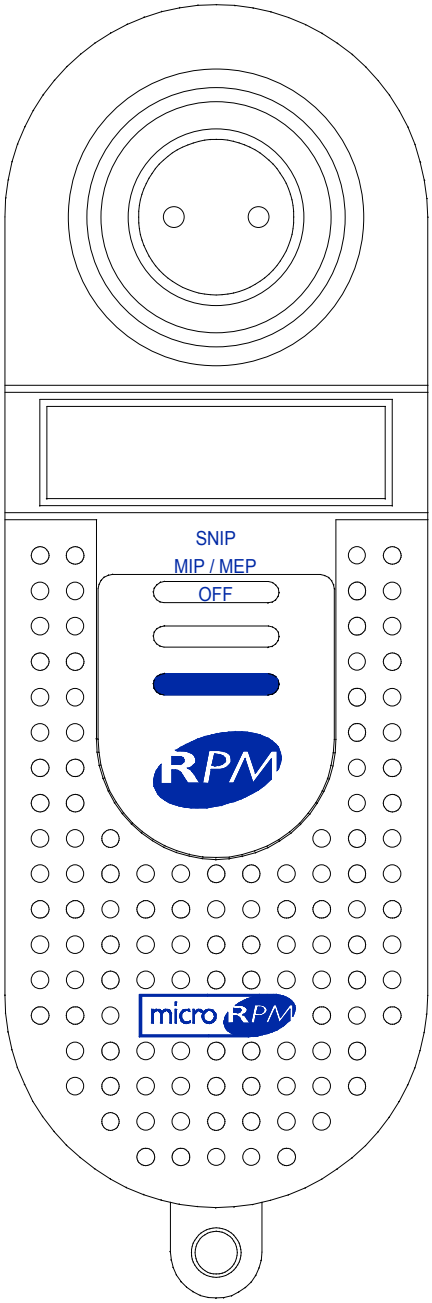

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Respiratory Pressure Meter

Service Manual

064-22 Iss. 1.0 October 2004

Micro Medical

Respiratory Pressure Meter

Service Manual

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Drawing no. 064-22

Version 1.0

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Introduction

The Micro Medical respiratory pressure meter (RPM) is a hand held instrument designed for rapid assessment of inspiratory and expiratory muscle strength. The unit can measure the maximum inspiratory and expiratory mouth pressures, MIP and MEP, and the Sniff Nasal Inspiratory Pressure, SNIP. The result of each measurement is presented in units of cmH2O gauge pressure on the liquid crystal display screen.

The MIP and MEP measurements represents the maximum pressure sustained for 1 second. The SNIP measurement represents the peak pressure detected in the manoeuvre.

Respiratory Pressure Meter Layout

1. Respiratory Pressure Meter PCB
2. Top Moulding
3. Bottom Moulding
4. Mouthpiece Holder
5. Retaining ring
6. 55mm of 1/16" I.D. 1/8" O.D. 'Tygon' tubing
7. Nylon barb connector
8. Countersunk screws
9. Plastic bolt M5 x 6mm
10. Cable tie

