ISSN (Print) : 0974-6846
Indian Journal of Science and Technology, *Vol 8(26), DOI: 10.17485/ijst/2015/v8i26/81202, October 2015* ISSN (Online) : 0974-5645

Instantaneous Temperature Measuring System Design of Skin Tissue in Medical CO_2 Laser Device with Power and Pulse Time Variation

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Abstract

The purpose of the system design when using the CO_2 laser beam to the contact area to prevent heat damage. Changes in output and the pulse of the laser to investigate the correlation between the temperature and Safe procedure, based on data detected by the temperature of the automatic return (control) system is proposed. First, the normal procedure of the rough as medical device approved for CO_2 laser, Manufacturers for the purpose of presenting symptoms in the range of thermal damage, do not express. Second, users of the skin tissue when used to induce clotting, Confirmed by experiments. Irradiation time and energy in proportion to the intended expression of heat damage, but too much of the damage that can result. Third, the temperature detection data based on the detection of laser distance sensor and a non-contact could be infrared temperature detection sensor configuration. The operating temperature of the irradiation time and energy to set and the signal sent to control the intensity. As a result, the effect of CO_2 laser of fine focus was confirmed that the change in focus in a distributed.

Keywords: CO_2 Laser, Laser Energy, Skin Tissue

1. Introduction

Recent domestic supply of CO_2 laser was thanks to rely on overseas development of new technologies is increasing the situation. In the case of a 100 ~ 200 W high power laser its penetration is being not still active, but 25 ~ 35 W low power laser products have spread to almost every plastic surgery or the department of dermatology hospital because of significant stability. However, recently of demand of obstetrics is on an increasing trend[3]. In the case of obstetrics used need a method of medical treatment that the region of an operation and the process of treatment has been by thermal damage. But therapy CO_2 laser efficiency invite trouble a considerable thermal damage or depressed scar in skin at every part of face and body that will be exposed to the sun. In this study, CO_2 laser was research into a study of thermal damage cause analysis and a method of prevention, to cope actively CO_2 laser system. We knew stimulation and tissue thermal of CO_2 laser has perceived thermal accumulation phenomenon by a pain sensory of the human body[1,2]. First this study has differentiation previous. The method is during treatment of non-contact CO_2 laser surgery through lens, the contact laser method isn't fiber-optic cable direct insert in subcutaneous[4]. Second, in spite of the square distance CO_2 laser low power at a continuity laser mode study prevention of thermal damage[7-9].

2. Materials and Methods

2.1 Ladder Logic Programmable Micom Controller

By using Ladder logic programmable MICOM controller, digital number changed into A/D convert

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through loaded analog from sensor and real time dater change has monitored by computer with program upload of RS232 port. CO_2 laser manufacture used local thing[5,6,11].

2.2 Temperature Detector and Control

Temperature detector and signal transduction control can be configured a safe detector and I/O control as shown in Figure 1. Figure 2 is an I/O PIN detail drawing of MICOM use in the controller, by utilizing the R-T temperature table in Figure 3 that the A/D conversion values are as follows.

Voltage formula is resistance of 1k ohm and input voltage 5V be divided for sensor resistance value (THR)[17-19].

$$v = \frac{5}{(1000 + THR)} \times THR$$

The final value of V get to multiply V value by 204.8 that V converted A/D converter of 10 bit resolution through 0 between 1024. By the above formula, it is to output a control signal in real time through alternation assignment and cross comparisons by ladder logic shown in Figure 4.

