Assignment-01

Q1 Assume that your group has decided to make microprocessor based instrumentation system for Ice cream factory using an 8255 PPI card at base address 5000H in memory mapped I/O mode for controlling purpose. You need to measure pressure and temperature of a manufacturing plant.

→ i) List out the collected douments and components.
ii) List out different signals you need to derive and /or can be directly connected to your interfacing circuit.
iii) Draw minimum maping circuit for above system
iv) What are the address captured by your card? Generate the control word for the system.
v) WAP module for measuring temperature and control if the temperature is not in the range. Assume suitable data if necessary.

Soln

i) Components:
a) 8255 card,
b) ADC
c) MUX
d) Memory
e) Processor
f) connecting wires
g) power supplies
h) gates
etc.

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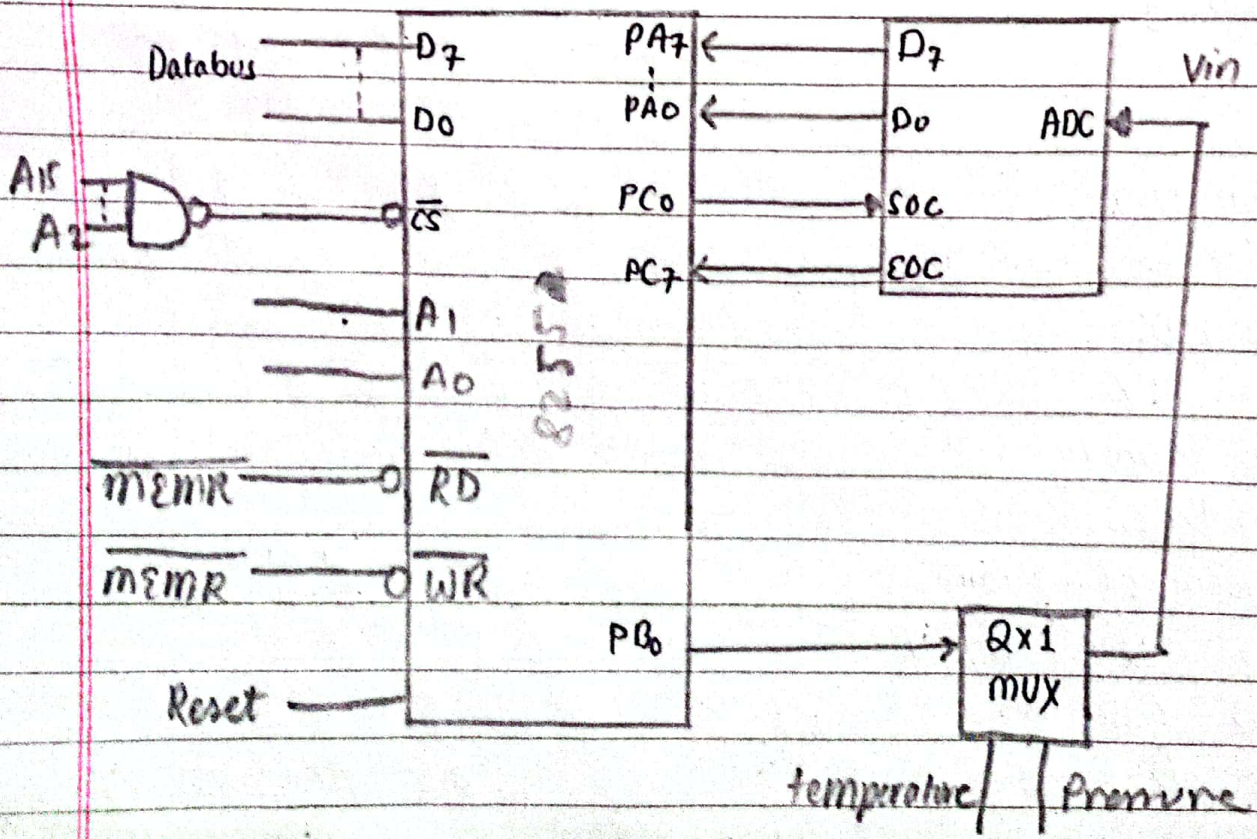
Documents: Datasheet, technical and specification documents of above mentioned components.

