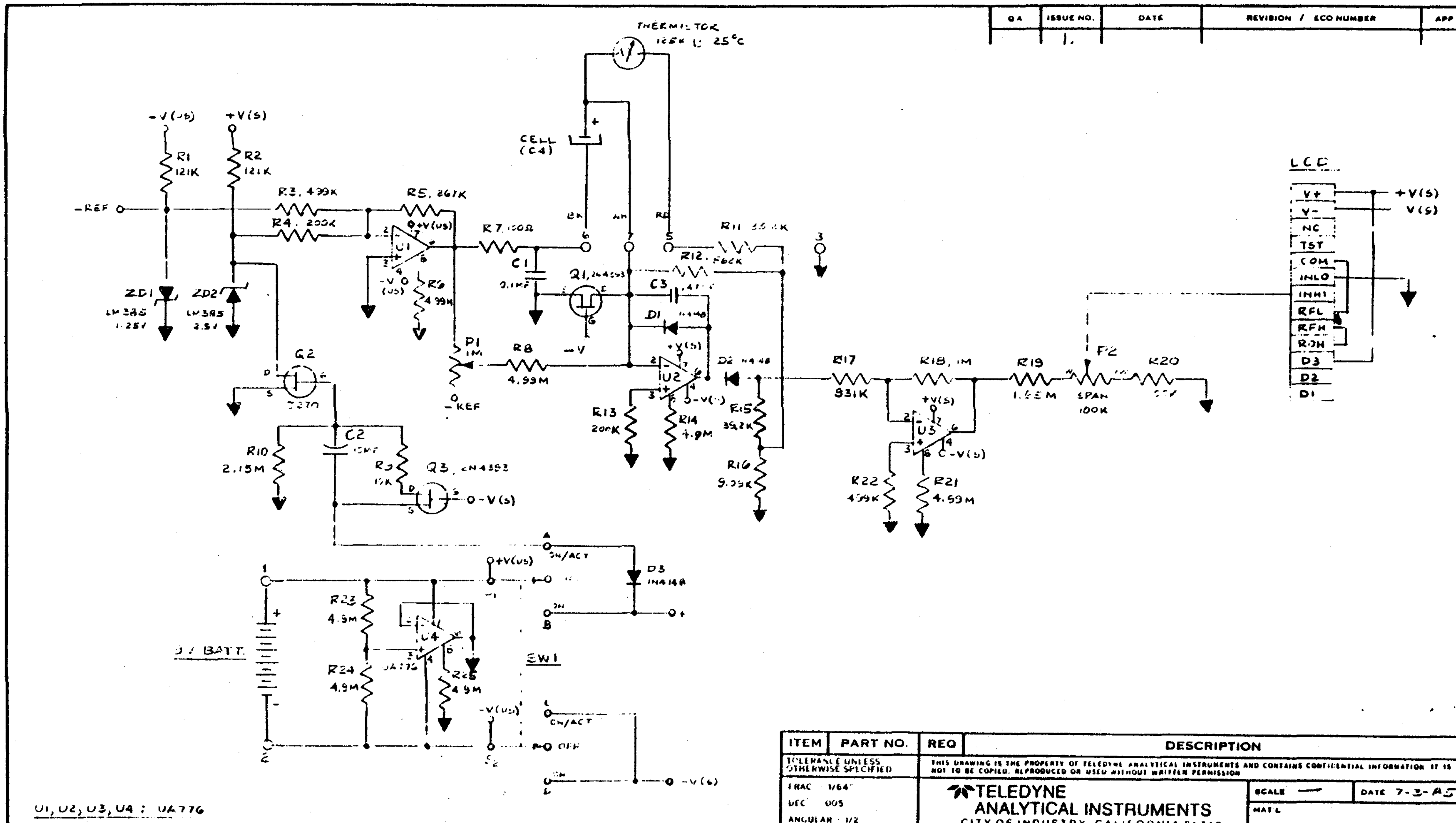

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FINISH

SCHEMATIC
TED MDL. 60 O_2-ANALYZER

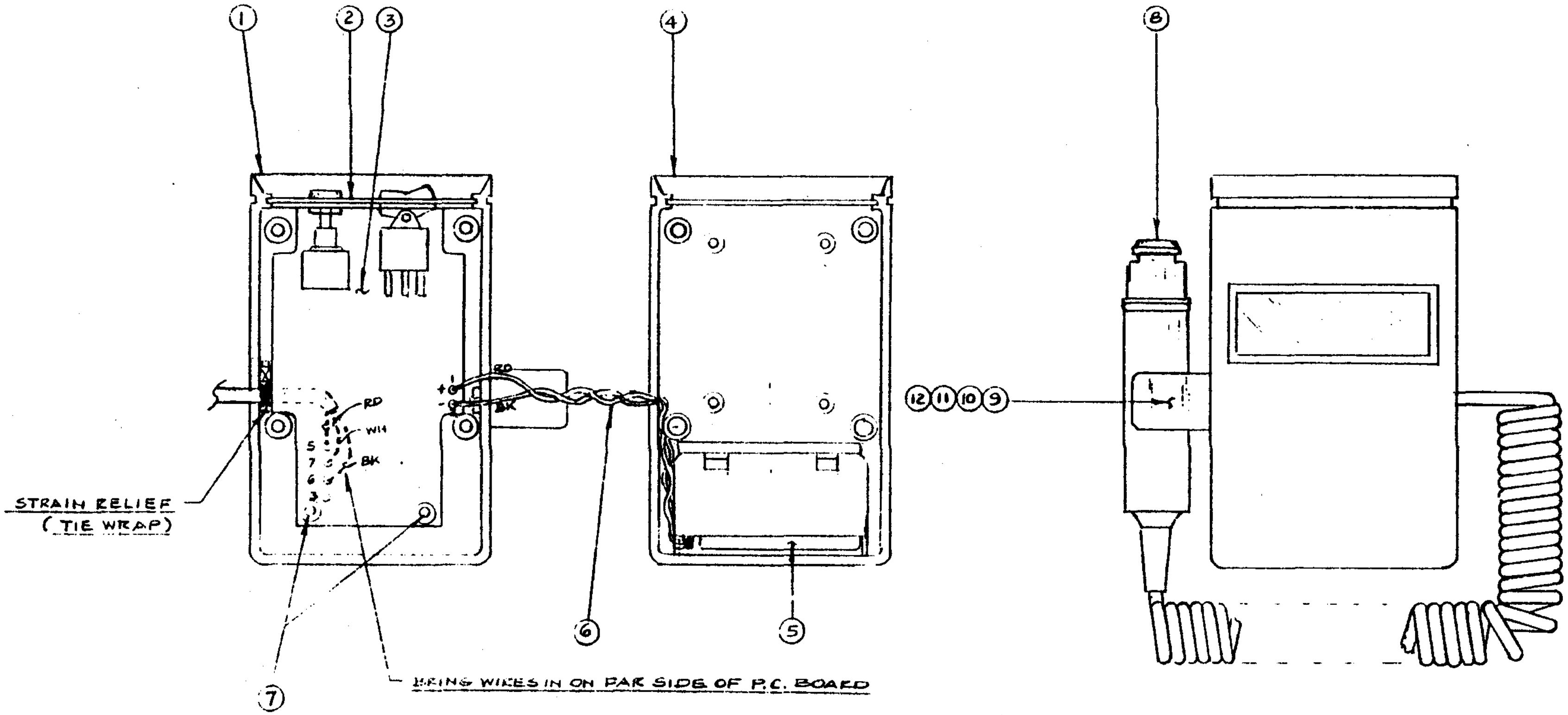
DR ENGR APP

B-38120

6.0

BISHOP GRAPHICS ACCUPRESS REORDER NO. A22478

ISSUE NO	DATE	REVISION	NUMBER	APP
1				



ITEM	PART NO.	REQ	DESCRIPTION

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

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TELEDYNE
ANALYTICAL INSTRUMENTS
CITY OF INDUSTRY CALIFORNIA 91748

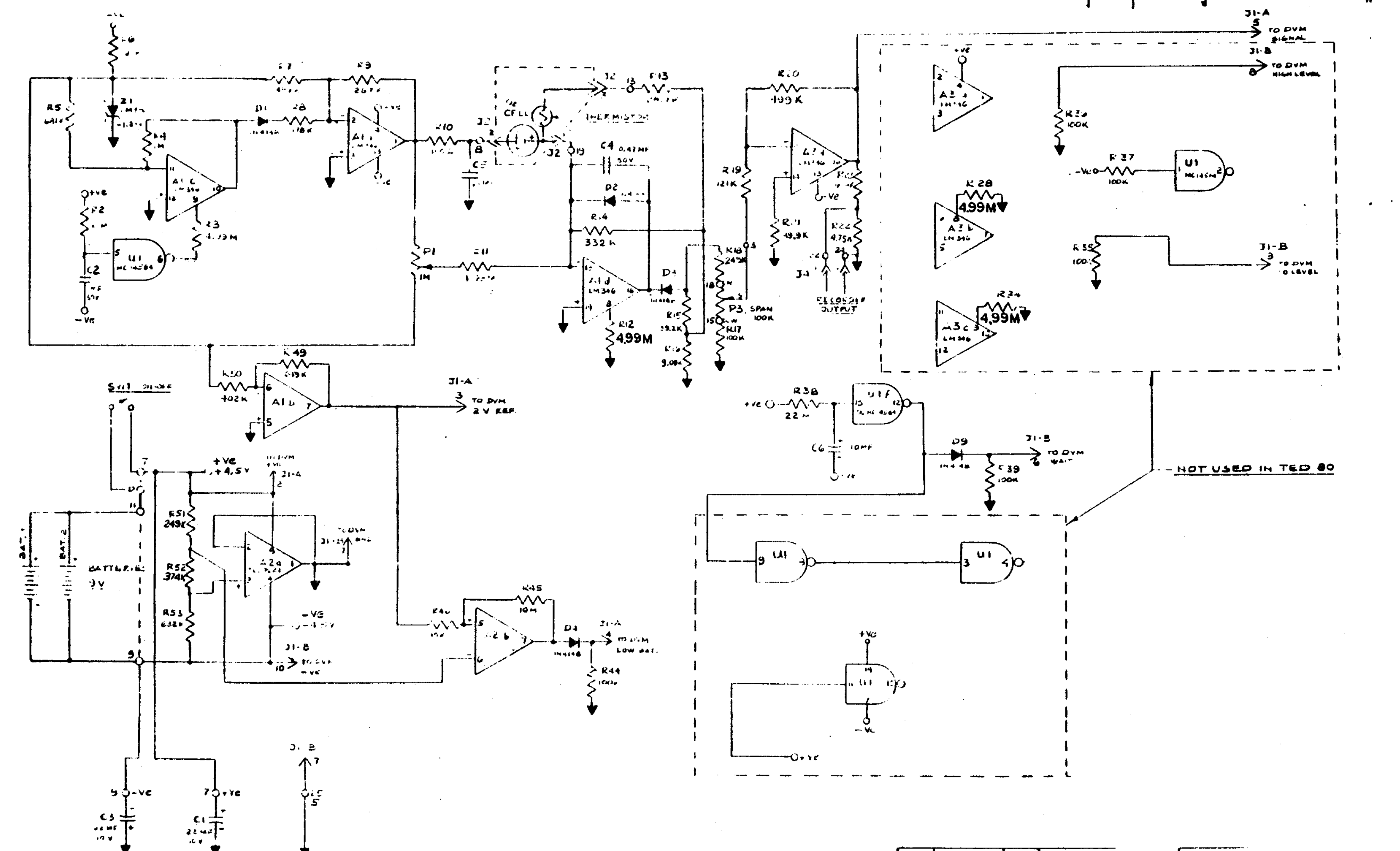
SCALE 1/1 DATE 8-9-85
MAT'L SEE PARTS LIST
FINISH ———