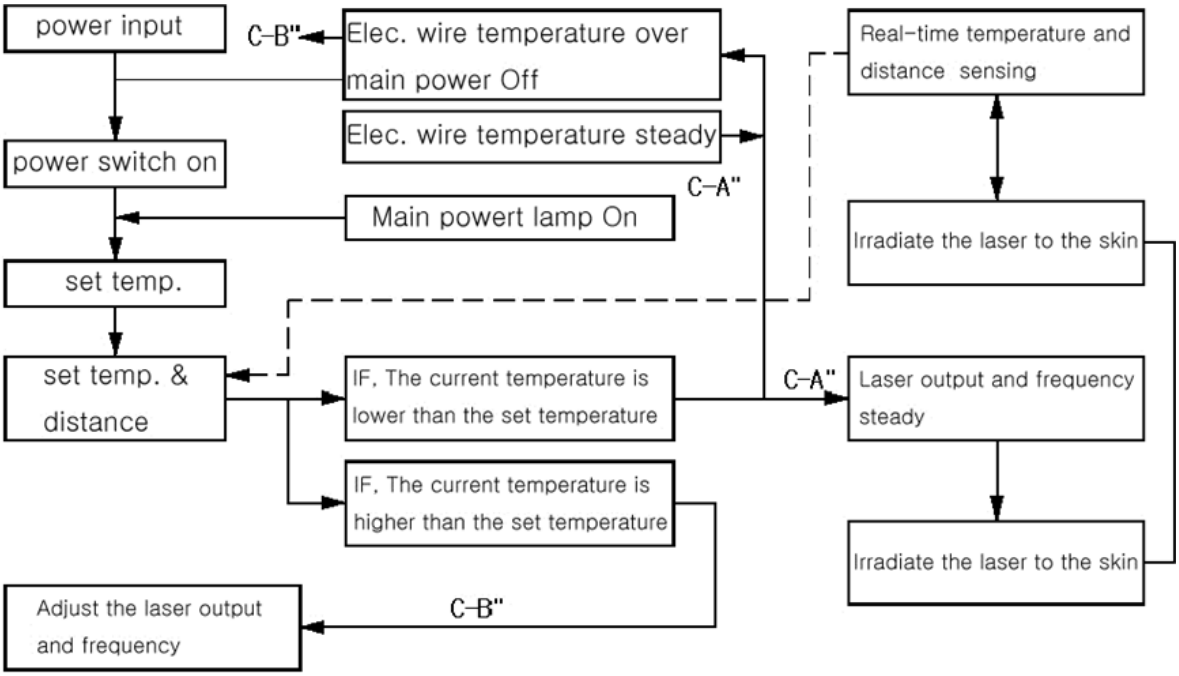

Figure 1. Temperature detector and signal transduction diagram.

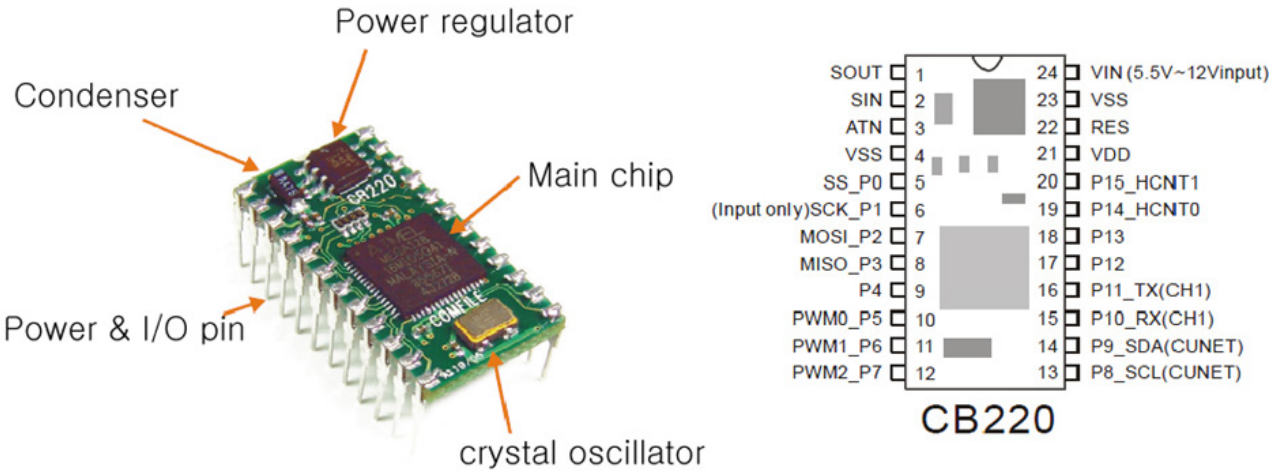

Figure 2. MICOM use in the auto controller.

```
'
'     NTC THERMISTOR READ TABLE
'     10K DIODE TYPE
'     With Ladder Logic

Const Device = cb280

Const Integer TH_TABLE = (992,990,989,987,985,983,981,979,977,975,
           973,970,968,965,963,960,957,954,951,948,
           945,942,938,935,931,927,923,919,915,911,
           907,902,898,893,888,883,878,873,868,862,
           857,851,845,839,833,827,821,815,808,802,
           795,788,781,774,767,760,753,746,738,731,
           723,716,708,700,692,684,677,669,661,652,
           644,636,628,620,612,604,596,587,579,571,
           563,555,547,538,530,522,514,506,498,491,
           483,475,467,460,452,445,437,430,422,415)

Dim a As Integer,b As Integer
Set Ladder on
Do
      b = Tadin(0)
      If b > 990 Or b < 400 Then
           _D(10) = 65535
      Else
        For a=0 To 100
           If b > TH TABLE(a) Then Exit For
        Next
        _D(10) = a
      End If
      Delay 500
Loop
```

Figure 3. Sensor temperature table used for automatic control.

