

ValveExpert 3.3

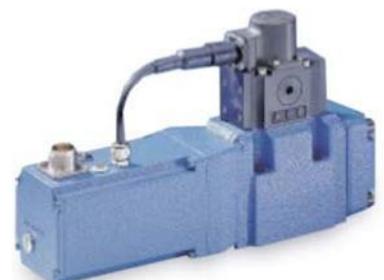
Automatic Servovalve Test Equipment



Introduction

ValveExpert 3.3 was developed to test servovalves and proportional valves. A recent and well-thought computer technology is used to test 4-way flow control valves with a flow up to 80 L/min and pressure up to 350 bar. The user will be guided with graphic help on the screen. The test results can be saved on the computer and printed out.

Shall you have to test servovalves or proportional valves; the test-rig ValveExpert offers you practically a full laboratory in a small space and at lowest cost.



Features

Plug and Play

This saying describes well the nature of this test stand. The user connects the test rig to a Hydraulic power supply and switches on electric power. He mounts a servovalve to be tested. That's it. Few minutes later test results are available, ready to be printed out or saved.

Fully automatic test

Beside the possibility to test a valve manually, the operator of the test stand can perform a fully automatic test. The operator enters the model number of the valve to be tested, he pushes the "run" button and approximately 5 minutes later he receives 3 to 4 pages of test results which he can save or print out.

No skills

The user is guided thru graphic displays. No sophisticated skills are required. The operator shall only have some basic knowledge in how to use Windows and as well some knowledge how a servovalve works.

Closed loop system pressure control

Thanks to a closed loop pressure control system with a servovalve, the system pressure is accurately controlled throughout the test process.

Repeatability

The used pressure transducers have a long-term stability of less than 0.1% FS. A high precision flow-meter is used to determine the flow. The accuracy of the flow meter is $\pm 0.3\%$ of the measured value.

Reliability

- The flow meter is used in very clean oil and enjoys a long and reliable live time.
- The switching valves, transducers and filters are mounted on a manifold. Very few fittings decrease the probability of external leakage.

Low cost

- The installation is restricted to the connection to a hydraulic power supply.
- Low dimensions of the stand save floor space.
- ValveExpert is a low cost device.

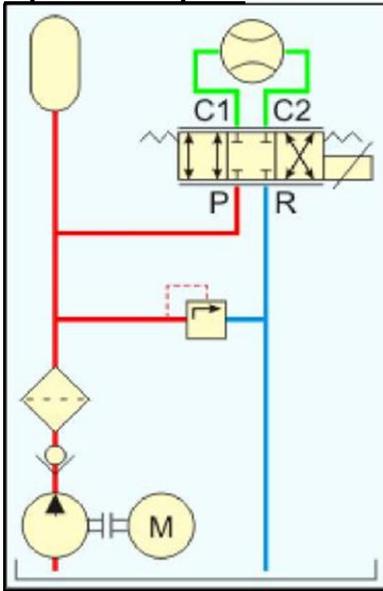


ValveExpert 3.3 in a labor

Hydraulic Configuration

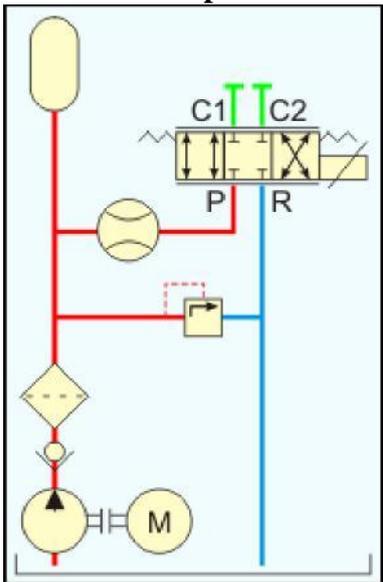
There are many different analyses and test procedures for servovalves and proportional valves. For certain aerospace servovalves some 20 pages of data sheets have to be produced. The test rig as here described may produce 7 different plots as well as the analysis of the characteristic specification values as bias, leakage, symmetry, linearity, pressure gain, the maximum and minimum flow values etc. To produce these plots and measurements two different hydraulic configurations can be selected:

Open control ports



With this configuration the flow of the servovalve will be determined. For most servovalves the flow is defined for a valve pressure drop of 70 bar (1000psi). For the flow test, the flow-meter is connected to the control ports and the system pressure will be set at 70 bar. Valves equipped with a position transducer on the spool and internal electronics, the spool position will be measured at the same time as the flow.