ASSEMBLY, FINAL
TED MDL. 60, O_2-ANALYZER

DR ...
CHKR ...
APP

C-38535

ISSUE	DATE	REVISION		APP
3	2-13-84	ECO 84		
4	6-1-84	ECO 84-		
5	8-23-84	ECO-84-0104		



NOTES:

1. SEE B-30662 FOR L C D P.C BOARD SCHEMATIC
2. SEE C-33218 MAIN P.C BOARD ASSEMBLY
3. SEE C- WIRING DIAGRAM

ITEM	PART NO.	REQ	DESCRIPTION

TOLERANCE UNLESS OTHERWISE SPECIFIED: FRAC ± 1/64; DEC ± .005; ANGULAR ± 1/2°

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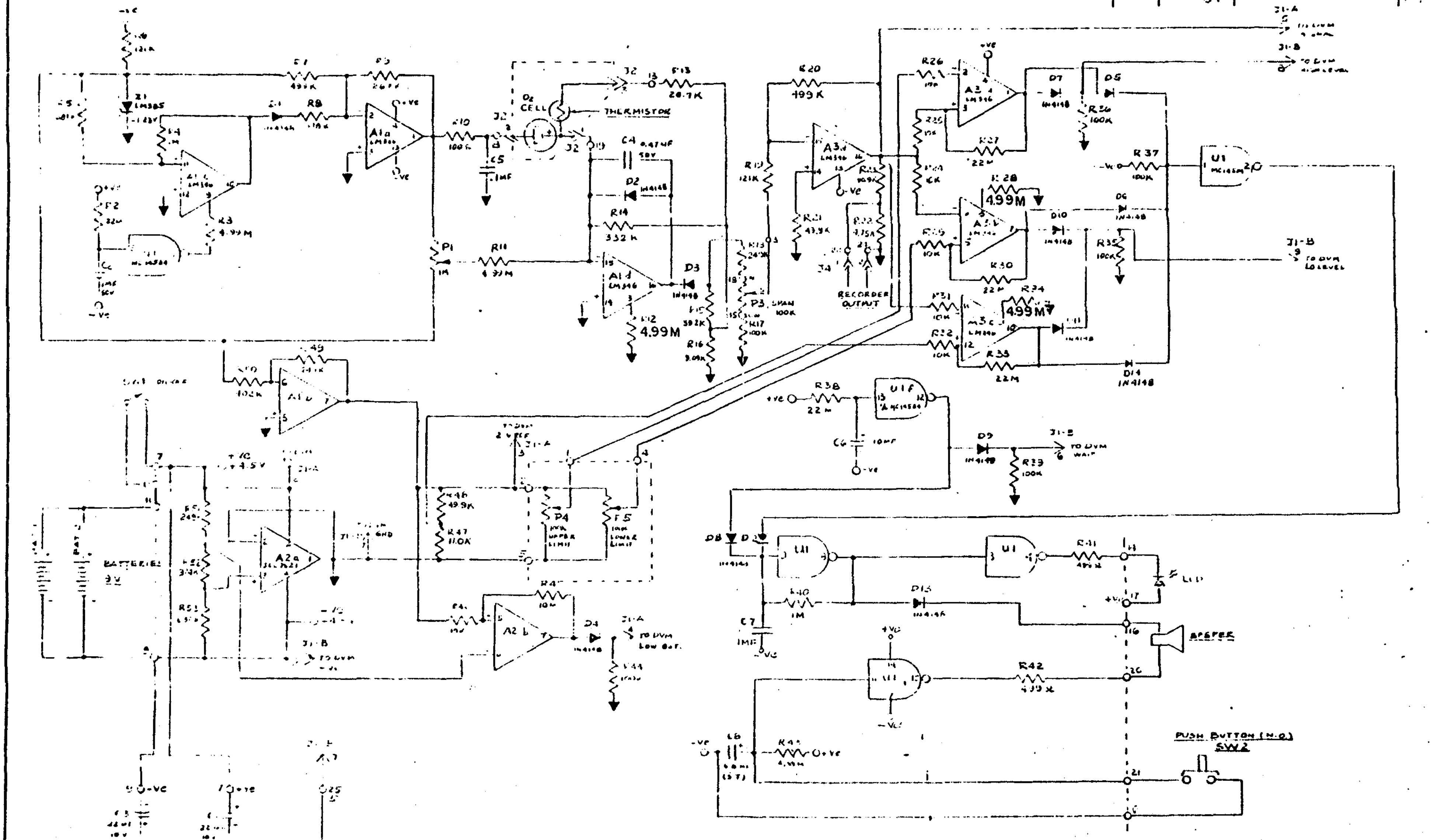
TELEDYNE ELECTRONIC DEVICES
CITY OF INDUSTRY, CALIFORNIA 91748

SCALE — DATE 2-15-84

MEDICAL O_2 ANALYZER
MOD. TED 80
MAIN P.C. BOARD SCHEMATIC

C-33220

5	[illegible]	ECO [illegible]	[illegible]
6	8-23-84	ECO 84-0104	[illegible]



NOTES: 1. SEE B-30662 FOR L.C.D. P.C. BOARD SCHEMATIC

2. SEE C-30169 MAIN P.C. BOARD ASSEMBLY-

3. SEE C-31103 WIRING DIAGRAM-

ITEM	PART NO.	REQ	DESCRIPTION

TOLERANCE UNLESS OTHERWISE SPECIFIED

FRAC ± 1/64"

DEC ± .005"

ANGULAR ± 1/2°

TELEDYNE
ELECTRONIC DEVICES
CITY OF INDUSTRY CALIFORNIA 91749

SCALE — DATE 11-20-82

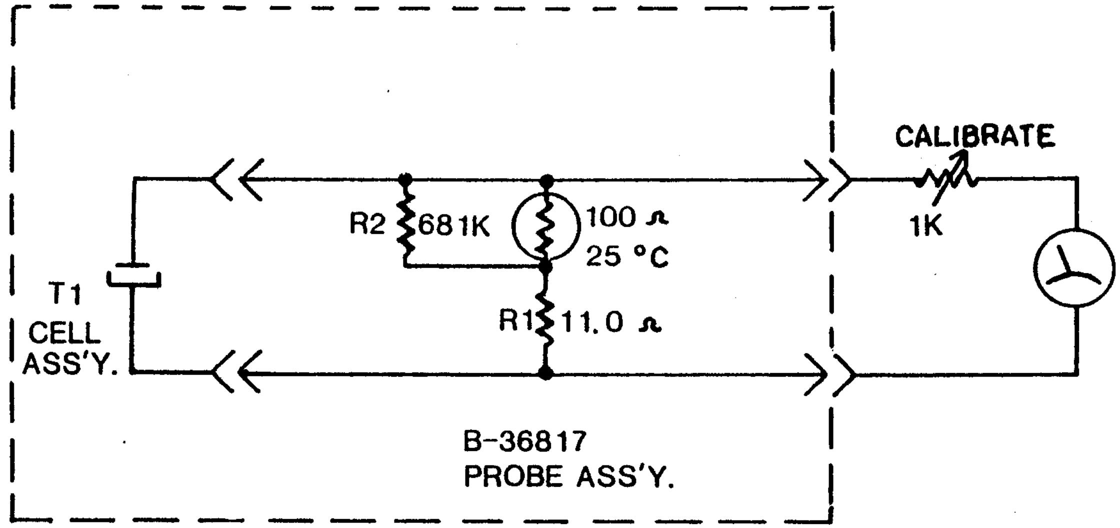
DRAWN —

CHECKED —

MEDICAL O2 ANALYZER
MODEL TED 100
MAIN P.C. BOARD SCHEMATIC

C-30661

ISSUE NO.	DATE	REVISION / ECO NUMBER	APP
1.	9-10-85	———	



FOR T-6 CELL
PROBE ASS'Y IS B-38012

ITEM	PART NO.	REQ	DESCRIPTION
TOLERANCE UNLESS OTHERWISE SPECIFIED			THIS DRAWING IS THE PROPERTY OF TELEDYNE ELECTRONIC DEVICES AND CONTAINS CONFIDENTIAL INFORMATION. IT IS NOT TO BE COPIED REPRODUCED OR USED WITHOUT WRITTEN PERMISSION
FRAC. ± 1/64" DEC. ± .005 ANGULAR ± 1/2°			TELEDYNE ELECTRONIC DEVICES CITY OF INDUSTRY CALIFORNIA 91748

