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TED 191

PORTABLE OXYGEN MONITOR

TECHNICAL MANUAL

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NOTE: THIS PRINTED MATTER IS SUBJECT TO CHANGE WITHOUT NOTICE

TELEDYNE ELECTRONIC TECHNOLOGIES

Sensor Technologies

2. TECHNICAL DESCRIPTION

The electronic circuitry which is all mounted on one PCB can be considered as two functional entities : signal conditioning and display, and alarm sensing and muting. Please refer to the circuit diagram for the detailed descriptions which follow. This description is for the circuit diagram with part number TM CD20B0000172.

2.1 SIGNAL CONDITIONING AND DISPLAY

Two sensor cells are catered for in this circuit - the R17, and the T7 - but only one connector will be provided on the rear panel, so usually only one circuit will be active.

For the T7 sensor, U1 is an inverting amplifier, whose feedback network includes the thermistor in the T7 cell. The diodes and capacitor associated with this stage suppress noise, and P2 provides offset adjustment. Note that U1 is referenced to a voltage level of 2.5V derived from U2c and D4. U2a inverts and amplifies the signal from U1.

For the R17 sensor, U3 simply amplifies the signal, and allows offset adjustment. R9 is the load for the sensor.

The outputs of U2a (T7 sensor) and U3 (R17 sensor) are summed by U2b. The resulting signal is divided down by R14 and R17 for input to the display driver, U4. J7 is provided for implementation of an alarm check feature at some future date. U4 is also referenced to the 2.5V level, being connected directly to the reference diode to suit the internal circuitry of this device. For display as a percentage, the display driver requires a reference voltage which is provided by P1, the calibration control on the front panel. This calibration voltage is derived from a 1.2V reference above the 2.5V level, and buffered by U2d. P7 allows correction of the calibration control to ensure that the control can achieve calibration at 21% at sea level. Since the signal is divided down, the reference voltage is also divided down (R18 and R19) by a factor which includes provision for display of 102%.

The display driver connects directly to the 3.5 digit LCD, with some minor supporting circuitry. R21 and C5 set the digital oscillation frequency from which all other timing is derived. C2, C3, C4 and R20 are the components used for integration of the signal and the reference voltage. At power up, the circuit around Q1 holds the test pin active for 2 or 3 seconds, enabling a display of "188" on the LCD. U5 drives the +, - and LOBAT segments for alarm purposes. The backplane frequency (pin 21 of U4) is nominally 68 Hz.

1. Oxygen Monitor : Functional description

Using a fuel cell sensor, the oxygen monitor measures and displays the oxygen concentration in the gas mixture to which the cell is exposed, and displays this value as the percentage of oxygen in the gas mixture. The user may define high and low limits for this concentration - if the measured concentration falls outside these limits, an audible and visual alarm is generated. The audible alarm may be temporarily muted.

2.2 ALARM CIRCUITRY

The reference voltage from P1 is buffered by U6b, and used to derive two alarm thresholds - one for the high alarm, the other for the low alarm. P3 and P4 are the respective settings on the front panel. The thresholds are compared to the signal by two comparators, U6c and U6d, for high and low alarms respectively.

When a high alarm is active, the output of U6c is high, which allows the 2Hz square wave on pin 1 of U10 to appear on pin 3 of U10. This signal passes through U7c to drive the LED in the mute button via U10c and Q2. If the audible alarm enable signal (pin 13 of U10 is high), i.e. mute is not active, the 2Hz signal also drives the buzzer via Q3. Similarly, for a low alarm, the output of U6d is high, allowing the 1Hz square wave on pin 6 of U10 to appear on pin 4 of U10. This signal drives the LED and buzzer in the same manner as the 2Hz signal. Thus the audible and visual alarms are cadence matched to the alarm type.

U9 divides the backplane frequency to provide the 1Hz and 2Hz signals mentioned above. Further stages of U9 are used to provide the mute period. This period is usually 60 seconds, but by breaking a track on the PCB and inserting a link, periods of 30 or 120 seconds may also be selected.

