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Abstract

Resistance Meter is a device which is used to find the unknown resistance in a closed circuit. This device provides the unknown resistance in very small period of time and output unknown resistance value on three 7-segment display using 8051 microcontroller. Device uses Analog to Digital converter of 8-bit (8-bit ADC) to convert analog input voltage to 8-bit digital data for calculation of resistance.

The resistance meter can measure resistance in the range of 0 ohm to 50k ohm.

Introduction

Resistance Meter is a device which is used to identify the unknown resistance of a closed circuit. The device takes voltage of unknown resistance as input and calculates resistance value and calculated resistance is displayed on the 7-segment display.

The device works by measuring potential difference of unknown resistance and converts this analog value to 8-bit digital value using Analog to Digital converter and then it uses below formula to calculate unknown resistance.

$$R_{unknown}=\frac{R_{\text{known}}*V_o}{5-V_o} \qquad (1)$$

V_o = input to the device

R_{known} = 1K ohm

The calculated resistance value is displayed on 7-segment. The displayed value of resistance unit is in K ohms.

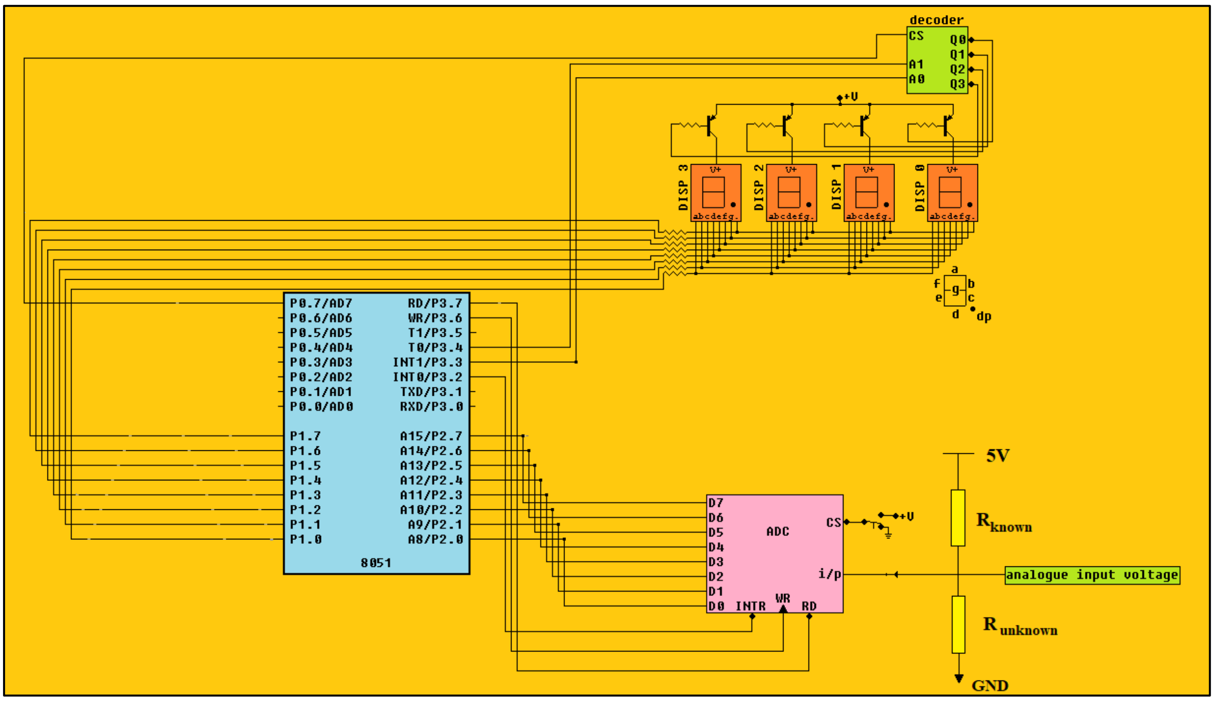
For example:

For input =2.55 V

Calculated Resistance =1.08 k ohm

The resistance meter can read resistance from 0 to 50k ohm.