SCALE ——— DATE 9-6-85
MAT'L ———
FINISH ———

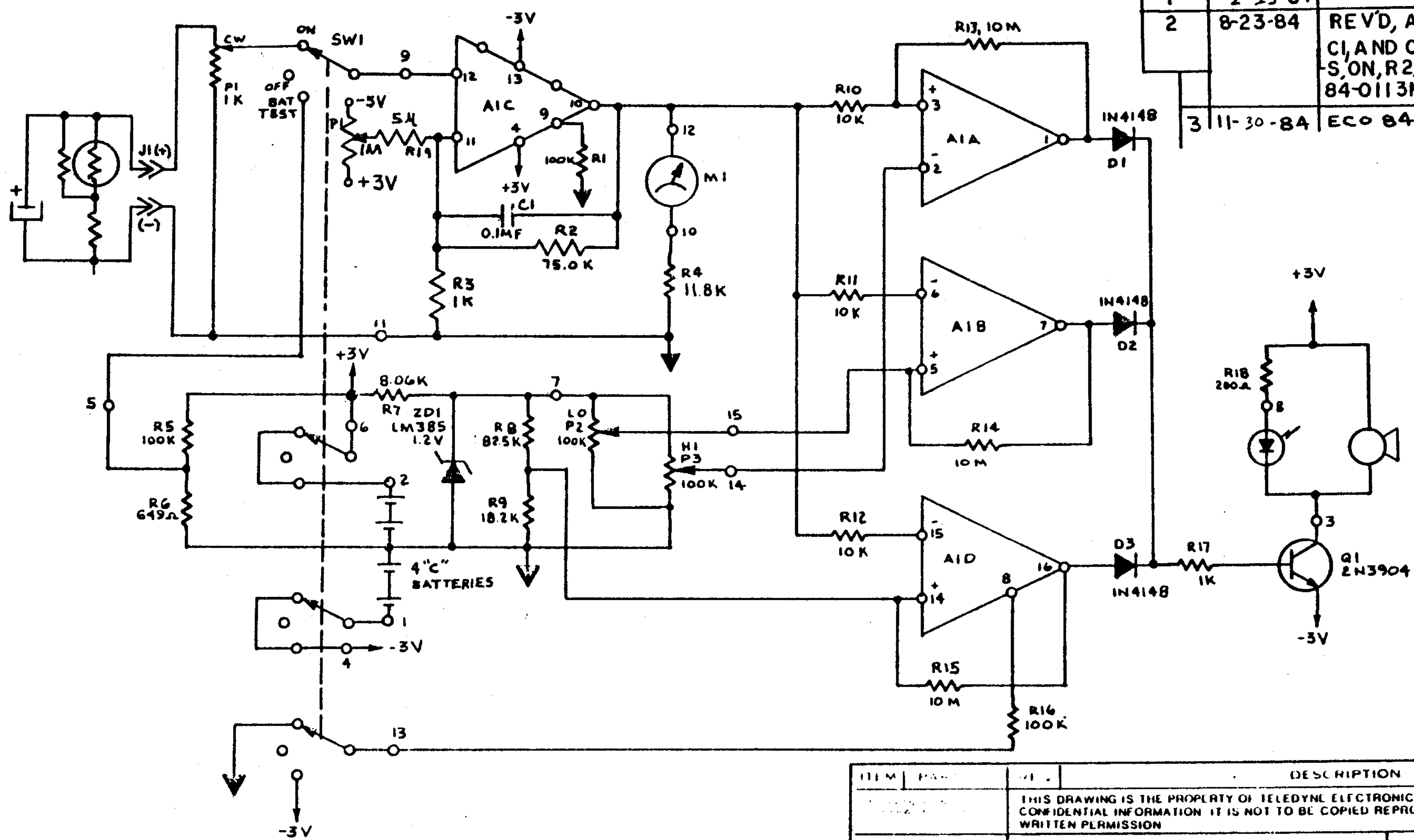
MDLTED 120
SCHEMATIC

F/C-34744
S.O.

DR D.C. ENGR APP

A-38749

BISHOP GRAPHICS, ACCUPRESS
REORDER NO. A2115?



ISSUE NO	DATE	REVISION	APP
1	2-23-84		JMZ
2	8-23-84	REV'D, ADDED P1, R19, C1, AND CHANGE VALUES ON R2, R4 PER ECO 84-0113M	JMZ
3	11-30-84	ECO 84-0149M	JMZ

DESCRIPTION

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TELEDYNE ELECTRONIC DEVICES
CITY OF INDUSTRY, CALIFORNIA 91748

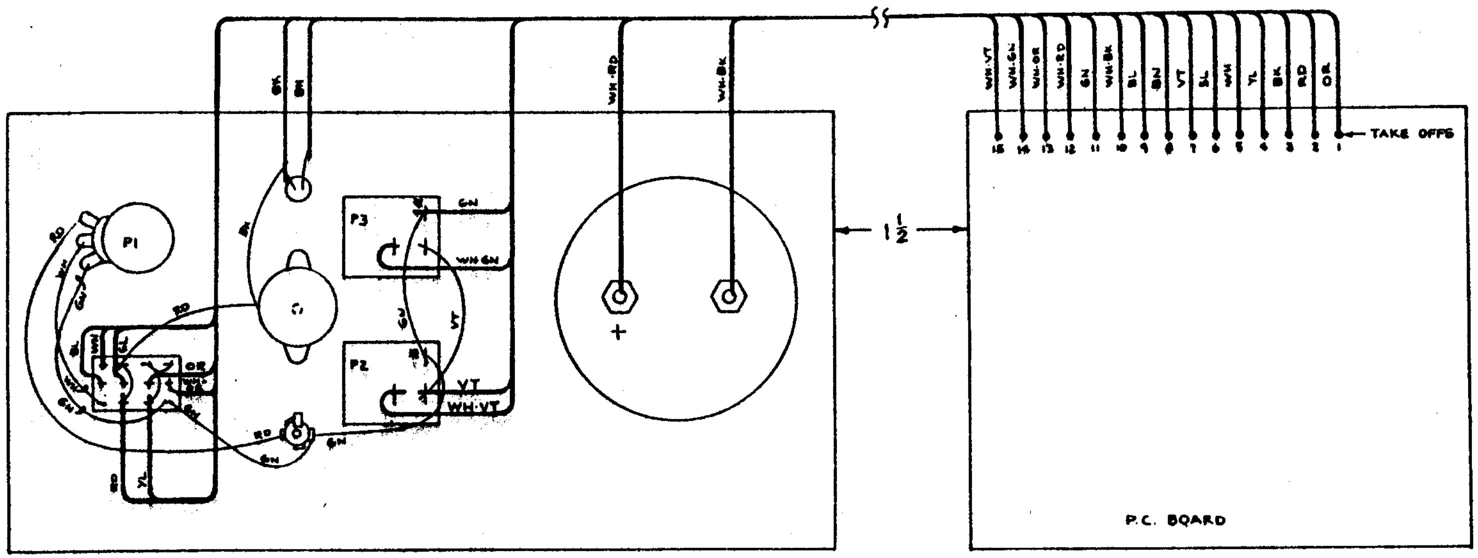
SCALE ~ DATE 1-24-84
MAT'L ~
FINISH ~
DR Nancy ENGR APP JMZ

MDL. TED 140
OXYGEN ALARM
SCHEMATIC

N/C-34620

B 34518

BY	ISSUE NO	DATE	REVISION NUMBER	APP
	1	2-27-84		



NOTE:
1) ALL WIRES TO BE 22 AWG. WIRES BETWEEN P.C. BD. & PANEL.
NOTE: WIRING SHOWN IN FINE LINES IS EXISTING FROM FRONT PANEL WIRING DIAGRAM. (B-34685)

2) CONNECTIONS MARKED WITH (#) REQ'D TWO WIRES SOLDERED TO ONE TERMINAL (2 PLC'S)

WIRE LIST		
PCB T/O Nº	COLOR	LENGTH
1	OR	
2	RD	
3	BK	
4	YL	
5	WH	
6	BL	
7	VT	
8	BN	
9	BL	
10	WH-BK	
11	GN	
12	WH-RD	
13	WH-OR	
14	WH-GN	
15	WH-VT	

