Programming of the ATE for Fuze calibration using Lab View Software

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Abstract—The FUZE is a self-powered radio transmitting and receiving unit, operating on Doppler principle. The HF circuit in Fuze is responsible for the proximity mode operation. During dynamic testing, all the parameters and their values are noted which are then used in anechoic box (static testing) as a reference reading for testing of FB40 Fuze. The anechoic box is connected to HF test station which guides the entire test to be performed on Fuze.
The programming is done in LabView software. The tests are coded in LabView and then implemented on the test station to check the proper functioning of the Fuze.

Keywords: FUZE, FB-40, Labview

I. INTRODUCTION

In military munitions [1] [3], a fuze is the part of the device that initiates function. The term fuze is used to indicate a sophisticated ignition device incorporating mechanical and/or electronic components

A fuze is a device used in munitions which is designed to detonate, or to set forces into action to ignite, detonate or deflagrate the charge (or primer) under specified conditions. In [3], e.g. a proximity fuze for M107 artillery shell, magnetic/acoustic fuze on a sea mine, spring-loaded grenade fuze.

A munition fuze assembly may contain only the electronic or mechanical elements necessary to signal or actuate the detonator, but some fuzes contain a small amount of primary explosive to initiate the detonation.

II. GENERAL INFORMATION ABOUT FUZE FB-40

In this test station the specific FB40 fuze is tested. The FB40 proximity fuze has been developed for PFF (Performed Fragmentation) shell to be used in 40 L 70 gun. It is designed for effective use against air targets.
FB-40 fuze works in 3 modes:

1) *Proximity mode:* Automatic detects the target through RF transreciever section.

2) *Impact mode:* When the missile hits the target, percussion switch is pressed (when proximity mode is disabled).

3) *Self-destruction mode:* Automatic triggers the primary charge after 7-10 seconds.

III. FUZE FB-40 FUNCTIONING

In [1], at firing the shock beaks the ampoule of the battery, thus releasing the electrolyte liquid. The spin motion of the projectile spreads the electrolyte in the stacks causing the voltage to build up.

At this stage two independent safeties still prevent fuze functioning.

In [1] [3], *The mechanical S. & A.* provides a safety range exceeding 50 meter from the muzzle, which provides bore and trajectory safety.

In [1] [3], *The electronic trajectory* safety is implemented by an electronic timing circuit which inhibits the firing circuit during the initial part of the flight; corresponding approximately to 300 meters.

The RF unit transmits a CW (continues wave) signal. Any reflective surface in the surrounding area sends back part of the impinging energy to the fuze. Due to the well-known Doppler Effect the reflected wave is received by the fuze with a frequency shift which is proportional to the relative velocity between the fuze and the reflective object.

All three modes have equal priority. Whichever occurs first is responsible for fuze firing. The self-destruction function is affected by an electronic timer and takes place after 8.5 seconds of flight with 1.5 second tolerance. The impact function is due to the deformation of the fuze nose upon percussion which closes a mechanical switch acting as an electric contact.

IV. FUNCTIONAL STRUCTURE

Some tests performed on automatic test equipment are:

- System self -test
- Card slot position
- FUZE contact test
- Protection test

V. LABVIEW SOFTWARE

LabView is a program development application [2], much like various commercial C or BASIC development systems, or National Instruments Lab Windows. LabView uses a graphical programming language [2] [4], G, to create programs in block diagram form. LabView also contains application-specific libraries for GPIB and serial instrument control, data analysis, data presentation, and data storage. LabView includes conventional program development tools, so you can set breakpoints, animate program execution to see how data passes through the program and single-step through the program to make debugging and program development easier.

LabView programs are called virtual instruments (VIs) because their appearance and operation imitate actual instruments. The following are descriptions of VI features.

1) VIs contains an interactive user interface, which is called the front panel, because it simulates the panel of a physical instrument.

2) VIs receives instructions from a block diagram, which you construct in G. The block diagram supplies a pictorial solution to a programming problem. The block diagram contains the source code for the VI [2].

3) VIs uses a hierarchical and modular structure. You can use them as top-level programs, or as subprograms within other programs or subprograms. A VI within another VI is called a subVI. The icon and connector pane of a VI work like a graphical parameter list so that other VIs can pass data to it as a subVI [2].