Closed control ports



To measure the differential pressure and the internal leakage, the control ports will be closed. Valves equipped with a position transducer on the spool and internal electronics, the spool position will be measured at the same time as the differential pressure and leakage. All two or three plots, differential pressure, leakage and spool position will be obtained by a single test run.

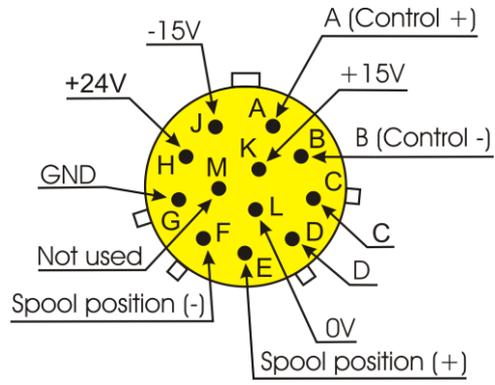
All control valves, pressure gauges, the flow meter and the filters are mounted on a single manifold. This way, a minimum of pipes and fittings are used which reduce the probability of external leakage.

A filter with a 10 micron high pressure element is used as a "last chance" filter. Indeed, the test rig will be connected to a power supply which shall be equipped with a filtration system assuring the pollution class 5 of NAS1638 or better.

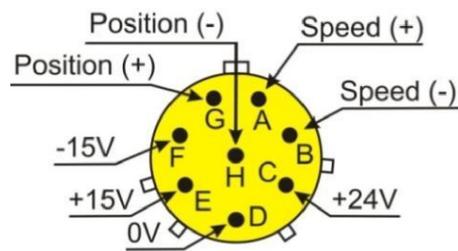
Miniature fitting connections are available to access the supply pressure and the two load pressures. Such a miniature fitting connection can also be used to feed a separate pilot stage with the supply pressure. All maintenance work on the hydraulic equipment can be performed from three sides of the test rig. Verification of the accumulator pressure and loading, exchange of filter elements, verification of various pressures via miniature fittings etc., all this is of easy access.