TELEDYNE ELECTRONIC DEVICES

SCALE ~ DATE 2-13-84

MATL ~

FINISH ~

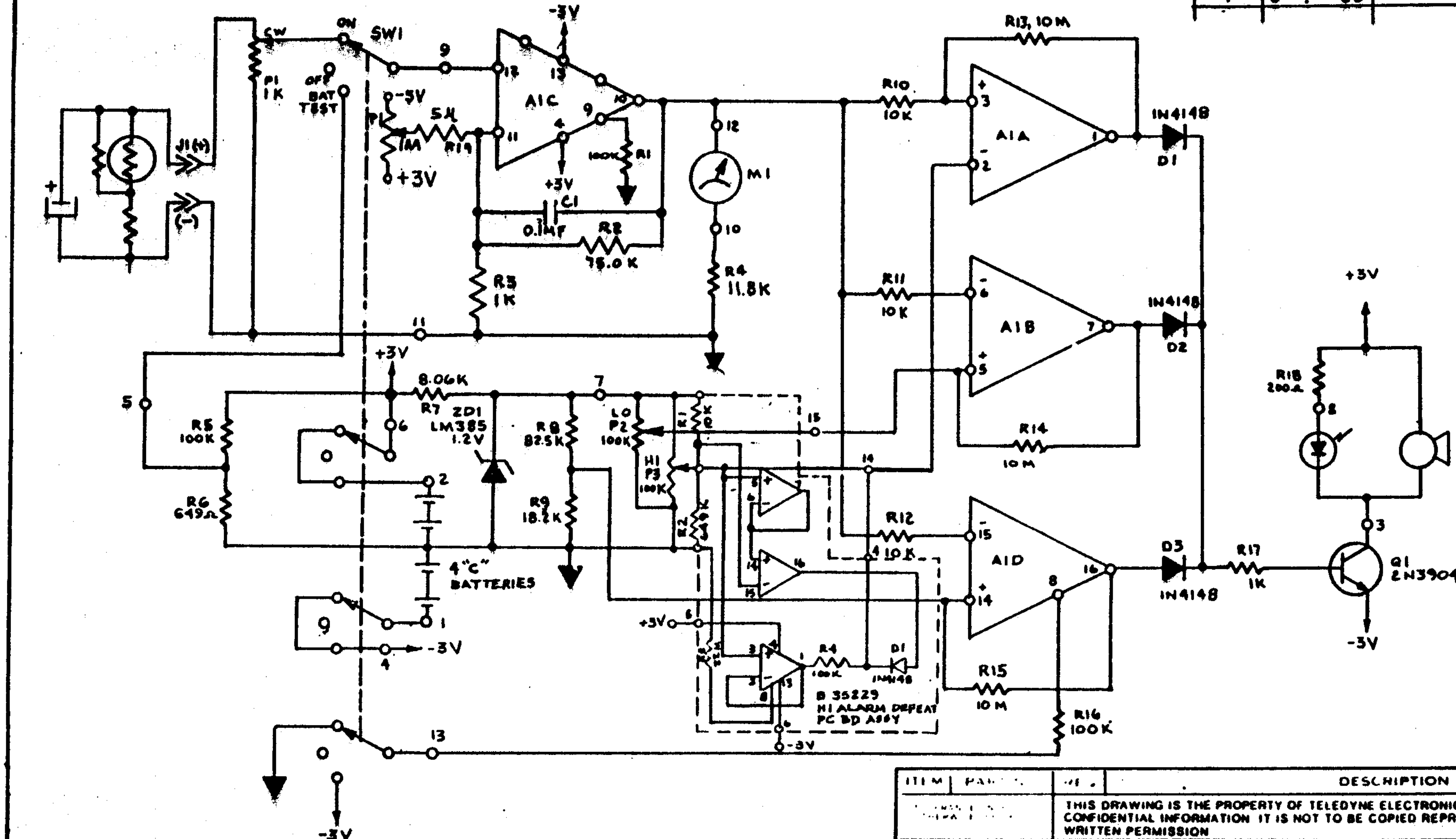
DR Nancy

F/C 34682

MDL. TED 140
OXYGEN ANALYZER
WIRING DIAGRAM

C-34684

ISSUE NO	DATE	REVISION ECO NUMBER	APP
1	9-4-85		JBK



ITEM	PART NO.	REF.	DESCRIPTION

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TELEDYNE
ELECTRONIC DEVICES
CITY OF INDUSTRY CALIFORNIA 91748

SCALE ~ DATE 9-5-85

MAT'L ~

FINISH ~

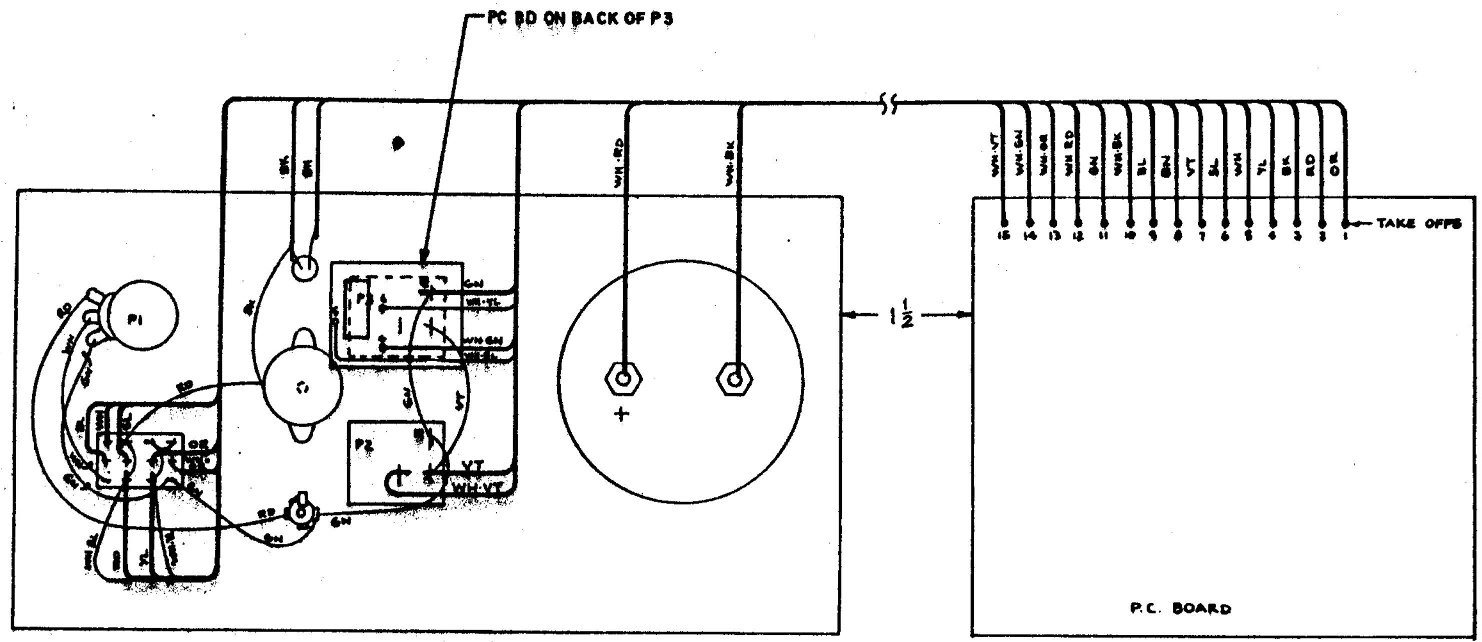
F/ 34682
W/ C 38733
N/C-34620

MDL. TED 140 D
OXYGEN ALARM
SCHEMATIC

DR LM ENGR APP

B 38734

ISSUE NO.	DATE	APP
1	9-4-85	JMX



NOTE:

1) ALL WIRES TO BE 22 AWG. WIRES BETWEEN P.C. BD. & PANEL.
NOTE: WIRING SHOWN IN FINE LINES IS EXISTING FROM FRONT PANEL WIRING DIAGRAM. (B-34685)

2) CONNECTIONS MARKED WITH (#) REQ'D TWO WIRES SOLDERED TO ONE TERMINAL (2 PLC'S).

3) INSTALL HI ALARM DEFEAT PC BD ASSY B 35229 PRIOR TO CONNECTING WIRES TO HI ALARM POTENTIOMETER (P3).
ADD WH-BL & WH-YL WIRES.

WIRE LIST

PCB T/O Nº	COLOR	LENTGH
1	OR	
2	RD	
3	BK	
4	YL	
5	WH	
6	BL	
7	VT	
8	BN	
9	BL	
10	WH-BK	
11	GN	
12	WH-RD	
13	WH-OR	
14	WH-GN	
15	WH-VT	