ii. Signals needed to be derived are:
- A_0, A_1
- Chip select ($\overline{CS}$)
- Read ($\overline{RD}$)
- Write ($\overline{WR}$)
- Reset (reset out)
- Start of conversion (SOC)
- End of conversion (EOC)
- Data lines (D_0-D_7)
- Address lines (A_2-A_{15})

iii. Minimum mapping circuits:



iv) Address captured by the card:

Port A = 5000H ($A_1 = 0, A0 = 0$)
Port B = 5001H ($A_1 = 0, A0 = 01$)
Port C = 5002H ($A_1 = 1, A0 = 0$)
Control Register = 5003H ($A_1 = 1, A0 = 1$)

Control Word

1	0	0	1	1	0	0	0	= 98H
PC7							PC0	

v. Program module:

```
LXI   H, Memory
MVI   A, 98H ; control word on
STA   5003H ; control register
MVI   B. 00H ; selection pin for MUX
MOV   A, B
STA   5001H; select temp. from MUX
MVI   A, 01H ; BSR word to set PC0
STA   5003H ; reable for C
Read : LDA 5002H ; read port C for EOC
RLC
JNC   READ
LDA   5000H; read temp. at port A
MOV   M, A
CPI   MAX_VAL
JNC   CONTROL
CPI   MIN_VAL
```

JC CONTROL
INX H
RET

Q.2. A/D converter requires signal to start the conversion and indicates the completion of operation with the end of conversion signal. 8255 PPI is interfaced with 8085 microprocesor at 80H. Microprocessor reads 8 bit output data of the ADC at port A and displays the same data to eight LED's connected to port B of 8255A. State any assumptions made.

a. Identify the address captured by the card.

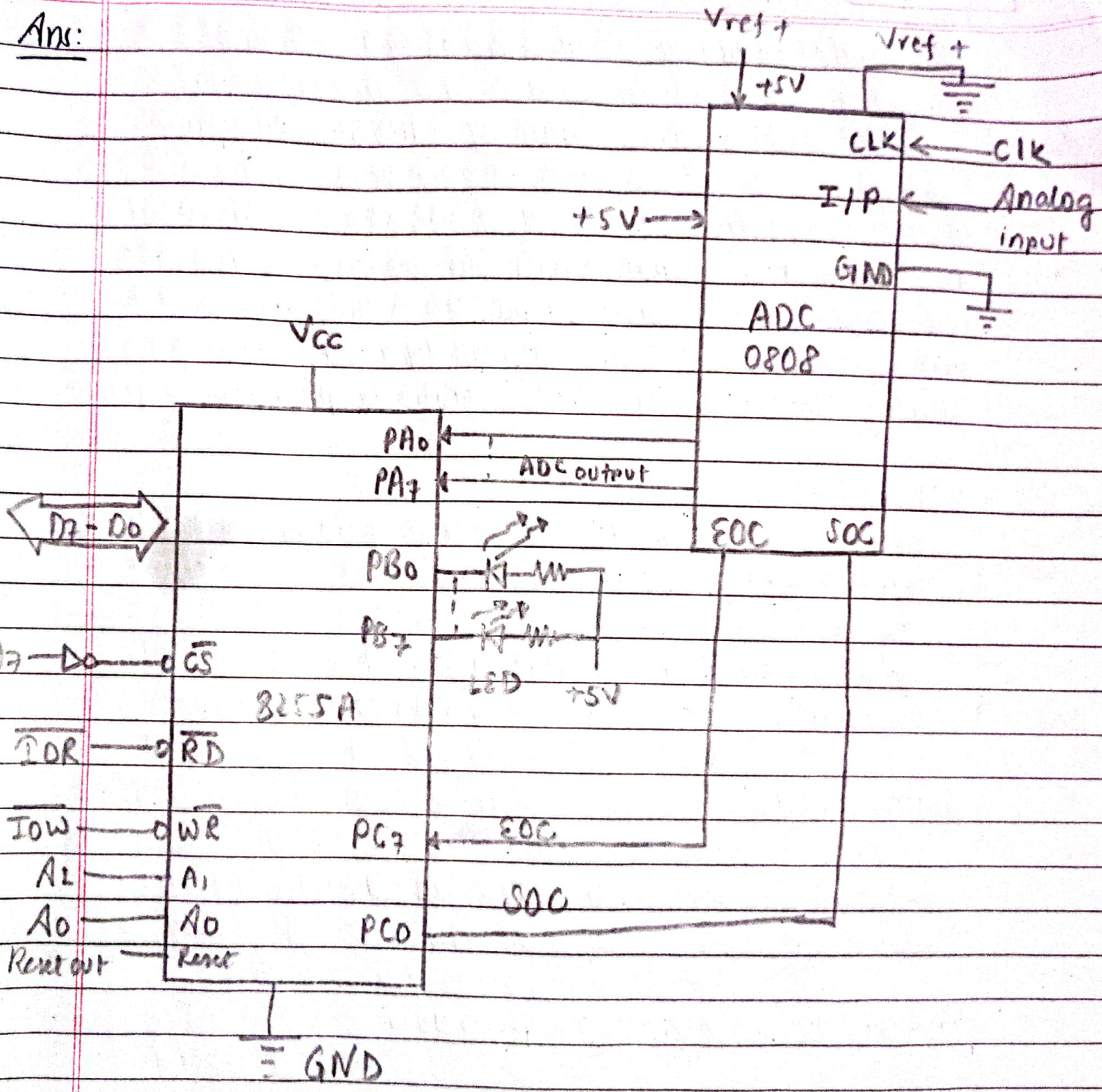
b. Determine the necessary control word.

