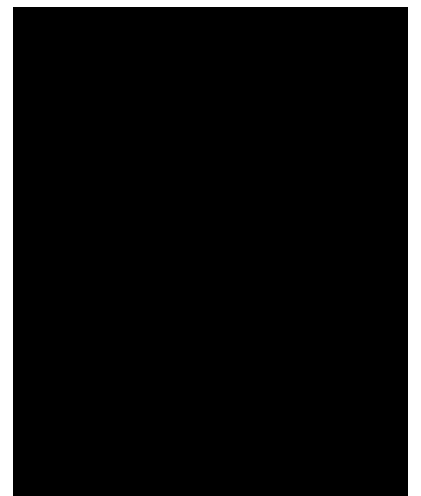


MicroRint - ServiceManual

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Contents

System Overview.....	2
Figure 1	2
Disassembling the MicroRint Computer for Circuit Investigation	3
Reassembling the MicroRint Computer	4
Disassembling the Interrupter Transducer for Circuit Investigation	5
Reassembling the Interrupter Transducer	6

Circuit Description-Microcomputer

Overview.....	7
Address Bus.....	7
Reset.....	7
Keypad.....	7
Real Time Clock.....	8
Display.....	8
Battery Monitoring.....	8
Power Supply.....	8

Circuit Description-Interrupter Transducer

Overview.....	9
Power supply	9
Battery monitor.....	9
Pressure monitor.....	9
Shutter operation	9

Parts List - MicroRint Computer	10
--	-----------

Parts List - Interrupter Transducer	12
--	-----------

Technical Support	14
--------------------------------	-----------

Fault Analysis	15
-----------------------------	-----------

Circuit Diagram - MicroRint Microcomputer	16
--	-----------

Circuit Diagram - Interrupter Transducer	17
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MicroRint Microcomputer - System Overview (Fig. 1)

The Micro Medical MicroRint is a data recording airways resistance meter consisting of a microcomputer unit (1) incorporating an LCD graphic display, data entry keypad, RS232 serial interface and all associated circuitry. This is supplied with an interrupter transducer (2), resistive element holder (3) resistive element (4) Pressure calibration adapter (5) and Mouthpiece adapter (6). The MicroRint is powered by internal rechargeable Nickel Cadmium cells or by the mains adapter supplied.

The interrupter transducer is used to measure the subject's airways resistance in accordance with the operating manual.

