USER MANUAL

Valve System Test Centre

DTC-UM-001

Revision: 6

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1   General

This manual covers software version:

Software for VSTC unit:
Software ID: DTC-SW-002
Software Version: 1.01

This manual covers hardware revision: Rev. 1

Software for PC:
Software ID: DTC-SW-003
Software Version: 3.05

1.1   Safety instructions

For a safe use of a VSTC, the following must be observed. The VSTC must only be used by qualified personnel who are familiar with the national and international laws, directives and standards that apply to this product as well as all instructions in this manual.

The information in this user manual is subject to changes without notice.

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2 Application

Val Controls Valve System Test Centre (VSTC) can do On/Off and Modulating test of all types of hydraulic and pneumatic controlled valves, linear, rotary, spring-return (SR) and double-acting (DA) actuators on the market.

The product is designed to be used in a workshop or in the field and connected directly to the valve system. All connections are easy to connect and disconnect. With this product, it is very easy to store all data from a valve system and create signatures for the valves.

The VSTC is connected directly to a PC and all set up and storing of data is done from the PC. Software for signature and report generating is included in the VSTC.

All configuration is done on the PC and the VSTC is only for connecting equipment.

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3　Specifications

3.1　Environment

Temperature range: –20 to 50 ˚C
Relative Humidity: < 95% (No condensation)

3.2　Terminals

Quick terminals:　　　　　For 4mm banana plugs and wire
4 poled connector:　　　　For distance sensor

3.3　Dimensions and weight

Dimension: L640mm x W505mm x H250mm
Weight: 9 kg

3.4　System requirements

Operating system: Windows XP (SP3), Windows 7
Programs: Microsoft Excel 2010

The user must be local administrator on the PC.

Minimum requirements for the hardware
Screen resolution: 1280 pixels times 960 pixels

Processor: Pentium 4 or equivalent
RAM: 256 MB, Disk space: 400 MB

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4 Electrical specifications

Power supply	
Power supply	20.4 – 27.6VDC
Power dissipation, no position sensor/loop or valves are connected.	< 2W
AI0, AI1, AI2, AI3, AI4	
External position loop max Rload	820 ohm @20mA and 16,4VDC
Operating area	4 – 20mA
Minimum span	12mA
Cable length	1000 meters
Linearity	< 0.1%
Temperature coefficient	0.01% / 1°C
Rin	< 100 ohm
Digital output – DO1, DO2, DO3; DO4	
Max load per digital output	up to 48W @24VDC
Max load total	up to 192W @24VDC
Digital input – DI1, DI2	
Type On/off	Normally Open or Normally Close
Type NAMUR	According to DIN19234
Cable length (unknown resistance)	20 meters
Maximum cable resistance	100 ohm
Analogue output – AO1	
Max load	550 ohm @20mA and 20,4 VDC supply
Linearity	< 0.1%
Temperature coefficient	0.015% / 1°C

Power supply
Must be connected to the connector or the terminals marked with Power Input 24VDC.
Please notice: Only connect one type of power supply at the time.

The power supply must handle the total Amp load of the equipment.
Max system load is 192W.

Position signal (AI0)
The position feedback must be from a 4-20mA loop powered transmitter.

Distance sensor (AI1)
Val Controls offers a Distance Sensor for measurement of travel of a valve system.
The sensor can be mounted on all types of linear valve systems.
With this sensor a very accurate signature can be easily made.

Pressure signal (AI2)
Passive 4-20mA sensor

Extra Analogue inputs (AI3 and AI4)
The 2 analogue inputs can be used for passive 4-20mA loops.

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Solenoid valve (DO1)
24 VDC output

Extra Digital outputs (DO2, DO3)
These outputs can be used for 24VDC solenoids or similar.

ESD solenoid valve (DO1)
This is for an ESD solenoid valve.

Open /Close switches (DI1 and DI2)
Normally open or normally close.

Control loop (AO1)
This is for Modulation Test and must be used by a 4-20mA loop.

X1/ X2 (N/A)
These 2 terminals can be configured by Val Controls by customer request.

Terminals
This is general for all terminals:
Red = +
Black = -

On/Off buttons
For all single inputs and outputs there is a 2 poled on/off button.
The button must be in off position, before connecting and disconnecting sensors.

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5 Software

5.1 Installation

Software for the program used to communicate with the VSTC must be installed on a pc.

5.2 VSTC installation

Unpack "DTC-SW-003 VSTC x.xx.xx.zip"
Run setup.exe
Follow the on screen instructions.

5.3 Installation of driver for USB to RS485 cable.

1) Unpack "FTDI - RS485 USB driver.zip"
2) Plugin the USB cable.
3) Follow the on screen instructions.
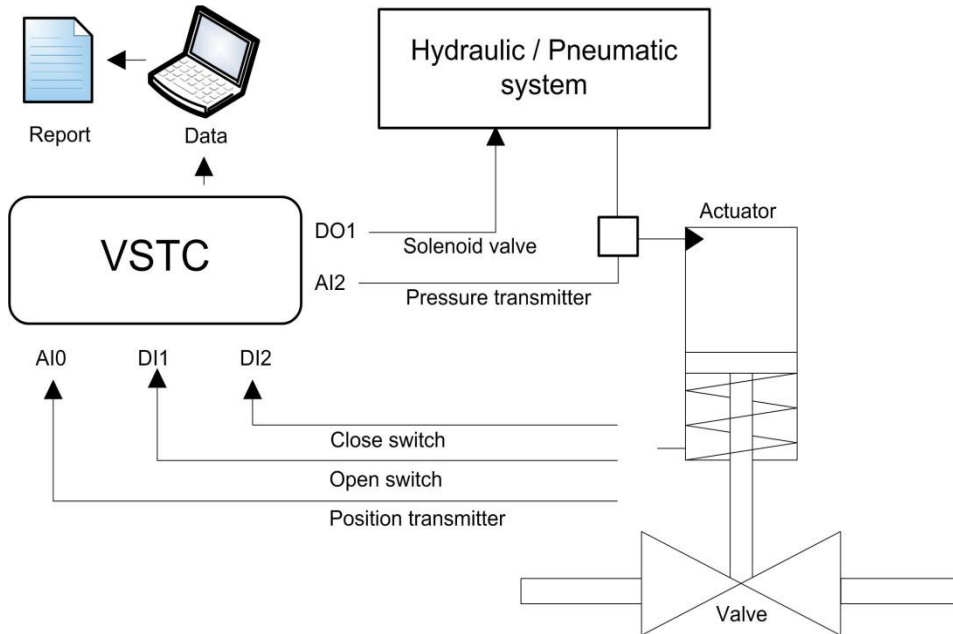4) When asked for a driver, point to the unpacked files.

5.4 Logging of signals

All connected signals will be logged automatically.