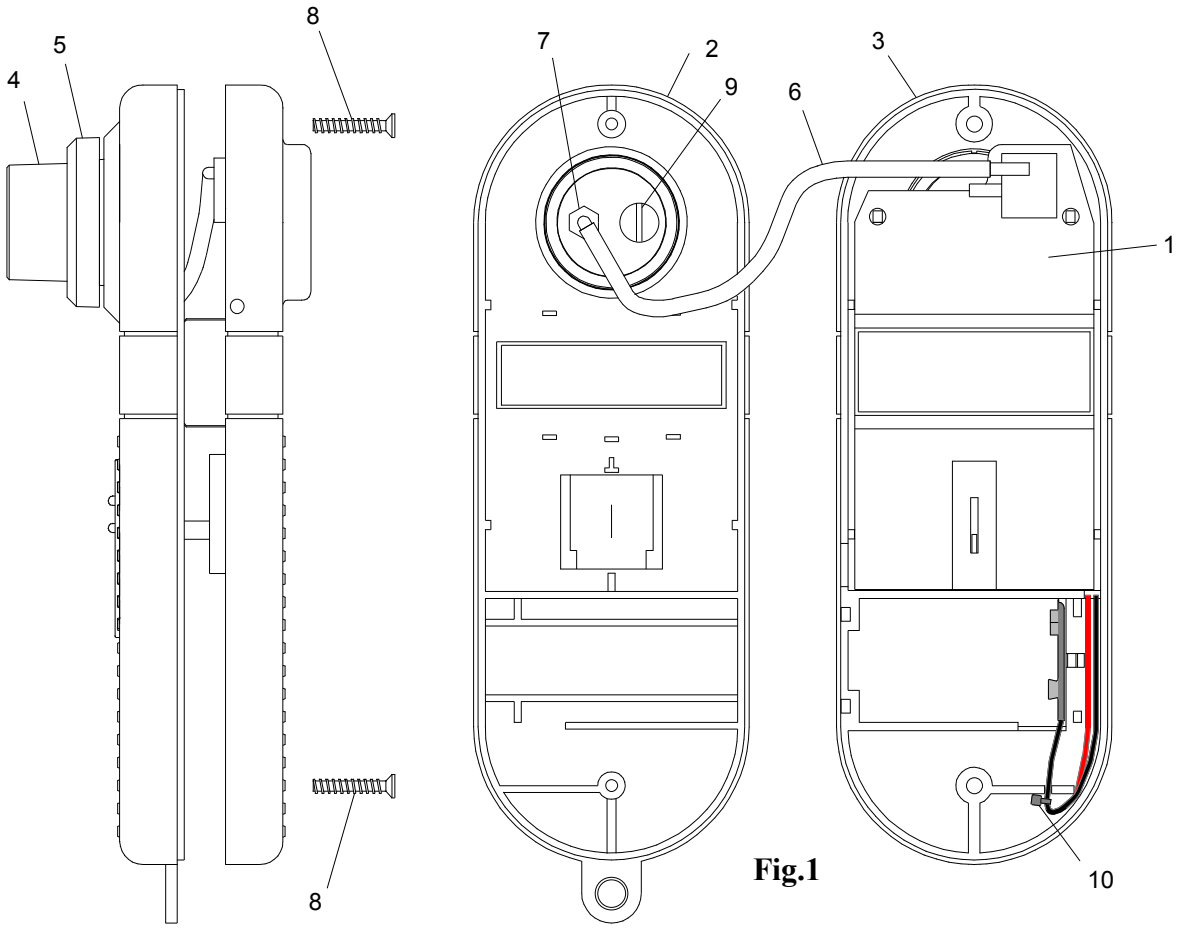

Fig.1

Cleaning and maintaining the Respiratory Pressure Meter

The Micro Medical Respiratory Pressure Meter requires no routine maintenance or servicing.

Calibration is factory set and should remain constant throughout the lifetime of the device. However the Respiratory Pressure Meter can be calibrated, if in doubt by the Micro Medical Service Centre.

Disassembling the Respiratory Pressure Meter.

If the Respiratory Pressure Meter becomes faulty then the following procedure is needed to investigate the fault.

1. Turn the unit face down and slide back the battery cover.
2. Remove the battery and place to one side.
3. Remove the 2 screws from the bottom moulding (Item 8) and put to one side.
4. Turn the unit face up and ease the top moulding from the bottom moulding and turn the top moulding to reveal the PCB as shown in Fig.1 (page 4).
5. Remove the PCB from the bottom moulding and put the bottom moulding to one side.
6. The Respiratory Pressure Meter is now ready for fault finding.

Reassembling the Respiratory Pressure Meter

1. Place the PCB into the bottom moulding and route the battery lead as shown in Fig.1.
2. Position the top moulding on top of the bottom moulding and push together (ensure that the battery leads are not trapped).
3. Turn the unit face down and secure the unit with the retained screws.
4. Refit the PP3 battery ensuring correct polarity.
5. Slide on the battery cover.
6. The Respiratory Pressure Meter is now ready for operation.

