

Multi Channels Digital Electrotherapy for Acupuncture DC-12

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Abstract: *Electrotherapy methods have been used for a long time, giving a clear treatment effect for chronic patients. The electrical stimulation therapy devices on the market are limited in technology, system cost and tropical compatible. Technical from "Traditional Medicine Hospital of Police" in conjunction with experts from the Hanoi University of Science and Technology researchers built "Multi channels digital electrotherapy for acupuncture DC-12". Equipment using advanced ATmega128 processor, the ability to display the number on the LCD and the various treatment regimens. DC-12 device with high accuracy, functioning warned of the treatment period, allowing the choice of pulse therapy patients avoid the familiar line, easy to use, and especially the cost of just one-third of imported exchange. "Multi channels digital electrotherapy for acupuncture DC-12" has been tested in the laboratory of University of Hanoi and positive results.*

Keywords: electrotherapy, acupuncture, microcontroller, ATmega128, DC-12.

1. Introduction

Electrotherapy is the use of electrical energy as a medical treatment [1]. In medicine, the term electrotherapy can apply to a variety of treatments, including the use of electrical devices such as deep brain stimulators for neurological disease. The term has also been applied specifically to the use of electric current to speed wound healing. Additionally, the term "electrotherapy" or "electromagnetic therapy" has also been applied to a range of alternative medical devices and treatments.

In electricity and electromagnetism, electrical current is the flow direction of the flow of charge. Because the quantities characterizing the current is the amperage, the word "current" is often understood as amperage. Treatment Electronic known from BC. Currents were studied in detail from the 17th century.

The rapid development of techniques and technology have given rise to these devices use current treatments. The flexibility of power that allows humans can apply it to numerous fields, especially health. One of the current applications of medical treatment that is current. Electric current is the current treatment inserted to heal the damage in the body. Medical call this method of electrotherapy.

In the field of cancer treatment, DC electrotherapy showed promise as early as 1959, when a study published in the journal Science reported total destruction of tumor in 60% of subjects, which was very noteworthy for an initial study [2]. In 1985, the journal Cancer Research published the most remarkable such study, reporting 98% shrinkage of tumor in animal subjects on being treated with DC electrotherapy for only five hours over five days [3]. The mechanism for the

effectiveness of DC electrotherapy in treating cancer was suggested in an article published in 1997 [4].

The use of electrotherapy has been researched and accepted in the field of rehabilitation [5] (electrical muscle stimulation). The American Physical Therapy Association acknowledges the use of Electrotherapy for Pain management, Treatment of neuromuscular dysfunction, Improves range of joint mobility, Tissue repair, Acute and chronic edema, Peripheral blood flow, Iontophoresis and Urine - fecal incontinence.

Transcutaneous electrical nerve stimulation (TENS) is the use of electric current produced by a device to stimulate the nerves for therapeutic purposes. TENS, by definition, covers the complete range of transcutaneous applied currents used for nerve excitation although the term is often used with a more restrictive intent, namely to describe the kind of pulses produced by portable stimulators used to treat pain [6].

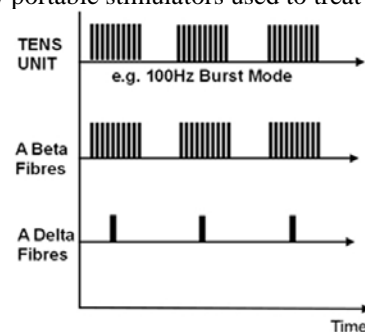


Figure 1: TENS wave in electrotherapy.

The unit is usually connected to the skin using two or more electrodes. A typical battery-operated TENS unit is able to modulate pulse width, frequency and intensity. Generally

TENS is applied at high frequency (>50 Hz) with an intensity below motor contraction (sensory intensity) or low frequency (<10 Hz) with an intensity that produces motor contraction [7]. The benefit of TENS for pain management is controversial. TENS applied at low intensity-high frequency, as opposed to "acupuncture-like" TENS administered at high intensity-low frequency. Conventional and acupuncture-like TENS activated similar fiber types, predominantly in the A alpha beta range. Our findings suggested that the effects of these two types of TENS may be mediated by the activation of similar peripheral afferent fibers.

2. Microcontroller and Digital Technology in Electrotherapy

2.1 ATmega32

The ATmega32 provides the following features: 32Kbytes of In-System Programmable Flash Program memory with Read-While-Write capabilities, 1024bytes EEPROM, 2Kbyte SRAM, 32 general purpose I/O lines, 32 general purpose working registers, a JTAG interface for Boundary scan, On-chip Debugging support and programming, three flexible Timer/Counters with compare modes, Internal and External Interrupts, a serial programmable USART, a byte oriented two-wire Serial Interface, an 8-channel, 10-bit ADC with optional differential input stage with programmable gain, a programmable Watchdog Timer with Internal Oscillator, an SPI serial port, and six software selectable power saving modes.

