Spectroscopy Amplifier
Prerna Kumbhar, Ritika K. Oswal, Harshal Rawal, Abhishek Jain, Dr. D.K. Shedge
Department of Electronics Engineering
AIISSMS’S Institute of Information Technology Pune, Maharashtra, India

Abstract — Protection from the harmful radiation is top most safety priority for any organization all around the world. The paper illustrates A sixteen channel programmable spectroscopy amplifier having high performances has been developed to answer the demanding of nuclear experiments. Housed in single width NIM unit, the module is fully programmable through a special interface. Usually in nuclear experiments. Micro controller based system which displays measured value on LCD.

Keywords — Spectroscopy amplifier, Micro Controller, NIM unit

I. INTRODUCTION
The cruel reality of today’s world forces mankind to be alert and prepared for all kinds of terrorist threats, including exposure to radiation. There is need for cost effective measurement devices [6].

Table: Maximum Energy Considered

<table>
<thead>
<tr>
<th>Particle</th>
<th>Energy (MeV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>α</td>
<td>20</td>
</tr>
<tr>
<td>β</td>
<td>10</td>
</tr>
<tr>
<td>γ</td>
<td>20</td>
</tr>
<tr>
<td>η</td>
<td>20</td>
</tr>
<tr>
<td>Heavy ions</td>
<td>100</td>
</tr>
</tbody>
</table>

II. MATERIALS AND METHODS
A. System Description:
The system is broken down into major blocks: linear power supply, micro controller, signal conditioning, input peripheral and output peripheral. Figure shows each block’s relation to one another and to the project as a whole.

Ionizing Radiation has been studied very intensively for more than a century compared with many things which influence human health, it is well understood scientifically. The main internationally recognized authority on ionizing radiation (UNSCEAR), set up in 1995. Its mandate is to assess and report levels and effects of exposure to ionizing radiation [7]. Intensive research first with silicon and then with the Germanium resulted in detectors suitable for gamma and X-ray spectrometry having resolving powers at low photon energies intermediate between those proportional counter and crystal dispersion techniques[2].
This is hardware design of Spectroscopy amplifier which has functionality of measuring the detected radiations. The input to the system is given through the tail pulse generator, there are various parameters like ULD, LLD, gain, etc. values which are settable and these values are given to the system using keypad interface. The output that is the count of the radiation is displayed on the LCD which is interfaced with the PIC micro-controller.

B. Circuit Description

The Spectroscopy Amplifier is divided into different modules:

1. Pole Zero Compensation: the pulse bombardment from the detector causes the pile-up the pulse duration time should be decreased in the main amplifier so that the voltage baseline is not saturated. To prevent this, a differentiator i.e., a pole-zero compensator is used.

2. Shaping circuit: In order to increase the performance of a nuclear spectrometer and to reach high counting rate, shaping is required.

3. Baseline restorer: Reason for baseline shift is the AC couplage usage between each operational division of the amplifier’s circuit during the pulse processing. Distorted part is rejected by BLR circuit. Thus, the pulses
whose amplitudes do not distort and are proportional to the particle energies are obtained.

IV. Single channel analyzer: It acts as a window comparator. Single channel analyzer produces output only if the peak amplitude of its input signal falls within the pulse height window that is established with two preset threshold levels.

V. PIC 18 F4620 Micro controller counts the TTL pulses as per the function setting and are converted to engineering units and displayed on LCD.

VI. Peripherals: Keypad is used as a input blog, it consist of 4 press keys namely: Menu, Shift, Arrow, Enter keys. Shift and arrow keys can also perform acknowledgment and reset operation respectively.

D. Display
16 x 4 liquid crystal display (LCD) is used to display the counted value. LCD displays the CPS count, gain, ULD and LLD values.

E. Software
For programming part in the development of the project we have used the MPLAB software. It is a software program that runs on a PC (Windows, Mac OS, and Linux). It is compiler as well as a debugger.

III. CONCLUSIONS
From the above study, it can be concluded that the designed spectroscopy amplifier can function satisfactorily as well as that of standard device used here. The high degree of linearity was achieved by using novel techniques. This high event rate capability insured that the circuit would perform well in high resolution energy spectroscopy systems. Using this device we can measure the radiations and the counted value can be displayed on LCD.

ACKNOWLEDGMENT
It gives us great pleasure to submit this paper on “Spectroscopy amplifier” as a part of curriculum. We like to express our special thanks and gratitude towards Dr. D.K.Shedge (HOD - Electronics, AISSMS-IOIT, Pune) and Mr.Muneeb Shaikh (ASICOT TECHNOLOGIES PVT LTD) for providing us the platform to design our system.

REFERENCES

BIOGRAPHIES

Prerna Kumbhar, Final year B.E. Electronics student of Savitribai Phule, University of Pune and All India Shri Shivaji Memorial Society’s Institute of Information Technology, member of IETE.

Ritika Oswal, Final year B.E. Electronics student of Savitribai Phule, University of Pune and All India Shri Shivaji Memorial Society’s Institute of Information Technology, member of IETE.

Harshal Rawal, Final year B.E. Electronics student of Savitribai Phule, University of Pune and All India Shri Shivaji Memorial Society’s Institute of Information Technology, member of IETE.

Abhishek Jain, Final year B.E. Electronics student of Savitribai Phule, University of Pune and All India Shri Shivaji Memorial Society’s Institute of Information Technology, member of IETE.

Dr. D K Shedge, Head of Department, Department of Electronics Engineering Savitribai Phule Pune University, All India Shri Shivaji Memorial Society’s Institute of Information Technology, Pune. B.E. (Electronics), PhD (E&T). Specialization in Digital signal processing, Network Synthesis, Electronic Measurement, CMOS circuit design, Electronic Product Design. Having Teaching Experience-27 Years.