Schematic Diagram



Working Procedure

1. First initialize R5, R6, R7 registers ,7-segment display and make Port P2 as input port.

2. Set Read (RD) pin and clear Write (WR) pin.

3. Provide unknown resistance as input and then 8051 waits for INTR signal from ADC.

4. After receiving digital value from ADC, 8051 call subroutine ‘CAL’.

5. CAL subroutine calculates the value of unknown resistance by using the equation (1).

6. The calculation is done using the opcode MUL, DIV, SUBB for multiplication, division and subtraction respectively.

7. The calculated value upto 2 decimal value is then stored at reg. R4, R5, R6 and R7.

8. Reg. R4 and R5 contains tens and unit place values respectively and reg. R6 and R7 contains after decimal point upto 2 decimal values.

9. After knowing the unknown resistance value microcontroller 8051 assigns the 7-segement hex-decimal value to corresponding R0, R1 and R2 and R3 registers.

10. Then call the display subroutine that enables 7-Segments and assigns respective hex values to 7-Segments 0, 1,2 and 3.

Program Code

Memory address	Label	Machine code/Opcode	Mnemonics With Operands	Comments
0000	START:	7D 00	MOV R5,#00H	Initialize R5
0002		7E 00	MOV R6,#00H	Initialize R6
0004		7F 00	MOV R7,#00H	Initialize R7
0006		75 90 FF	MOV P1,#0FFH	Initialize 7-segment LED
0009		75 A0 FF	MOV P2,#0FFH	Make port P2 as input port
000C		D2 B7	SETB P3.7	Set RD pin
000E		C2 B6	CLR P3.6	Clear WR pin
0010		D2 B6	SETB P3.6	Set WR pin
				Wait for INTR from ADC
0012	GET:	20 B2 FD	JB P3.2, GET	Jump if INTR not received to loc. GET
0015		C2 B7	CLR P3.7	Clear RD pin
0017		E5 A0	MOV A,P2	Move digital value from P2 to reg.A
0019		11 1D	ACALL CAL	Absolute call to loc. CAL
001B		80 E3	JMP START	Unconditional jump to loc. START
				Calculating resistance value
001D	CAL:	75 F0 0A	MOV B,#10	Move value to reg .B
0020		84	DIV AB	Divide A by B
0021		75 F0 02	MOV B,#2	Move value to reg .B

