Chapter 4

4.1 The Simulation result:-

Pressure management can be simple or complex, but must meet the needs of the customers and the community. It should be noted that low water pressure can affect fire protection and, possibly, water quality; expert advice should be sought before undertaking a pressure management program. Such a program can also be used to reduce night time pressure increases. This would lower the water lost from leakage and reduce the frequency of water main re-leakage from pressure increases.

Pressure control valves are also part of malfunctioning distribution system controls, and can have a large impact on water loss. Pressure control valves should be regularly maintained and their settings recalibrated as recommended by the manufacturer and as determined by their use. Similarly, pressure relief valves should have their pressure set points regularly verified to ensure they do not open prematurely, thus wasting water.

Water pressure has a substantial impact on water loss, as the higher the system pressure, the more water is lost through leaks. Typically a 1 percent reduction in pressure should reduce existing system leak flow rates by between 0.5 percent and 1.5 percent, depending upon pipe materials and type of leak. Pressure rise and system pressure variations and surges can increase the frequency of water leakage. System operators should be aware of system pressure variations and attempt to mitigate the operational root causes creating this condition. Some pressure management strategies include looping within the system and use of elevated storage, which also provides many other functions.

Supervisory control and data acquisition systems provide a municipality with a real-time look at water flow, pressures, and quality. Sensing system also tabulates the water supplied into the water distribution system

and can be automated to turn pumps on and off, regulate pressure, and maintain storage reservoir levels as required. The proper use and operation of a SENSING system can have tremendous benefits for a municipality, not only in the reduction of water loss, but also in regards to water quality management, system reliability, and efficient system operation**.**

1) Pressure range of the sensor :-

Table 4.1 the range of the sensor

Type	minimum	maximum
Pressure	15Kpa	115Kpa)

2) Voltage range of the sensor :-

Table 4.2 Voltage range of the sensor

Type	minimum	maximum
Voltage	0.204 Vdc	4.794 Vdc

3) The relation between pressure and voltage is represent to the function :

$$V_{out}=V_s*(0.009*P-V_{ref})\ldots\ldots\ldots\ldots(1)$$

V_{out} is the voltage output of the sensor.

V_s is the supply voltage of the sensor(5.1Vdc).

P is the pressure of the sensor.

V_{ref} is the reference pressure(.090Kpa).

4- The level of pressure are three :

Table 4.3 the level of pressure are three

Type	minimum	maximum
Low	1Kpa	15Kpa
medium	16Kpa	70Kpa
High	75Kpa	115Kpa above

Note :(Exposure beyond the specified limits may cause permanent damage or degradation to the device).

Because the sensor when read lase than 1Kpa is may be not work or there is leak in main pipe .

After maximum reading of the sensor has certain temperature if increase may be error reading.

5- Valve situation has three states :

Table 4.4 Valve situation has three states(DC servomotor)

Close totally the motor rotate angle	Half open the motor rotate angle	Full open the motor rotate angle
180°	90°	0°

6- The Data to be transmuted are:

- The reading of all the sensors .
- The level of pressure in any sensor (Low, Medium, High).
- The situation in any valve (close, half open, full open).

Table 4.5 the truth Table of three sensors and Valves

No.	Sensor1	Sensor2	Sensor3	Valve1	Valve2	Valve3	action
0	L	L	L	open	open	open	No operation
1	L	L	H	open	X	X	Check V1&V2
2	L	H	L	open	close	open	Check V1&V2
3	L	H	H	open	x	X	Check V1
4	H	L	L	close	Open	open	Check V2&V3
5	H	L	H	close	open	close	Check V2
6	H	H	L	close	close	open	Check V3
7	H	H	H	close	close	close	No

Notes:-

- L is the low pressure
- H is high pressure

One way to circumvent this problem was to design and implement a pressure measurement system using a pressure sensor and a PVC tube immersed in the water losses measured, a signal conditioning circuit (CAS), an LCD screen, a microcontroller and memory storage. An advantage of this system is its low cost of development and reproduction according to the required amount.

Every measurement requires three basic function detection of the magnitude measured, signal processing with information about the measures quantity and presentation of results .Now they are developing with microcontroller which has internal ADC to digitize the signal and they can add information display system (LCD). The sensor signal need to be handled by CAS to be recorded by the ADC.

The integration of these systems in terms of cost negligible with respect to commercial systems shows the block diagram of classical measuring electronics.

Block Diagram of control of water mitigation and losses in Distribution system :-