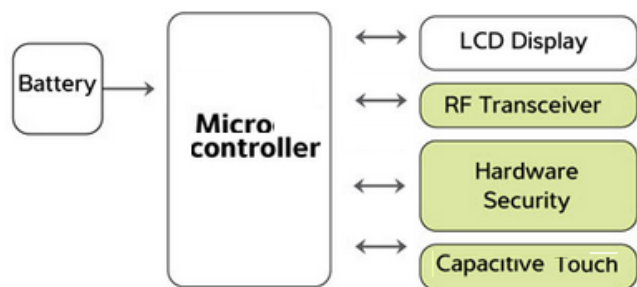


Figure 2: ATmega32 functions with battery, lcd, rf and hardware security

The On chip ISP Flash allows the program memory to be reprogrammed in-system through an SPI serial interface, by a conventional nonvolatile memory programmer, or by an On-chip Boot program running on the AVR core. By combining an 8-bit RISC CPU with In-System Self Programmable Flash on a monolithic chip, the Atmel ATmega32 is a powerful microcontroller that provides a highly-flexible and cost-effective solution to many embedded control applications. The Atmel AVR ATmega32 is supported with a full suite of program and system development tools including: C compilers, macro assemblers, program debugger/simulators, in-circuit emulators, and evaluation kits.

2.1 Multi channels digital electrotherapy for acupuncture DC-12 design

The team has designed functional block diagram of Multi channels digital electrotherapy for acupuncture DC-12 design in the figure 3 below:

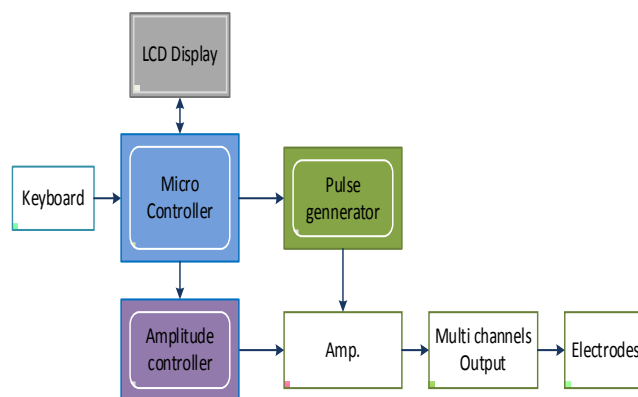


Figure 3: Multi channels digital electrotherapy for acupuncture DC-12 design.

- *LCD display*: This function blocks display parameters such treatment frequency display of pulse therapy, pulse therapy, duration of treatment.
- *Pulse generator*: This function blocks generate different pulse therapy serves as the pulsed oscillation stuffy, spikes, pulses aliasing. This unit also has the function to create modulation (changing) the frequency of the pulse is generated used to reduce the flow of patients.
- *Amplification controller*: This block amplifies the pulse shape was created from blocks around to gain amperage and voltage excitation stimulus large enough to meet the functional treatment.
- *Electrodes*: This block has the function of changing the amplitude of the pulse treatment to achieve a stimulating current intensity and voltage stimulation desired.
- *Multi Channels Output*: This block transfer function of stimulus in the form of electric current to the patient. This block also the entire grid voltage isolation from patients, increase electrical safety for the machine.
- *Amp*: This block can function as a primary controller entire operation of the device, set the function of the machine, the control order, timer and shutdown.
- *Keyboard*: This volume is the key, button, knob. Functional block is the input of the processing service orders, operation and machine operation.

3. Multi Channels Digital Electrotherapy for Acupuncture DC-12

3.1 Design Standard

The process of analysis and assessment and construction of the DC-12 device functions, the authors follow the European standards of IEEE, ISO and Vietnam standard for devices with embedded programming solutions in medical devices.

Table 1: DC-12 Design standard

No	Index	Standard rangers
1	Power	110 - 240V AC ± 10%
2	Frequence	50 - 60Hz
	Current Pulse	3W/cm2 ±20%
	Current cont.	2W/cm2±20%
	Size	295 x 240 x 108mm
	Weight	2kg

3.2 DC-12 Features

Multi channels digital electrotherapy for acupuncture DC-12 has the advantages such as:

- Safety for patients.
- There are electronic timer.
- Has charging system to ensure safety for patients and equipment
- Displays LCD display Vietnamese.
- Pulse frequency from 1Hz to 500Hz numbers, have the ability to adjust the frequency accuracy
- The pulse width maximum is 100µs.
- The intensity of the pulse stream reaches 30mA maximum output.

3.3 DC-12 Models



Figure 4: DC-12 front end and electrodes.