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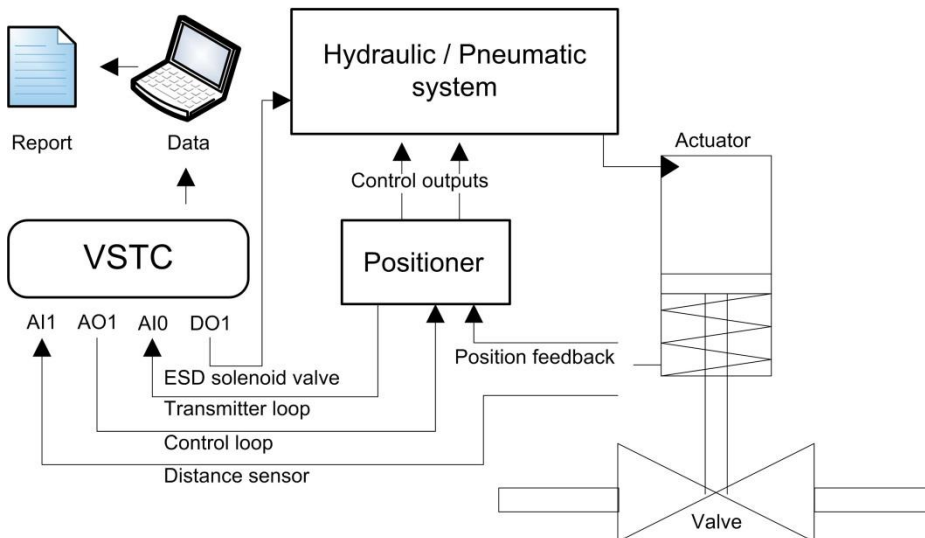
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6 Connection drawings

6.1 On/off system

Following drawing shows how to connect the VSTC to an on/off system:
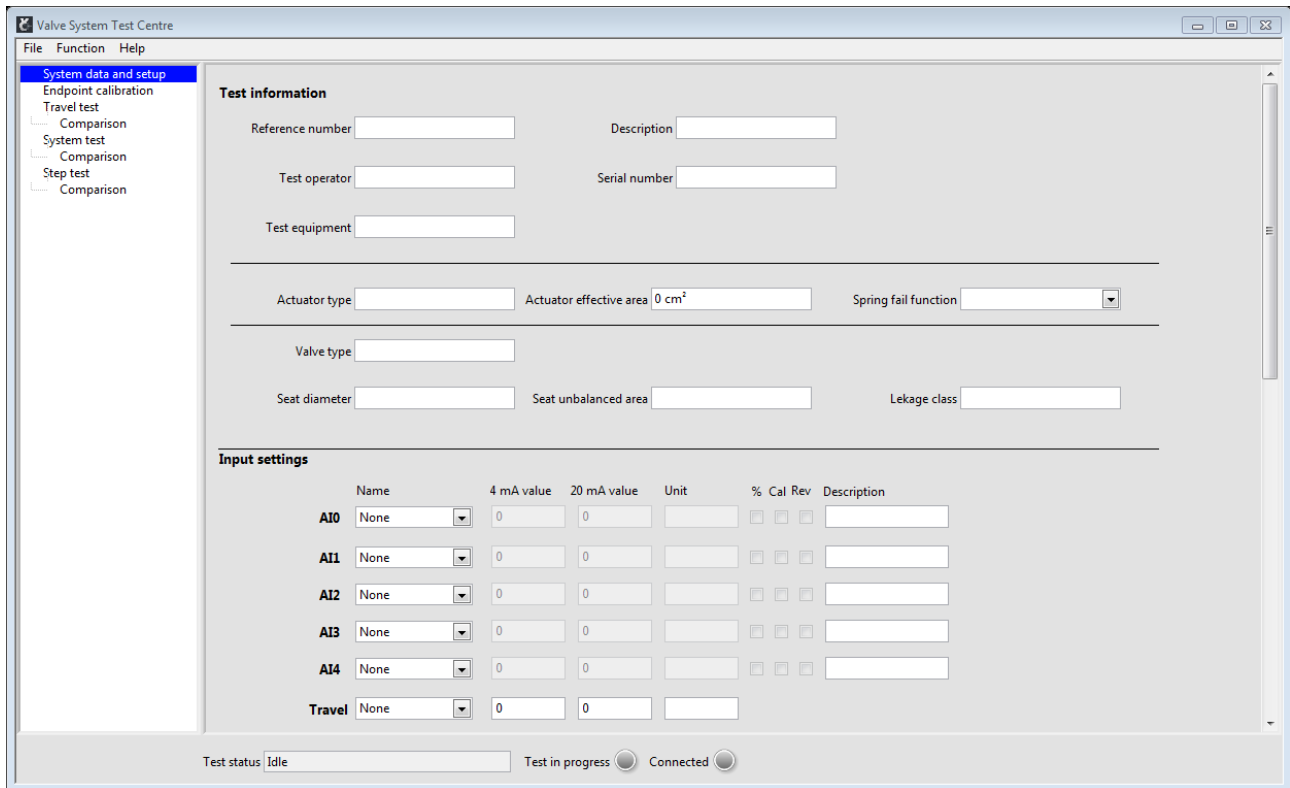
6.2 Modulating system

Following drawing shows how to connect the VSTC to a modulating system:

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7 Configuration

The system data and setup page

7.1 Test data

Reference:	Will be included in the report and saved file.
Description:	Will be included in the report and saved file.
Test operator:	Will be included in the report and saved file.
Order number:	Will be included in the report and saved file.
Test equipment:	Will be included in the report and saved file.
Serial number:	Will be included in the report and saved file.
Actuator type:	Will be included in the report and saved file.
Actuator effective area:	Used in calculation for friction
Spring fail function:	Used in calculation for friction
Actuator volume:	Will be included in the report and saved file.
Valve type:	Will be included in the report and saved file.
Seat diameter:	Will be included in the report and saved file.
Seat unbalanced area:	Will be included in the report and saved file.
Leakage class:	Will be included in the report and saved file.

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7.2 Input settings

To select the sensors to be used click on the box for the single analogue input. (AI). In the scroll down box you can select a sensor from the sensor database.
Please notice that sensors have to be created in the database. See section 9.
After a sensor has been defined, a description can be added and be shown in the report.

By filling the travel fields can the VSTC measure the travel and put the information in the report.