VI. CODING AND RESULT

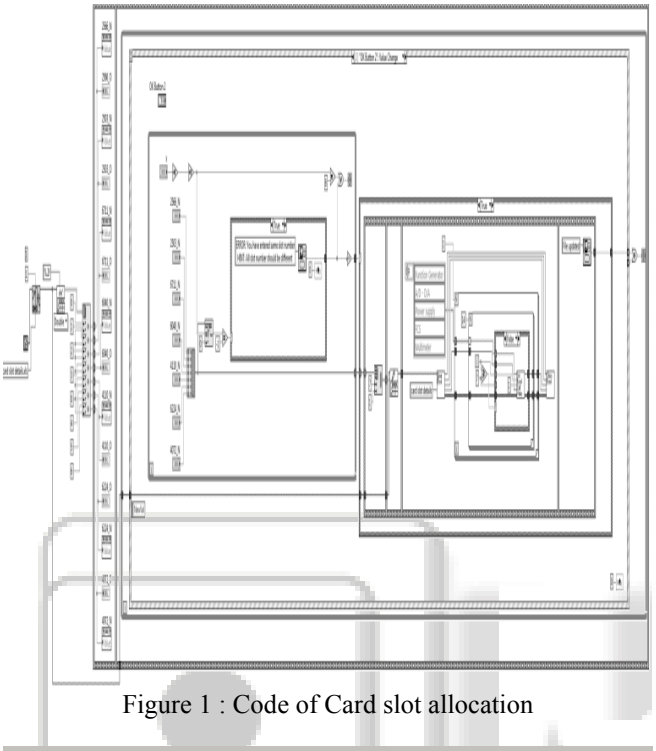

Figure 1 : Code of Card slot allocation

Fig. 2 : Output of Card slot

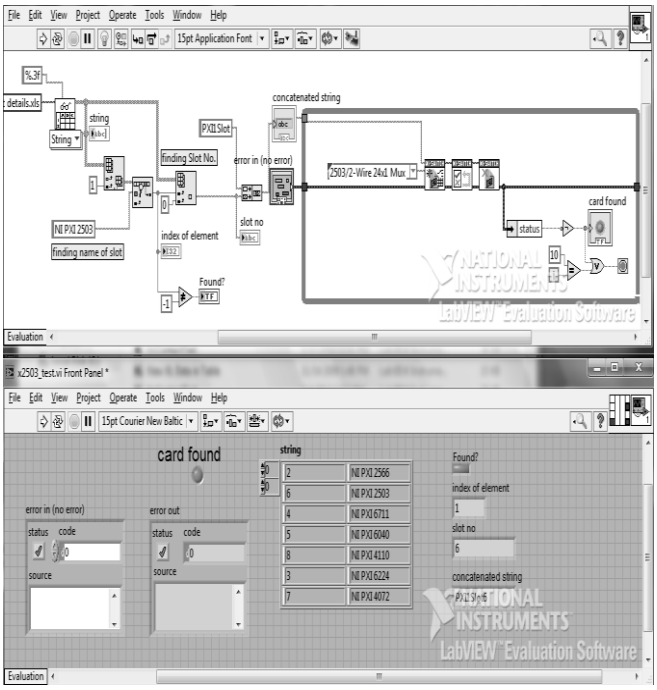

Fig. 3 : Code and result of verification particular card

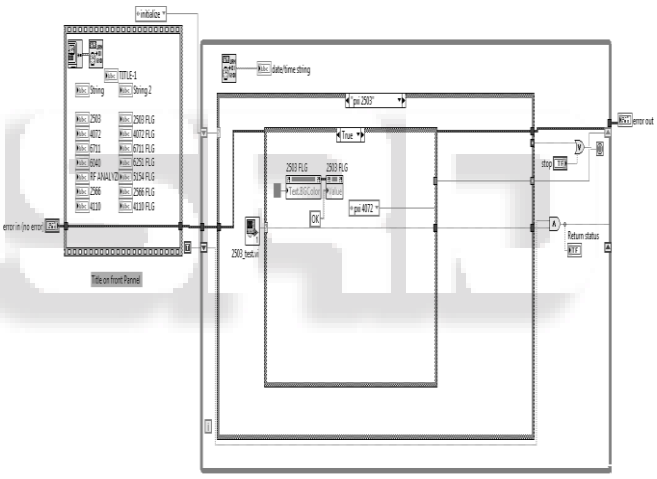

Fig. 4 : Device status program

Fig. 5 : Result for device status VI

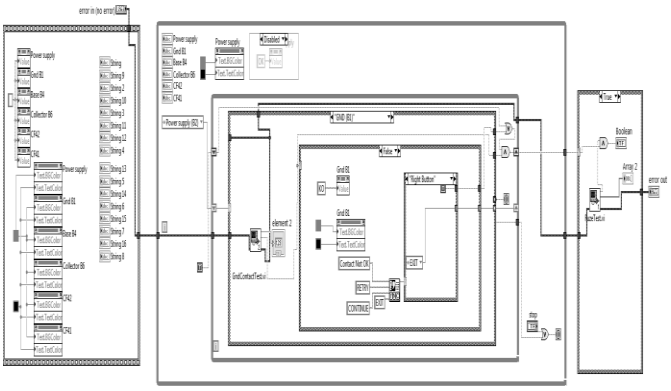

Fig. 6 : Code of FUZE contact test

Fig. 7 : Result of FUZE contact test VI

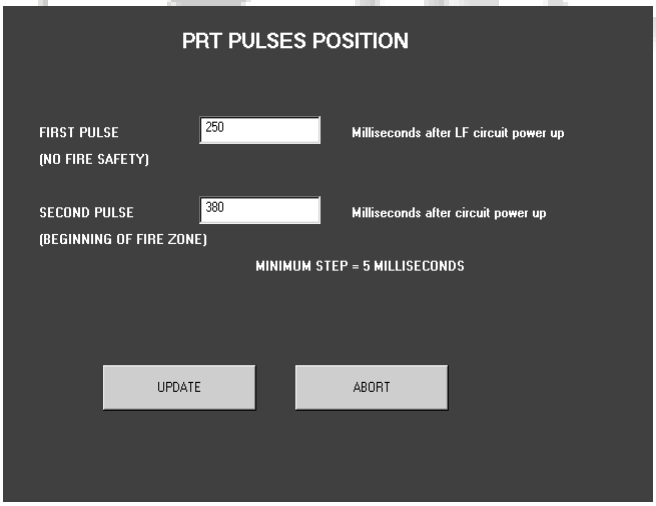

Fig. 8 : Defining Protection pulse

VII. CONCLUSIONS

In this paper, designing of real-Time embedded control for automatic test equipment and Real-Time Modules of LabView software for testing FB-40 FUZE via different NI DAQ cards.

LabView into automations not only makes it easier to design but also increases the accuracy and speed of the system. At the end of the discussion, we can conclude LabView has many advantages over embedded system but it is the cost which has restricted LabView to only large scale applications.

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