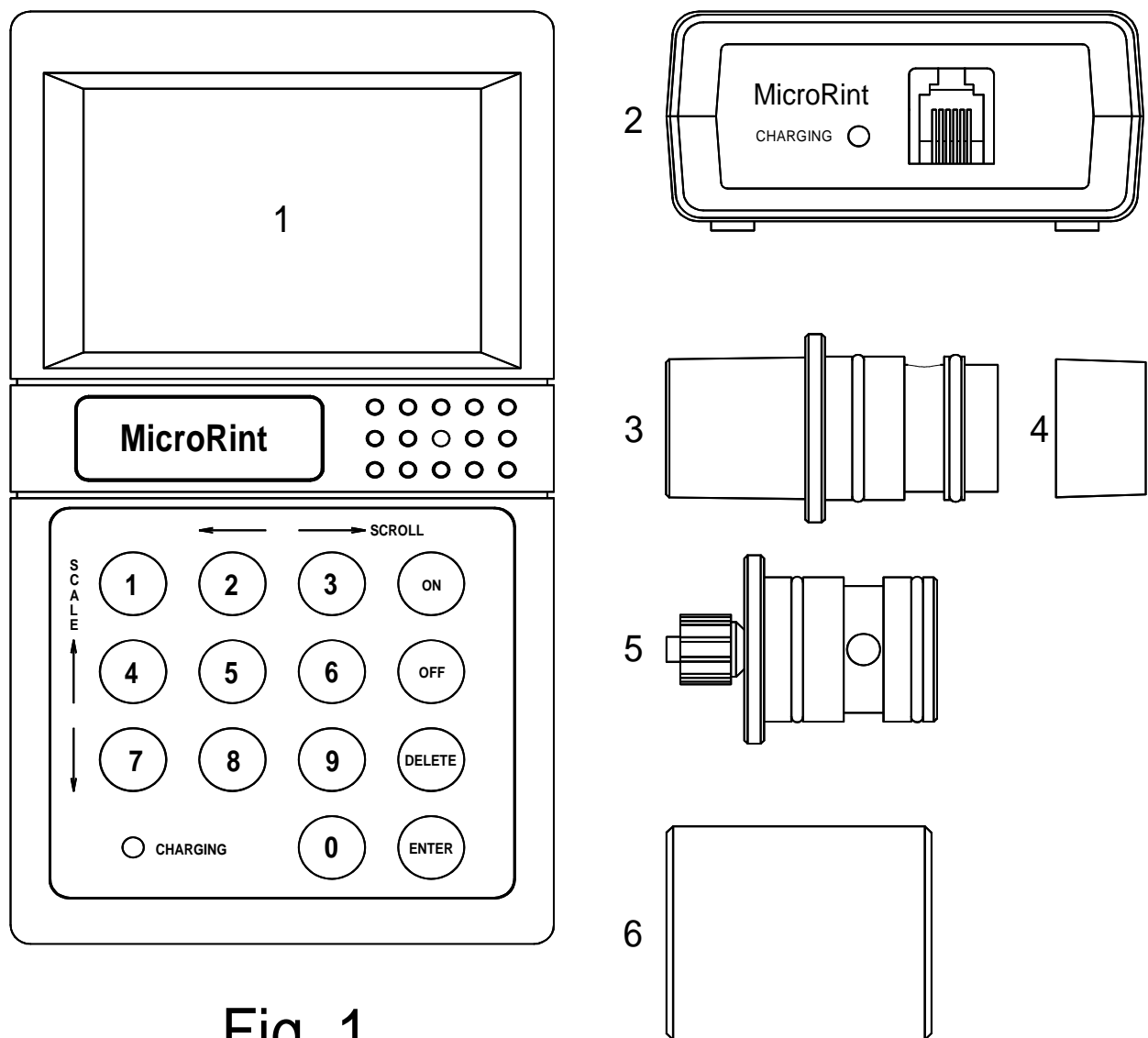



Fig. 1

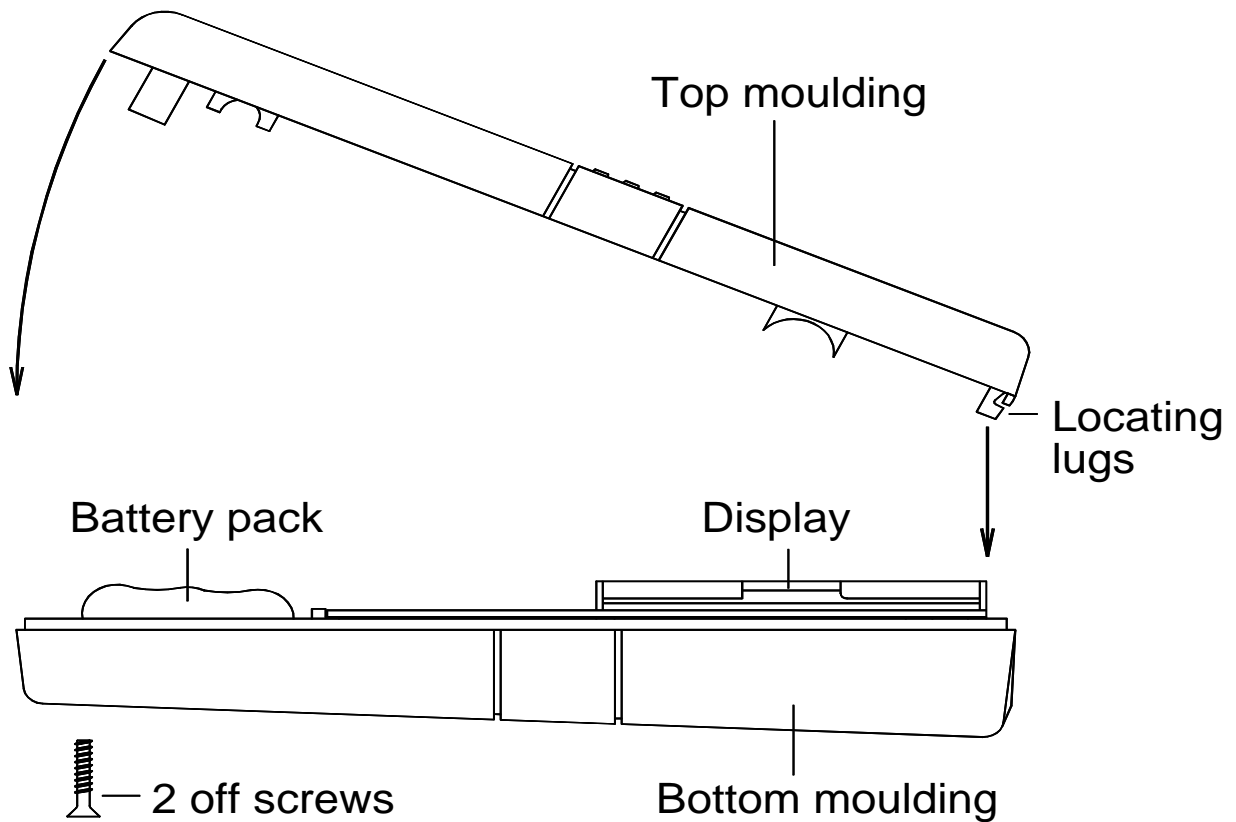
Disassembling the MicroRint Computer for Circuit Investigation

1. Disconnect all mains power supplies

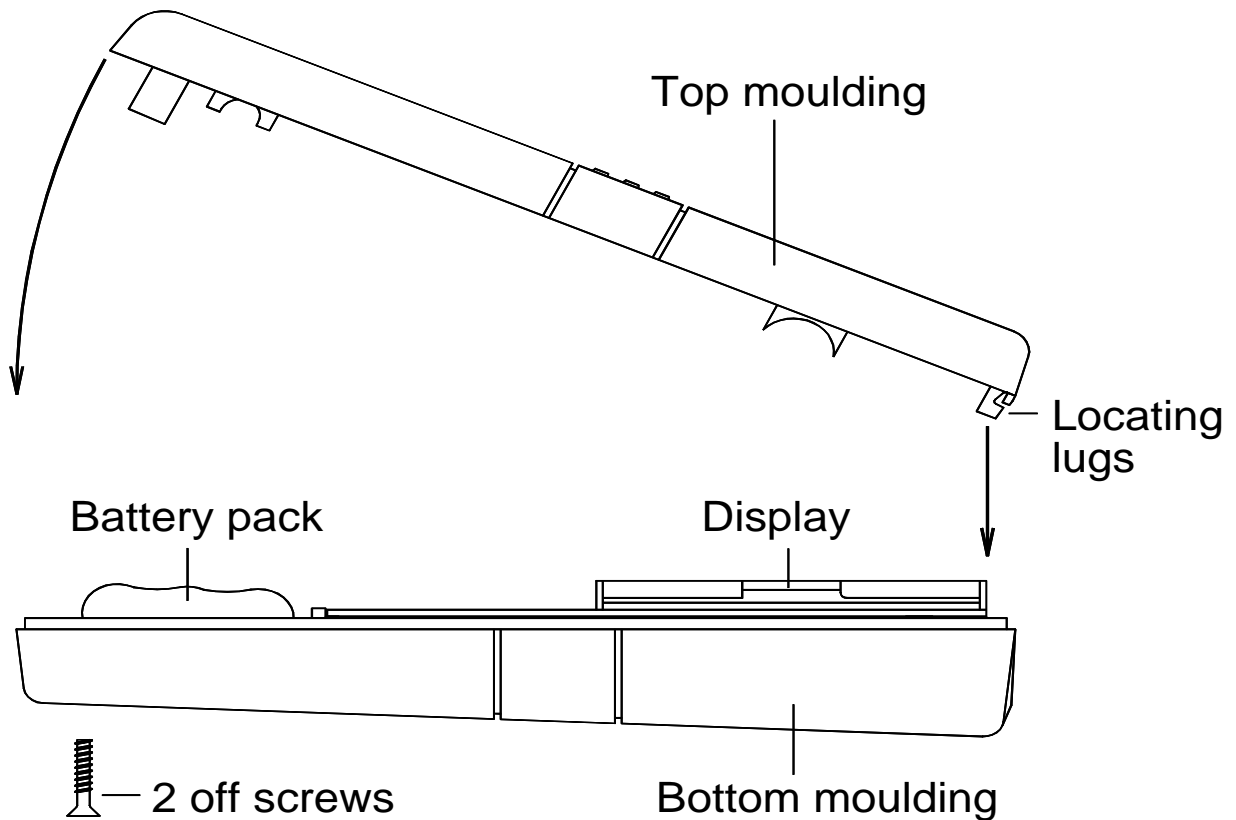
	<p>We recommend that you use a Philip Number Zero screwdriver for the following instruction.</p>
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2. Place the MicroRint face down to remove the two screws in the lower moulding, and put the screws to one side.
3. Turn the unit face up and ease the upper and lower mouldings apart by lifting the top moulding at an angle as illustrated in the diagram below until it becomes loose.
4. Reconnect mains power supply
5. The MicroRint is now ready for Circuit Investigation.