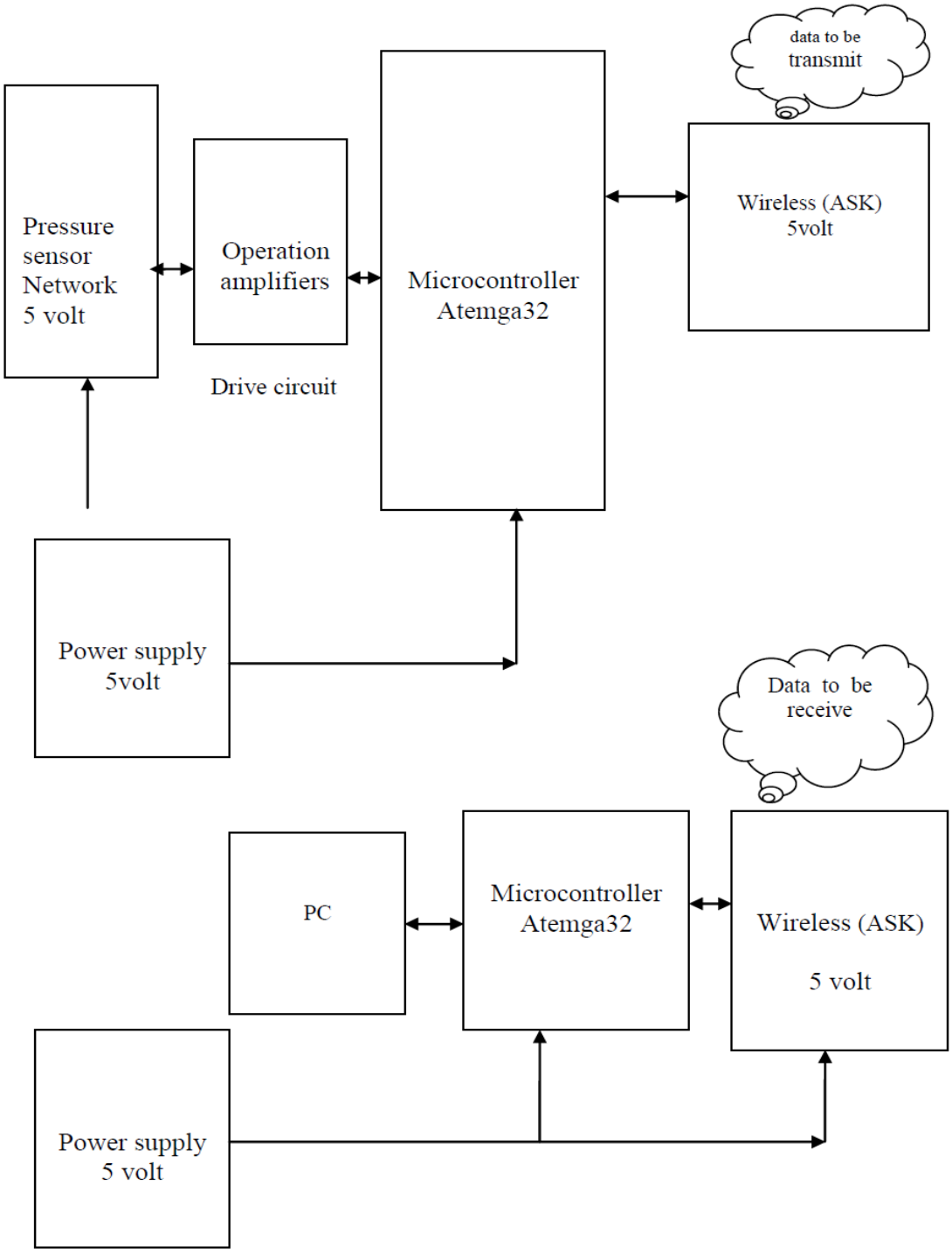

Figure 4.1 :model (initial schemes)

The main function of the processing unit is to digitize the signal obtained MPX4115A pressure sensor and interpreter the information water losses in kpa by the microcontroller .The ADC ´s atemga32. El ADC del atemga32, is configured to use the analog input A0, with a resolution of the 10 bits (1023 steps), and a reference voltage from 0 to 5 volts. Once the pressure sensor signal is digitized it is stored in the microcontroller and performs the following calculation to obtain the Transfer function:

$$V_{out=V_s} * (0.09 * P - 0.95) \text{.....(2)}$$

P is pressure reading from sensor

Vout is the output voltage of the sensor

Vs is the reference voltage equal 5.1v

The level calculation results are sent to an LCD screen, in which we can see the results, as shown in the Fig4.2., the simulation of the measurement system was made with the PROTEUS software.

