Programmable Generator of External Triggering Signal
For Dantec PIV Timer Box 80N77

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Abstract – The Programmable generator of external triggering signal facilitates the automated recording of (quasi-) periodic or repeated physical processes. The device allows for the unmanned activation and tracking of the physical process and the control of connected recording system. The device automatically changes selected record parameters in a sequence of repeated measurement steps.

Keywords - synchronizer; recording; measurement; particle image velocimetry

I. INTRODUCTION

Particle image velocimetry (PIV) is a whole-flow-field technique providing instantaneous velocity vector measurements in a cross-section of a flow. The measurement consists in camera recording (high-speed digital cameras are usually used) of tracer particles added to the flow and illuminated by means of a laser in a plane of this flow at least twice within a short time interval (see e.g. [1]). If the air flow is investigated, oil drops of size from 1 µm to 5 µm are usually used as the particles being traced. The camera recording and the laser illumination have to be synchronized.

In the double-frame PIV variant the investigated area (the slice of the volume where the tracer particles are randomly distributed) is repeatedly illuminated by a pair of laser light pulses and corresponding images (frames A and B) are recorded using the camera, see Fig. 1. The time interval Δt between the A and B frames (see Fig. 1) should be adjusted according to the average flow velocity, the interrogation area size (see [2]), and the properties of the optical system being used. The double-frame images sequence forms the acquired datasets (one measurement, labeled as “image ensemble” in Dynamic studio database) [2]. Displacement vectors used for velocity field calculation are determined and calculated using a special correlation algorithm on the A-B pairs (see e.g. [1, 2] for further explanation and commentary). The double-frame PIV variant was used for the measurements described bellow.

The Dantec PIV system equipped with the Timer Box 80N77 synchronizer unit was used for the measurements. The synchronizer unit serves for the camera and laser synchronization. With the aid of the Dynamic studio control and analysis software version 3.41 the system allows several synchronization setups [2].

In the External synchronization mode with internal trigger the internal trigger rate is derived from the external Sync signal (External trigger signal connected to the Timer Box Input port 1), see Fig. 1. However, only a constant Trigger delay (the delay between the external trigger signal and the first laser light pulse, see Fig. 1) can be selected for each measurement.

When a slow laser (double pulses repetition rate is in the order of tens of Hz) is used for a continuous recording of a (quasi-) periodic flow, it is necessary to carry out multiple measurements with gradually changing trigger delays. Even with the use of the Acquisition Manager (which is part of Dynamic studio software, see [2]) the total acquisition time is long (after each measurement the acquired datasets are saved to the database and a new initialization takes place), there is a risk of operating errors possibly resulting in the necessity of measurement repetitions, and the datasets structure of the measurements (ensembles) is not suitable for subsequent processing in the Dynamic studio (version 3.41).

Using the Programmable generator of external triggering signal (connected to the Timer Box Input port 1) producing an appropriately defined sequence of triggering pulses, the investigated flow can be recorded and saved as a single measurement (datasets)