DESCRIPTION

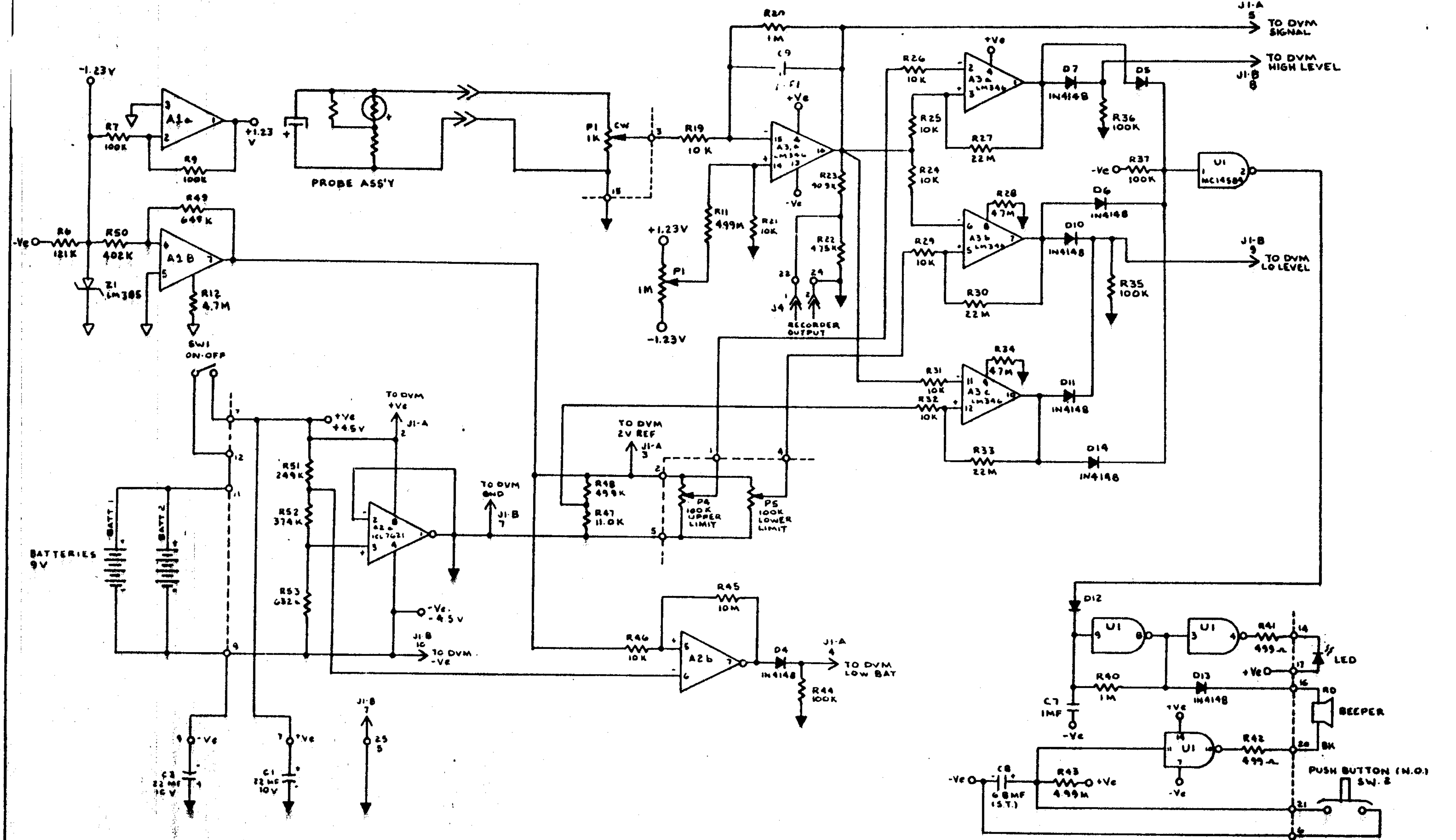
TELEDYNE
ELECTRONIC DEVICES

SCALE ~ | DATE 9-3-85
MATL ~
FINISH ~
DR LM | ENGR | APP JMX

S/B 38734
F/C 34682

MDL. TED 140 D
OXYGEN ANALYZER
WIRING DIAGRAM

V	ECO 85-0142 M 5) 7- -85		
		2	7- -84	REV'D DWG
		3	9- -84	ECO 84-0120 M
		4	11- -84	ECO 84-0150 M



NOTE:
THIS DWG VALID FOR B 30170-4 P.C. BOARD ONLY

DESCRIPTION

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TELEDYNE ELECTRONIC DEVICES

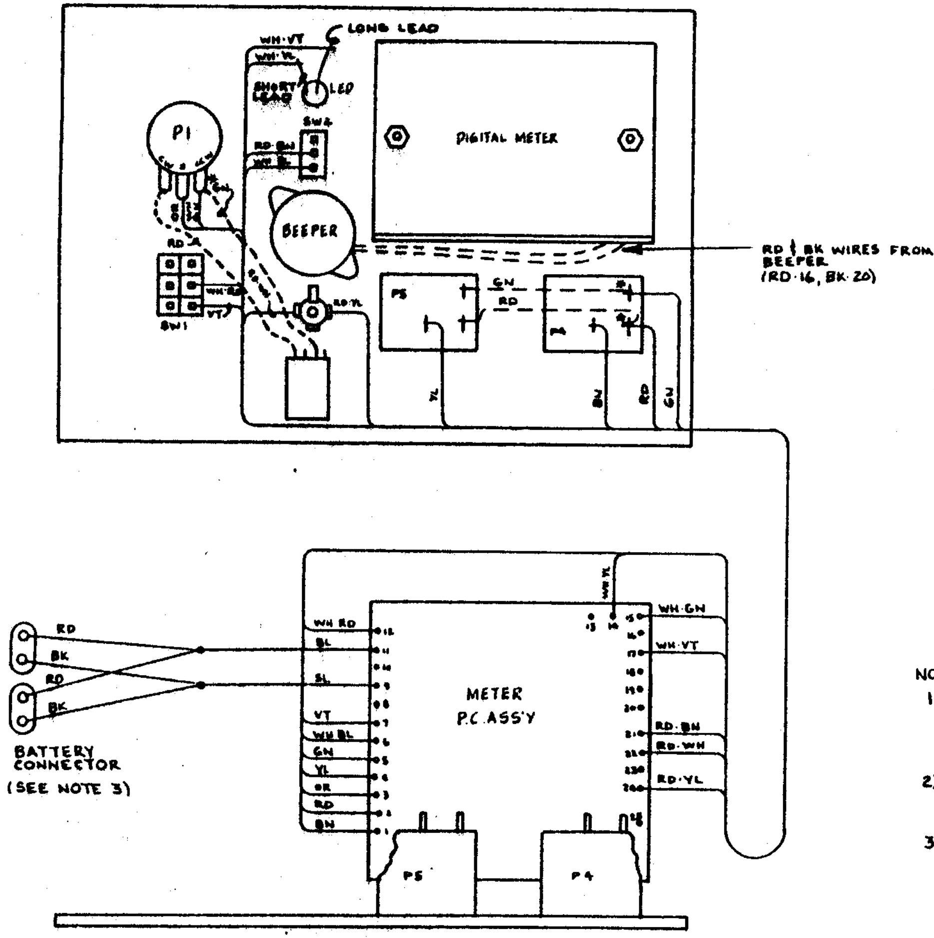
SCALE ~ | DATE 2-22-84

MDL. TED 160
OXYGEN ANALYZER
SCHEMATIC (DIGITAL)

F/C 34767

C 34769

	ISSUE NO	DATE	REVISION	APP
	1	2-23-84		[illegible]
	2	8-?-84	RELOCATED BATTERY CONN.	[illegible]
	3	11-??-84	ECO 84-150M	[illegible]



BOTTOM VIEW

NOTE:

1) ALL WIRES TO BE 22 AWG. WIRES BETWEEN P.C. BD & PANEL
NOTE: WIRING SHOWN IN DOTTED LINES ARE EXISTING FROM FRONT PANEL WIRING DIAGRAM B-34771.

2) CONNECTIONS MARKED WITH (*) REQ'D TWO WIRES SOLDERED TO ONE TERMINAL. (3 PLACES)

3) ADD SPOT TIES TO FORM "CABLE" TO BATTERIES. MAKE BL & SL WIRES LONG ENOUGH TO ALLOW SERVICE LOOP. (SEE DWG B 34771 FOR BATTERY CONNECTOR P/N)

ITEM	PART NO.	REQ	DESCRIPTION

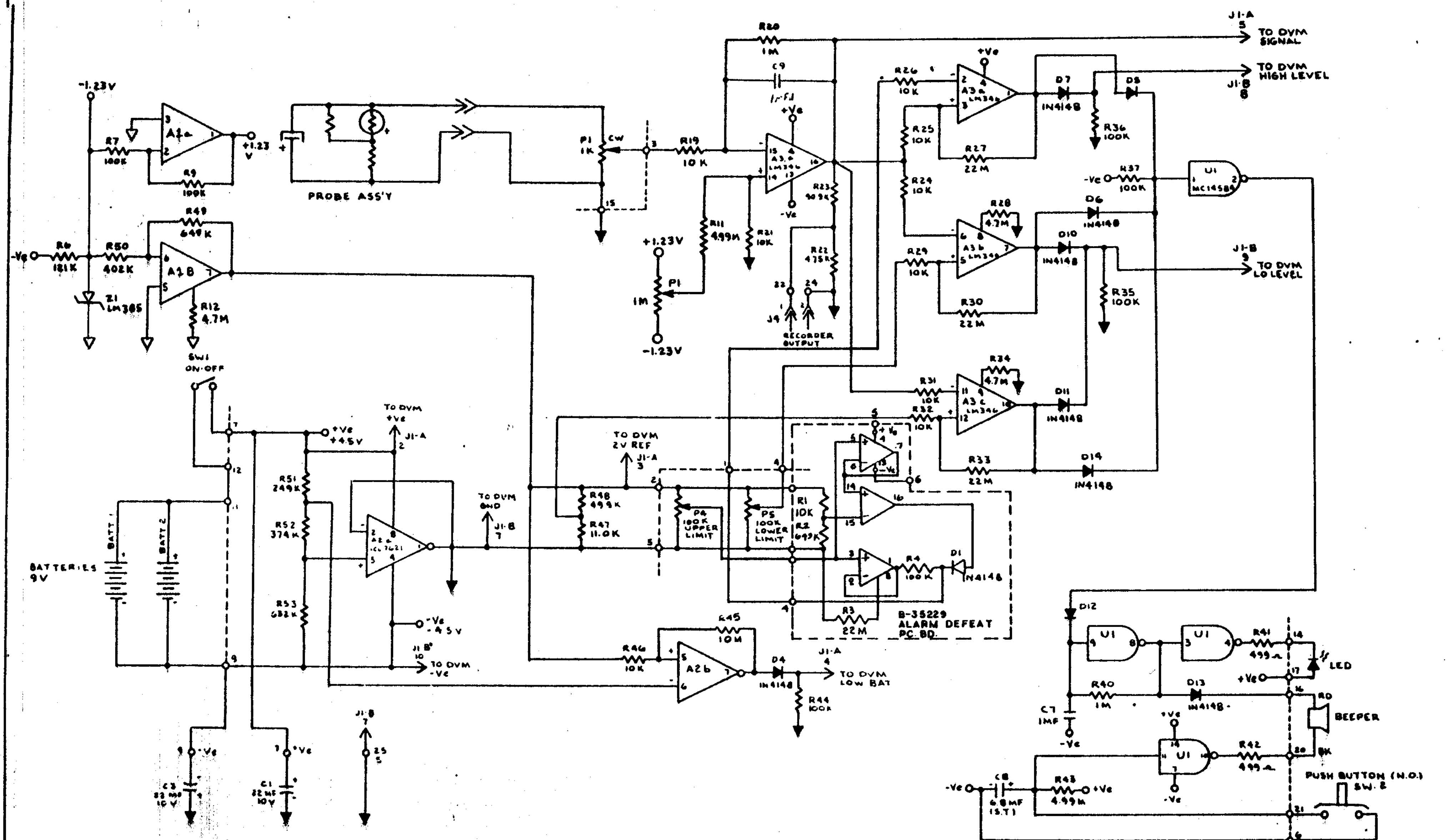
TELEDYNE ANALYTICAL INSTRUMENTS

SCALE ~ | DATE 2-23-84 | MAT'L ~ | FINISH ~ | DR Nancy

F/C34767

S/C34769

MDL TED 160 (DIGITAL)
WIRING DIAGRAM



NOTE:
THIS DWG VALID FOR B 30170-4 P.C. BOARD ONLY

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TELEDYNE ELECTRONIC DEVICES

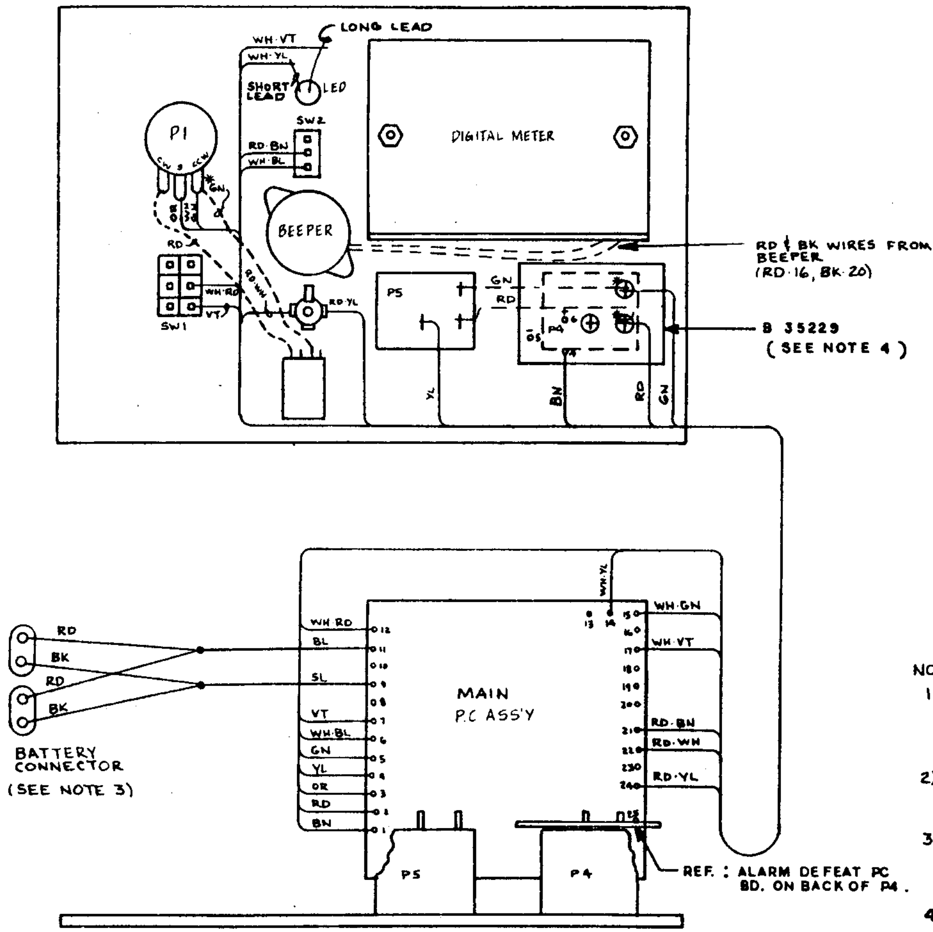
8-12-85

MDL. TED 160 D
OXYGEN ANALYZER
SCHEMATIC (DIGITAL)

F/C 34767

C 38548

QA	ISSUE NO.	DATE	REVISION NUMBER	APP
	1	8-13-85		



BOTTOM VIEW

NOTE:

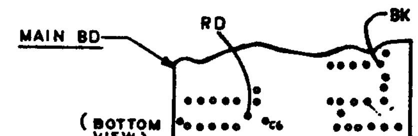
1) ALL WIRES TO BE 22 AWG. WIRES BETWEEN P.C.BD & PANEL
NOTE: WIRING SHOWN IN DOTTED LINES ARE EXISTING FROM FRONT PANEL WIRING DIAGRAM B-34771.