Figure 5: DC-12 power and outputs

4. Testing and Evaluation DC-12

4.1 Electrotherapy Current Output

Intensity is the output of electrotherapy distributed by the unit to the patient. Depending on the waveform, intensity is measured in milliamps (mA), volts (V), and micro amps (µA).

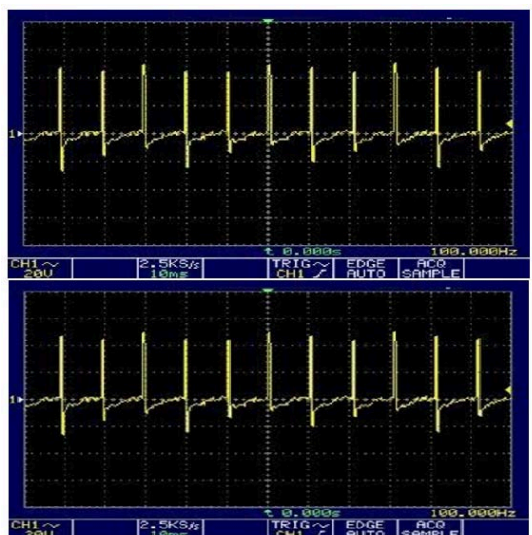


Figure 6: Testing DC-12 output current on oscilloscope.

The output from the machine is pulsed such that the ‘on’ time is considerably shorter than the ‘off’ time, thus the mean power delivered to the patient is relatively low even though the peak power (i.e. during the on pulses) can be quite high (typically around 15 – 20 Watts peak power with modern machines, though some still go up to 35W). The control offered by the machine will enable the user to vary (a) the mean power delivered to the patient and (b) the pulsing parameters governing the mode of delivery of the energy. It would seem from current research that the mean power is probably the most important parameter.

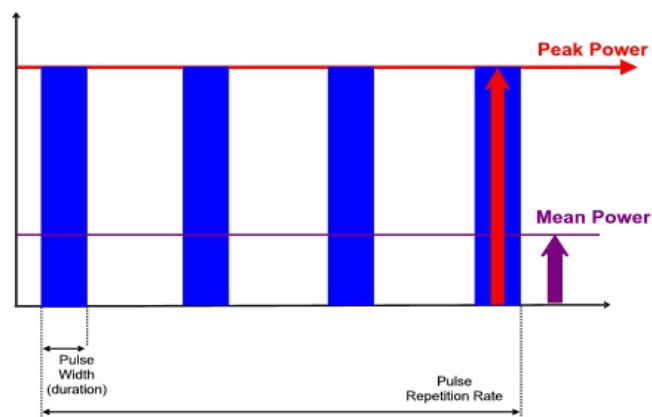


Figure 7: Calculate DC-12 output current

4.2 Testing and evaluation DC-12 in biomedical laboratory

Inspection process equipment in the laboratory level for consistent results. Line treatment was safe under the proposed threshold. Sense of line appeared continuous treatment. Effective treatment unsatisfactory. There are still some minor glitches in the quality of electrodes and contacts. Equipment is designed with plastic and rubber soles not very good.

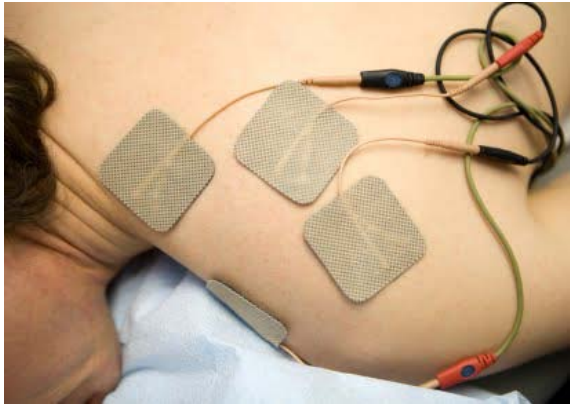


Figure 8: Testing and evaluation DC-12 in biomedical laboratory

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General evaluation, equipment design standards and ensure electrical safety. Output number 6 top, serve many different therapeutic purposes. These are improvements that similar devices on the market do not have.

5. Conclusions

After research efforts and systems builders "Multi channels digital electrotherapy for acupuncture DC-12", finally we have complete finished product, machine inherits the outstanding features of the models on the market. Equipment using advanced ATmega128 processor, the ability to display the number on the LCD and the various treatment regimens.

DC-12 device with high accuracy, functioning warned of the treatment period, allowing the choice of pulse therapy patients avoid the familiar line, easy to use, and especially the cost of just one-third of imported exchange. Certainly in the near future, with the continuous efforts of our machines will become more complete, with the great value that it brings, certain "magnet electrical machines digital "will be available in all countries worldwide.

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