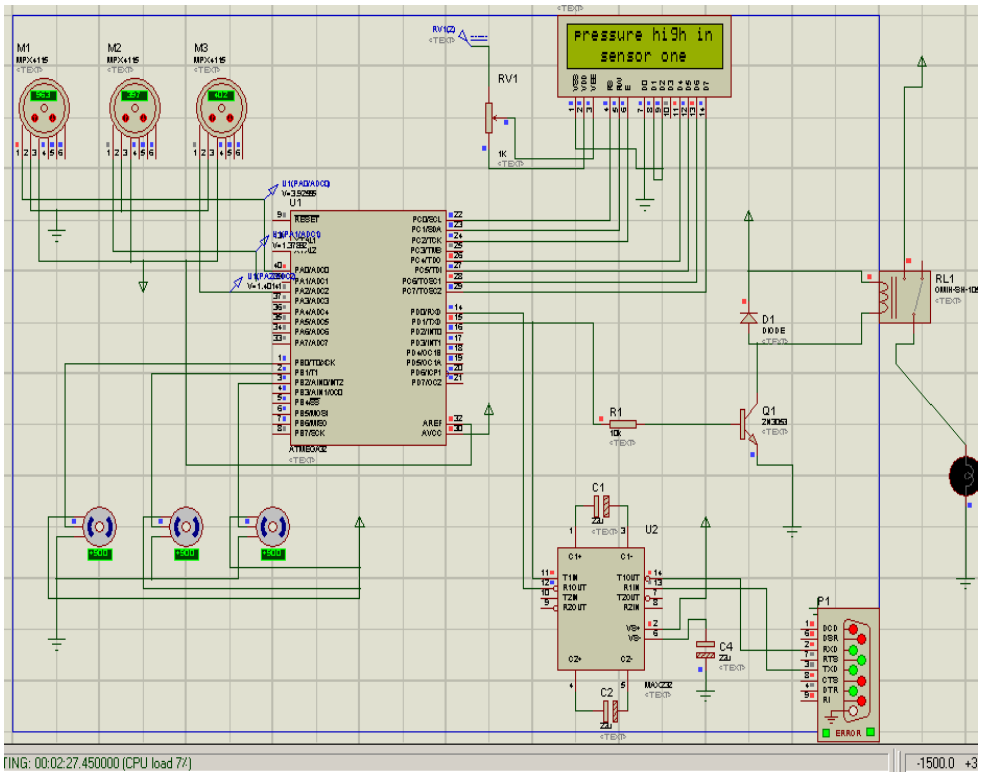

Fig 4.2 simulation circuit of sensors , microcontroller and servo DC motors

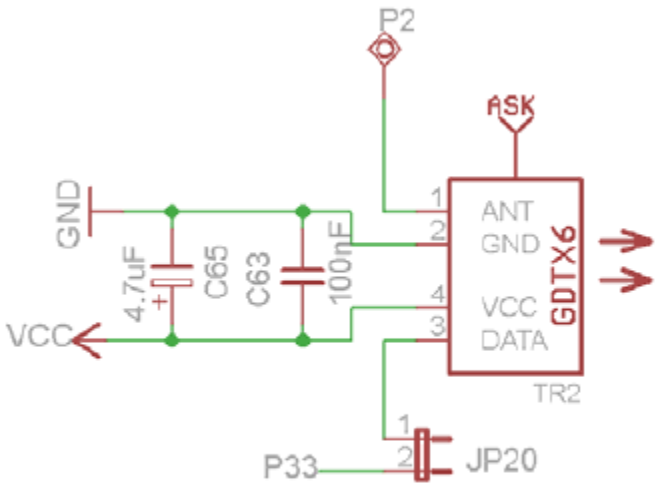

Figure 4.3 ASK Transmitter simulation circuit

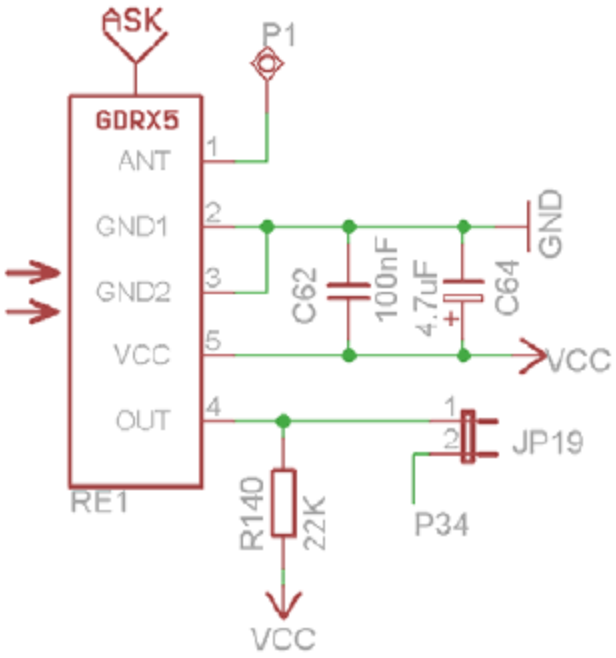

Figure 4.4 ASK Receiver simulation circuit

Constructed for two separate circuits for testing on Atmega32microcontrollers.

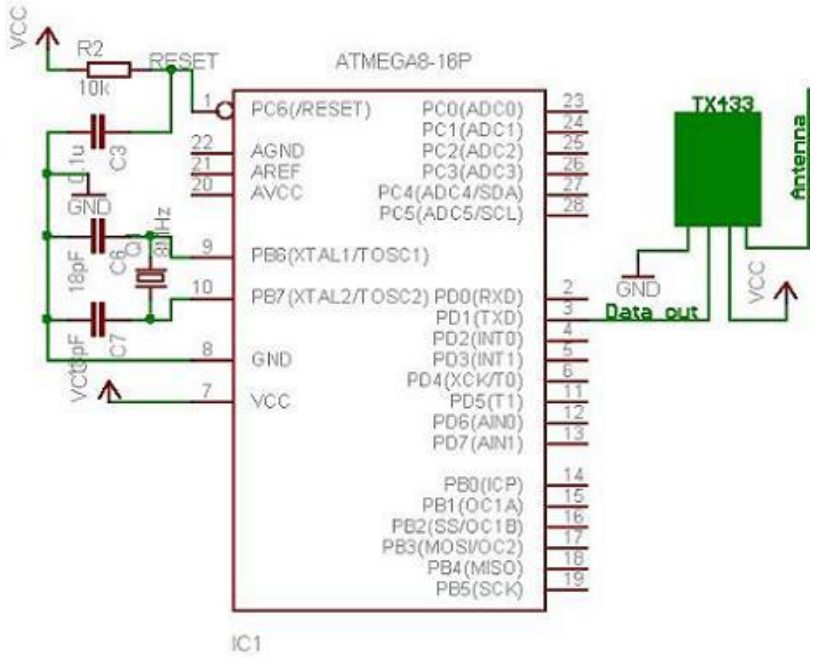

Figure 4.5Circuit diagram show transmitter (Ask) interface with Microcontroller At mega32

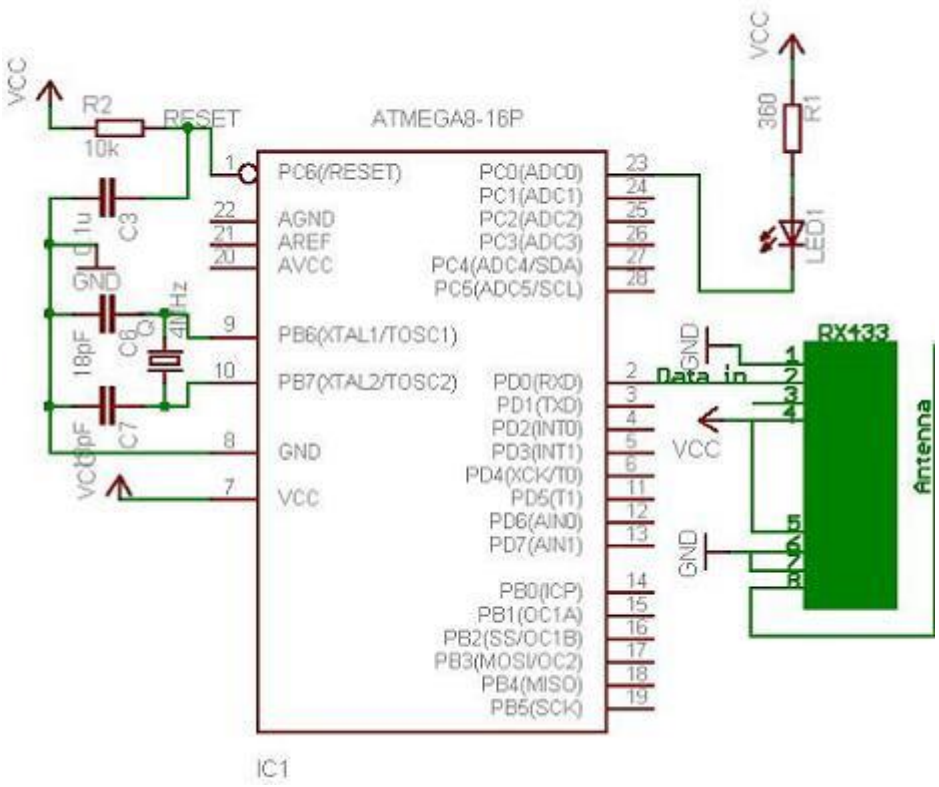

Figure4.6 Circuit diagram show Receiver (Ask) interface with Microcontroller At mega32