c. Draw the schematic interfacing circuit.

d. WAP to perform the operation.

P.T.O

Ans:


Vref +
+5V
Vref +
CLK
Clk
I/P
Analog input
+5V
GND
ADC 0808
Vcc
PA0
PA7
ADC output
D7 - D0
EOC
SOC
PB0
PB7
LED
+5V
A7
CS
8255A
IOR
RD
IOW
WR
PC7
EOC
A2
A1
SOC
A0
A0
PC0
Reset out
Reset
GND

Above figure shows that the interfacing connections of ADC 0808 with 8085 using 8255. The analog input is used and a clock input of suitable frequency is available for ADC. Port C lower acts as the output port to send SOC (start of the conversion) to ADC and port C upper acts as the input port to receive the digital data output from the ADC while port B acts as an 8 bit output data port to display the received data using eight LEDs.

Port addresses:

Ciruit is I/O mapped I/O using A_7 high

Port A = 80H ($A_1=0; A_0=0$)

Port B = 81H ($A_1=0$ $A_0=1$)

Port C = 82H ($A_1=1, A_0=0$)

Control register = 83H ($A_1=1, A_0=1$)

Control word:

D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0	
1	0	0	1	1	0	0	0	= 98H

Program to perform the operation

```
MVI A, 98H   ; control word
OUT 83H      ; control register
MVI A, 01H   ; BSR word to set PC0 (SOC)
OUT 83H      ; starts conversion
NEXT: IN 82H ; read port C to check EOC
```

```
RLC                ; Check PC7
JZ NEXT
IN 80H             ; read ADC data in port A
OUT 81H            ; display data in port B
RET
```

Q.3. A microprocessor kit has an onboard 8255. Interface to the 8255 eight single-pole-double-throw (SPDT) switches numbered S0 to S7 and a seven segment (common anode LED) display. Draw the complete circuit setup. Define clearly the function of all ports. Write a program to initialize 8255, detect a switch closure, and display the value of the switch number on the LED display.