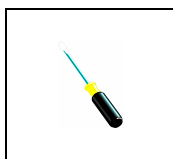
	<p>If you are not familiar with the operation of the MicroRint please read the following section in this manual 'Circuit Description' and use the Circuit diagrams at the back of this manual.</p>
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Reassembling the MicroRint Computer for Ready for Operation



1. Replace printed circuit board (If removed during investigation) into the bottom moulding.
2. Place the top moulding locating lugs into the bottom moulding at an angle as illustrated above.
3. Push the top moulding together with the bottom moulding making sure that there are no wires caught between the top and bottom moulding.



We recommend that you use a Philip Number Zero screwdriver for the following instruction.

4. Turn the unit face down and insert the two screws into the bottom moulding and secure.
5. The unit will now require calibration - Refer to operating manual.

Disassembling the Interrupter Transducer for Circuit Investigation

1. Disconnect the Interrupter Transducer from the MicroRint Computer
2. Remove the Resistive element holder and put to one side.
3. Remove the four rubber feet and put to one side.

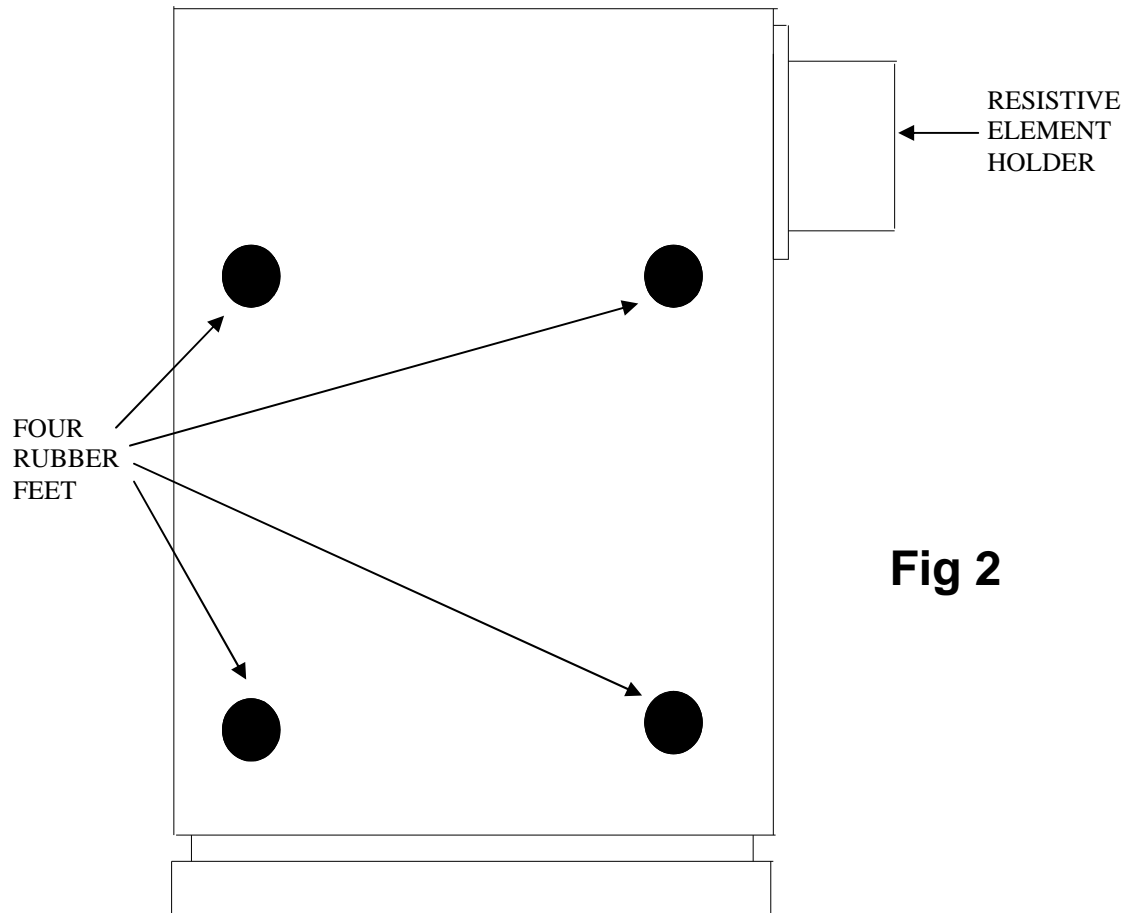




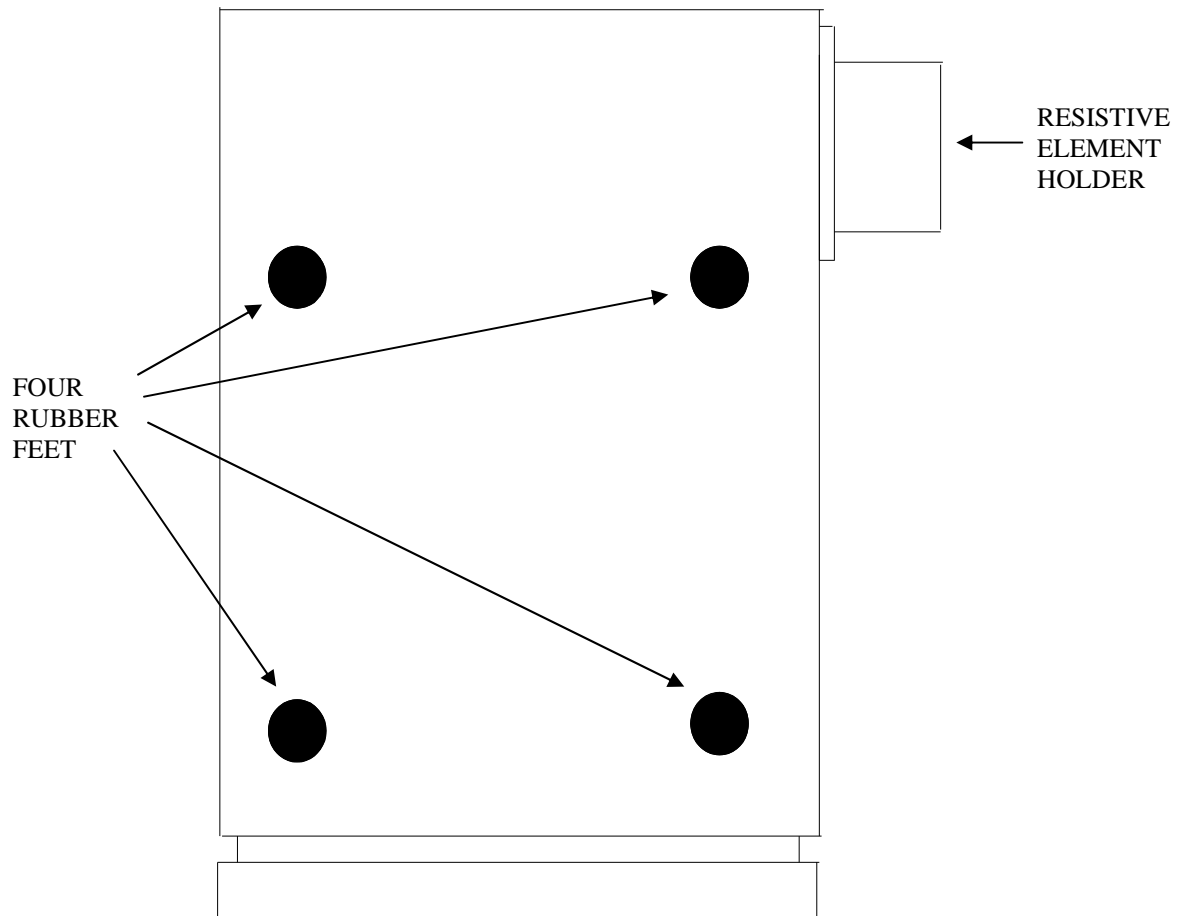
Fig 2

	<p>We recommend that you use a Philip Number Zero screwdriver for the following instruction.</p>
---	---

4. Remove the four screws located under the rubber feet and put to one side.
5. Ease the moulding apart to reveal the circuitry.
6. The Interrupter Transducer is now ready for fault finding.

	<p>If you are not familiar with the operation of the MicroRint please read the following section in this manual 'Circuit Description' and use the Circuit diagrams at the back of this manual.</p>
---	---

Reassembling Interrupter Transducer



1. Push the two mouldings together ensuring that no tubing is caught between the two mouldings.

	We recommend that you use a Philip Number Zero screwdriver for the following instruction.
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2. Replace the four screws into the moulding and secure
3. Replace the four rubber feet over the screws as shown above.
4. Push the resistive element holder into the Interrupter transducer.
5. The unit will now require calibration – Refer to operating manual.

Circuit Description – Microcomputer (Refer to Drawing (047-01))

Overview

The microprocessor control circuit carries out the spirometry routines, monitors the transducer operation and keypad, and drives the display under the control of the program stored in the battery backed RAM.