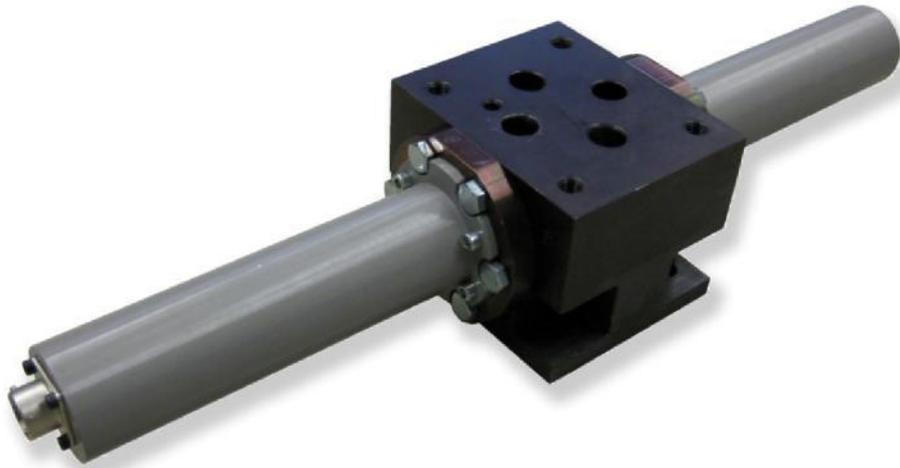
Main hydraulic manifold



Main connector



Connector for frequency response cylinder

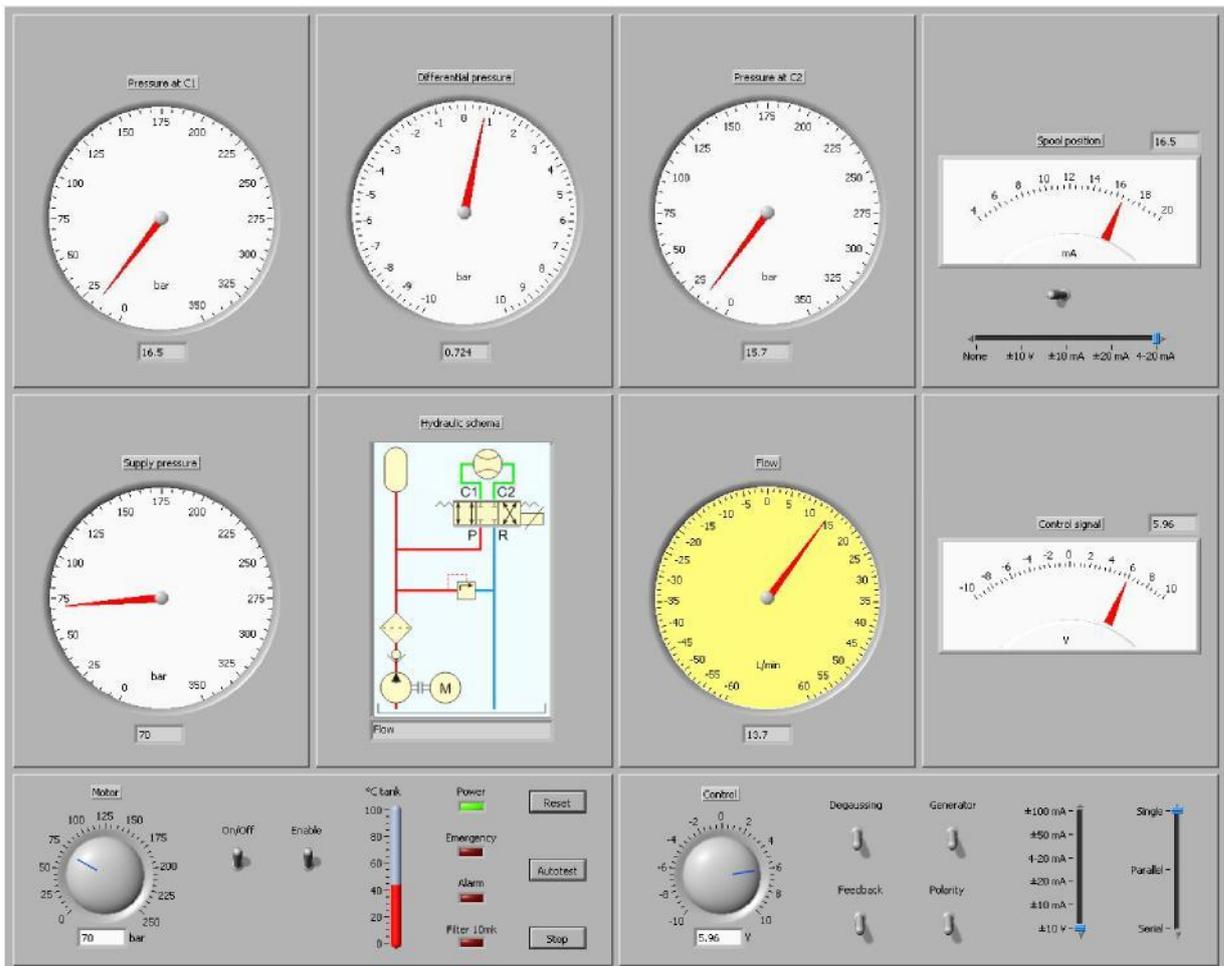


Frequency response cylinder (optional)