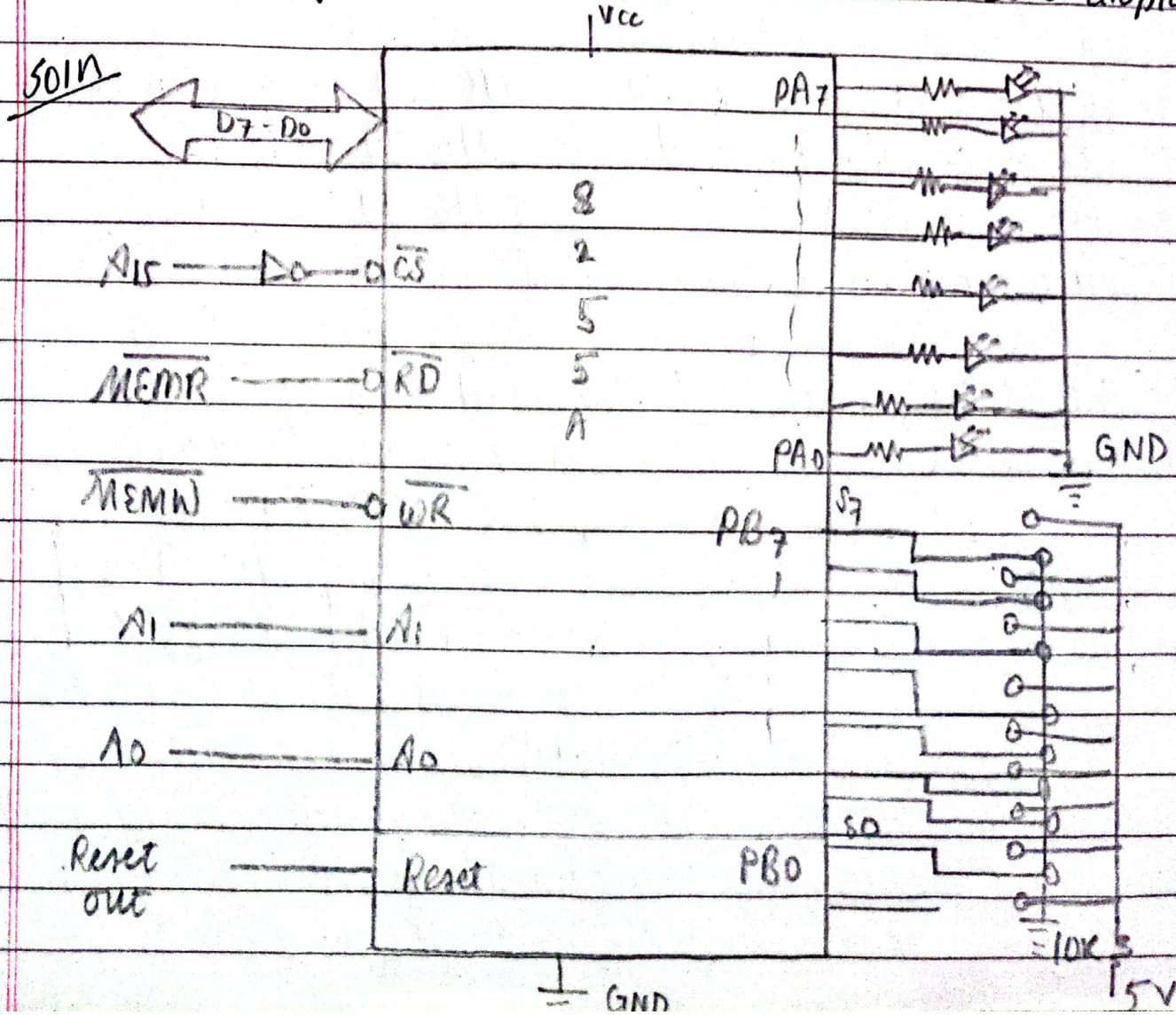


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Fig: 8255 interfacing circuit with SPDT switch and seven segment common LED display

The interfacing circuit is drawn to interface an 8255A with single pole double throw (SPDT) switch and seven segment common LED display. Here port B is connected in mode 0 with SPDT switches numbered S_0 to S_7, which are tied high through 10K registor. Port A is connected in mode 0 with seven segment common LED display.

