VELOCITY OF DETONATION

[1]T.KUNDAN KUMAR, [2]V.SHIVA PRASAD, [3]K.SRIDHAR, [4]T.PRASHANTH, [5]MUDASAR BASHA
[1]STUDENT, [2]STUDENT, [3]STUDENT, [4]STUDENT, [5] ASSISTANT PROFESSOR
[1]ELECTRONICS AND COMMUNICATION DEPARTMENT,
[1]B. V. RAJU INSTITUTE OF TECHNOLOGY, NARSAPUR, INDIA.

Abstract: The rate at which the detonation wave travels through an explosive column is the Velocity of Detonation (VOD). It is one of the most important properties of explosive on which its performance is dependent. In this paper design and execution of VOD measurement unit is discussed. This unit has to be compatible with sensor designed earlier and has to work in synchronism with the detonation wave as sensed by the sensor in real time. A high speed event capturing unit based on high frequency stable clock, signal accession hardware to capture fast rising/falling edges of the event and long line driving capability are some of the basic requirements of the unit.

Index Terms **– Detonation, sensor, event capturing.**

- **Introduction**

The combustible are characterized by their possessions such as strength, density, velocity of detonation etc. It is the most important property for selection of explosives. Velocity of detonation is specified by combustible produce in their product literature. Usually these VOD values are based on the measurement in laboratories. A depletion in the VOD will produce a reduction in the ignition pressure as well as in the availability of the shock energy of the combustible. It is important that the combustible explode at its optimum rate and induces sufficient detonation pressure leading to good detonated. In the VOD meter whenever, the start and stop interrupts occurs the, it calculates the velocity of the detonator. In this project the event is stored in the flash memory of the controller, with the help of the RS 232 cable the event report can be send to PC. In the VOD before the event, we need to find the probe distance because; by varying of the probe distance the velocity of detonator also changes.

- **Objectives of the study**
  - To measure VOD in blast holes in order to understand the effect of explosive compositions (for bulk), primer to base ratio (for cartridge explosives), hole diameter, water, contamination, primer location and size, sleep time etc.,
  - To rate the performance of different explosives and to evaluate the blast performance.

- **Proposed system**

In the VOD meter we used STM 32-f103 rct6- 32 bit microcontroller, LCD module and RS 232 cable. For interface with the LCD module we used the SPI protocol. When the detonation is started it will sends the interrupt to the microcontroller, then the delay time is calculated. By using the delay time we can find the velocity of the detonation. In the VOD meter we used the real time clock to make the log files of the detonator. By the log files we can find the date of detonation.VOD of any explosive is influenced by its chemical composition, diameter of the blast hole, confinement, temperature, degree of priming etc. VOD of commercial explosives falls in the range of 2500 – 5000 m/s. Point to point VOD systems are essentially start and stop devices which are based on an electronic timer. The first sensor cable (i.e. channels) starts a clock and the following channels stop the clock in cumulative time relative to the start signal or relative to each other subsequent channel. Points to point VOD systems are essentially start and stop devices which are based on an electronic timer. The first sensor cable (i.e. channels) starts a clock and the following channels stop the clock in cumulative time relative to the start signal or relative to each other subsequent channel.

- **Block diagram**
- **Hardware components**

Hardware components required are less, this makes the product low cost and low power consumption. The important hardware components are:

- Arm cortex 32 bit micro controller
- RS 232 cable
- Power adapter
- External memory

Micro controller: As the system doesn't have more interfacing, it is better to use low power and efficient micro controller like STM 32-f103 rct6 32 bit controller. It has in built flash memory of 8 MB which is used for storing the data. It has in built real time clock to monitor the event reports.

RS 232 cable: RS 232 cable is used for interfacing between the micro controller and the PC. The reports which are stored in the meter are transferred with the help of the cable and the event report is stored in the form of the log files as per the event occurrence.

- **APPLICATIONS OF VOD**
  - Evaluate the consistency of detonation
  - Study the influence of primer size on explosive performance.

- **CONCLUSION**

A variety of equipment and measuring techniques for VOD are now commercially available. However, only a limited number of field investigations have been carried out. The measured VODs can be used to evaluate the performance of explosive, to determine minimum primer requirements, to confirm whether detonation, deflagrations or failures have taken place.

- **REFERENCES**

- "EVALUATION OF EXPLOSIVES PERFORMANCE THROUGH IN-THE-HOLE DETONATION VELOCITY MEASUREMENTNATIONAL INSTITUTE OF ROCK MECHANICS" (An Autonomous Research Institute under Ministry of Mines, Govt. of India) Champion, Kolar Gold Fields, Karnataka, India.
- Aruna D. Tete, Amol Deshmukh, R.R.Yerpude "Design and Implemen- tation of Sensor for Velocity of Detonation Measurement "(IOSR-JEEE) 2320-3331, Volume 9, Issue 3 Ver. I (May – Jun. 2014), PP 77-83 IJSER
- Edwin M.Chan, Vivian Lee, Samuel P. Mickan, Phil J. Davies "Low cost optoelectronics devices to measure velocity of detonation", Proceedings of SPIE Vol. 5649(SPIE, Bellingham, WA,2005) [3]. M. Pradhan, "Effect of Charge Temperature on the detonation Velocity of Bulk Emulsion Explosives" IE(I) Journal-MN vol.90, August 2009.
- "Evaluation of explosive performance through in-the-hole detonation velocity measurement" by National Institute of Rock Mechanics August 2001.
- J.Benterou, E. udd, P.Wilkins, F.Roeske, E.Roos, D.Jackson"In-Situ Continuous Detonation Velocity Measurements using Fiberoptic Bragg Grating Sensors"