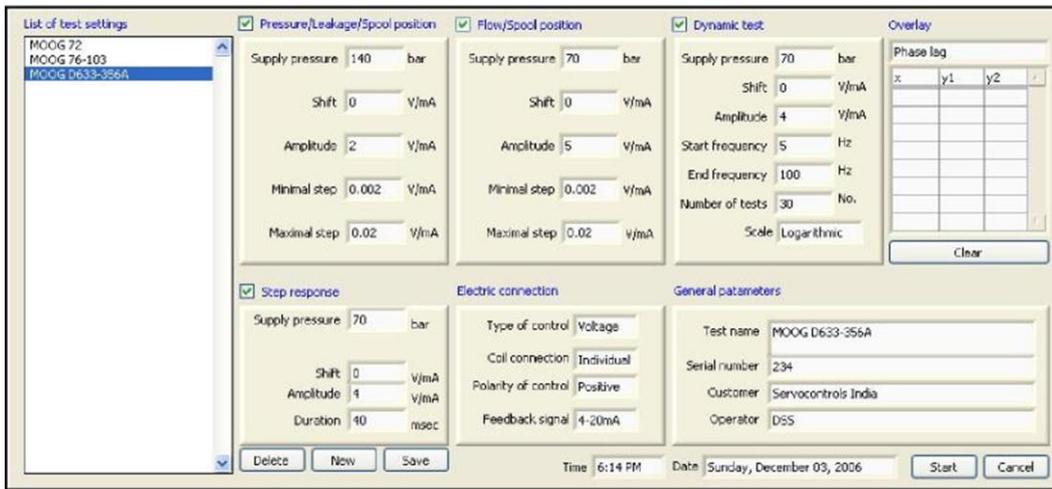
Manual Test

By calling the manual test, the 19" monitor shows the picture below. You have virtually a full laboratory on your disposal.

- Four manometer can be individually changed to a different scale....250 bar, 100 bar or 20 bar.
- Flow measurement instrument can be configured to a different sensitivity. Also shows digital indication.
- Two voltmeter / ampere meter, one for the servovalve control signal, the other for the spool position signal of valves with electric feedback. Digital indication of the current values.
- Analog oil-temperature indication.
- Two different hydraulic configurations can be selected as control ports open or closed.
- The control panel allows setting the system pressure and the servovalve control signal either analogue per "potentiometer" or digital per key-board. Selection of the servovalve connection whether series, parallel or individual configuration. Selection of the sensitivity of the servovalve spool position signal.
- Particular attention shall be paid on the "Feedback" control. The adjustment of the Null of servovalves with conventional test equipment is often painful. Not so with ValveExpert: a mouse click on "Feedback" and the servovalve under test searches automatically its hydraulic null in a closed loop mode. Now, the null can be adjusted to zero control signal or to any other predefined value while the feedback function keeps the servovalve at hydraulic null.