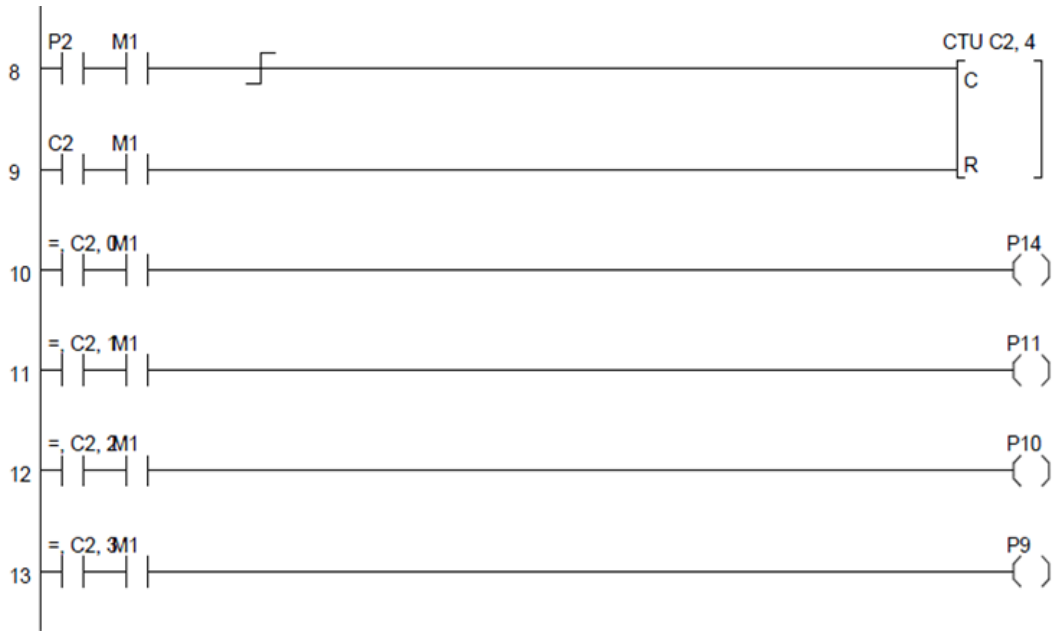

Figure 4. Temperature control is used for automatic control ladder logic.

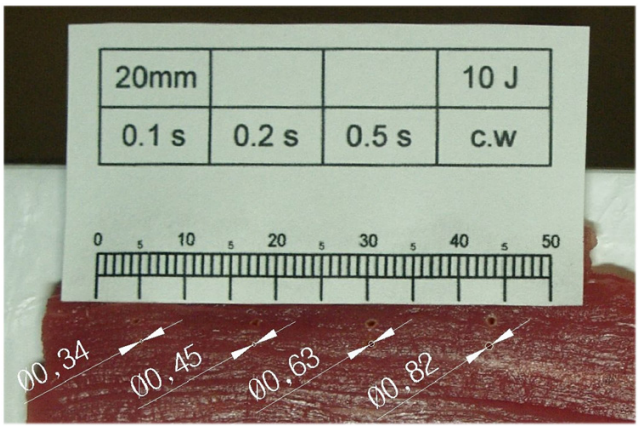

Figure 5. Distance 20 mm from the same energy of 10J.

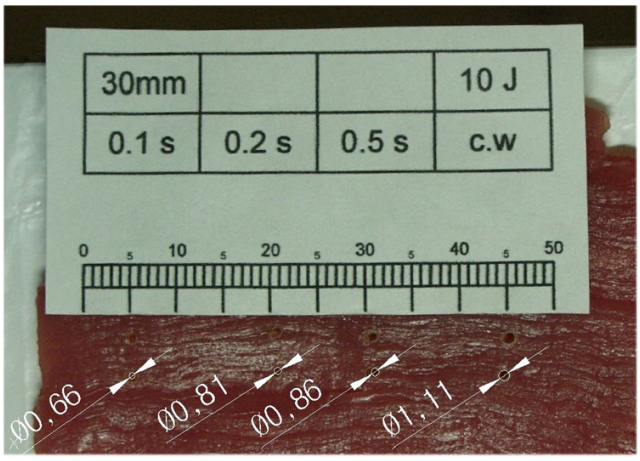

Figure 6. Distance 30 mm from the same energy of 10J.

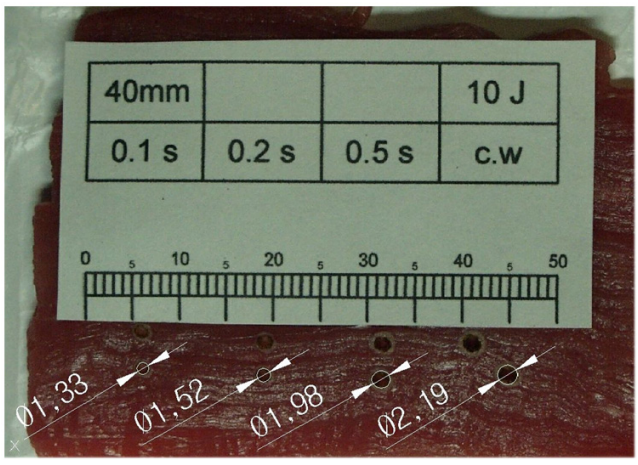

Figure 7. Distance 40 mm from the same energy of 10J.