Travel: Selection of input and range for distance sensor

Invert: DI1 to DI4 can be inverted

7.3 Output settings

Control signal: Select the control signal to be either 4-20mA or digital output. The step test and deadband test always uses 4-20mA

AO1: Set the unit of the AO1, and the direction

Open/Close: Set the configuration of the digital outputs to open and close the valve

7.4 Test settings

Sample time: Set the sample time

Wait before start: Number of seconds test delay, before starting the tests

Actuator fill time: Maximum fill time of actuator. This controls the waiting times in the test where the actuator is being pressurised or de-pressurised

Position input: Selected sensor to be used as position input for calculation of data

Position deadband: Deadband around setpoint to start the travel time

Solenoid in loop: The endpoint calibration, stroke test and system test can be performed, with the solenoid in loop. That means the solenoids are not controlled directly but the state is measured on a digital input. The required action of the solenoid is shown to the use in the status line

7.5 Stroke test settings

Position reference input:

7.6 System settings

Pressure input: Selected sensor to be used as pressure input for calculation of data

Pressure wait: Stabilized pressure time

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7.7   Step settings

Position step deadband:	Dead band around the defined step
Ref. position input:	Reference input to be compared with selected position input
Steps:	Set up of steps

7.8   Life cycle settings

Position step deadband:	Dead band around the defined step
Ref. position input:	Reference input to be compared with selected position input
Number of cycles:	Set the number of times to repeat the steps
Steps:	Set up of steps

7.9   Deadband test settings

Test position:	Choose the centre of the test
Step:	Size of the steps
Step time:	Time to stay on the steps

7.10   Pressure test settings
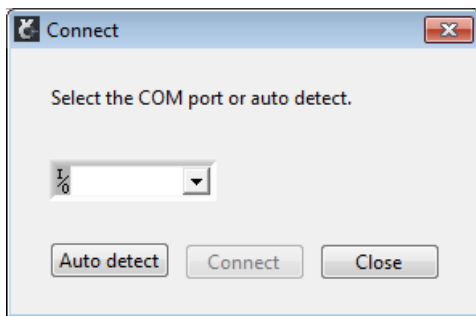
Test start time:	set the time before the start pressure is measured
Test duration:	Set time after the start time where the end pressure is meassured
Pressure 1 input:	Pressure sensor 1 input selection
Pressure 2 input:	Pressure sensor 2 input selection
Pressure 3 input:	Pressure sensor 3 input selection

7.11   Pressure switch test settings

Pressure input:	Input to measure pressure
Pressure switch:	Digital input to measure when pressure switch reacts

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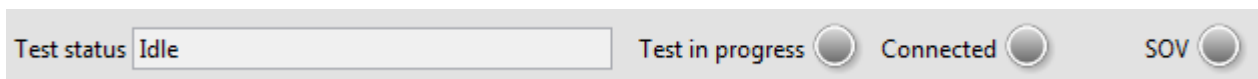vc@valcontrols.com • www.valcontrols.com

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8 Communication

Connect the USB cable from the VSTC to a PC, and go to "Funktion → Connect…"

Press auto detect and then connect.

In the status bar at the button of the screen will the connected LED start to light.
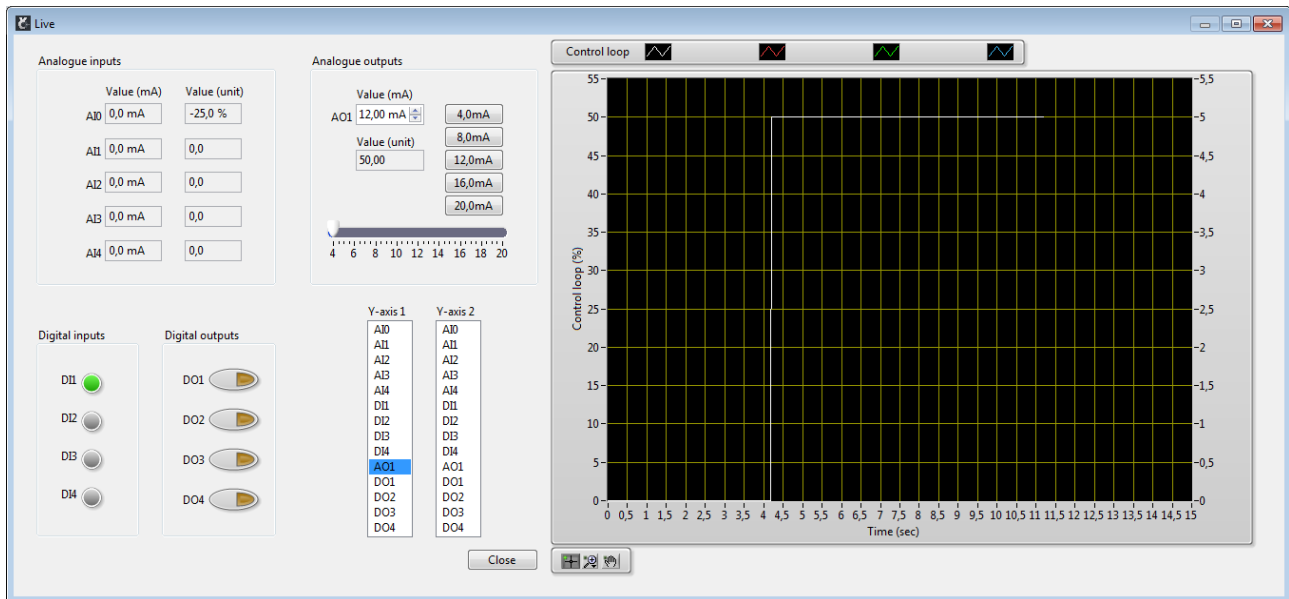
The status bar shows the following:

- Status for the tests
- Indication of test in progress
- VSTC connected to PC
- SOV request when testing with solenoid in loop

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9 Sensor database

The sensors database is locate under "Funktion → Sensor database…"

Name	4mA value	20mA value	Unit	%	Cal	Rev	Description
Laser	5,0	120,0	mm	Off	Off	Off	Laser
Transmitter	0,0	0,0	%	On	Off	Off	
Laser pct	0,0	0,0	%	On	On	Off	

Name: [   ] 4 mA value [0,00] 20 mA value [0,00] Unit [   ] % ☐ Cal ☐ Rev ☐ Description [   ]

[Delete] [Add] [Update]   [Close]

Name:	Sensor name
4 and 20mA value:	Range of sensors.
Unit:	Type of sensor units. (mm, Bar, % etc.)
%:	If the measurement is the position signal and must be in %.
Cal.:	Is only for position sensors which are not calibrated! (If 4mA = 0% and 20mA = 100% then this is not needed)
Rev:	For reversing signals.
Description:	Description of the sensor

10 Manual

In this menu the system can be tested manually.