The 8255A connected as memory mapped I/O using A15 high. The addresses of individual ports are selected as:

port A = 8000H ($A_1 = 0, A_0 = 0$)
port B = 8001H ($A_1 = 0, A_0 = 1$)
Port C = 8002H ($A_1 = 1, A_0 = 0$)
Control register = 8003H ($A_1 = 1, A_0 = 1$)

The control word of the interfacing circuit will be:

D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0
1	0	0	0	X	0	1	X

= 82H

Below is the program subroutine to intialize 8255A to detect switch closure and display the switch number on LED display;

```
MVI A, 82H          ; control word
STA 8003H           ; control register address
CALL KCHECK         ; check if a switch is pressed
CALL KPUSH          ; check the pushed switches
CALL KNUM           ; check the pressed switch number
CALL DISP           ; display switch number in 7-
                    ; segment
                    ; LED display.
RET
KCHECK: LDA 800LH   ; read port B for SPDT switch
        CPI FFH     ; check key is presed or not
        JNZ KCHECK  ; if not, wait in loop
        RET
KPUSH;  LDA 800LH   ; read port B for SPDT switch
        CPI FFH     ; check key is presed or not
        JZ KPUSH    ; if not, wait in loop
        CMA         ; set 1 for key number.
                    ; set 0 for other.
        RET
KNUM: MVI C, 08H    ; set code counter
NEXT: DCR C         ; adjust the code
      RAL           ; place MSB in CY
      JNC NEXT      ; if bit=0 so back to check next bit
      MOV A,C       ; place key number in accumulator.
      RET
```

```
DISP: LXI H, HCODE ; define hexcode of number
                   ; which are stored in
                   ; lookup table
      ADD L
      MOV L, A
      MOV A, M      ; read LED code to display
                    ; key number
      STA 8000H     ; display key number in 7
                    ; segment LED
      RET
HCODE: DB 40H, 79H, 24H, 30H, 19H, 12H, 02H, 78H
       ; common anode seven segment codes for digits
       ; from 0 to 7 are stored sequentially in
       ; memory as table lookup
```

Q.4 ~~Assume that~~

You have to interface ADC with 8085 using 8255A ports. Interface a fan and a heater using opto-couplers to drive the I/O devices. If the temperature is less than 10°C turn on the heater and if the temperature is higher than 35°C, turn the fan. Use port A of 8255 for transferring digital data output of ADC to the CPU and port C for control signals. Assume that an analog input is present at second input of the multiplexer and a clock input of suitable frequency is available for ADC. Draw the circuit diagram of your design and write the subroutine.