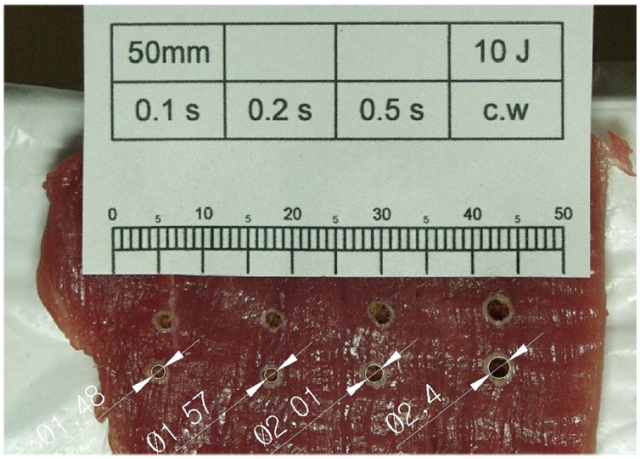

Figure 8. Distance 50 mm from the same energy of 10J.

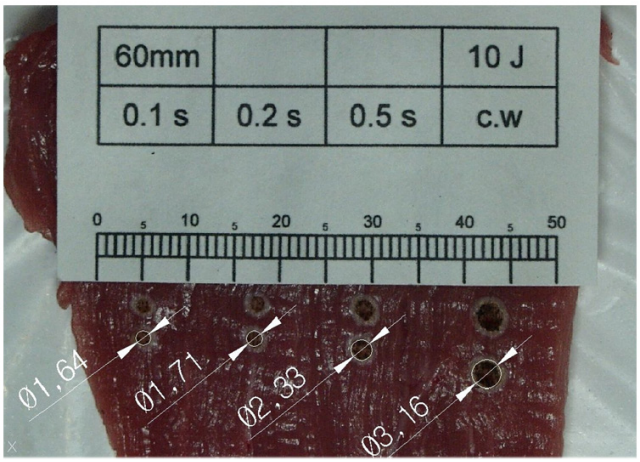

Figure 9. Distance 60 mm from the same energy of 10J.

3. Result

CO_2 laser device and IR thermal measuring equipment, laser distance measuring instrument and automatic control PCB to be linked the device switches and cystis part of skin is applied docaine 20 minutes local anesthesia after CO_2 laser basked super pulse mode[10,13]. As a result if the same irradiation tissue around a diameter of about 3mm to more than three to five times the same location, but the thermometer doesn't change data. However, the strong pain decreased form the skin to the standard distance of equipment but it felt heat sensation[12].

In case of the sensor insertion method, because of the irradiated energy in subcutaneous was accumulation, an enough time is required for data load into the measuring

device[2]. But, in case of the skin exposed to the air (or When the skin was exposed to the air), the cause of the impossible of measurement is estimated to be rapidly irradiation cycle of CO_2 laser, vaporization of the cells and evaporation rate. Other cause, we estimated, affect for the measurement of temperature changes due to the composed air suction part in CO_2 laser device in the based on the results of this study.

3.1 CO_2 Laser Output and the Optimal Focal Distance Change

The skin was been measurement in proportion to distance when the optimal focal distance of CO_2 laser. Figure 5, 6, 7, 8, 9 resulted distances 20, 30, 40, 50, 60mm from the same energy of 10J and energy irradiation time change. As a result a peculiarity of handpiece lens of therapy CO_2 laser widened the optimal focal distance farther away form the irradiation range, but it was reduced the focused energy, a laconic evaporation effect or sample perforate concise decreased the irradiation range around cell observed change of tissue color by heat accumulation. As shown in Figure 5 and Figure 6, 0.5s time from sample surface observed change of tissue color but 40mm distance of CO_2 laser is 0.2s time, 50mm is 0.1s. In addition, the more CO_2 laser distance is far, the more damage surface of sample increased. 0.1m/s standard were compared with 20mm and 60mm relative to the area of tissue damage showed damage difference of about 5 times[14-16].

4. Conclusion

CO_2 laser and diode laser (for hair removal) device was protected for thermal damage of skin tissue by when it must is at proper distance or close adhesion. At CO_2 laser optimum, the energy power is proportional to get CO_2 laser impact skin tissue. In this study was identified through this study, if CO_2 laser device is out of the proper effective distance for distance measurement sensor installation that immediate laser irradiation must be stop.

5. References

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