2) CONNECTIONS MARKED WITH (*) REQ'D TWO WIRES SOLDERED TO ONE TERMINAL. (3 PLACES)

3) ADD SPOT TIES TO FORM "CABLE" TO BATTERIES. MAKE BL & SL WIRES LONG ENOUGH TO ALLOW SERVICE LOOP. (SEE DWG B 34771 FOR BATTERY CONNECTOR P/N).

4 INSTALL ALARM DEFEAT P.C BD ASS'Y B 35229 PRIOR TO CONNECTING WIRES TO HI ALARM POTENTIOMETER
ADD TWO WIRES:

COLOR	DEFEAT BD
RD	6
BK	5



ITEM	PART NO.	REQ	DESCRIPTION

TOLERANCE UNLESS OTHERWISE SPECIFIED

FRAC 1/64
DEC .005
ANGULAR 1/2

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TELEDYNE
ANALYTICAL INSTRUMENTS
CITY OF INDUSTRY CALIFORNIA 91748

SCALE ~ DATE 8-12-85
MAT'L ~
FINISH ~

MDL. TED 160D (DIGITAL)

F/C34767

instruction manual

TELEDYNE ANALYTICAL INSTRUMENTS

Sensors • Analyzers • Systems

Scientific Solutions

16830 CHESTNUT STREET, CITY OF INDUSTRY, CA 91749-1580 U.S.A. • (818) 961-9221 • (213) 283-7181 • TWX (910) 584-1887 • TDYANYL COID • FAX (818) 961-2538

PARTS LIST FOR MODEL TED-60

Prices effective 9/5/85
(subject to change without notice)

PART#		DESCRIPTION	PRICE
A-	53	INTEGRATED CIRCUIT # UA776	2.50
A-	36872	CLIP	1.00
B-	56	CLIP AND WIRE, BATTERY	1.00
B-	326	BATTERY, 9V	2.50
B-	38118	ASSEMBLY, PC BOARD	Call Factory
B-	38541	SUBASSEMBLY, PROBE	Call Factory
C-	46	CAPACITOR, 0.47 MICROFARAD	2.50
C-	73	CAPACITOR, 0.1 MICROFARAD	3.80
C-	931	CAPACITOR	2.50
D-	62	DIODE # 1N4148	1.00
D-	212	LCD DISPLAY (W/A-38607 BEZEL)	58.00
E-	310	EYELET	1.00
K-	39	CAP	1.00
P-	389	POTENTIOMETER, 1 MEG	2.50
P-	509	POT, 100 K, # P486 CLAROSTAT	7.50
R-	311	RESISTOR, 10 K, 1/8 W, 1%	1.00
R-	327	RESISTOR, 39.2 K, 1/8 W, 1%	1.00
R-	341	RESISTOR, 33.2 K, 1/8 W, 1%	1.00
R-	343	RESISTOR, 100 OHM, 1/8 W, 1%	1.00
R-	345	RESISTOR, 9.09 K, 1/8 W, 1%	1.00
R-	381	RESISTOR, 562 K, 1/8 W, 1 %	1.00
R-	445	RESISTOR, 12 K, 1/8 W, 1%	1.00
R-	500	RESISTOR, 4.9 MEG, 1/8 W, 1%	1.00
R-	502	RESISTOR, 4.99 K, 1/8 W, 1%	1.00
R-	512	RESISTOR, 200 K, 1/8 W, 1%	1.00
R-	514	RESISTOR, 1 MEG, 1/8 W, 1%	1.00
R-	519	RESISTOR, 267 K, 1/8 W, 1%	1.00
R-	905	RESISTOR, 931 K, 1/8 W, 1%	1.00
R-	912	RESISTOR, 2.15 MEG, 1/8 W, 1%	1.00
R-	929	VOLTAGE REGULATOR, #LM385, 1.25 V	2.50
R-	953	RESISTOR, 1.65 MEG, 1/8 W, 1%	1.00
R-	1054	VOLTAGE REGULATOR # LM385, 2.5 V	2.50
S-	208	SOCKET, 8 PIN DIP	1.00
S-	637	SWITCH	10.25
T-	648	TRANSISTOR # 2N4393	2.50
T-	797	TRANSISTOR # J270	2.50

PARTS LIST FOR TED-80 AND TED-100

Prices effective 9/5/85
(subject to change without notice)

PART#	DESCRIPTION	PRICE
A- 133	INTEGRATED CIRCUIT (LM346N)	
A- 171	I.C. AMPLIFIER (ICL7621)	
A- 176	SONALERT AUDIBLE ALARM	
A- 31070	RETAINER, SUB-ASSEMBLY, BATTERY	
A- 31071	RETAINER, SUB-ASSEMBLY, BATTERY	
A- 34054	CASE BOTTOM	
A- 36872	PROBE CLIP	
B- 56	BATTERY CONNECTOR	
B- 314	BEZEL	
B- 30170 -3	P.C. BOARD	
B- 30172	P.C. BOARD	
C- 219	.15 MICROFARAD CAPACITOR	
C- 250	33 PICO-FARAD CAPACITOR	
C- 348	22 MICRO-FARAD CAPACITOR	
C- 598	6.8 MICRO-FARAD CAPACITOR	
C- 775	1 MICRO-FARAD CAPACITOR	
C- 817	10 MICRO-FARAD CAPACITOR	
C- 818	.1 MICRO-FARAD	
C- 820	.47 MICRO-FARAD CAPACITOR	
C- 821	CONNECTOR	
C- 30169	MAIN P.C. BOARD ASSEMBLY	
C- 30171	LCD PC BOARD ASSEMBLY	
D- 62	DIODE	
I- 18	INTEGRATED CIRCUIT (4030BE)	
I- 40	INTEGRATED CIRCUIT (MC14584)	
I- 47	INTEGRATED CIRCUIT (TSC 7126CPL)	
J- 6	JACK RECEPTACLE	
J- 23	JACK RECEPTACLE	
L- 150	LCD	
L- 154	L.E.D. LAMP	
L- 156	LENS	
P- 395	1 MEG TRIM POT	
P- 443	100k POTENTIOMETER (DIGITAL)	
P- 456	100k POT.	
R- 318	10 MEG 1/4 WATT 5% RESISTOR	
R- 338	150k 1/8 W 1% RESISTOR	
R- 345	9.09k 1/8 W 1% RESISTOR	
R- 358	100k 1/8 W 1% RESISTOR	
R- 366	22 MEG 1/4 W 5% RESISTOR	
R- 372	90.9k 1/8 W 1% RESISTOR	
R- 377	750 OHM 1/8 W 1% RESISTOR	
R- 389	24.9k 1/8 W 1% RESISTOR	
R- 415	332k 1/8 W 1% RESISTOR	
R- 424	681k 1/8 W 1% RESISTOR	
R- 441	499 OHM 1/8 W 1% RESISTOR	
R- 443	100 OHM 1/8 W 1% RESISTOR	

PARTS LIST FOR TED-80 AND TED-100

Prices effective 9/5/85
(subject to change without notice)

PART#		DESCRIPTION		PRICE
R-	445	121k 1/8 W 1% RESISTOR		
R-	500	4.99 M 1/8 W 1% RESISTOR		
R-	502	499k 1/8 W 1% RESISTOR		
R-	514	1 M 1/8 W 1% RESISTOR		
R-	519	267k 1/8 W 1% RESISTOR		
R-	630	178k 1/8 W 1% RESISTOR		
R-	644	28.7k 1/8 W 1% RESISTOR		
R-	719	4.75k 1/8 W 1% RESISTOR		
R-	754	402k 1/8 W 1% RESISTOR		
R-	904	634k 1/8 W 1% RESISTOR		
R-	906	1.87 MEG 1/8 W 1% RESISTOR		
R-	929	VOLTAGE REGULATOR		
R-	955	649k 1/8 W 1% RESISTOR	(LM385)	
R-	1019	5 X 10k RESISTOR NETWORK		
S-	130	4-40 X 5/8 SPACER		
S-	173	TOGGLE SWITCH		
S-	183	DIP SOCKET 16 PIN		
S-	184	PUSH BUTTON SWITCH		
S-	207	14 PT. DIP SOCKET		
S-	208	DIP SOCKET 8 PIN		
S-	567	STRIP SOCKET (FOR LCD)		
S-	572	40 PT. DIP SOCKET		
S-	574	DIP SOCKET		

PARTS LIST FOR TED-120

Prices effective 9/5/85
(subject to change without notice)

PART#	DESCRIPTION	PRICE
A- 34752	CASE BASE	
B- 332	BEZEL SIDES	
B- 334	BEZEL TOP & BOTTOM	
B- 336	BUMPER FEET	
B- 34749	BACK PANEL	
B- 34751	CASE	
C- 800	PROBE CLIP	
D- 193	METER DIAL	
H- 189	HANDLE	
K- 35	KNOB (SPAN POT)	
M- 173	METER	
P- 322	5.k POT.	