The audible alarm enable signal is derived from the OR of the high and low alarms (U7a). This high-OR-low alarm signal is inverted by U5d and passed to the clock of U8b via U7b. When no alarm is active, the output of U7b remains high, effectively blocking clock signals to U8b. The high-OR-low alarm signal is latched by the D flip-flop (U8a) which is clocked by the backplane signal. The output of U8a is the audible alarm enable signal which results in an audible alarm as described above.

When the mute button is pressed, U9 is reset, and U8b has a logic high presented to its D input. A short period later, determined by C9 and R45, a clock pulse is applied to U7b, latching the high signal on the D input (note that pin 6 of U7 is low because an alarm is active). U8a is then held in reset by the Q output of U8b, causing the Q output of U8a to be low - this is the audible alarm enable signal which is now low, so the pulse train from U7c does not propagate through U10d, and the buzzer is therefore muted. U9 has been reset, and starts to count up from 0. When the Q13 output goes high after 60 seconds, U8b is reset, causing its Q output to go low, and thus releasing U8a from reset. If the high-OR-low alarm signal is still present on the D input of U8a, this signal will be latched by the next rising edge of the backplane signal, asserting the audible alarm enable signal, and the buzzer will sound. Note that if the alarm condition should be cleared while a mute period is active, U7b applies a rising edge to U8b, clearing the mute state of U8b. Thus if an alarm condition re-occurs, the buzzer will sound immediately.

The battery voltage level is monitored by U6a, and if it drops below 4.8V, the "LOBAT" segment on the display is illuminated. U5 enables illumination of the segments by causing the drive to the segment to be out of phase with the backplane signal when illumination is required.

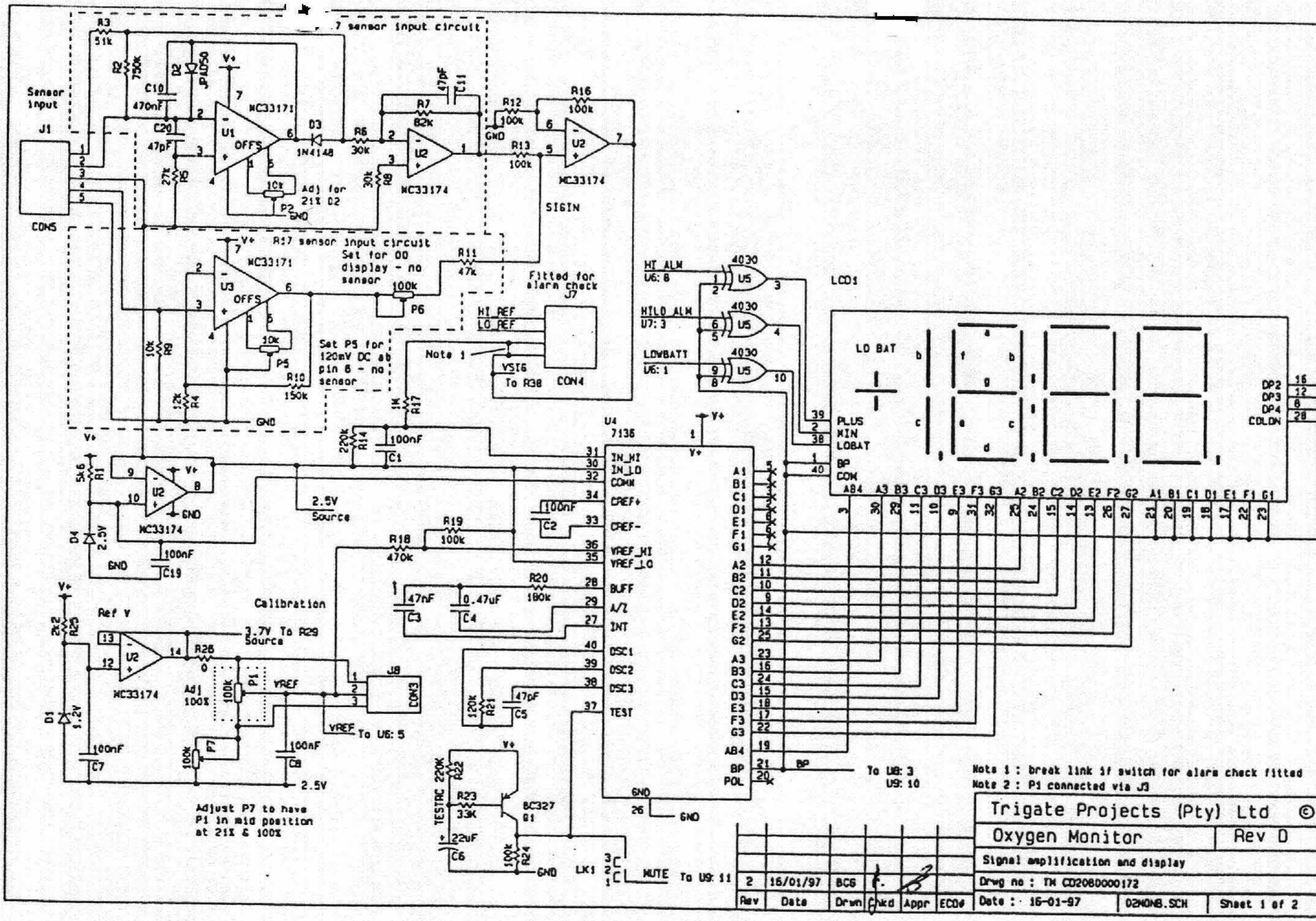
Power is usually supplied by battery - 4 'AA' size batteries in a battery box which is accessible from the rear panel. After passing through a power switch mounted on the front panel, the power passes through a fuse. With the aid of a zener diode, the fuse provides protection against excessive current, over voltage and reverse polarity.