The power supply uses the mains adapter, internal Nickel-Cadmium (Ni-Cad) cells and an internal lithium backup as its sources of energy. The supply provides 5 volts to the control circuit, -12 volts supply for the display and RS232 driver circuit, 3 volts RAM backup, controls the charging current to the Ni-Cad battery pack, and provides for battery management.

The microprocessor (IC1) communicates with the real time clock (IC6), the output latch (IC5), and the display under the control of the program, stored in the RAM (IC2), using a multiplexed address and data bus decoded by a data latch (IC3). The RAM, which is used both for program storage and for temporary data storage, has a memory map which is partitioned by the action of the PAL (IC4) into writable and non-writable areas.

Address bus

The microprocessor (IC1) uses a multiplexed address bus. The lower order address lines are latched into IC3 with the address strobe (AS).

The program for the microprocessor (IC1) is stored in a 128kByte, battery backed static ram, (IC2). As the address space of the processor is limited to 64kBytes the ram address space is paged using a programmable array logic device (IC4). This device decodes address lines A1, A13, A14, A15, port lines PD5, PA4, control line R/W, clock signal E, mode control lines MODA, MODB, and the external reset line to provide the following outputs:

RAM address lines A15 and A16

Chip select lines (CS) for the display and latch (IC5)

Write enable (WR) for display, latch, and RAM

Read enable (RD) for the display

Output enable (OE) for the RAM

Reset

The reset circuit consists of a single chip reset (IC9) which holds the reset line (RES) low for 350ms after the 5 volt supply has reached the threshold voltage of 4.5 volts. The reset signal is applied to the microprocessor (IC1), display, programmable array logic device (IC4), and the printer driver processor (IC17).

Keypad

The 12 keypad switches (0 to 9, ENTER and DELETE) are arranged in a 3 column by 4 row matrix. When the keypad is being read by the processor the 3 columns are sequentially driven high by the output latch (IC5 pins 19,16 and 15). The state of the 4 rows is read by the general purpose port PE4 to PE7 of the processor. The diodes in the package D2 isolate the outputs from IC5 to ensure that a high current will not flow from an output set high to one set low if two keys are pressed simultaneously. The ON and OFF keys are connected to the power control circuitry described in the **Power Supply** section.