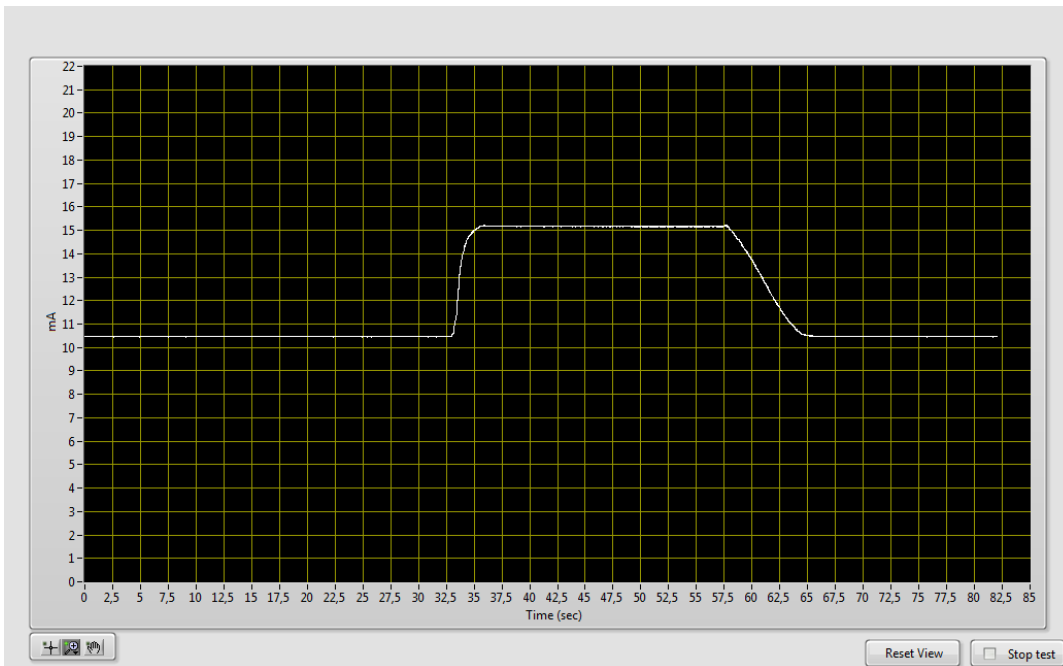|	
Analogue inputs:	Will show the actual value for the connected sensors.
Analogue outputs:	Set the analogue output 1. For modulating systems this is the control loop.
Digital inputs:	Will show status for connected digital inputs
Digital outputs:	Indication of status for solenoid valves. Manually activation SOV's by pushing the yellow button.

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11 Endpoint calibration

The endpoint calibration must be performed if there are connected some position sensors which requires calibration, e.g. a distance laser.

The graph shows the mA output of the signal which is selected as the position input.

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12 Stroke test

The stroke test can be performed both on modulating and on/off systems. For modulating systems are 4mA and 20mA is used to open and close, for on/off systems is DO1 used. The following parameters are found during the test:

- Opening breakaway time
- Opening time
- Closing breakaway time
- Closing time
- Travel
- Switch reaction opening
- Switch reaction closing

If the position feedback is digital inputs and a reference position sensor is used, then the reaction position of the switches can be meassured.
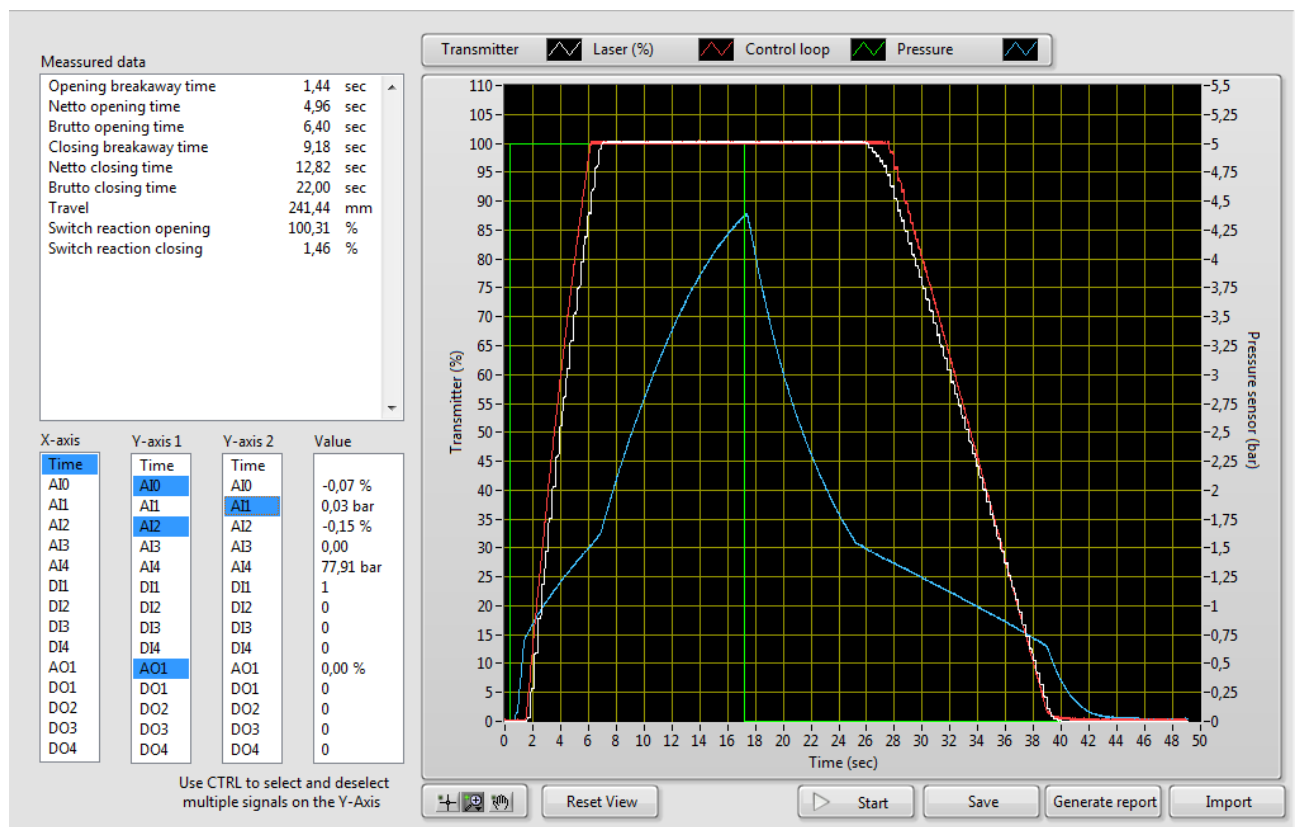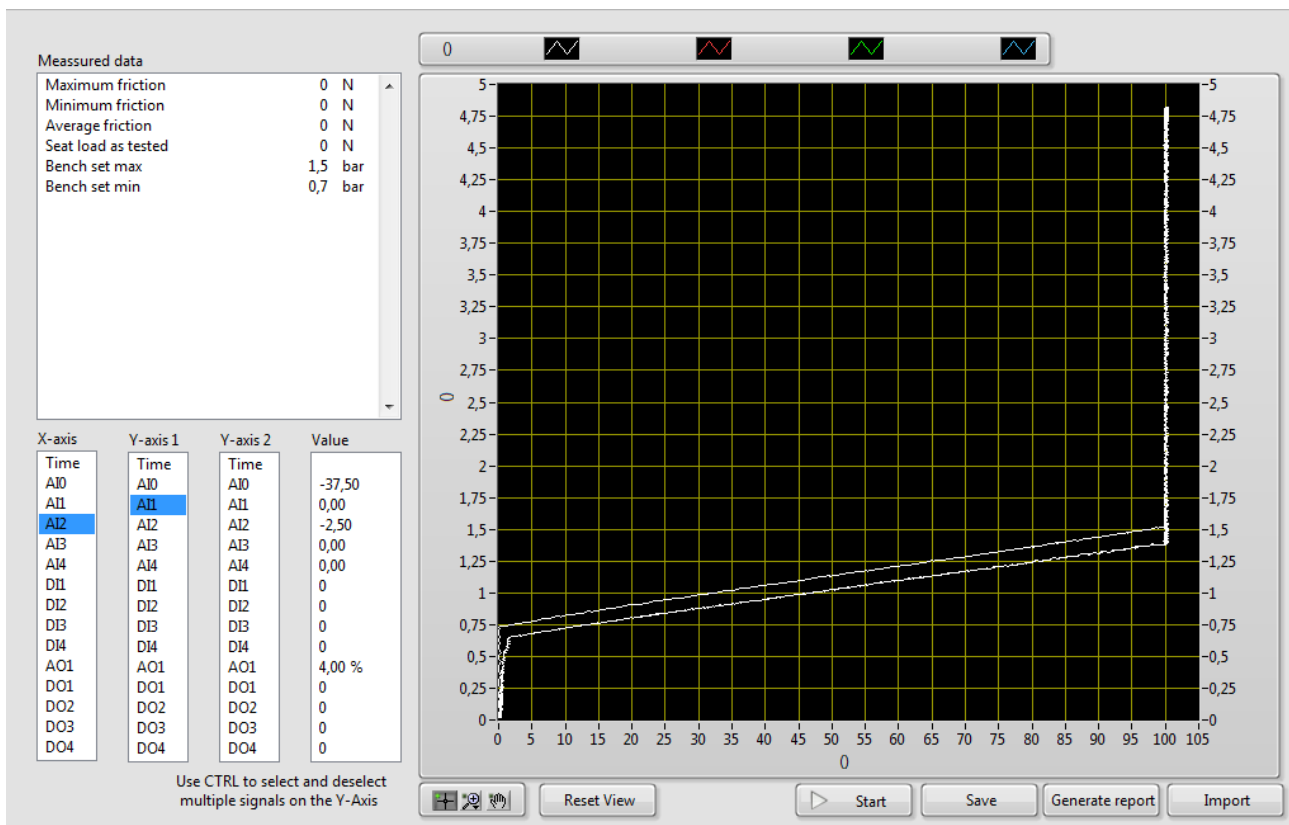
13 System test