PARTS LIST FOR TED-140

Prices effective 9/5/85
(subject to change without notice)

PART#		DESCRIPTION	PRICE
A-	133	AMPLIFIER	
A-	176	AUDIO ALARM	
A-	34712	OUTER BACK PANEL	
A-	34713	INNER BACK PANEL	
A-	34727	P.C. BOARD RETAINER PLATE	
B-	331	BEZEL (TOP & BOTTOM)	
B-	332	BEZEL (SIDES)	
B-	336	BUMPER FEET	
B-	34686	FRONT PANEL	
B-	34688	CASE	
B-	34689	BASE	
C-	460	.1 MICRO-FARAD CAPACITOR	
C-	34619	P.C. BOARD	
C-	34620	P.C. BOARD ASSEMBLY	
D-	62	DIODE	
H-	32	BATTERY HOLDER	
H-	189	HANDLE	
K-	35	KNOB (FOR P-1)	
L-	154	LAMP	
L-	156	LENS	
M-	173	METER	
P-	322	5k SPAN POT.	
P-	395	1 MEG TRIM POT.	
P-	443	100k POT (DIGITAL)	
R-	310	1k 1/8 W 1% RESISTOR	
R-	311	10k 1/8 W 1% RESISTOR	
R-	358	100k 1/8 W 1% RESISTOR	
R-	367	10 M 1/8 W 1% RESISTOR	
R-	386	200 OHM 1/8 W 1% RESISTOR	
R-	411	4.99k 1/8 W 1% RESISTOR	
R-	442	11.8k 1/8 W 1% RESISTOR	
R-	490	82.5k 1/8 W 1% RESISTOR	
R-	512	200k 1/8 W 1% RESISTOR	
R-	641	18.2k 1/8 W 1% RESISTOR	
R-	929	VOLTAGE REGULATOR	
R-	1094	8.06k 1/8 W 1% RESISTOR	
S-	609	ROCKER SWITCH	
T-	507	TRANSISTOR (2N3904)	

PARTS LIST FOR TED-160

Prices effective 9/5/85
(subject to change without notice)

PART#		DESCRIPTION	PRICE
R-	345	11k 1/8 W 1% RESISTOR	
R-	358	100k 1/8 W 1% RESISTOR	
R-	359	4.7 M 1/4 W 5% RESISTOR	
R-	372	90.9k 1/8 2 1% RESISTOR	
R-	377	750 OHM 1/8 W 1% RESISTOR	
R-	420	71.5k 1/8 W 1% RESISTOR	
R-	441	499 OHM 1/8 W 1% RESISTOR	
R-	445	12k 1/8 W 1% RESISTOR	
R-	500	4.99M 1/8 W 1% RESISTOR	
R-	502	499k 1/8 W 1% RESISTOR	
R-	514	1 M 1/8 W 1% RESISTOR	
R-	514	1M 1/8 W 1% RESISTOR	
R-	530	249k 1/8 W 1% RESISTOR	
R-	630	178k 1/8 W 1% RESISTOR	
R-	719	4.75k 1/8 W 1% RESISTOR	
R-	754	402k 1/8 W 1% RESISTOR	
R-	902	374k 1/8 W 1% RESISTOR	
R-	904	634k 1/8 W 1% RESISTOR	
R-	906	1.87 M 1/8 W 1% RESISTOR	
R-	929	VOLTAGE REGULATOR	
R-	955	649k 1/8 W 1% RESISTOR	
R-	1019	10k X 5 RESISTOR NETWORK	
S-	183	16 PIN DIP SOCKET	
S-	184	PUSH BUTTON SWITCH	
S-	207	14 PT. DIP SOCKET	
S-	208	8 PIN DIP SOCKET	
S-	573	I.C. SOCKET	
S-	574	SIP SOCKET	
S-	576	STRIP SOCKET	
S-	595	ROCKER SWITCH DP DT	

PARTS LIST FOR TED-160

Prices effective 9/5/85
(subject to change without notice)

PART#		DESCRIPTION	PRICE
A-	133	INTEGRATED CIRCUIT	
A-	171	AMPLIFIER	
A-	176	AUDIO ALARM	
A-	34777	OUTER BACK PANEL	
A-	34778	INNER BACK PANEL	
A-	34779	BATTERY MOUNTING BRACKET	
B-	56	BATTERY CONNECTOR	
B-	314	METER BEZEL	
B-	324	SWITCH BEZEL	
B-	332	BEZEL (SIDES)	
B-	334	BEZEL (TOP & BOTTOM)	
B-	336	BUMPER FEET	
B-	30170 -3	PRINTED CIRCUIT BOARD	
B-	30172	P.C. BOARD	
B-	34772	FRONT PANEL	
B-	34774	CASE	
B-	34775	CASE BASE	
C-	250	33 PICO-FARAD CAPACITOR	
C-	348	22 MICRO-FARAD CAPACITOR	
C-	598	6.8 MICRO-FARAD CAPACITOR	
C-	775	1 MICRO-FARAD CAPACITOR	
C-	800	PROBE CLIP	
C-	818	.1 MICRO-FARED CAPACITOR	
C-	819	.15 MICRO-FARED CAPACITOR	
C-	820	.47 MICRO-FARED CAPACITOR	
C-	821	CONNECTOR	
C-	30171	L.C.D. P.C. BOARD ASSEMBLY	
C-	34850	MAIN P.C. BOARD ASSEMBLY	
D-	62	DIODE	
H-	81	BATTERY HOLDER	
H-	189	HANDLE	
I-	18	INTEGRATED CIRCUIT (4030)	
I-	40	INTEGRATED CIRCUIT	
I-	47	INTEGRATED CIRCUIT	
J-	23	JACK	
K-	35	KNOB (FOR P-1)	
L-	150	LCD	
L-	154	LED	
L-	156	LENS	
P-	322	5k POT.	
P-	395	1 MEG TRIM POT.	
P-	443	100k DIGITAL POTENTIOMETER	
R-	311	10k 1/8 W 1% RESISTOR	
R-	313	49.9k 1/8 W 1% RESISTOR	
R-	318	10 MEG 1/4 W 5% RESISTOR	
R-	336	22M 1/8 W 1% RESISTOR	

REFERENCE DRAWINGS

Schematic - LCD (for models 80, 100, 160)	B-30662

MODEL TED-60

Schematic	B-38120
Final Assembly (shows wiring)	C-38535

MODEL TED-80

Schematic - Main	C-33220
Wiring Diagram	C-31103

MODEL TED-100

Schematic - Main	C-30661
Wiring Diagram	C-31103

MODEL TED-120

Schematic and Wiring Diagram	A-38749

MODEL TED-140

Schematic - Main	B-34518
Wiring Diagram	C-34684

MODEL TED-140D (defeatable high alarm)

Schematic - Main	B-38734
Wiring Diagram	C-38733

MODEL TED-160

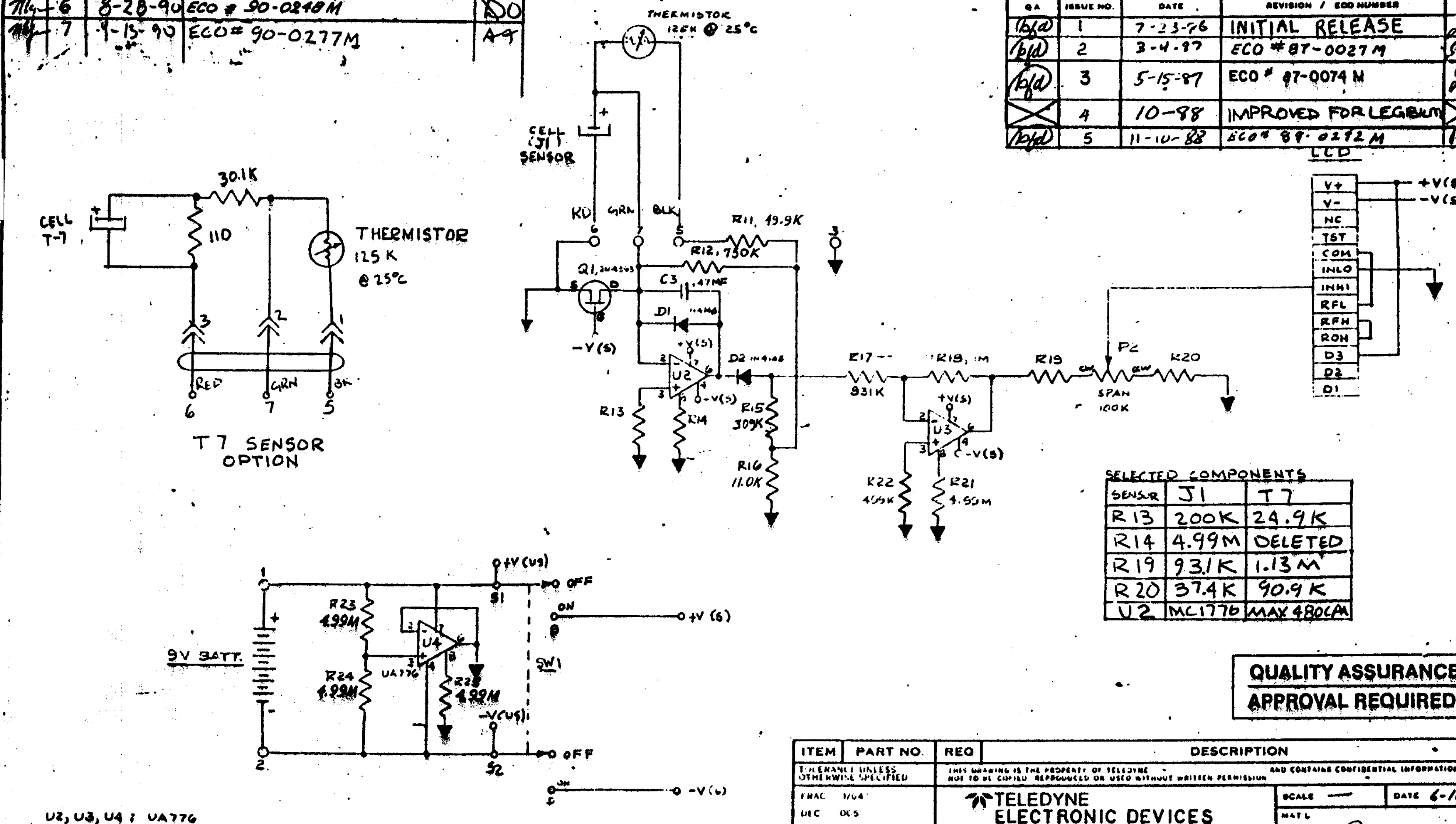
Schematic - Main	C-34769
Wiring Diagram	C-34770

MODEL TED-160D (defeatable high alarm)

Schematic - Main	C-38548
Wiring Diagram	C-38549

	6	8-28-90	ECO # 90-0248 M	D0
	7	9-13-90	ECO# 90-0277M	A4

QA	ISSUE NO.	DATE	REVISION / ECO NUMBER	APP
bfd	1	7-23-76	INITIAL RELEASE	
bfd	2	3-4-87	ECO # 87-0027 M	
bfd	3	5-15-87	ECO # 87-0074 M	
	4	10-88	IMPROVED FOR LEGIBILITY	
bfd	5	11-10-88	ECO # 88-0272 M	



SELECTED COMPONENTS

SENSOR	J1	T7
R13	200K	24.9K
R14	4.99M	DELETED
R19	931K	1.13M
R20	37.4K	90.9K
U2	MC1776	MAX 480CPA

QUALITY ASSURANCE APPROVAL REQUIRED!