Real Time Clock

The real time clock (IC6) is set by the processor during the factory set-up and may be set to the local time zone –see operating manual. The processor communicates with the real time clock (RTC) with a serial interface line to pin 5 of the RTC. The RTC is selected by the signal from pin 12 of the output latch (IC5).

Display

The display is a custom graphic 128 by 64 dot LCD with in-built control circuitry. The contrast is adjusted by varying the voltage on pin 3 between –6.5 and -11 volts with VR1. This potentiometer varies the output of the voltage inverter, IC12.

Battery monitoring

The microprocessor contains eight, 8 bit analogue to digital converters. One of these, AN3 is used to monitor the condition of the main supply (BAT1). The main supply is monitored at the input to the logic 5-volt regulator (IC11) and the user will be alerted to a low battery condition when the voltage falls below 6 volts. The voltage is divided by two with R8 and R9 to bring the voltage within the range of the A/D converter (5 volts). AN3 also detects when the external power supply has been applied. One end of R10 is pulled to 0 volts when the external supply is not applied and the voltage read on the A/D converter will be up to 4 volts for a fully charged battery. With the external supply applied, the voltage will rise above 5 volts.

Power Supply

The power supply consists of linear 9 volt and 5 volt regulated supplies (IC7 and IC11), an adjustable switching regulator (IC12) and a lithium backup battery (BAT2), together with the NI-CAD charging circuit and low battery detector. The 9 volt regulator, IC7, is only operational when the mains adapter is connected and effectively replaces the 7.2 volt battery pack (BAT1) as the two supplies are connected through the dual diode D6. During this time the battery pack is trickle charged from the external supply by the 25mA constant current source formed by TR6, D1, R4, and R7. The bridge diode network, D4, provides protection against reverse polarity on the external supply. The inductors L1 and L2 provide attenuation of conducted noise to the external supply. The terminal voltage of the battery pack is monitored by an analogue input of the processor, AN3, through the potential divider network formed by R8 and R9. R8 is connected to the 9 volt supply, which is only active when the external supply is in use. The processor can detect when the external supply is in use as the analogue input will rise to above full scale, 5 volts, when this occurs. The input to the 5-volt regulator (IC11), and the voltage inverter (IC12), is controlled by TR5, which is turned on when the output of IC10 A is high. IC10 (gates A and B) form a bi-stable latch controlled by the ON and OFF switches on the keypad or by the microprocessor via TR1 and TR7.

Circuit Description – Interrupter Transducer (Refer to Drawing 046-10)

Overview

During measurement the interrupt transducer monitors tidal flow and provides for a means of momentary airways occlusion during which time the pressure at the mouth is measured. The flow is measured by monitoring the pressure across a resistive element using a high frequency silicon solid state sensor. Occlusion is provided by a fast acting rotary solenoid attached to a shutter. During occlusion the pressure sensor is used to monitor the pressure developed at the mouth.

Power supply

The power supply consists of a voltage converter (IC6) which produces a 12v supply, an adjustable regulator configured so as to produce a 10V supply for the pressure monitor circuit and a linear 5V regulator (IC4). The rechargeable Ni-cad battery pack is trickle charged from the 12V supply through R5 and D3. TR3, R6 and R7 are not used.

Battery Monitor

The comparator (IC1A) compares a reference voltage (IC1A Pin 6) to the voltage developed across the current sensing resistor (R9) when the shutter solenoid (M1) is activated. The output from this comparator (Pin 7) is used to shutdown the A/D converter (IC5) when insufficient current is passing through R9 during solenoid activity indicating a discharged battery. The Microcomputer unit will detect that the A/D converter is shutdown during operation and will indicate a battery low condition to the user on the LCD display.

Pressure Monitor

During solenoid operation the differential output of the pressure transducer (PT1) is applied to the instrumentation amplifier configuration of IC2. The output from this amplifier is applied to the analogue input of the A/D. Serial data is clocked out of the A/D by the SCLK input when CS is low.

Shutter Operation

The shutter solenoid is energised when the trigger input is taken to 5V, turning on TR1 and TR2. When the valve is de-energised the shutter returns to the open position by the action of the internal spring.

Parts List - Microcomputer

Designation	Description
IC1	(MC68HC11E1FN) MICROCONTROLLER
IC2	(KM681000BLG/BLG-L) SAMSUNG 1 MEG SURFACE MOUNT STATIC RAM 55 TO 150nS ACCESS TIME
IC3	(74HC573) SURFACE MOUNT OCTAL LATCH
IC4	(PALCE16V8Z25PC) AMD ZERO POWER CMOS PLD DIP PACKAGE
IC5	(74HC273) SURFACE MOUNT OCTAL D FLIP-FLOP
IC6	(PCF8583T) PHILIPS SURFACE MOUNT CLOCK CALENDER WITH 256 BYTE RAM
IC7	(LM2940T-9.0) LOW DROP OUT 9 VOLT 1 AMP REGULATOR
IC8	(74HC14) SURFACE MOUNT HEX SCHMITT INVERTOR
IC9	(DS1233D-10) DALLAS ECONO RESET
IC10	(4093) SURFACE MOUNT QUAD NAND GATE
IC11	(LM2931M-5.0) LOW DROP OUT 5 VOLT 100mA SURFACE MOUNT REGULATOR
IC12	(LT1054CS8) SURFACE MOUNT VOLTAGE CONVERTOR
IC15	(BU4S11) OR (BU4S01) RHOM INDIVIDUAL CMOS GATE
R1	100K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R2	1M SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R3	1K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R4	27 OHMS SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R5	330 OHMS SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R6	1K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R7	10K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R8	100K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R9	100K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R10	100K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R11	100K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R12	100K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R13	1K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R14	33K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R15	330K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R16	10K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R17	10K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R18	4.7K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R19	4.7K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R20	3.3K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R21	3.3K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R22	3.9K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R23	1K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R24	100 OHMS SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R25	1M SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
RN1	4 WAY COMMONED 10K SIL NETWORK
VR1	(T18 S/I S/B S/T 20KA) PHIER 20K LINEAR POTENTIOMETER
C1	RUBYCON 22uF 35 VOLT ELECTROLYTIC CAPACITOR TYPE 35MH522M0563
C2	RUBYCON 47uF 16 VOLT ELECTROLYTIC CAPACITOR TYPE 16MH547M6357
C3	RUBYCON 47uF 16 VOLT ELECTROLYTIC CAPACITOR TYPE 16MH547M6357
C4	RUBYCON 47uF 16 VOLT ELECTROLYTIC CAPACITOR TYPE 16MH547M6357
C5	RUBYCON 47uF 16 VOLT ELECTROLYTIC CAPACITOR TYPE 16MH547M6357
C6	RUBYCON 47uF 16 VOLT ELECTROLYTIC CAPACITOR TYPE 16MH547M6357
C7	RUBYCON 47uF 16 VOLT ELECTROLYTIC CAPACITOR TYPE 16MH547M6357
C8	RUBYCON 47uF 16 VOLT ELECTROLYTIC CAPACITOR TYPE 16MH547M6357
C9	10nF PHILIPS SURFACE MOUNT CERAMIC CAPACITOR SIZE 1206
C10	15pF PHILIPS SURFACE MOUNT CERAMIC CAPACITOR SIZE 1206
C11	10nF PHILIPS SURFACE MOUNT CERAMIC CAPACITOR SIZE 1206