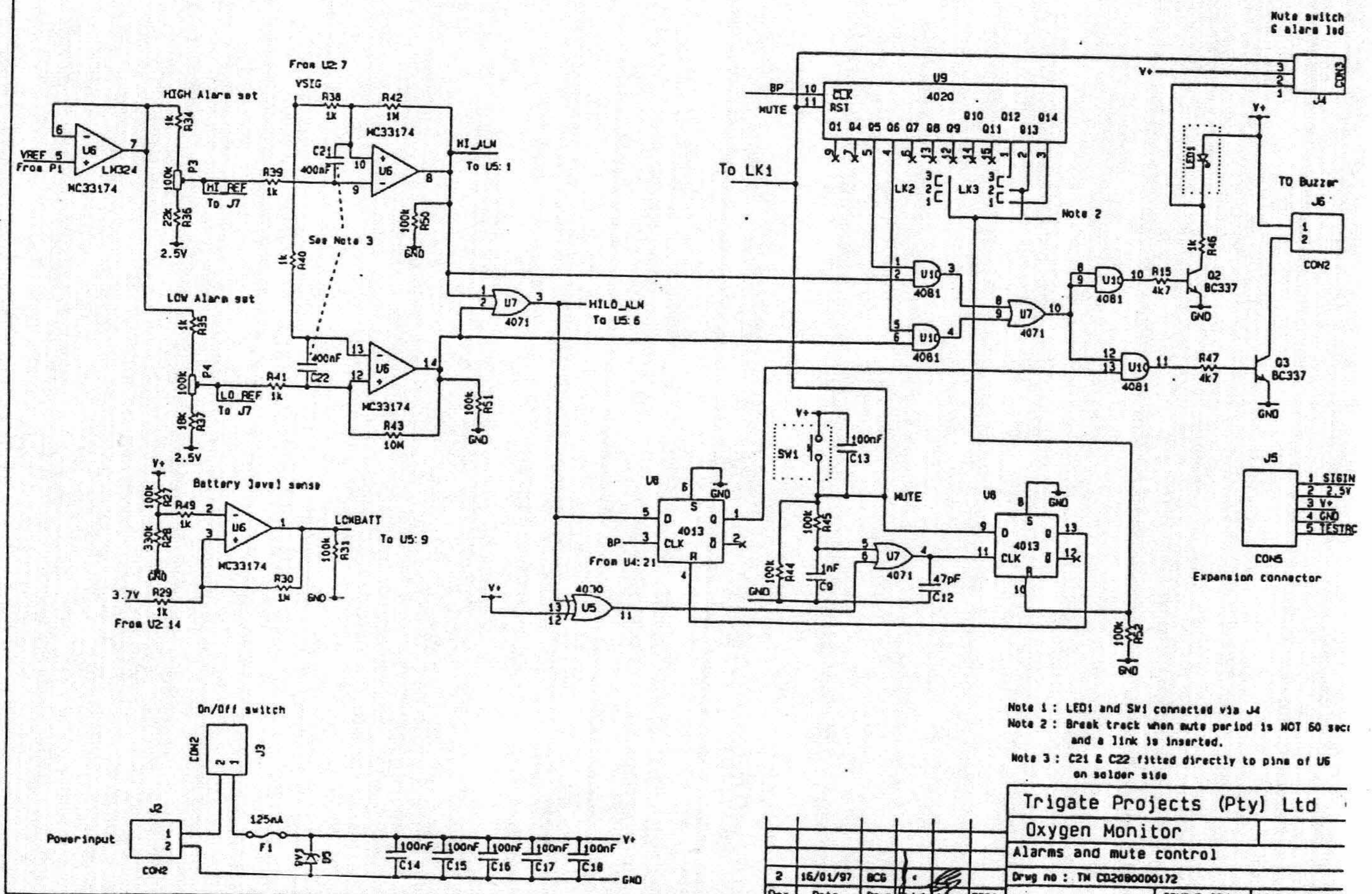
3 SETUP PROCEDURE

The following procedure applies regardless of which sensor is to be used. This setup is performed during manufacture, and if required, during service of the unit.

- Switch unit on.
- With NO sensor connected, adjust P5 for 120mV DC at pin 6 of U3.
- Adjust P6 for display of "00".
- Place front panel calibration knob in centre position (of its travel), and lock in place.
- Connect an R17 sensor, and adjust P7 for 21% reading.
- Expose sensor to 100% Oxygen, and adjust P7 for 100% reading.
- Repeat 5 & 6 until readings of 21% and 100% can be achieved without further adjustment of P7.
- Disconnect R17 sensor, and connect T7 sensor.
- Adjust P2 for display of 21%.

Further calibrations by the user will only be done at 100% oxygen, using the front panel calibration control.


Trigate Projects (Pty) Ltd ©
Oxygen Monitor
Rev D
Signal amplification and display
Drwg no : TM CD2080000172
Date : 16-01-97
O2MONB.SCH