The system test can be performed both on modulating and on/off systems, but requires a pressure transmitter mounted to measure the actuator pressure.
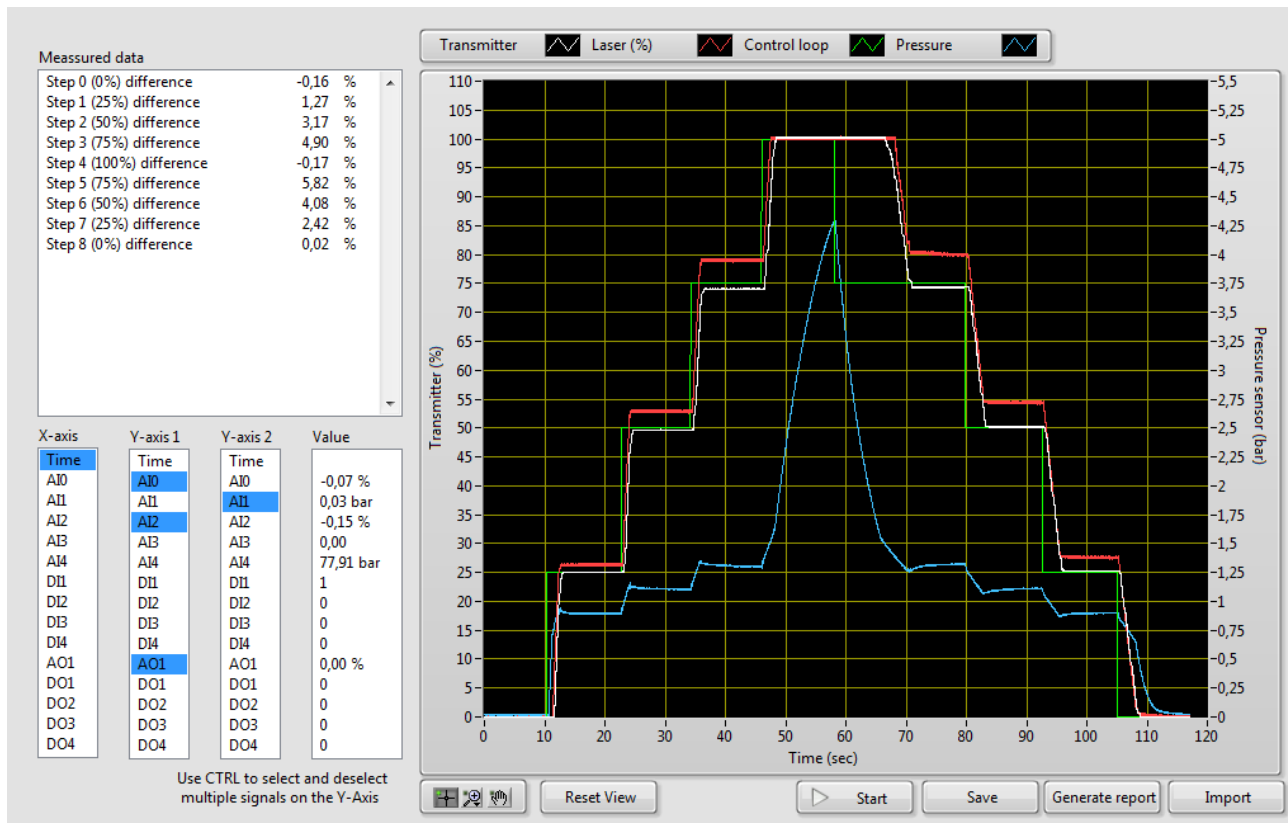
Based on the fail position of the system and the actuator effective area the following parameters are calculated:

- Minimum friction
- Maximum friction
- Average friction
- Seat load as tested
- Bench set minimum
- Bench set maximum