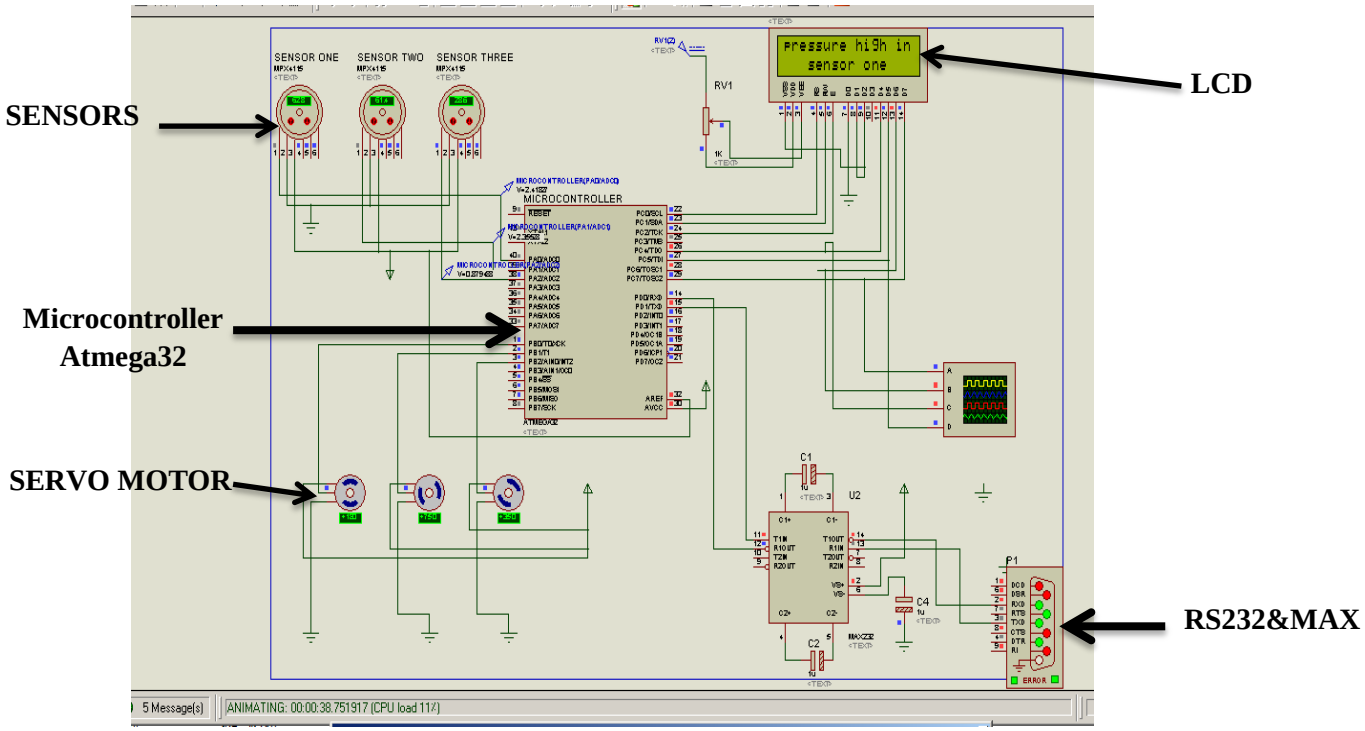

Figure 4.7 The result of reading in sensor one show in LCD

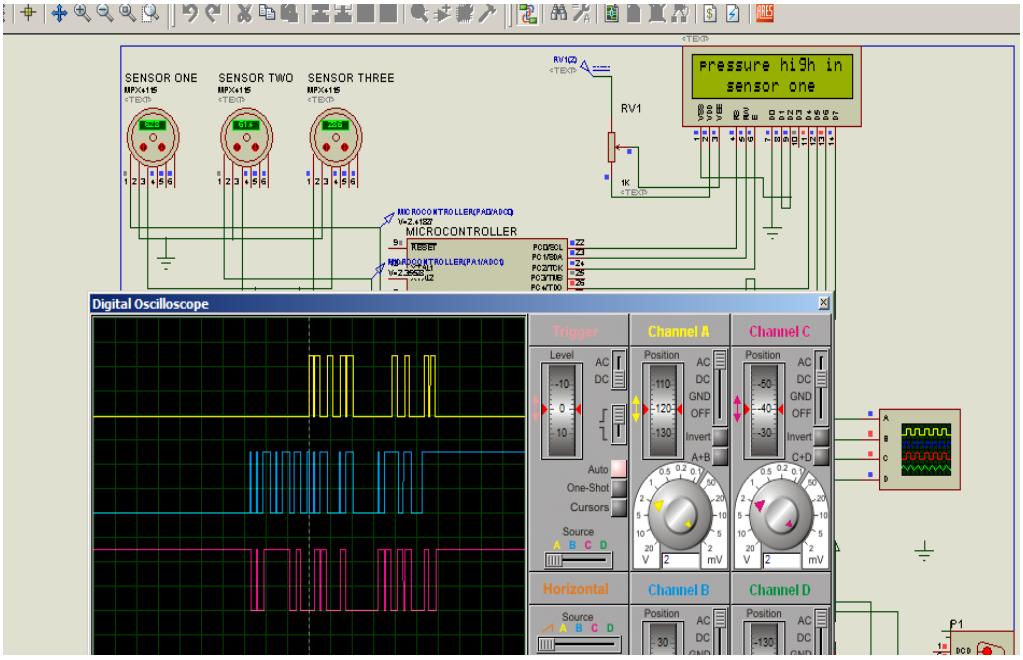

Figure 4.8 show the ADC output of the sensors