Circuit Description

Overview

A piezo resistive pressure transducer monitors pressure at the mouthpiece holder. After conditioning, the signal from the pressure transducer is applied to a 12 bit analogue to digital converter. A micro controller reads the A/D converter and after applying a calibration factor displays the result on an LCD, which is directly driven from the controller. The measurement displayed is the maximum pressure recorded over a one second interval when the unit is switched to the MIP/MEP position. When the unit is switched to the SNIP position the peak pressure is displayed

Power Supply and battery monitoring

The Mouth pressure meter is powered by a PP3 9V Alkaline battery with reverse polarity protection, D1, and is monitored by channel 2 of the A/D converter through the resistive divider R13 and R14. Battery power is supplied to the circuit via TR2. A bi-stable circuit consisting of U2, U9, R6, R7, C5 and R17 controls TR2. The bi-stable circuit can be switched to the off state (pin 4 of U2 high) by either the front panel switch, SW1A, or by the micro controller via TR1 pulling pin 1 of U2 low. The unit is switched on when SW1A is set to the middle position, pulling on side of R7 low and applying a momentary pulse to pin 2 of U9 through the AC coupling action of R6 and C15. The nominal 9 volt supply from the battery is applied to the low drop-out 5 volt regulator, U4, which supplies the rest of the circuit.

Pressure Sensor Conditioning Circuit

The mouth pressure meter consists of an internally temperature compensated solid-state pressure transducer (U5). The instrumentation amplifier, U6, amplifies the differential signal from the pressure transducer. The gain of U6 is adjusted by the calibration potentiometer VR1 that is accessible externally. The reference pin of U6 and the A/D converter, U7, are driven by the output of U3B at a voltage derived from the reference output of the A/D converter. The signal from U6 is passed through a filter consisting of U3A, R3, R4, C3 and C1. This is further filtered by R30 and C30 before being applied to Channel 0 of the A/D converter.

Display

The display is a 3 1/2 digit custom LCD. A square wave of approximately 30 HZ is continuously applied to each segment and the back plane (BP). To turn a segment off, the square wave applied to it is in phase with the square wave applied to the back plane. To turn a segment on, the square wave applied to it is in anti-phase with the back plane. 22 of the segments and the back plane are driven directly from ports PA, PB and PC of the micro controller, U1. The remaining 4 segments are connected to the outputs of a serial to parallel converter, U11. The serial peripheral interface of U1 is used to clock data into U11. The clock signal is inverted

by TR3 to obtain the correct polarity. The pull-up resistor for TR3 is connected to the chip select line of the A/D converter, which is also on the serial peripheral interface, disabling the clock signal when the A/D converter is being accessed by the micro controller.

Analogue to Digital converter

The A/D converter, U7, is a 4 channel, 12-bit, serial device with internal reference and communicates with the micro controller using the serial peripheral interface. The A/D converter has an input range of COM-VREF/2 to COM+VREF/2 where VREF is the internal reference voltage of 2.5 Volts. The voltage applied to COM, pin 6, is approximately 1.5 volts. This is derived from VREF, pin 8, using a potential divider, R1 and R25, and a buffer amplifier, U3B. The input range for the A/D converter is therefore 0.25 to 2.75 volts. Channel 0, pin 2, is used to measure the pressure signal. Channel 1, pin3, is connected to the common pin (6) and to the reference pin of the instrumentation amplifier, U6, and is only read during factory set-up. Channel 2, pin 4, is connected to the reference output and is only read during factory set-up. Channel 3, pin 5, is used to read the battery terminal voltage via the potential divider, R13 and R14.

Micro controller

The micro controller, U1, is an 8-bit device with integrated RAM, FLASH program memory storage, and power on reset circuitry. The controller communicates with the A/D converter to measure the pressure signal and monitor the battery voltage using its serial peripheral interface bus. This synchronous bus consists of a clock line, pin 15, a data transmit line, pin14, and a data receive line, pin 13.

The controller directly controls 22 of the display segments and the back plane from ports PA, PB and PC. The remaining 4 segments are connected to the outputs of a serial to parallel converter, U11. The serial peripheral interface is used to clock data into U11.

The buzzer is driven from port D, pin 19, with a square wave at approximately 1 kHz. The buzzer is driven in a push-pull arrangement using the inverter U8.

The controller is factory programmed using the on-board connector CON1. The controller is set to program mode by activation of the reed switch, SW2.

Communication with PC software is achieved through a RS232 interface. The converter, U10, has on-board circuitry to generate the required +/- 10 Volts and is connected to the serial interface of the controller, pins 9 and 10.