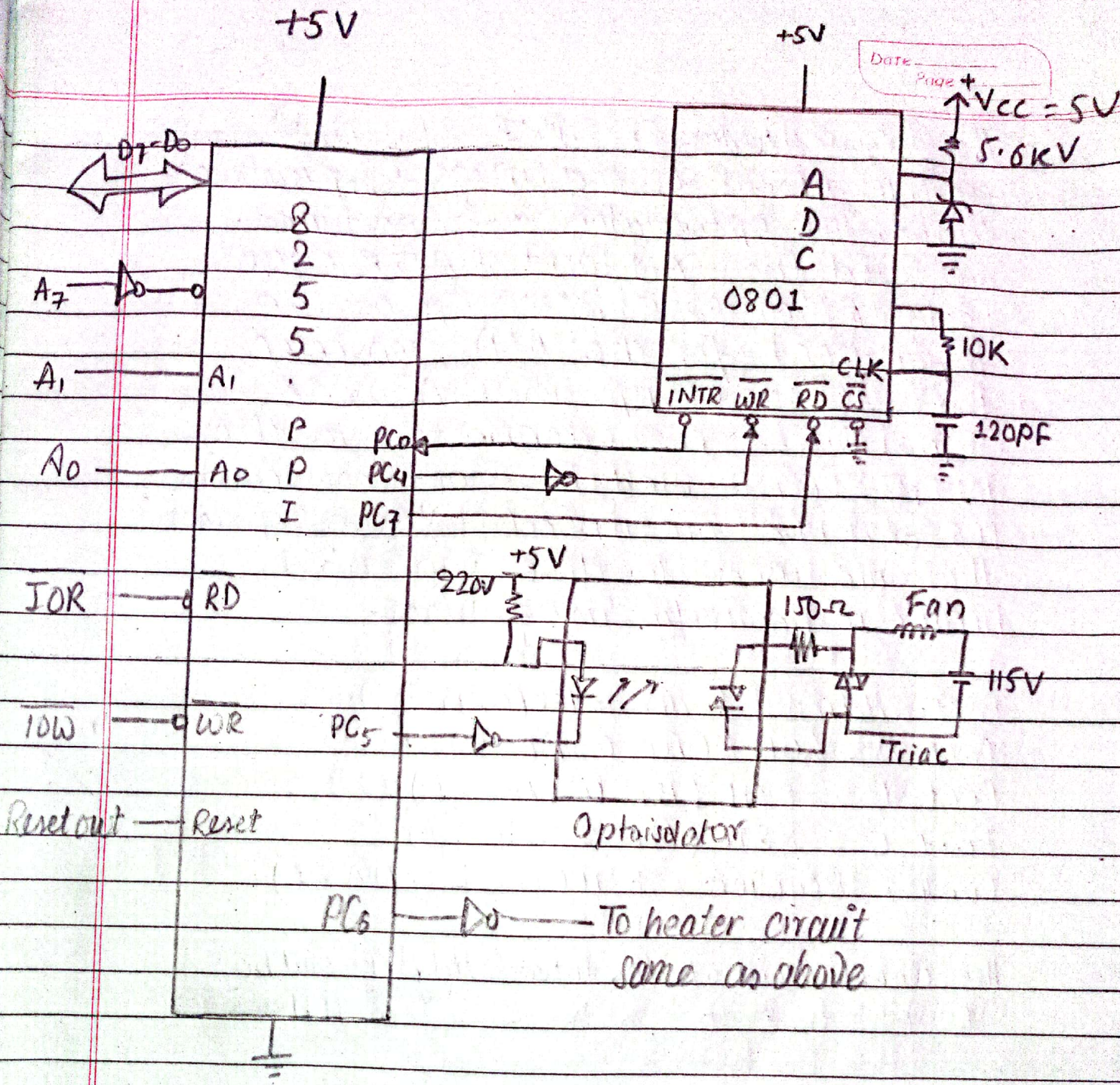

fig: circuit Diagram

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This design includes 8255 PPI, 8 bit A/D converter ADC 0801 and LM135 temperature sensor. Two optoisolators and two triacs are used for FAN and HEATER circuits. Port A of 8255 is set up as an input port for the A/D converter. Port C is set up in BSR mode. Signal lines PC0 is connected to the INTR, PC_4 is used to start conversion, PC5 and PC_6 are connected to optoisolators that are used to drive fan and heater respectively using triacs.