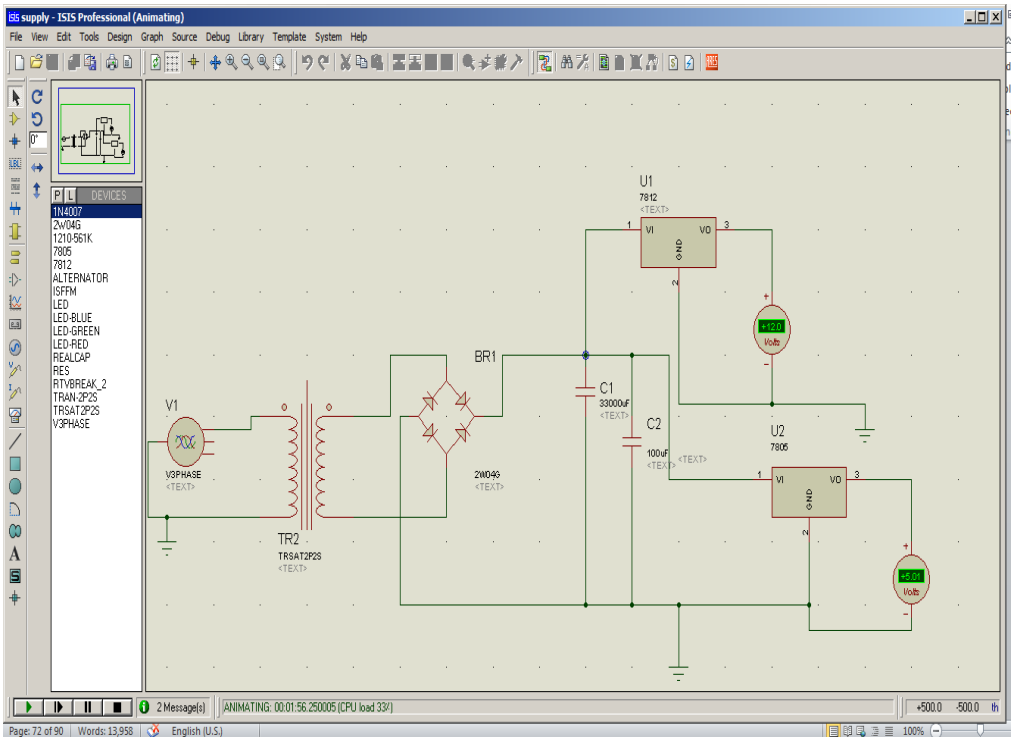

Figure 4.9 show CIRCUIT DIAGRAM OF POWER SUPPLY

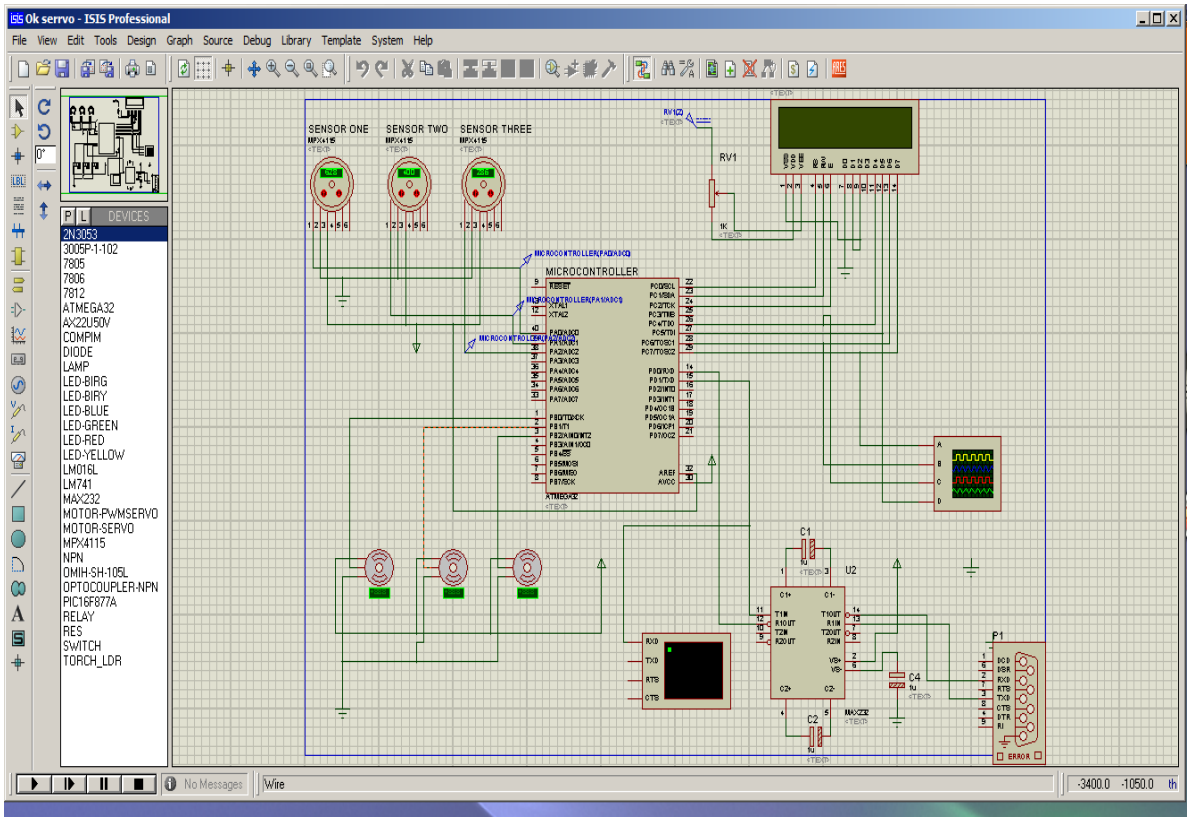

Figure 4.10 :Complete circuit of control and mitigate drinking water in distribution system