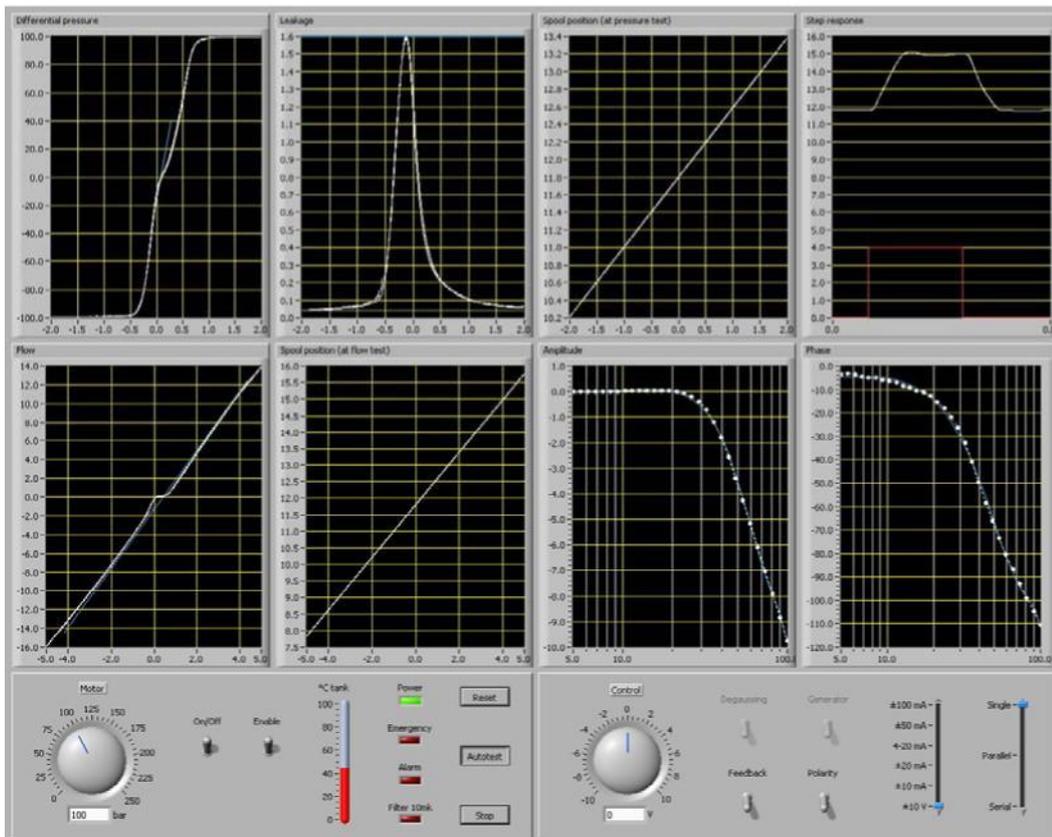


Automatic Test



In the data base are memorized the various servovalve specifications. For recent servovalves or proportional valves, the valve specification usually figures on a valve-label in a key form and with help of the product catalogue the valve parameters can be defined. If the label or the catalogue is not providing this information, it has to be asked for from the valve supplier.

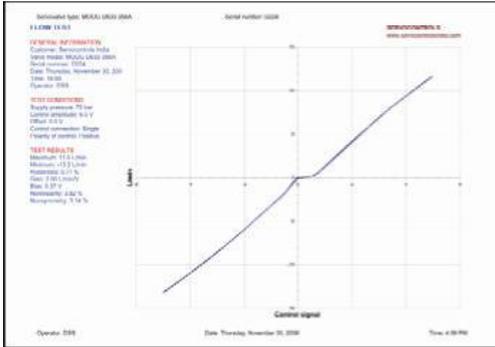
The operator calls up the program. He enters the model number of the valve to be tested. Then he enters the valve serial number, the customer name and his own name. He has also the option to choice for various test modes as for example static test without the flow test or dynamic test etc. On the command "Start", the test proceeds automatically. After 5 minutes the program terminates and the operator can analyse the test results. One great feature is that the test results can be memorized in the computer, called back any time, and be evaluated in the desired units.



During the test process, the results of the measurements are shown on the screen as they are obtained. If eventually the results shown on the screen do not satisfy the valve specifications, the test can be aborted by the operator.

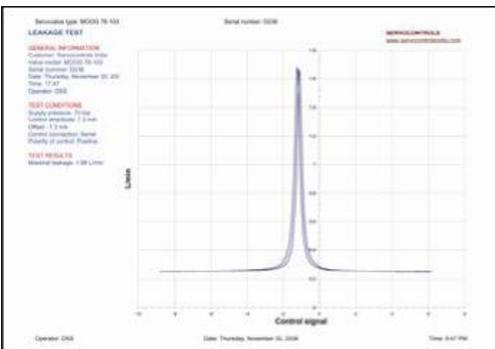
Evolution of the static performance (printout of the test results)

All measurements are loaded into an Excel file. These Excel files contain also the templates for the printouts as shown here below:



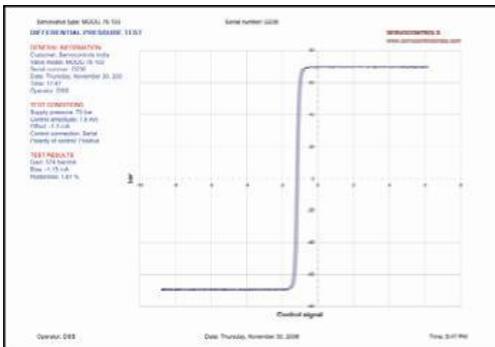
Flow test

This diagram shows the results of the flow measurement. Such a curve allows identifying some malfunction of the servovalve like nonlinearity, high hysteresis due to contamination or abnormal wear of the feedback ball (in specialist jargon: ball glitch).



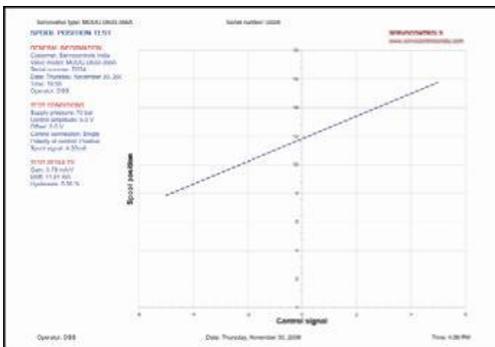
Leakage test

This diagram shows the leakage flow of the servovalve in relation to the input signal. The augmentation of the leakage around zero corresponds to the leakage of the valve spool. A higher value of this increased leakage flow gives indication on wear of the spool edges. The low values on right and left correspond to the leakage flow of the pilot stage. A non-symmetry of the first stage leakage is an indication of a damaged seal.