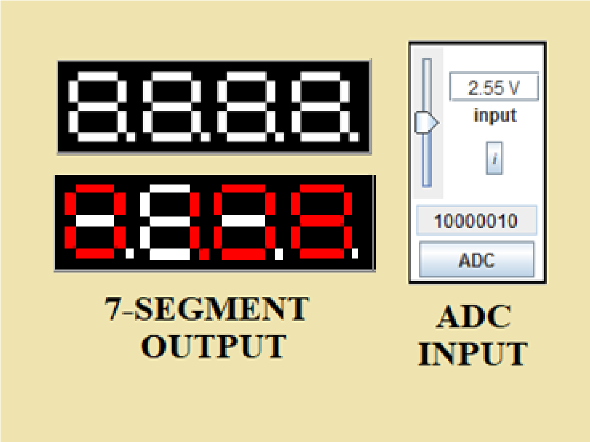
0024		A4	MUL AB	Multiply A with B
0025		F5 F0	MOV B,A	Move value to reg .B from reg. A
0027		74 32	MOV A,#50	Move value to reg .A
0029		95 F0	SUBB A,B	Subtract B from A
002B		A8 F0	MOV R0,B	Move value to reg .R0 from reg. B
002D		F5 F0	MOV B,A	Move value to reg .B from reg. A
002F		FC	MOV R4,A	Move value to reg .R4 from reg. A
0030		E8	MOV A,R0	Move value to reg .A from reg. R0
0031		84	DIV AB	Divide A by B
0032		FD	MOV R5,A	Move value to reg .R5 from reg. A
0033		E5 F0	MOV A,B	Move value to reg .A from reg. B
0035		75 F0 0A	MOV B,#10	Move value to reg .B
0038		A4	MUL AB	Multiply A with B
0039		8C F0	MOV B,R4	Move value to reg .B from reg. R4
003B		84	DIV AB	Divide A by B
003C		FE	MOV R6,A	Move value to reg .R6 from reg. A
003D		E5 F0	MOV A,B	Move value to reg .A from reg. B
003F		75 F0 0A	MOV B,#10	Move value to reg .B
0042		A4	MUL AB	Multiply A with B
0043		8C F0	MOV B,R4	Move value to reg .A from reg. R4
0045		84	DIV AB	Divide A by B
0046		FF	MOV R7,A	Move value to reg .R7 from reg. A
0047		ED	MOV A,R5	Move value to reg .A from reg. R5
0048		75 F0 0A	MOV B,#10	Move value to reg .B
004B		84	DIV AB	Divide A by B
004C		FC	MOV R4,A	Move value to reg . R4 from reg. A
004D		AD F0	MOV R5,B	Move value to reg . R5 from reg. B
				Finding 7-Segment hex-decimal value
004F		EF	MOV A,R7	Move value to reg .A from reg. R7

0050		11 69	CALL FIND	CALL SUBROUTINE FIND
0052		88 F0	MOV B,R0	Move value to reg .B from reg. R0
0054		AB F0	MOV R3,B	Move value to reg . R3 from reg. B
0056		EE	MOV A,R6	Move value to reg .A from reg. R6
0057		11 69	CALL FIND	CALL SUBROUTINE FIND
0059		88 F0	MOV B,R0	Move value to reg .B from reg. R0
005B		AA F0	MOV R2,B	Move value to reg . R2 from reg. B
005D		ED	MOV A,R5	Move value to reg .A from reg. R5
005E		11 69	CALL FIND	CALL SUBROUTINE FIND
0060		88 F0	MOV B,R0	Move value to reg .B from reg. R0
0062		A9 F0	MOV R1,B	Move value to reg . R1 from reg. B
0064		EC	MOV A,R4	Move value to reg .A from reg. R4
0065		11 69	CALL FIND	CALL SUBROUTINE FIND
0067		80 3C	JMP DISPLAY	Unconditional jump to loc. DISPLAY
				Allocating 7-segment hex-decimal values
0069	FIND:	78 C0	MOV R0,#0C0H	Move value to reg .R0
006B		B4 00 01	CJNE A,#0,MOVE1	Compare and jump if not equal to loc MOVE1
006E		22	RET	RETURN
006F	MOVE1:	78 F9	MOV R0,#0F9H	Move value to reg .R0
0071		B4 01 01	CJNE A,#1,MOVE2	Compare and jump if not equal to loc MOVE2
0074		22	RET	RETURN
0075	MOVE2:	78 A4	MOV R0,#0A4H	Move value to reg .R0
0077		B4 02 01	CJNE A,#2,MOVE3	Compare and jump if not equal to loc MOVE3
007A		22	RET	RETURN
007B	MOVE3:	78 B0	MOV R0,#0B0H	Move value to reg .R0
007D		B4 03 01	CJNE A,#3,MOVE4	Compare and jump if not equal to loc MOVE4