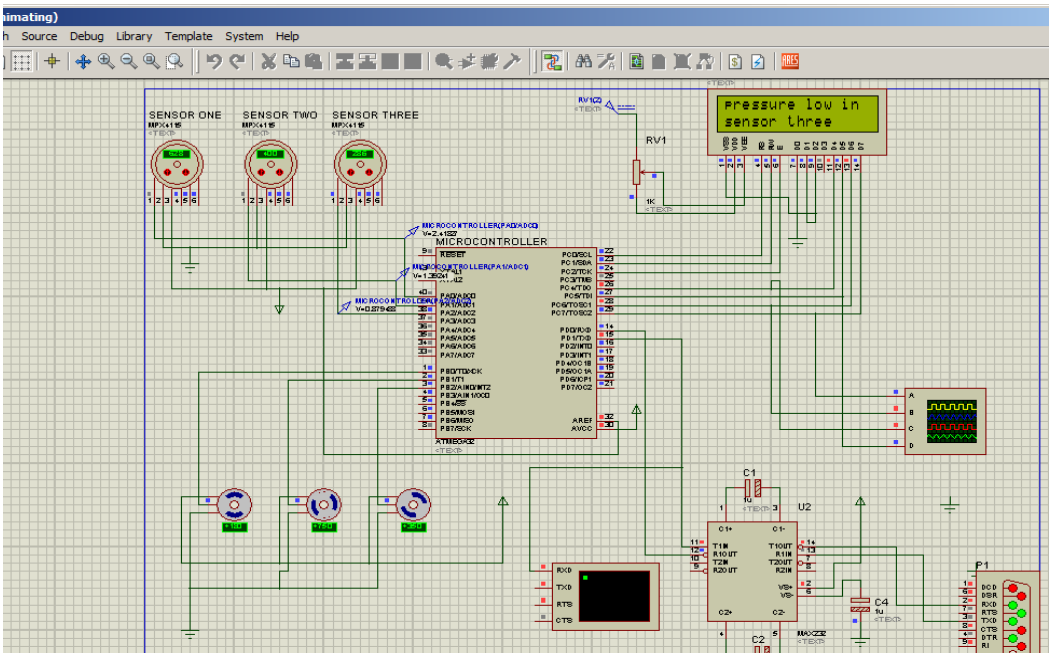

Figure 4.11 :Show the angles of servomotor during reading of sensors

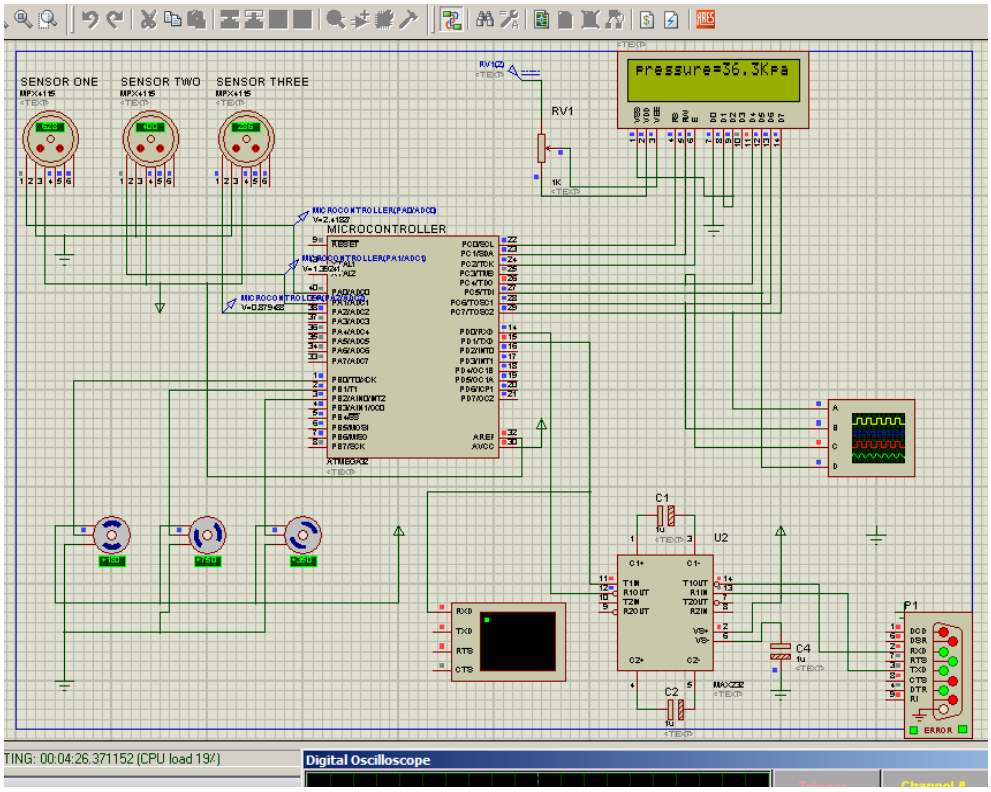

Figure 4.12 :Show the value pressure in main valve

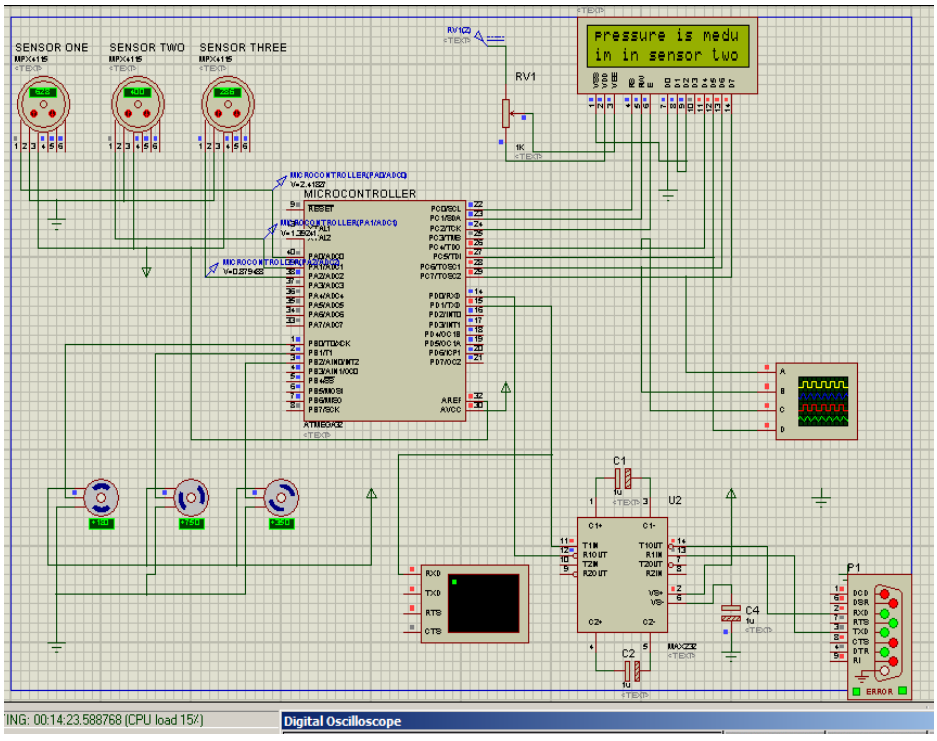