Parts List

Designation	Description.
U1	Motorola OPT Microcontroller
U2	Single surface mount NAND gate
U3	Texas Instruments dual low power OP-Amp
U4	Low drop out surface mount 5 volt regulator
U5	5 PSI pressure transducer
U6	Analogue devices instrumentation amplifier,
U7	Maxim 12 bit 4 channel surface mount serial D/A
U8	Single surface mount NAND gate
U9	Single surface mount NAND gate
U10	Maxim RS232 transceiver
U11	8-bit SIPO shift register
TR1	Rhom NPN surface mount transistor
TR2	Zetex PNP surface mount transistor
TR3	Rhom NPN surface mount transistor
D1	Schottky diode.
DISPLAY	3 1/2 digit custom display
R1	22K Surface mount resistor 0.125 watt 1% size 0805
R2	1.5K Surface mount resistor 0.125 watt 1% size 0805
R3	5.6K Surface mount resistor 0.125 watt 1% size 0805
R4	22K Surface mount resistor 0.125 watt 1% size 0805
R5	10K Surface mount resistor 0.125 watt 1% size 0805
R6	1M Surface mount resistor 0.125 watt 1% size 0805
R7	1M Surface mount resistor 0.125 watt 1% size 0805
R8	10K Surface mount resistor 0.125 watt 1% size 0805
R9	10K Surface mount resistor 0.125 watt 1% size 0805
R10	1K Surface mount resistor 0.125 watt 1% size 0805
R11	10 ohm Surface mount resistor 0.125 watt 1% size 0805
R12	10K Surface mount resistor 0.125 watt 1% size 0805
R13	100K Surface mount resistor 0.125 watt 1% size 0805
R14	39K Surface mount resistor 0.125 watt 1% size 0805
R15	10M Surface mount resistor 0.125 watt 1% size 0805
R16	10K Surface mount resistor 0.125 watt 1% size 0805
R17	1M Surface mount resistor 0.125 watt 1% size 0805
R18	10K Surface mount resistor 0.125 watt 1% size 0805
R19	Not used
R20	Not used
R21	Not used
R22	Not used
R23	10K Surface mount resistor 0.125 watt 1% size 0805
R24	10K Surface mount resistor 0.125 watt 1% size 0805
R25	33K Surface mount resistor 0.125 watt 1% size 0805
R26	Not used
R27	100K Surface mount resistor 0.125 watt 1% size 0805
R28	330K Surface mount resistor 0.125 watt 1% size 0805
R29	1.2K Surface mount resistor 0.125 watt 1% size 0805
R30	10K Surface mount resistor 0.125 watt 1% size 0805
VR1	Bourns 1k 25 turn potentiometer.
C1	2.2nF ceramic surface mount capacitor, size 0805

C2	22pF ceramic surface mount capacitor, size 0805
C3	6.8nF ceramic surface mount capacitor, size 0805
C4	1uF ceramic surface mount capacitor, size 0805
C5	22pF ceramic surface mount capacitor, size 0805
C6	1uF ceramic surface mount capacitor, size 0805
C7	1uF ceramic surface mount capacitor, size 0805
C8	1uF ceramic surface mount capacitor, size 0805
C9	1uF ceramic surface mount capacitor, size 0805
C10	0.1uF ceramic surface mount capacitor, size 0805
C11	10nF ceramic surface mount capacitor, size 0805
C12	33nF ceramic surface mount capacitor, size 0805
C13	0.1uF ceramic surface mount capacitor, size 0805
C14	0.1uF ceramic surface mount capacitor, size 0805
C15	0.1uF ceramic surface mount capacitor, size 0805
C16	0.1uF ceramic surface mount capacitor, size 0805
C17	0.1uF ceramic surface mount capacitor, size 0805
C18	0.1uF ceramic surface mount capacitor, size 0805
C19	0.1uF ceramic surface mount capacitor, size 0805
C20	0.1uF ceramic surface mount capacitor, size 0805
C21	0.1uF ceramic surface mount capacitor, size 0805
C22	1uF ceramic surface mount capacitor, size 0805
C23	0.1uF ceramic surface mount capacitor, size 0805
C24	0.1uF ceramic surface mount capacitor, size 0805
C25	33pF ceramic surface mount capacitor, size 0805
C26	33pF ceramic surface mount capacitor, size 0805
C27	33pF ceramic surface mount capacitor, size 0805
C28	10uF Tantalum capacitor size A.
C29	1uF ceramic surface mount capacitor, size 0805
C30	1uF ceramic surface mount capacitor, size 0805
C31	Not used
SW1	double pole 3 position slide switch
SW2	reed switch.
J1	3.5mm Stereo jack socket
SPK1	piezo ceramic sounder
X1	32.768 KHz crystal, WATCH package.

