MICRO-EPSILON

Test rig for pneumatic actuator

As an alternative to hydraulic cylinders, the company Festo has developed a so-called muscle (Fluidic muscle), which is intended to compensate for the inadequacies of hydraulic cylinders. A muscle does not consist of metal, but rather of a rubber-based material. It has the shape of a tube and is closed off at both ends. One end is firmly anchored as with a hydraulic cylinder, the other end is fastened to the moving object. If the hose is filled with compressed air, it is drawn in and therefore becomes shorter. Similarly, it also applies a force to the object to be moved.

To test the muscles a test rig has been developed by Micro-Epsilon in cooperation with Festo in order to obtain various characteristics. Figure 1 illustrates a muscle on the test rig.

Fig. 1 Test rig for the measurement of pneumatic actuators.

System set-up

On the test rig a laser-based optical sensor of the series optoNCDT 2200 from Micro-Epsilon is fitted which acquires the contraction of the muscle. A force transducer measures the forces arising, whereas a pressure transducer is inserted in the tube to determine the pressure. The software has been developed with ICONNECT and consists of over 200 modules. These three signals are read into ICONNECT via a measurement card. Since the dynamic system response is of the order of a few Hz, a sampling rate of 1000 Hz is selected. The block size is 256 values.

Apart from the three measured quantities of displacement, force and pressure, two others were determined: one was the velocity and the other the acceleration of the contraction. First, the signals were converted (scaled) in the desired value range. In the next stage they were zeroed with the autozero parameters, i.e. offset within the value range. The measurement parameters indicate which signals are to be recorded. Channels not required are masked out.

The two quantities of velocity and acceleration were found by numerical differentiation of the displacement signal. First however, smoothing is necessary by a low-pass filter, because for technical reasons the measured signal is slightly noisy.

Since the data recording occurs at a substantially higher sampling rate than can then be displayed, the five signals are reduced by resampling. Finally, they are collected in a data buffer and output to the two visual representations.

Application

In the visual display the measured and calculated values are displayed as curves, as can be seen in Figure 2. On the right side statistical values are calculated for each signal. These are composed of the minimum, maximum and mean.
The display can be printed out or exported as an image file (JPG). The raw data can be exported in an Excel data base for further analysis.

In order to find and document the interesting points after the measurement, the signals can be evaluated off-line. In the off-line evaluation mode scrolling, skipping and zooming over the whole measurement anywhere in the time spectrum is possible using cursors and slide controls. In this regard the statistics are always updated over the current display range and it is also possible to export any section.

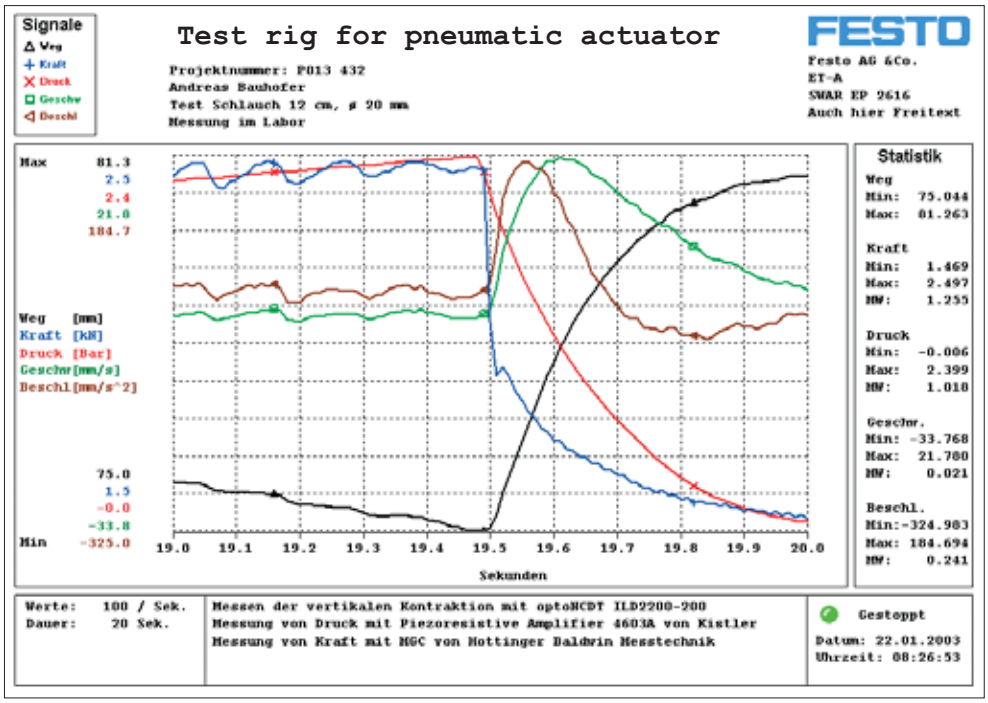

Fig. 2: Visual display of the test rig.