



Fig 6. Connection Sensor Real Time Clock with Arduino

## References

1. Pedometer. Overview of Pedometer. URL: <http://gotowalk.blogspot.ru/2013/12/shagomer.html>
2. Heart rate monitor URL: <https://ru.wikipedia.org/wiki/Пульсометр>

## COMPARISON OF X-RAY DIAGNOSTIC UNITS “PROTON” AND “MOVIPLAN”

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X-ray units are widely used in modern medicine to diagnose and treat a variety of diseases. Depending on the purpose, X-ray units are divided into medical and technical. In our research, we are going to consider medical X-ray units. They are divided into roentgen diagnostic and roentgen therapy units. Roentgen diagnostic units can be: stationary, mobile and portable. Roentgen therapy units can be general-purpose and specialized [1].

After studying the working principles and the main components of X-ray units, we are going to compare the characteristics of X-ray units of domestic and foreign production. These X-ray diagnostic units are Proton for two workplaces and MOVIPLAN for two workplaces. The first unit is manufactured in Russia, the second one in Italy.

1. Size and movement.

The size of the table top of X-ray diagnostic unit Proton is not less than 200x69 cm; the size of the table top of MOVIPLAN is not less than 75x218 cm. For the convenience of the patient and the doctor, the manufacturers provide longitudinal and cross motion of the table top. The range of motion and the movement of the emitter are very important.

X-ray diagnostic units		
Model	Proton	MOVIPLAN
Angular range of tomography	from 8° to 40°	from 5° to 45°
Total longitudinal motion of the table top, cm.	not less than 76	not less than 87
Total cross motion of the table top, cm.	not less than 24	not less than 23
Vertical motion of the table top	lift presence	lift presence

Table 1. Comparison of the table top

The maximum weight of the patient is an important characteristic. The possibilities of the lift and table top deflection depend on the weight of the patient. The maximum weight of the patient for the domestic X-ray unit is 200 kg. Foreign manufacturers do not provide this information. It complicates the evaluation and reduces the likelihood of purchase [2, 3].

2. Emitter support.

The emitter located on the support column is also used to perform research on the stand. So the distance on which the emitter support can be moved is important [4].

Model	Proton	MOVIPLAN
Type of fixation of the support column	floor standing	floor standing
Type of movement of the support column	motorized	motorized
Movement range of the support column, cm.	220	270

Table 2. Comparison of the emitter support.

3. Technical characteristics of the units. Technical characteristics are important choice criteria for buyers.

Model	Proton	MOVIPLAN
Generator capacity	50–55 kW	50–80 kW
Maximum value of the frequency of high-voltage transformation	400 khz	100 khz
Voltage value	from 40 to 150 kW	from 40 to 150 kW
Maximum operating voltage	150 kW	150 kW
Small focus, mm	0.6	0.6
Large focus, mm	1.2	1.2
Ability to read chargers, formats	from 18×24 to 35×43 cm	from 15×30 to 35×43 cm
Time for the appearance of the digitized image 35x43 cm on the monitor, sec	35	35

Table 3. Technical characteristics

Thus, foreign X-ray diagnostic unit has some advantages. They are automatic plate loading from the charger into the scanner without manual disclosure of the charger before installation; optoelectronic control of the disconnection of electro-magnetic brakes while domestic unit uses electro-magnetic brakes to fix the table top (the brake are controlled by pedals).

Another advantage of MOVIPLAN is an optical system of disconnection of the electromagnetic brakes. Traditional disconnection of brakes with pedals may lead to the fall of the patient [5].

The price of X-ray diagnostic unit Proton for two workplaces is 4.18 million rubles; the price of MOVIPLAN is 4.95 million rubles [2, 3].

Thus, foreign MOVIPLAN has more advantages than domestic X-ray diagnostic unit Proton. They are the range of movement of the emitter column on the rails and the maximum value of the frequency of high-voltage transformation. Moreover, foreign X-ray diagnostic unit is more convenient to use. However, there is a significant difference in price. Therefore, the domestic unit is more competitive on the market. Russian engineers develop

new technologies and soon domestic units will completely replace foreign units in our hospitals.

### References

1. Roentgen. <http://www.studfiles.ru/preview/3560930/> (accessed 24.04.16)
2. X-ray diagnostic unit “Proton” for 2 workplaces. <http://рентген-аппарат.рф/katalog-rentgen-apparatorv/statcionarnye-rentgen-apparaty/kompleks-rentgenovskiy-diagnosticheskiy-krd-proton-na-2-rabochikh-mesta> (accessed 24.04.16)
3. Roentgen diagnostic unit MOVIPLAN. <http://рентген-аппарат.рф/katalog-rentgen-apparatorv/statcionarnye-rentgen-apparaty/kompleks-rentgenodiagnosticheskiy-moviplan/> (accessed 24.04.16)
4. X-ray engineering. [http://www.amico.ru/images/cms/data/pdf/radiology\\_practik\\_may2002\\_n2.pdf](http://www.amico.ru/images/cms/data/pdf/radiology_practik_may2002_n2.pdf) (accessed 24.04.16)
5. X-ray unit MOVIPLAN <http://www.villasm.com/en/art/10/moviplan-ic.html> (accessed 2.05.16)

### ORGANIZATION OF THE MULTIPORT MEMORY AND COMMUNICATION INTERFACE USING THE FPGA

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The purpose of the research is to determine the time parameters of multiport memory modules based on FPGA and to estimate utilization internal crystal resources. This information can help for future FPGA-based devices developing.

The topic of this work is very important and actual because realization of digital devices based on FPGA is a very perspective line of modern electronics development. There are some advantages of FPGAs. In spite of the young age of the technology FPGAs are now available for product designers. Prices on FPGA are decreasing and the level of circuit integration is increasing. FPGA manufactures produce a wide range of chips with different configuration, level of integration and ip-cores, so the developers of the electronic device can make a choice of FPGA with better parameters. FPGAs represent universal element base [1].