Technical Support

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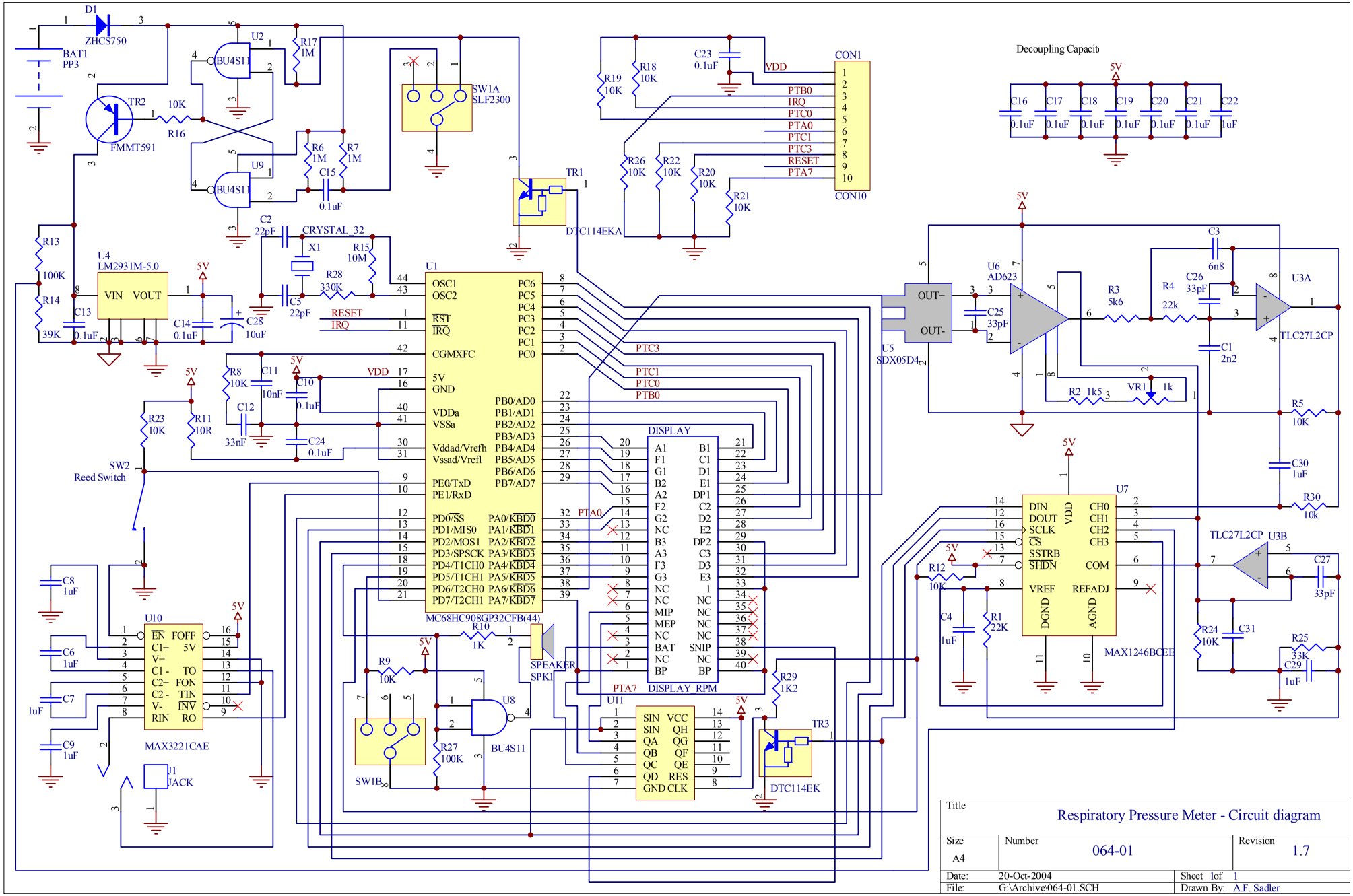

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