Figure 4.13: Show the reading of sensor two is medium pressure

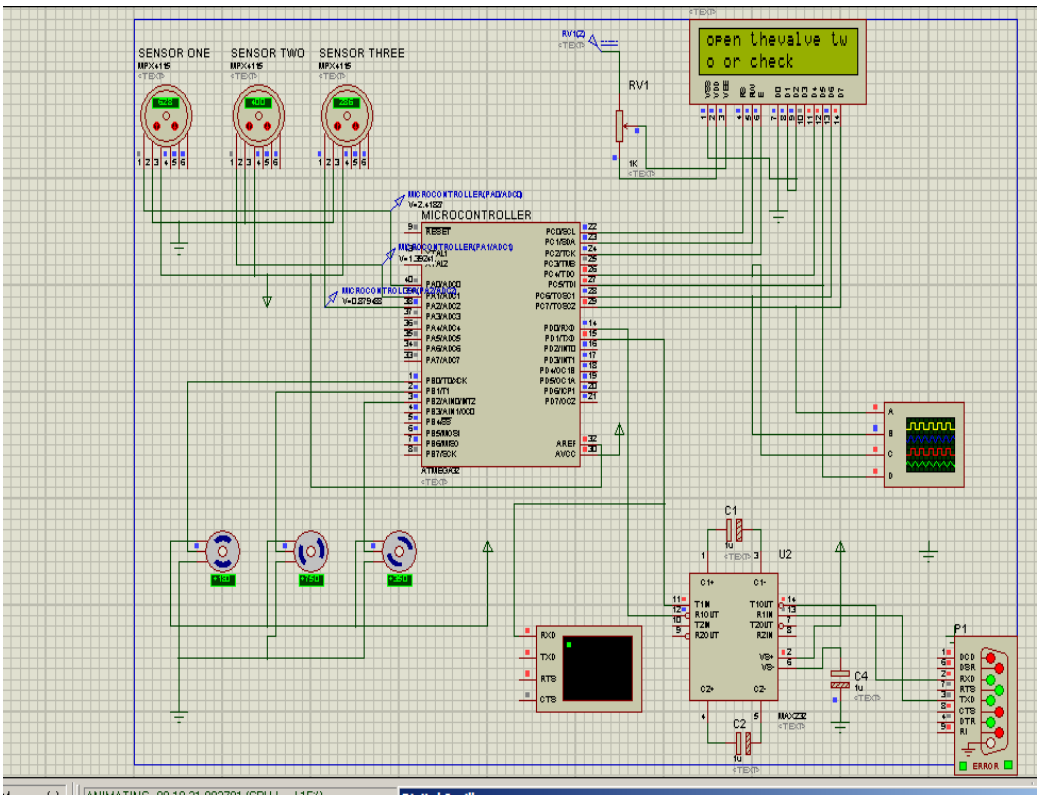

Figure 4.14: Show the status of valve two is medium pressure

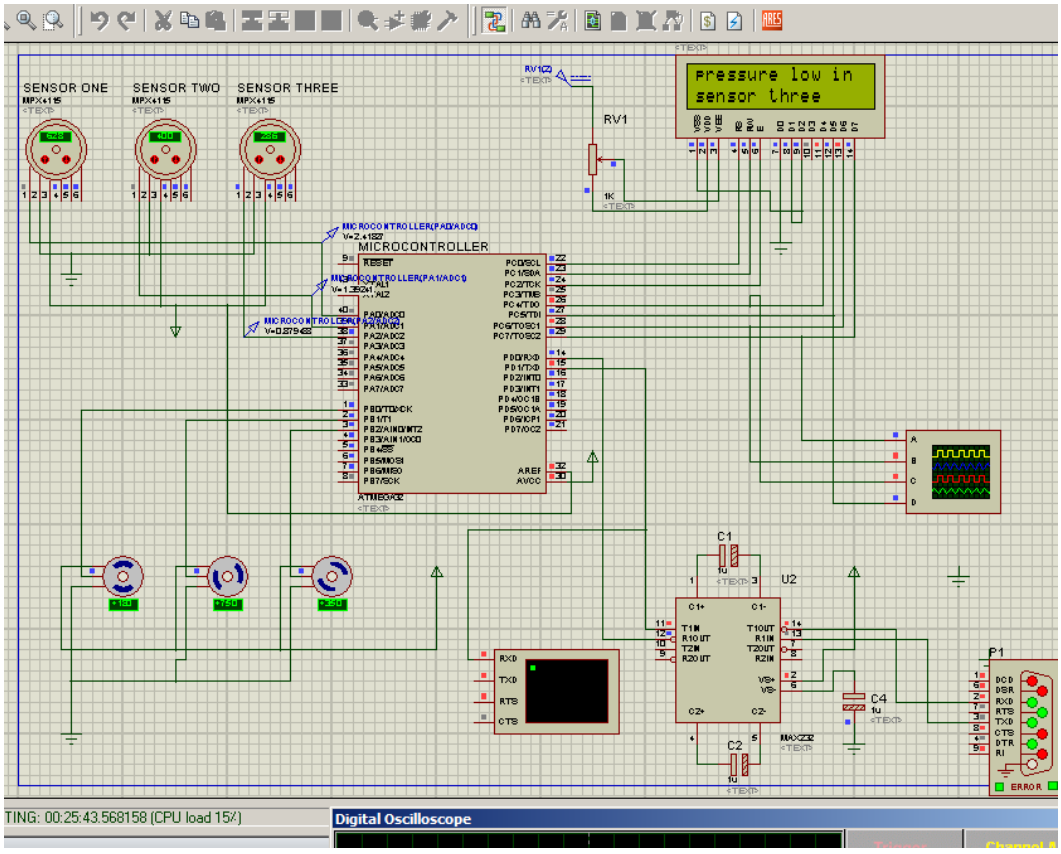