Differential pressure

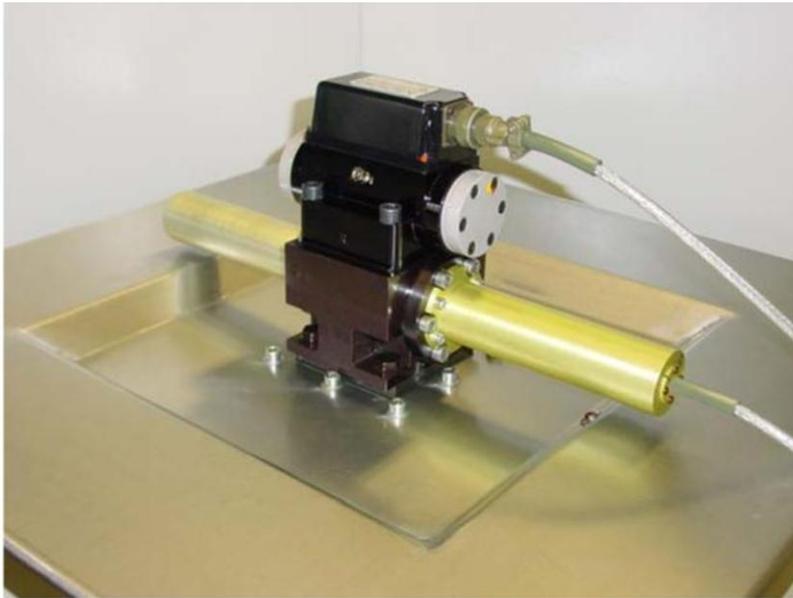
This diagram shows the pressure gain of the servovalve. This information is seldom used, and if required, then usually the curve around zero.



Spool position

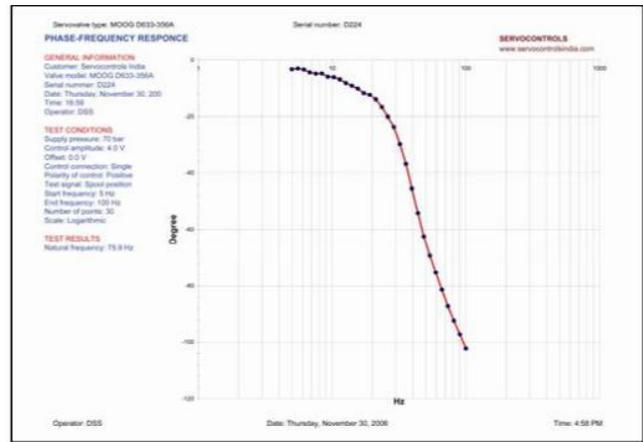
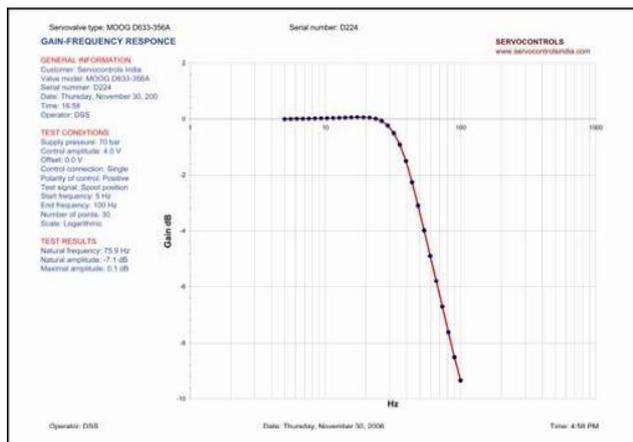
This diagram shows the spool position of a valve with electric feedback. This is an important diagram. For larger servovalves or proportional valves the spool position of the valve is often controlled in a closed loop position mode. A position transducer is used of which the output signal is foreseen on the connector of the valve. As big valves usually have a very high flow which would require very high hydraulic energy to be tested, it is sufficient to control the proper function of the accurate spool positioning. For such valves, flow will only be checked around zero (up to 80 L/min with ValveExpert).