0080		22	RET	RETURN
0081	MOVE4:	78 99	MOV R0,#99H	Move value to reg .R0
0083		B4 04 01	CJNE A,#4,MOVE5	Compare and jump if not equal to loc MOVE5
0086		22	RET	RETURN
0087	MOVE5:	78 92	MOV R0,#92H	Move value to reg .R0
0089		B4 05 01	CJNE A,#5,MOVE6	Compare and jump if not equal to loc MOVE6
008C		22	RET	RETURN
008D	MOVE6:	78 82	MOV R0,#82H	Move value to reg .R0
008F		84 06 01	CJNE A,#6,MOVE7	Compare and jump if not equal to loc MOVE7
0092		22	RET	RETURN
0093	MOVE7:	78 F8	MOV R0,#0F8H	Move value to reg .R0
0095		B4 07 01	CJNE A,#7,MOVE8	Compare and jump if not equal to loc MOVE8
0098		22	RET	RETURN
0099	MOVE8:	78 80	MOV R0,#80H	Move value to reg .R0
009B		B4 08 01	CJNE A,#8,MOVE9	Compare and jump if not equal to loc MOVE9
009E		22	RET	RETURN
009F	MOVE9:	78 90	MOV R0,#90H	Move value to reg .R0
00A1		B4 09 00	CJNE A,#9,MOVE10	Compare and jump if not equal to loc MOVE10
00A4	MOVE10:	22	RET	RETURN
				Display Value to 7-segment
00A5	DISPLAY:	D2 B3	SETB P3.3	Set decoder lower bit A0
00A7		D2 B4	SETB P3.4	SET decoder UPPER bit A1
00A9		88 90	MOV P1,R0	Move value to reg .P1 from reg. R0
00AB		11 CA	ACALL DELAY	Absolute call to loc. DELAY

00AD		C2 B3	CLR P3.3	CLEAR decoder lower bit A0
00AF		D2 B4	SETB P3.4	Set decoder lower bit A1
00B1		E9	MOV A,R1	Move value to reg .A from reg. R1
00B2		54 7F	ANL A,#7FH	Logical bitwise AND
00B4		F5 90	MOV P1,A	Move value to reg .P1 from reg. A
00B6		11 CA	ACALL DELAY	Absolute call to loc. DELAY
00B8		D2 B3	SETB P3.3	Set decoder lower bit A0
00BA		C2 B4	CLR P3.4	CLEAR decoder UPPER bit A1
00BC		8A 90	MOV P1,R2	Move value to reg .P1 from reg. R2
00BE		11 CA	ACALL DELAY	Absolute call to loc. DELAY
00C0		C2 B3	CLR P3.3	CLEAR decoder lower bit A0
00C2		C2 B4	CLR P3.4	Clear decoder UPPER bit A1
00C4		8B 90	MOV P1,R3	Move value to reg .P1 from reg. R3
00C6		11 CA	ACALL DELAY	Absolute call to loc. DELAY
00C8		01 00	JMP START	Unconditional jump to loc. START
				Providing Delay for display
00CA	DELAY:	78 06	MOV R0,#6H	Move value to reg .R0
00CC	RETR:	D8 FE	DJNZ R0, RETR	Decrement and jump if not zero to location RETR
00CE		22	RET	Return
			END	Terminate

Output/Result



INPUT	**OUTPUT**
Unknown Resistance Connected to Analog to Digital converter	Value of Unknown Resistance at 7-segment

The unknown resistance is calculated and displayed on the 7-segment display with 2 decimals point accuracy using the microcontroller 8051 and Analog to digital converter. The calculated resistance value is in K ohms and is in range of 0 to 50 k ohm.

Future Goals

Resistance Meter can be used to calculate unknown resistance in the range of 0 to 50k ohm, which can be further be enhanced for finding high resistance value.

It can be tuned for more than 2 decimal points accuracy of resistance value with less time complexity.

It can also be used to calculate unknown voltage and current flowing in a circuit for this the unknown voltage is equal to output of analog to digital converter and for calculation of current in the close circuit we need to divide calculated voltage by calculated unknown resistance.

$$I_{unknown} = \frac{\text{Voltage calculated}}{Unknown\ Resistance}$$

$$= \frac{ADC\ output}{Unknown\ Resitance}$$