C12	10nF PHILIPS SURFACE MOUNT CERAMIC CAPACITOR SIZE 1206
C13	33pF PHILIPS SURFACE MOUNT CERAMIC CAPACITOR SIZE 1206
C14	33pF PHILIPS SURFACE MOUNT CERAMIC CAPACITOR SIZE 1206
C15	1nF PHILIPS SURFACE MOUNT CERAMIC CAPACITOR SIZE 1206
C16	1nF PHILIPS SURFACE MOUNT CERAMIC CAPACITOR SIZE 1206
CD (X7)	100nF PHILIPS SURFACE MOUNT CERAMIC CAPACITOR SIZE 1206
TR1	(DTC114EK) RHOM NPN DIGITAL TRANSISTOR
TR2	(DTC114EK) RHOM NPN DIGITAL TRANSISTOR
TR3	(DTB113EK) RHOM PNP DIGITAL TRANSISTOR
TR4	(DTA114EK) RHOM PNP DIGITAL TRANSISTOR
TR5	(FMMT591) ZETEX PNP TRANSISTOR - SOT23
TR6	(2SB1189) RHOM PNP TRANSISTOR - MPT (SOT89)
TR7	(DTC114EK) RHOM NPN DIGITAL TRANSISTOR
LED	T1/3mm ORANGE LED
D1	(IMN10) RHOM 3 DIODE ARRAY - IMD PACKAGE
D2	(IMN10) RHOM 3 DIODE ARRAY - IMD PACKAGE
D3	(IMN10) RHOM 3 DIODE ARRAY - IMD PACKAGE
D4	(S1NB20) SHINDENGEN 1A BRIDGE RECTIFIER
D5	(1SR154-400) RHOM 1A DIODE - PSM PACKAGE. ALTERNATIVE SHINDENGEN (D1F20)
D6	(S1ZAS4) SHINDENGN 1.2A DUAL SCHOTTKY DIODE
D7	(S1ZAS4) SHINDENGN 1.2A DUAL SCHOTTKY DIODE
D8	(BAS19) SMALL SIGNAL DIODE SOT23 PACKAGE
D9	(ZHCS750) ZETEX SMALL SIGNAL SCHOTTKY DIODE SOT23 PACKAGE
L1	(NLC565050T-3R9K) TDK 3.9uH SURFACE MOUNT INDUCTOR
L2	(NLC565050T-3R9K) TDK 3.9uH SURFACE MOUNT INDUCTOR
DISPLAY	(DMF-50424N) OPTREX 128 X 64 GRAPHIC DISPLAY
SK1	(MDS4) 4 WAY MINI DIN SOCKET
SK2	(95001-2611) MOLEX 6 WAY DATA SOCKET
SK3	10 WAY PIN HEADER
SK4	(MJ-179P) DC POWER SOCKET
SK5	(B 3B-PH-SM3-TB) 3 WAY PCB SOCKET FROM JST
SPKR	(PKM35-4A0) MURATA PIEZO CERAMIC SOUNDER
X1	4.9152MHz CRYSTAL CAN STYLE HC49/4H
X2	32.768KHz CRYSTAL
BAT1	NI-CAD BATTERY PACK - 6 X AAA CELLS
BAT2	(CR2040) 280mA-Hr 3V LITHIUM PCB MOUNTED BATTERY