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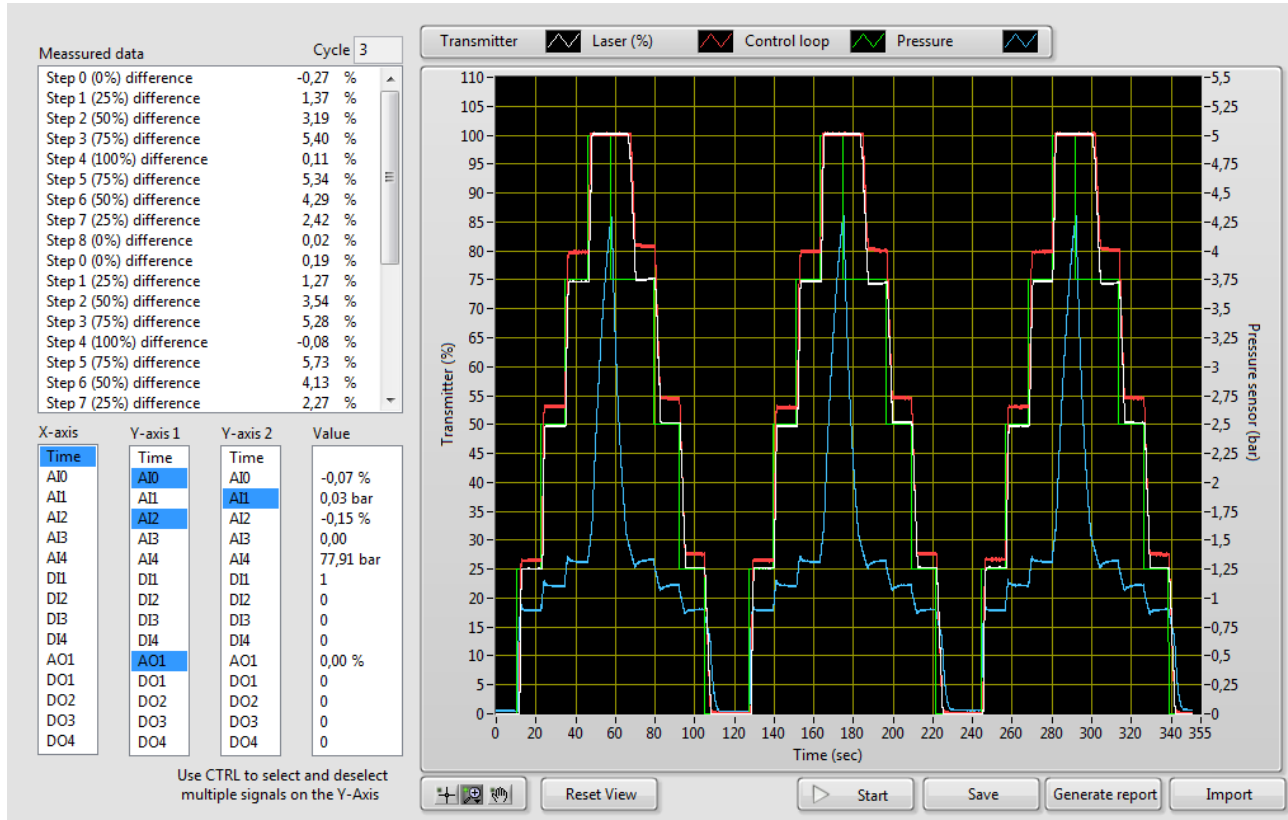vc@valcontrols.com • www.valcontrols.com

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14 Step test

The step test is for modulating systems. It tests how accurate the system is at different set points. The reference can in simple cases be the set point signal (AO1), or an external position sensor, e.g. a laser. For each step is the difference between the position and reference position calculated.

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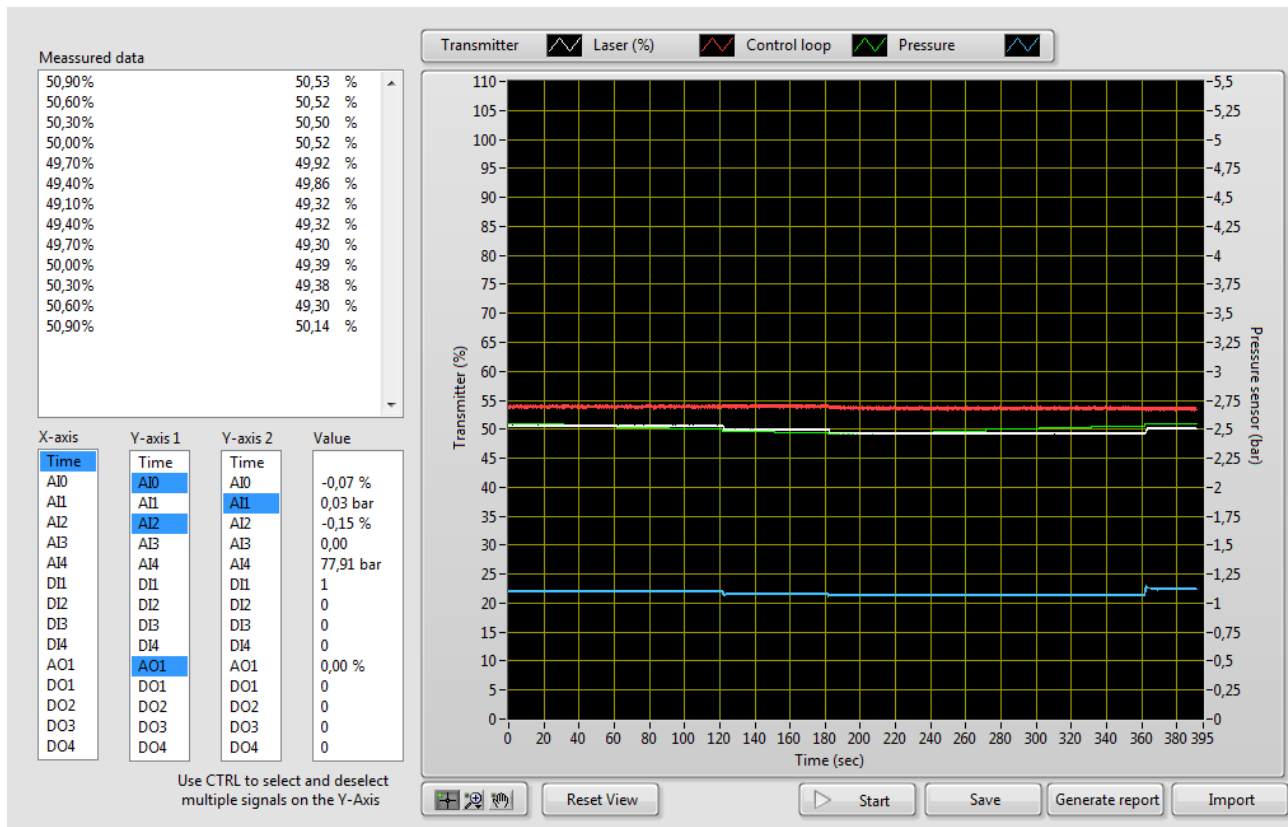vc@valcontrols.com • www.valcontrols.com

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15 Life cycle test

The life cycle test is similar to the step test but can be repeated a number of times to check if the system performance is the same for multiple cycles.