ITEM	PART NO.	REQ	DESCRIPTION

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

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TELEDYNE ELECTRONIC DEVICES
CITY OF INDUSTRY CALIFORNIA 91748

SCALE — DATE 6-16-86
MAT'L ~
FINISH ~

N/C 40575

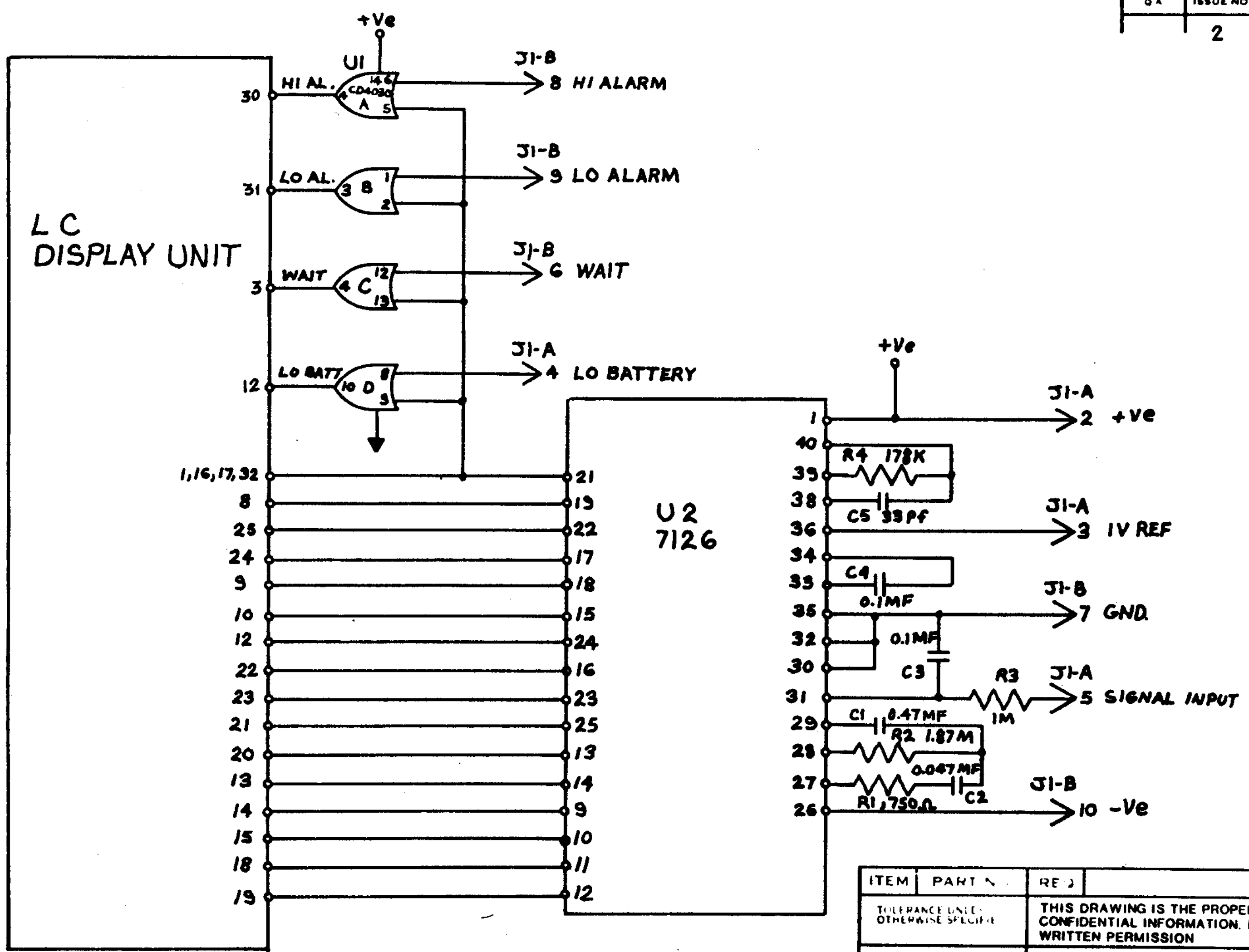
SCHEMATIC
TED MDL.60 J, 60T O_2 ANALYZER

DR ENGR APP

S.O. STD

B-40579

QA	ISSUE NO.	DATE	REVISION / ECO NUMBER	APP
	2	3- -84	REVISED AND REDRAWN	



SEE C-30661 MAIN P.C BD SCH.
P.C. BD ASS'Y: C-30171

ITEM	PART N	REQ	DESCRIPTION

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

TELEDYNE ELECTRONIC DEVICES
CITY OF INDUSTRY CALIFORNIA 91748

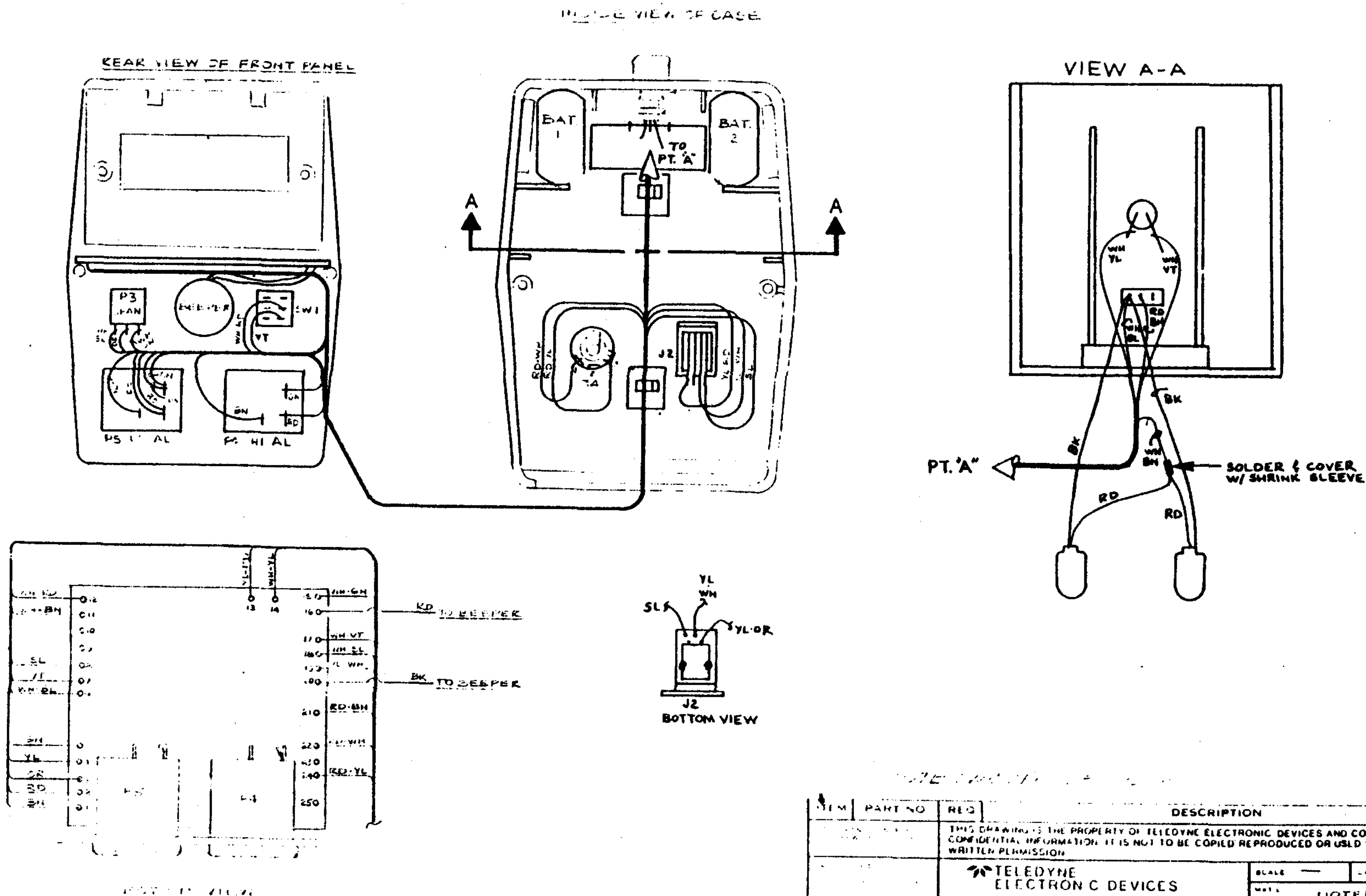
SCALE ~ DATE 3-22-84
MAT'L ~
FINISH ~
DR ENGR APP

MDL. TED 100
MEDICAL O_2 ANALYZER
LCD P.C. BD. SCHEMATIC

S.O.

B 30662

Q.A				
T	4	1-..-85	ECO 84-..47	



ITEM	PART NO	REQ	DESCRIPTION

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TELEDYNE ELECTRONIC DEVICES

SCALE —	DATE 3-7-83
MAT'L NOTED	
FINISH	
DR G	ENGR	APP JNK

S/C 30661
S/B 30662
A/C 30667

MEDICAL O_2 ANALYZER
MODEL TED 100
WIRING DIAGRAM