Parts List - Interrupter Transducer

Designation	Description
IC1	(LM393M) DUAL LOW POWER SURFACE MOUNT COMPARATOR
IC2	(OP490GS) QUAD LOW POWER SURFACE MOUNT PRECISION OP-AMP
IC3	(LP2951CM) LOW DROP OUT ADJUSTABLE SURFACE MOUNT REGULATOR
IC4	(LM2931M-5.0) LOW DROP OUT 5 VOLT SURFACE MOUNT REGULATOR
IC5	(MAX187CCWE) SERIAL A/D ALTERNATIVE MAX189 SUFFIX (A,B OR C) CWE
IC6	(LT1054CS8) SURFACE MOUNT VOLTAGE CONVERTOR
IC7	(BU4S11) OR (BU4S01) INDIVIDUAL CMOS GATE
IC8	(ZRT040GC1) 4.01V SURFACE MOUNT REFERENCE (NOT USED WITH MAX187)
TR1	(ZTX869) E-LINE NPN TRANSISTOR
TR2	(ZTX869) E-LINE NPN TRANSISTOR
TR3	NOT USED
R1	100K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R2	1.8K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 0805
R3	10K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 0805
R4	47 OHM SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 0805
R5	680 OHM SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R6	NOT USED
R7	NOT USED
R8	1M SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R9	0.1 OHM 0.25 WATT RESISTOR
R10	100K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R11	6.8K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R12	100K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R13	100K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R14	33K SURFACE MOUNT RESISTOR 0.125 WATT 1% SIZE 1206
R15	4.7K SURFACE MOUNT RESISTOR 0.125 WATT 1% SIZE 1206
R16	10K SURFACE MOUNT RESISTOR 0.125 WATT 1% SIZE 1206
R17	10K SURFACE MOUNT RESISTOR 0.125 WATT 1% SIZE 1206
R18	100K SURFACE MOUNT RESISTOR 0.125 WATT 1% SIZE 1206
R19	100K SURFACE MOUNT RESISTOR 0.125 WATT 1% SIZE 1206
R20	1M SURFACE MOUNT RESISTOR 0.125 WATT 1% SIZE 1206
R21	1M SURFACE MOUNT RESISTOR 0.125 WATT 1% SIZE 1206
R22	100K SURFACE MOUNT RESISTOR 0.125 WATT 1% SIZE 1206
R23	100K SURFACE MOUNT RESISTOR 0.125 WATT 1% SIZE 1206
R24	1.5K SURFACE MOUNT RESISTOR 0.125 WATT 1% SIZE 1206
R25	100K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R26	10K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R27	390 OHM SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R28	100K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
R29	1K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 0805
R30	4.7K SURFACE MOUNT RESISTOR 0.125 WATT 5% SIZE 1206
C1	NOT USED
C2	10nF MULTILAYER SURFACE MOUNT CERAMIC CAPACITOR SIZE 1206
C3	10uF16V TANTALUM SURFACE MOUNT CAPACITOR
C4	100uF16V TANTALUM SURFACE MOUNT CAPACITOR
C5	100uF 25 VOLT ELECTROLYTIC CAPACITOR 0.1" PITCH
C6	47uF 16 VOLT ELECTROLYTIC CAPACITOR 0.1" PITCH
C7	100uF 16 VOLT ELECTROLYTIC CAPACITOR 0.1" PITCH
C8	100uF 16 VOLT ELECTROLYTIC CAPACITOR 0.1" PITCH
C9	1nF MULTILAYER SURFACE MOUNT CERAMIC CAPACITOR 5% SIZE 1206

C10	1nF MULTILAYER SURFACE MOUNT CERAMIC CAPACITOR 5% SIZE 1206
C11	10nF MULTILAYER SURFACE MOUNT CERAMIC CAPACITOR SIZE 1206
C12	100pF CERAMIC CAPACITOR 0.1" PITCH
C13	100pF CERAMIC CAPACITOR 0.1" PITCH
C14	100pF CERAMIC CAPACITOR 0.1" PITCH
C15	100pF CERAMIC CAPACITOR 0.1" PITCH
C16	220nF MULTILAYER SURFACE MOUNT CERAMIC CAPACITOR SIZE 1206
D1	GENERAL PURPOSE SURFACE MOUNT 1A DIODE
D2	NOT USED
D3	(1N4148) GENERAL PURPOSE SMALL SIGNAL DIODE
D4	(10BQ040) 1A SCHOTTKY SURFACE MOUNT DIODE
D5	(10BQ040) 1A SCHOTTKY SURFACE MOUNT DIODE
BAT	5 x 1/3AA SIZE 110mA-hr SANYO BATTERY PACK
PT1	(176PC07HD2) HONEYWELL 7" H ₂ O PRESSURE TRANSDUCER
LED	LOW CURRENT YELLOW LED
M1	(GDAY 025 X20 B25) EMMESEM ROTARY SOLENOID 6.8V 7% DUTY 1.25 OHMS 65 DEG

Technical Support

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Fault Analysis

The following analysis is only a guideline and should be carried out in a logical sequence. If the fault is still apparent after the following suggestions then the unit should be fault found using the circuit descriptions and circuit diagrams provided.

When the unit is turned on there is no display present

- Rotate contrast thumb wheel anti-clockwise to see if screen darkens.
- Connect charger to see if screen darkens and charging light illuminates.

When the unit is turned on the display is dark purple

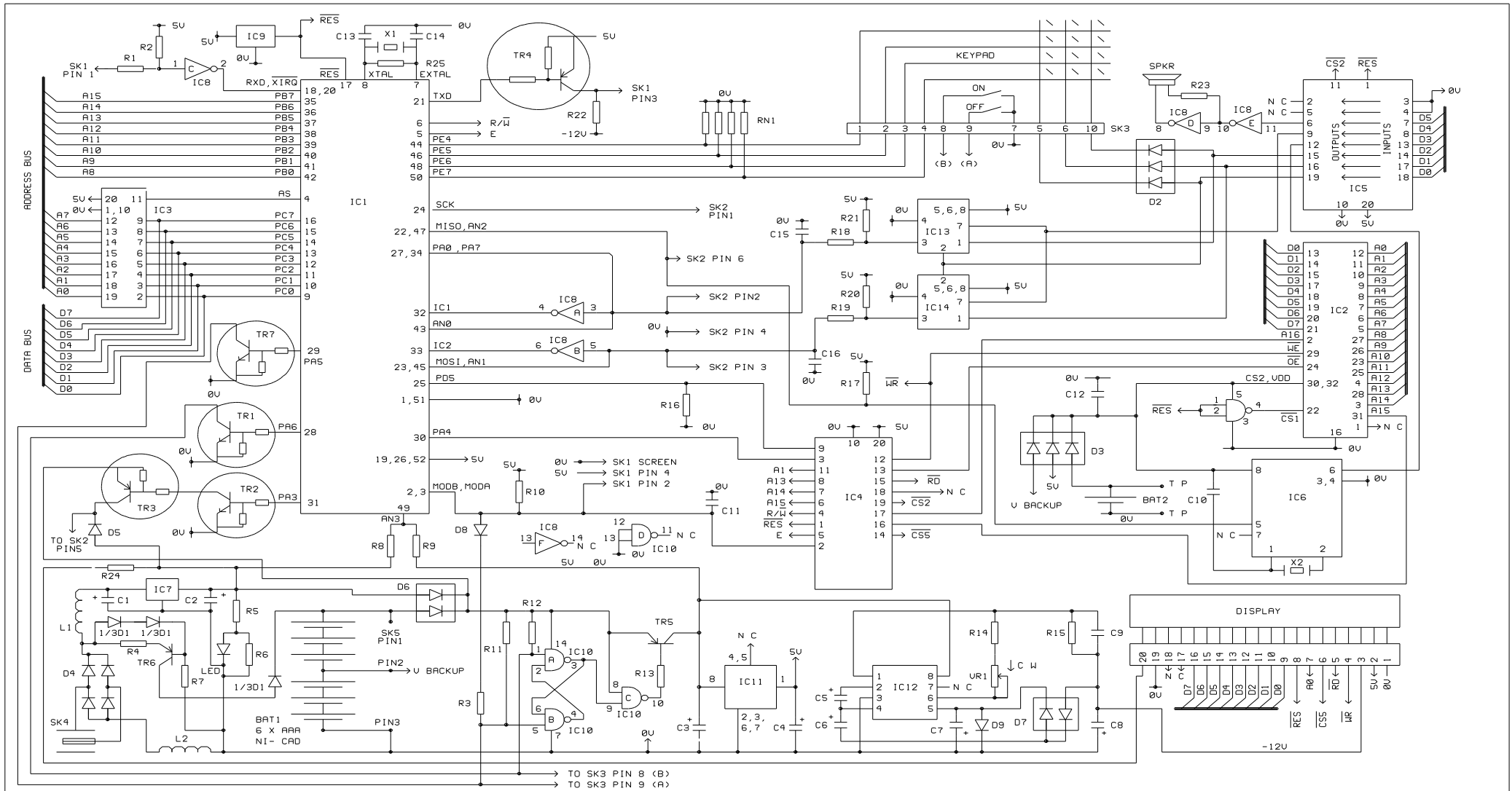
- Rotate contrast thumb wheel clockwise to see if screen colour becomes lighter and characters are displayed.
- Connect charger to see if screen characters appear.