Sheet 1 of 2
2 16/01/97 BCG
Rev Date Drwn Chkd Appr ECO#
Note 1 : break link if switch for alarm check fitted
Note 2 : P1 connected via J3
Sensor input
J1
CON5
R17 sensor input circuit
Set for 00 display - no sensor
Set P5 for 120mV DC at pin 6 - no sensor
Fitted for alarm check
J7
HI_REF
LO_REF
Note 1
VSIG
To R38
CON4
SIGIN
Adj for 21% O2
MC33171
MC33174
1N4148
U4
7136
LCD1
LO BAT
HI_ALM U6: 8
HILO_ALM U7: 3
LOWBATT U6: 1
4030
2.5V Source
Calibration
Ref V
3.7V To R29 Source
VREF To U6: 5
J8
CON3
Adj 100%
Adjust P7 to have P1 in mid position at 21% & 100%
To U8: 3
U9: 10
BC327
TESTRC 220K
LK1
MUTE
To U9: 11
GND



Note 1 : LED1 and SW1 connected via J4

Note 2 : Break track when mute period is NOT 60 sec and a link is inserted.

Note 3 : C21 & C22 fitted directly to pins of U6 on solder side

Trigate Projects (Pty) Ltd

Oxygen Monitor

Alarms and mute control

Drwg no : TN CD2080000172

Rev	Date	Drwn	Chkd	Appr	ECO#
2	16/01/97	BCG			

O2MONB.SCH

Sheet 2 of 2