Evaluation of the dynamic performances (optional)

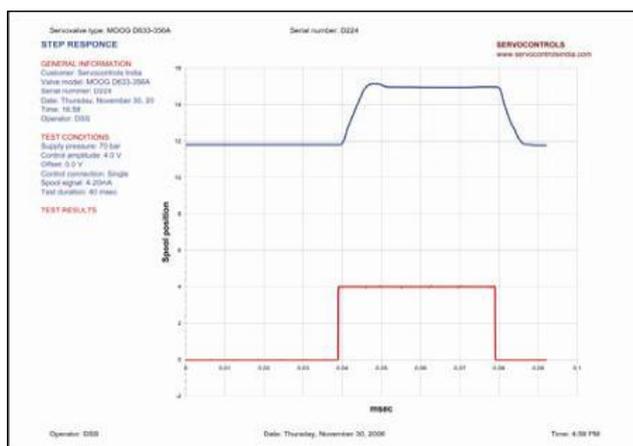


To evaluate the dynamic performances of a mechanical feedback servovalve, a frequency response piston has to be mounted below the valve under test (option). The piston is equipped with a position transducer which allows controlling the piston in its mid-position and a velocity transducer for the flow measurement. For electric feedback valves such a frequency response piston is not necessary as the signal of the spool position can be used for the dynamic evaluation.

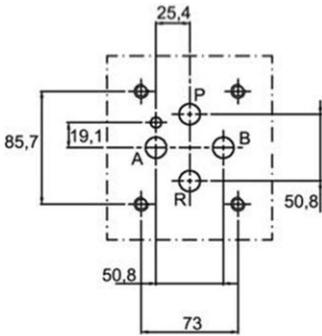
The results of the dynamic tests are represented in a Bode diagram as it is usually done by the servovalve manufacturers. The black points on the diagram show the actual measured values.



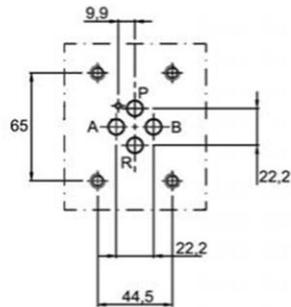
The step response can also be determined.



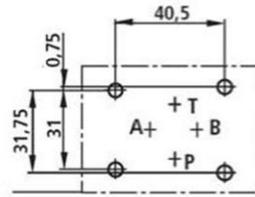
Accessories (optional)



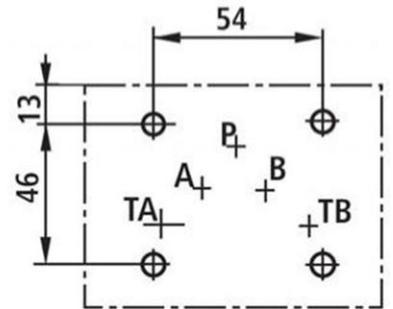
Norm ISO 10372-06-05-0-92
This corresponds to the basic port pattern on which can be mounted additional adapter manifolds.
The base port pattern is compatible for following servovalves:
MOOG X072,
MTS 252.3x,
STAR 8XX
ULTRA 4550
(with internal pilot)



Norm ISO 10372-04-04-0-092
For following servovalves :
ATCHLEY 209,
MOOG X062,
MOOG X073,
MOOG X076,
MOOG X760,
MOOG X761,
MOOG X765,
MTS 252.2x,
PEGASUS 122A,
REXROTH 4WSE2EM10A-45
STAR 5XX
ULTRA 4653,
VICKERSS M4-20,
VOSKHOD UG176
(with internal pilot)



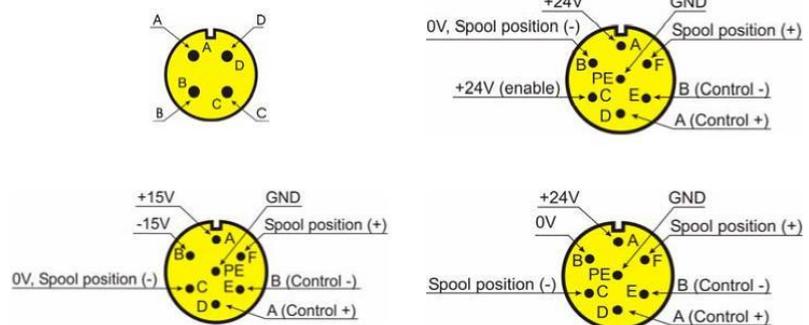
Norm ISO 4401-03-03-0-94
Norm NG6
For following servovalves:
MOOG D633
REXROTH 4WRAE
REXROTH 4WREE
REXROTH 4WRSE
REXROTH 4WRSEH
VOSKHOD 133