The recorded values are low

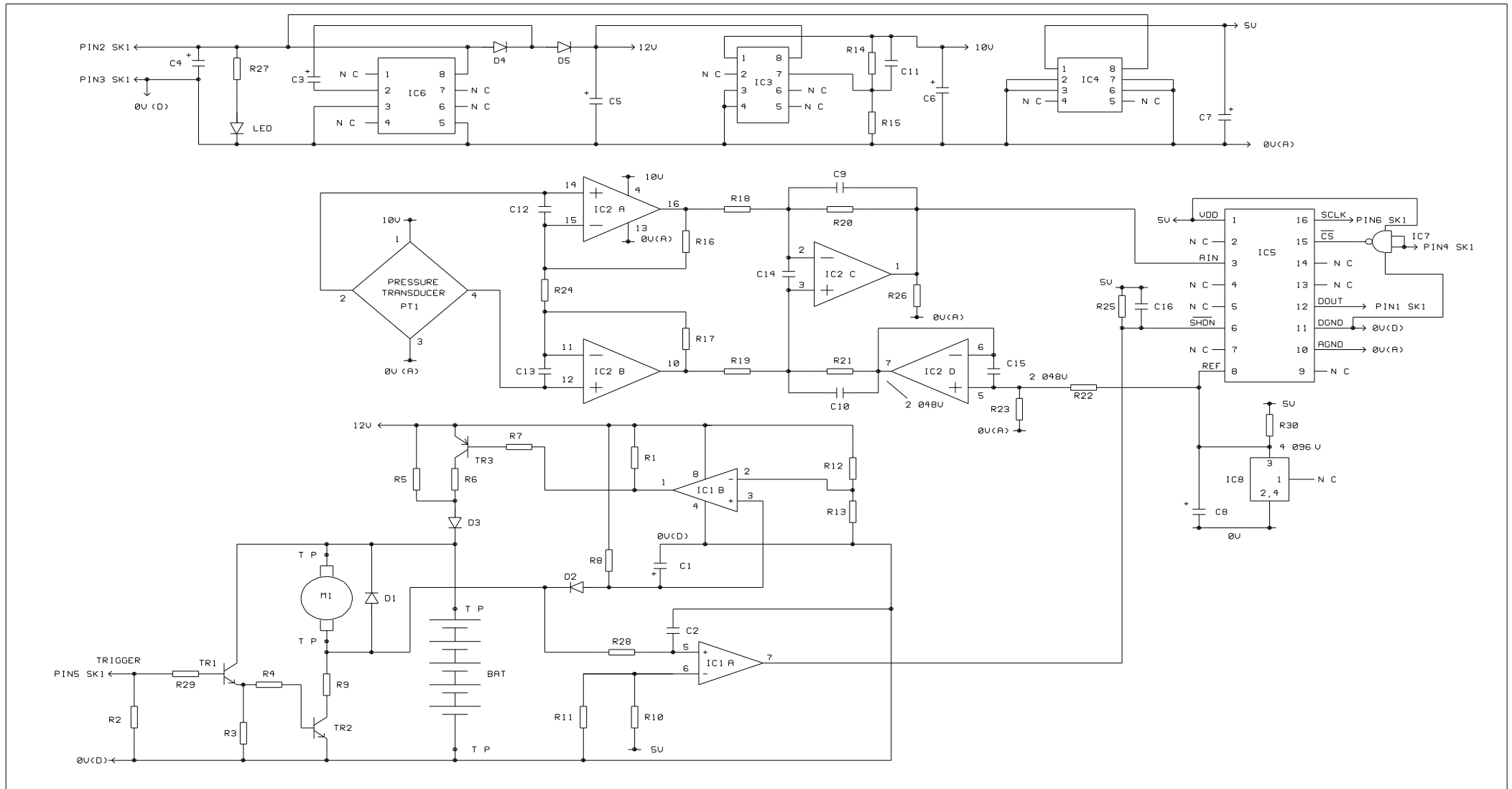
- Ensure that the unit is calibrated – Refer to operating manual.
- Ensure that the mouthpiece holder is fully inserted into the interrupter transducer unit.
- Check that the resistive element is not damaged.

The shutter does not activate

- Check that the battery low message is not displayed on the LCD display
- Ensure that the interrupter transducer is connected to the microcomputer unit.



DRAWN C P L	TITLE ML3535	ISSUE	DATE	DESCRIPTION OF MOD	DATE	DESCRIPTION OF MOD
DATE 1/12/97	DRAWING No 047-01	1 3				



DRAWN C P L	TITLE CIRCUIT DIAGRAM FOR MICRORINT TRANSDUCER	ISSUE	DATE	DESCRIPTION OF MOD	DATE	DESCRIPTION OF MOD
DATE 17/6/98	DRAWING No 046-10	1 3				