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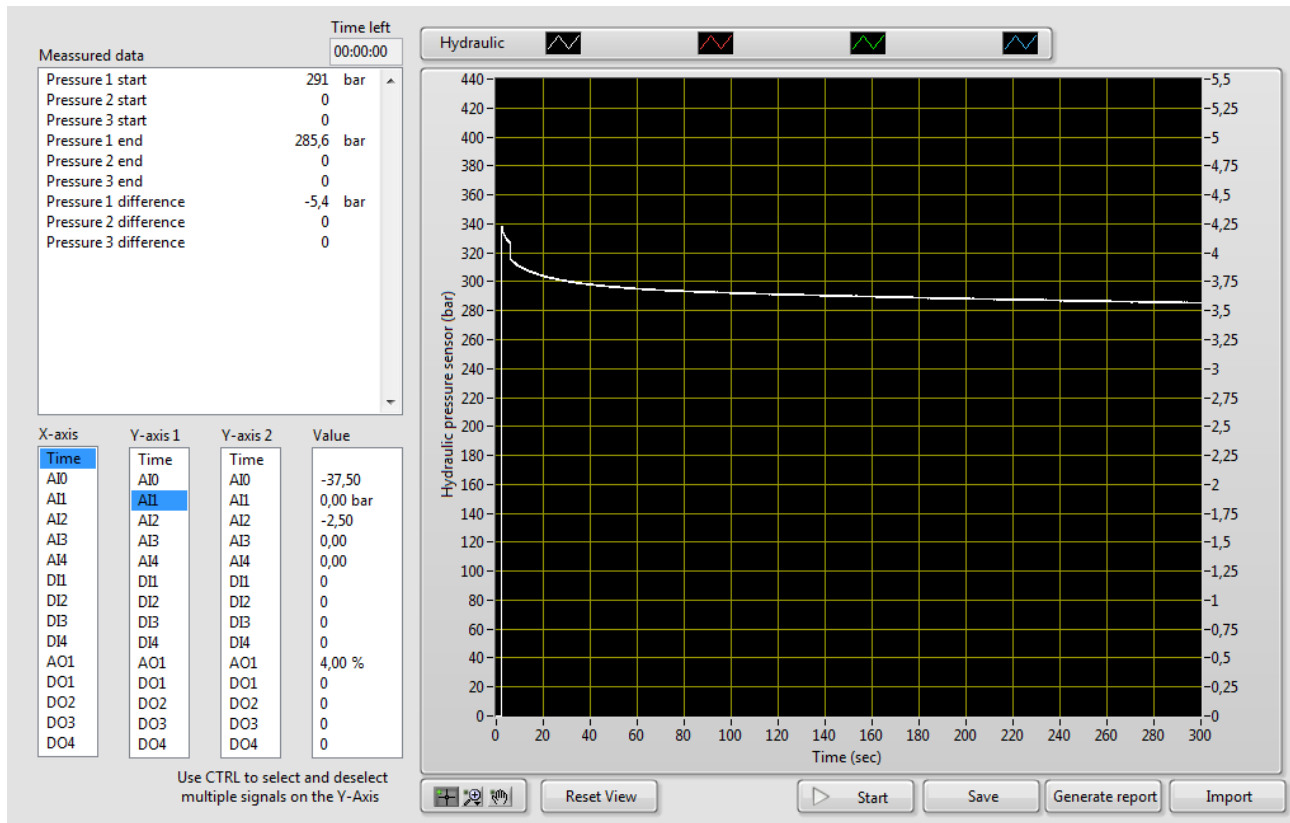vc@valcontrols.com • www.valcontrols.com

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16 Deadband test

The deadband test is used to measure the deadband of a valve system with positioner. The requested position to the positioner is changed with small steps and the deviation from AO1.

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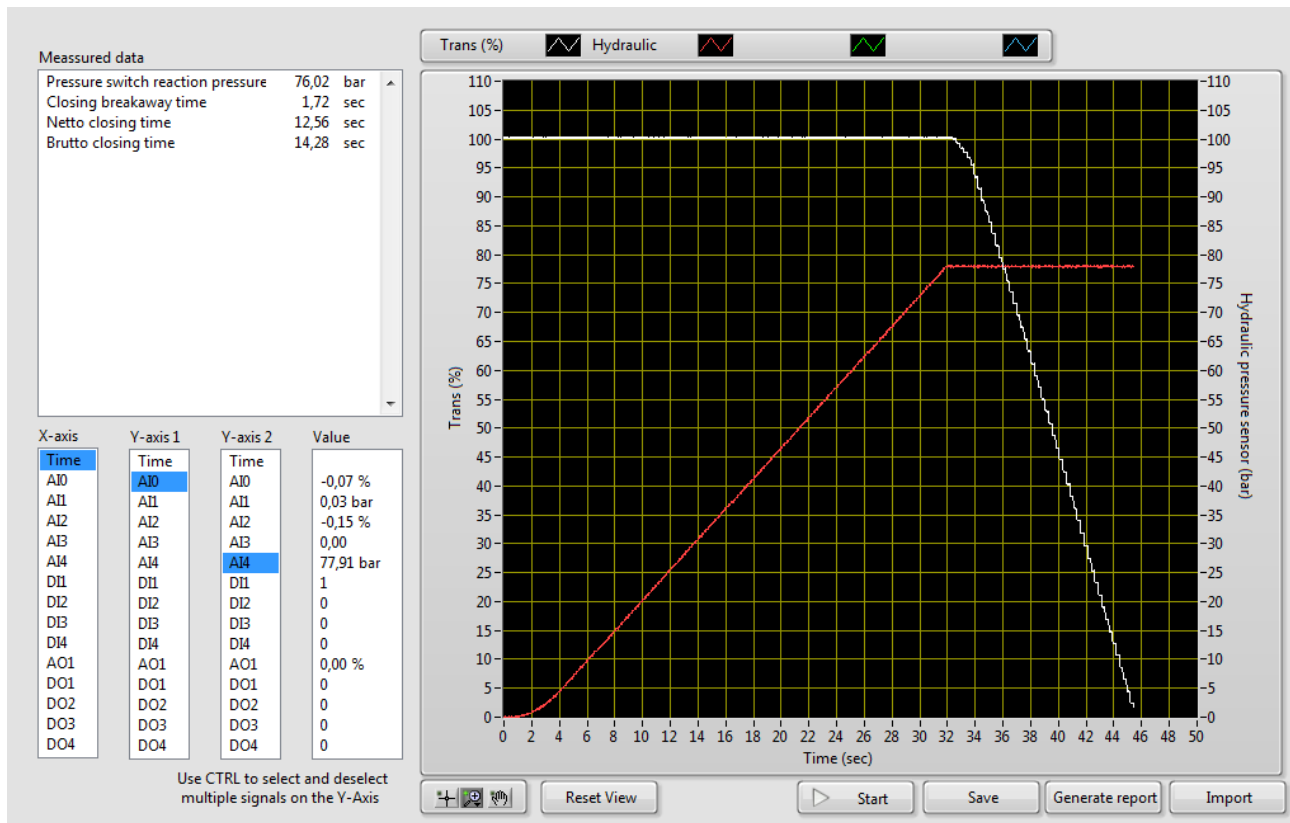vc@valcontrols.com • www.valcontrols.com

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17 Pressure test

The pressure test is used to test the steady state pressure drop in a system. The operator must add pressure sensors suitable places and then pressurise the system. The start measurement can be delayed to allow for system to settle before the measurements are started. At the end of the test the difference between the start pressure and end pressure is calculated.