Norm ISO 4401-05-05-0-94
Norm NG10
For following servovalves :
MOOG D634
MOOG D661
REXROTH 4WRAE
REXROTH 4WRDE
REXROTH 4WREE
REXROTH 4WRGE
REXROTH 4WRKE
REXROTH 4WRSE
REXROTH 4WRSEH
REXROTH 4WRTE
REXROTH 4WRZE
STAR 1652R



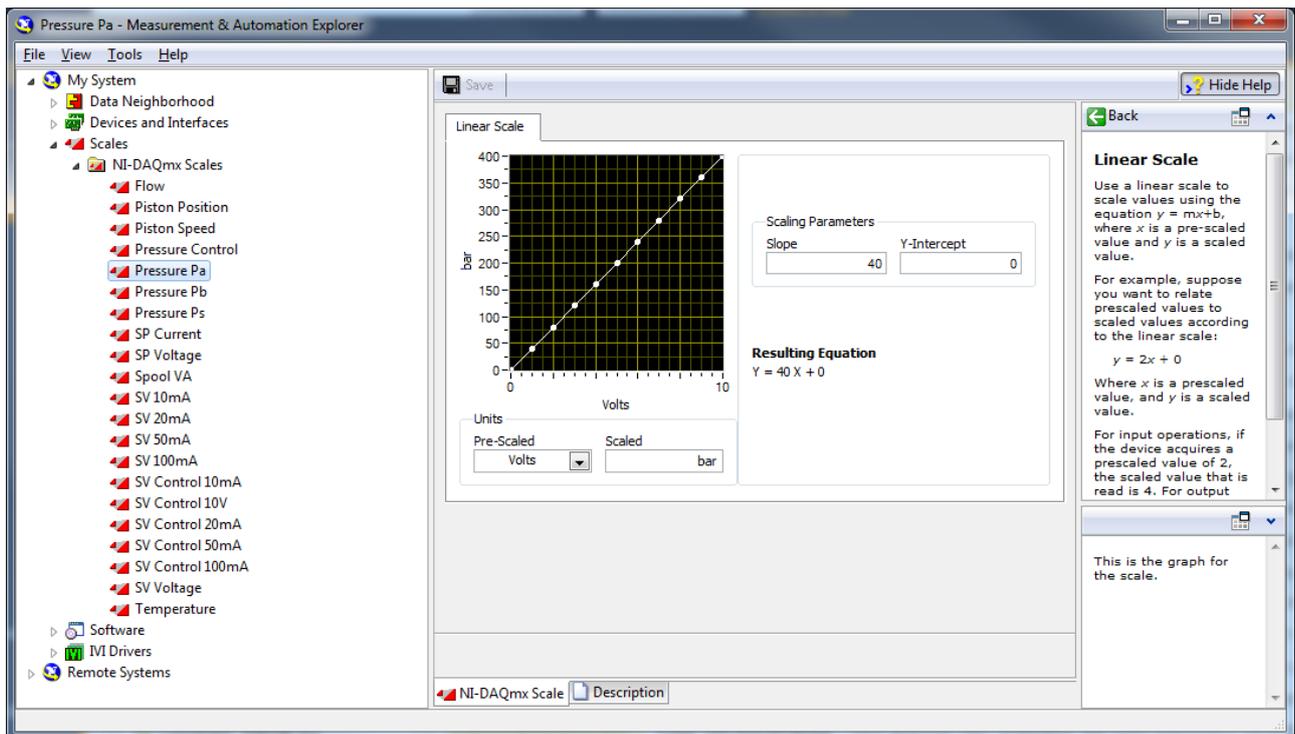
Standard adapter manifolds



Standard electric cables

Calibration process

Test system ValveExpert has robust and precision transducers which are factory pre-calibrated. Nevertheless, all transducers of the test stand can be simple recalibrated by an operator. In order to calibrate a transducer the operator has to use Measurement & Automation Explorer (MAX). This National Instruments software can use different formulas for calibration and can choose any physical units for pressure, flow, temperature and so on. In order to calibrate a transducer the operator has to correct the correspondent scale. The example below shows a linear scale which calculates pressure from voltage.



Measurement & Automation Explorer