Figure 4.15 :Show the status of sensor three

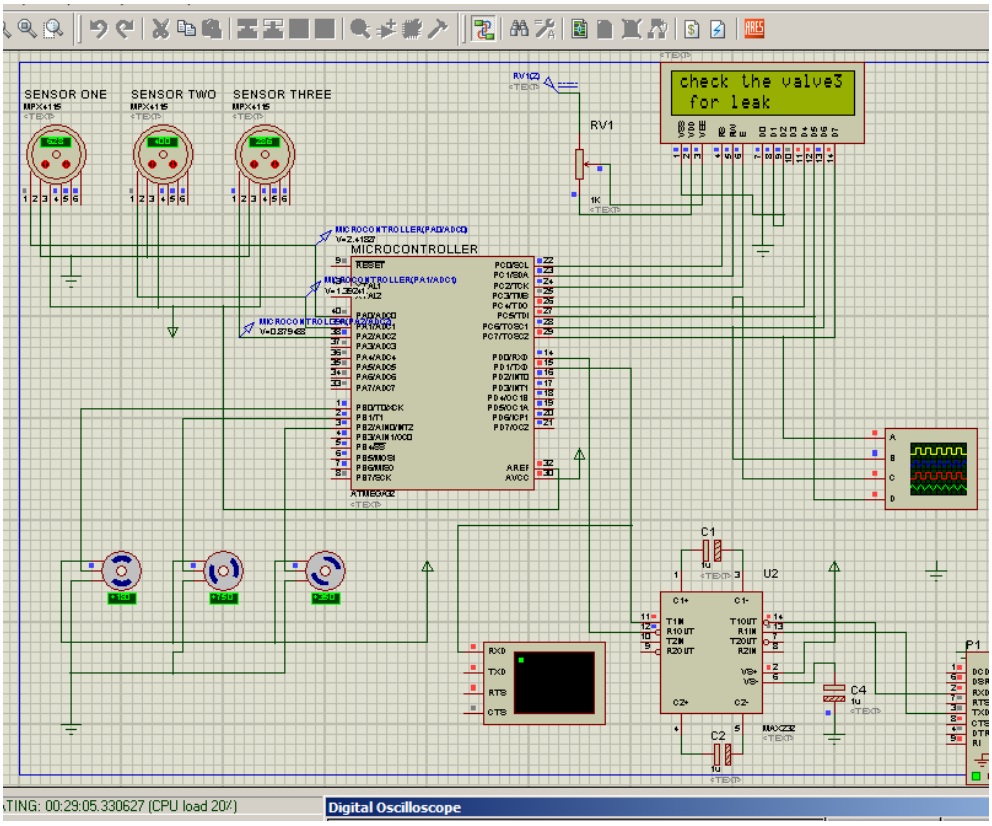

Figure 4.16 :Show the status of valve three .

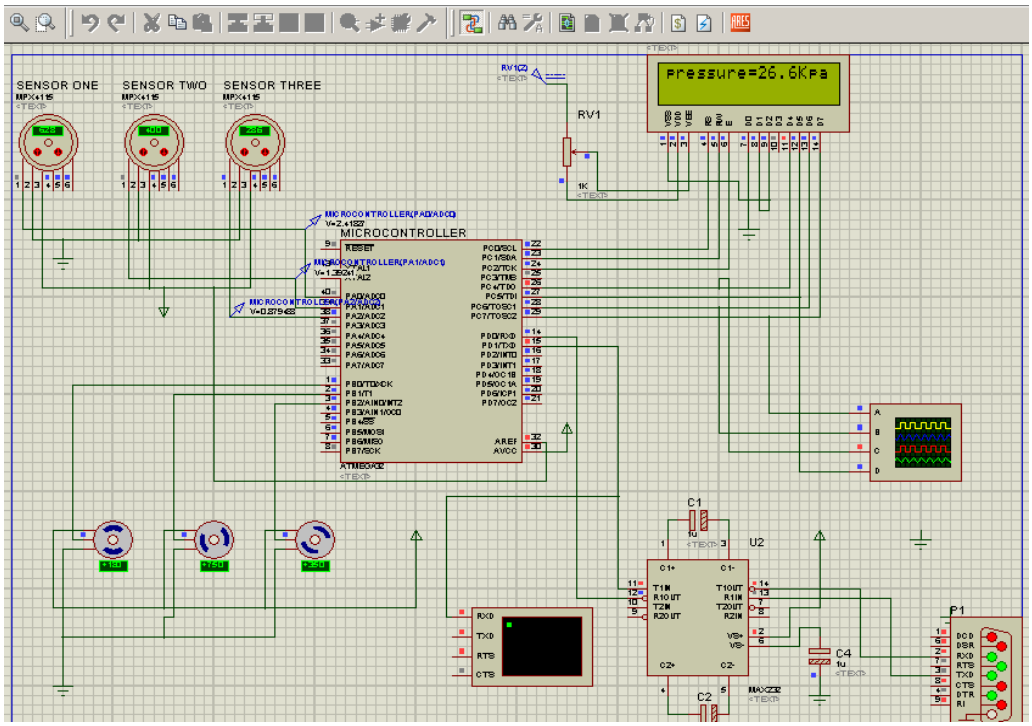

Figure 4.17 :Show the value of pressure in valve three.