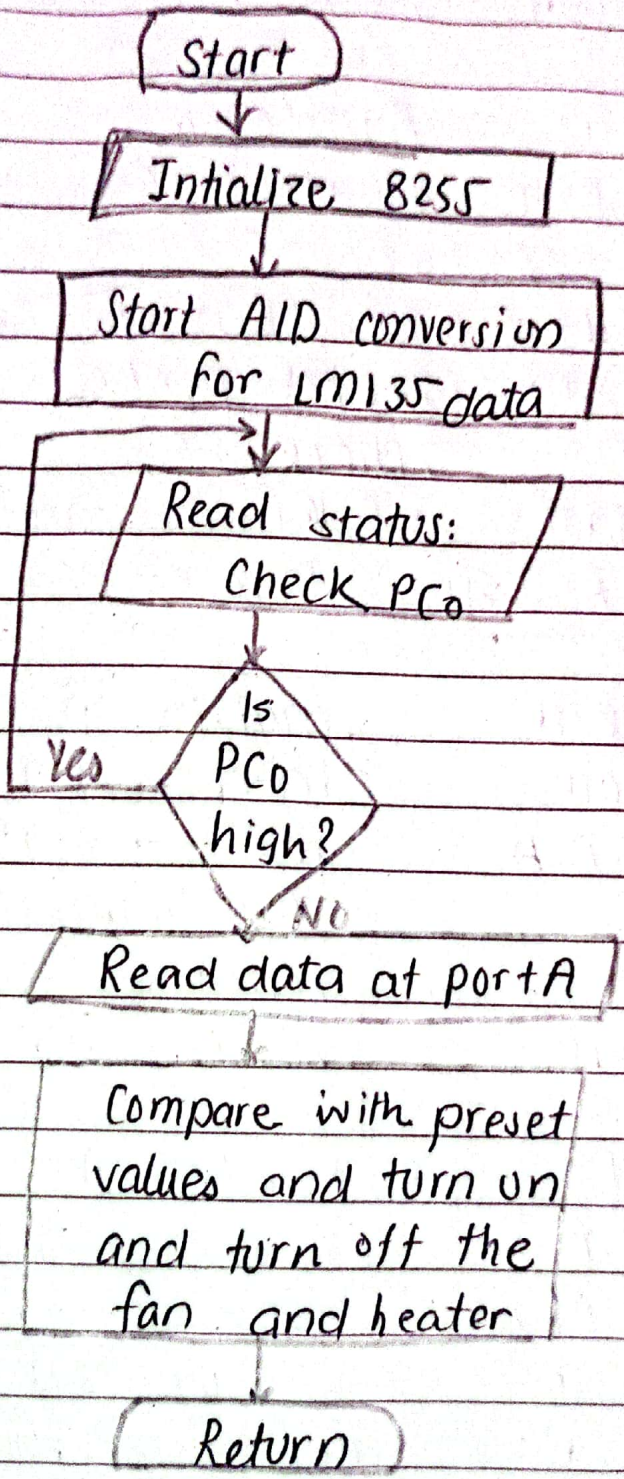
Port address of an interfacing circuits are
Port A = 80H ($A_1=0, A_0=0$)
Port B = 81H ($A_1=0, A_0=1$)
Port C = 82H ($A_1=1, A_0=0$)
Control Register = 83H ($A_1=1, A_0=1$)

The control word of the interfacing ckt will be:

1	0	0	1	0	X	X	1	= 91H

Here, Port A = mode 0 input
Port B = not used
Port C_L = Input (PC0)
Port C_U = Output (PC4-PC7)

The following flowchart facilities the operation of the design:



Following sub-routine facilitates the software operation

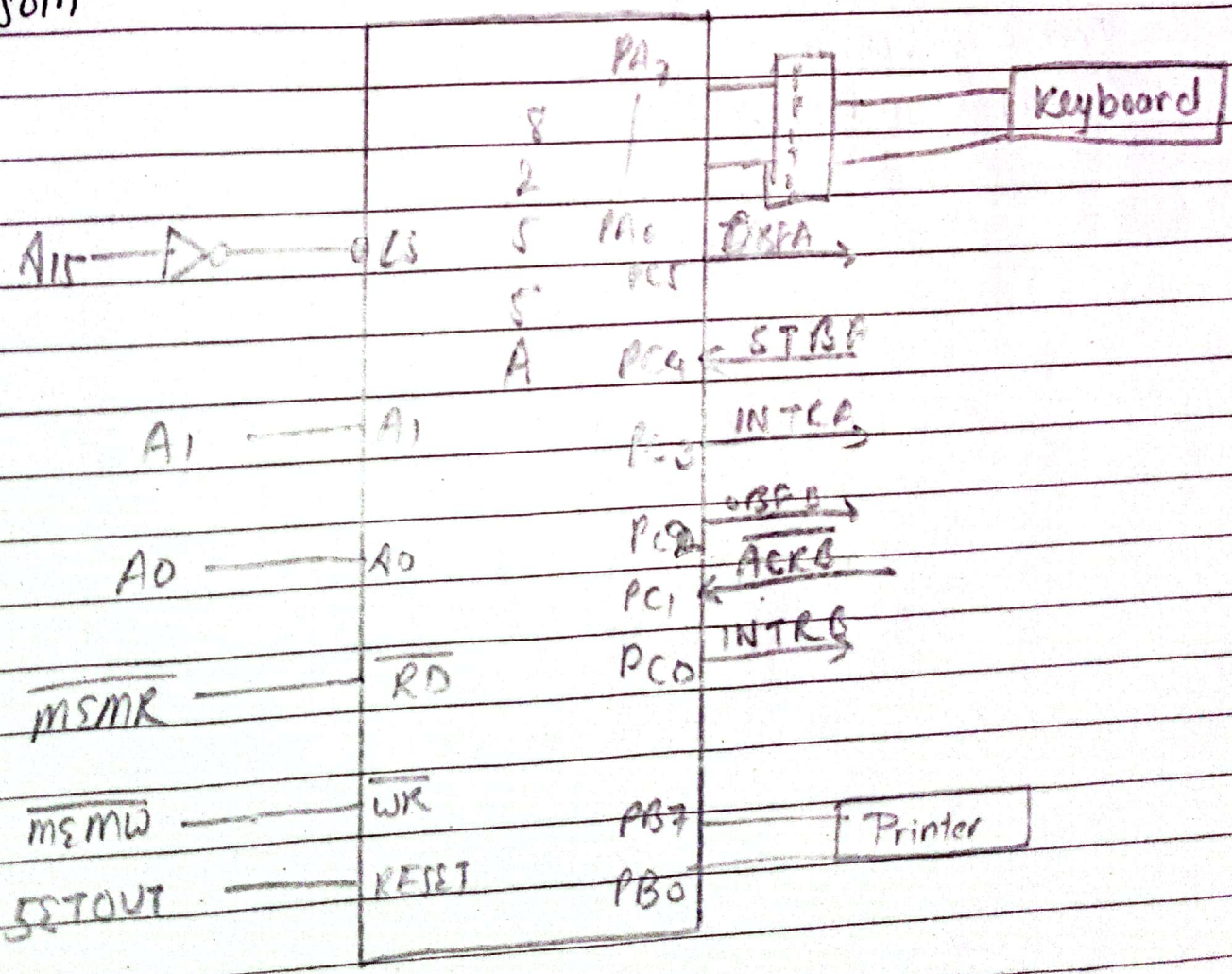
```
TEMP: MVI A, 91H    ; control word
      OUT 83H       ; control register
      MVI A, 0FH    ; to set PC7
```

```
OUT 83H        ;disable RD
MVI A,09H      ;to set PC4

OUT 83H        ;enable WR
MVI A,08H      ;to reset PC4

OUT 83H        ;SOC when WR goes to 1
STATUS: IN 82H ;read port C
   RAR         ;check PC0
   JC STATUS   ;if high stay in loop
   MVI A,0EH   ;to reset PC7

   OUT 83H     ;enable RD
   IN 80H      ;read port A
   MOV B,A     ;read port A
               ;save temperature
               ;reading
   OUT 83H     ;disable RD

   IN 80H      ;read port A
   MOV B,A     ;save temperature reading
   MVI A,0FH   ;to set PC7
   OUT 83H     ;disable RD
   MOV A,B     ;get temperature reading
   CPI 23H     ;check 35°C
   CNC FANON   ;
   CC FANOFF   ;
   CPI 0AH     ;check 10°C
```

CC Heater ON
CNC HEATEROFF
RET

Q.5 Interface a keyboard and a printer in mode 1. Port A is designed as input for keyboard with interupt I/O port B is designed as output for printer with status check I/O. Draw the mapping circuit and write the control word and address map.

Soln



Control word:

D_7	D_6	D_5	D_4	D_3	D_2	D_1	D_0	
1	0	1	1	X	1	1	X	= C6H

Address	A_{15}	A_{14}	A_{13}	A_{12}	A_{11}	A_{10}	A_9	A_8	A_7	A_6	A_5	A_4	A_3	A_2	A_1	A_0
2000H	0	0	1	X	X	X	X	X	X	X	X	X	X	X	X	X

Hence Port address are

Port A : 2000H

Port B : 2001H

Port C : 2002H

Control Register : 2003H