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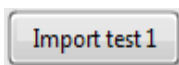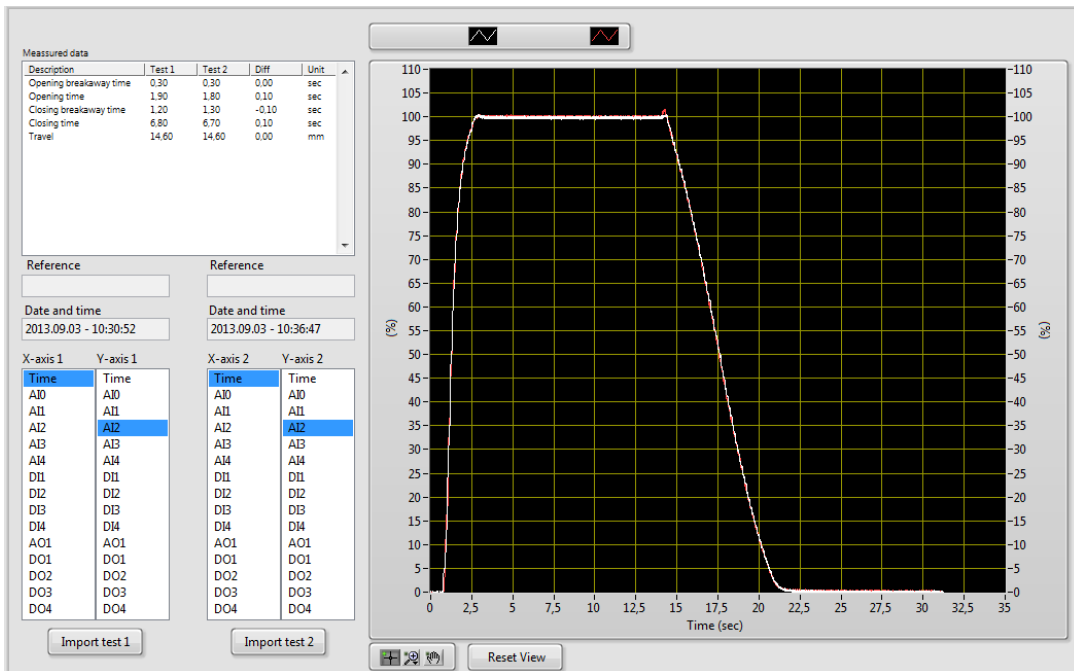vc@valcontrols.com • www.valcontrols.com

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18 Pressure switch test

The pressure switch test measures when a pressure switch reacts and measures the closing time for the actuator. The operator must energise the system and apply pressure to the switch until it reacts and closes the actuator.
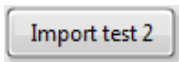
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19 Comparison

The tests can be compared by loading into the comparison page.

	Push this button to import test1.	
	Push this button to import test 2.	
	Use these functions for zooming, moving etc.	

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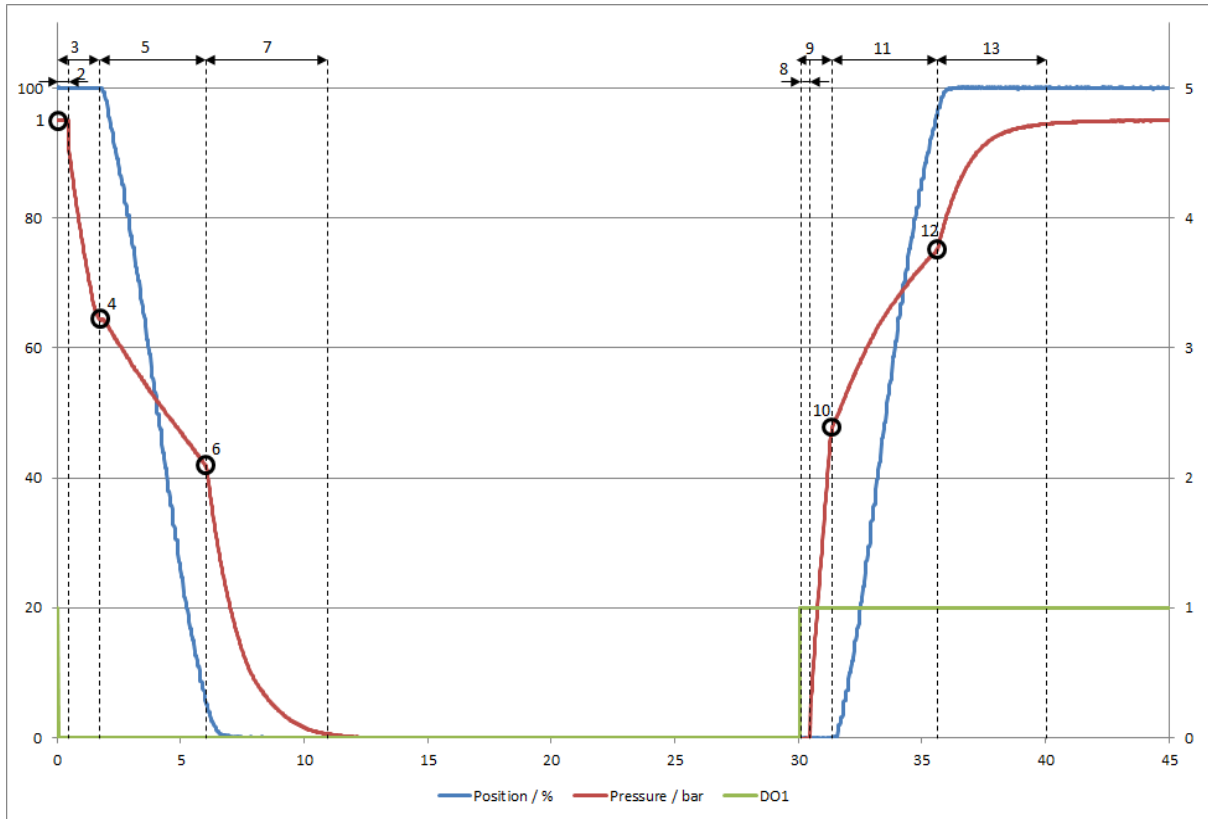vc@valcontrols.com • www.valcontrols.com

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20 Report generating

When pushing the "Generate report" button all data will be imported to an Excel template. There are templates for Travel, System and Step reports in included in the VSTC software. The templates can be customized by the customer with logo etc. Below is an example of a report with the template for on/off.

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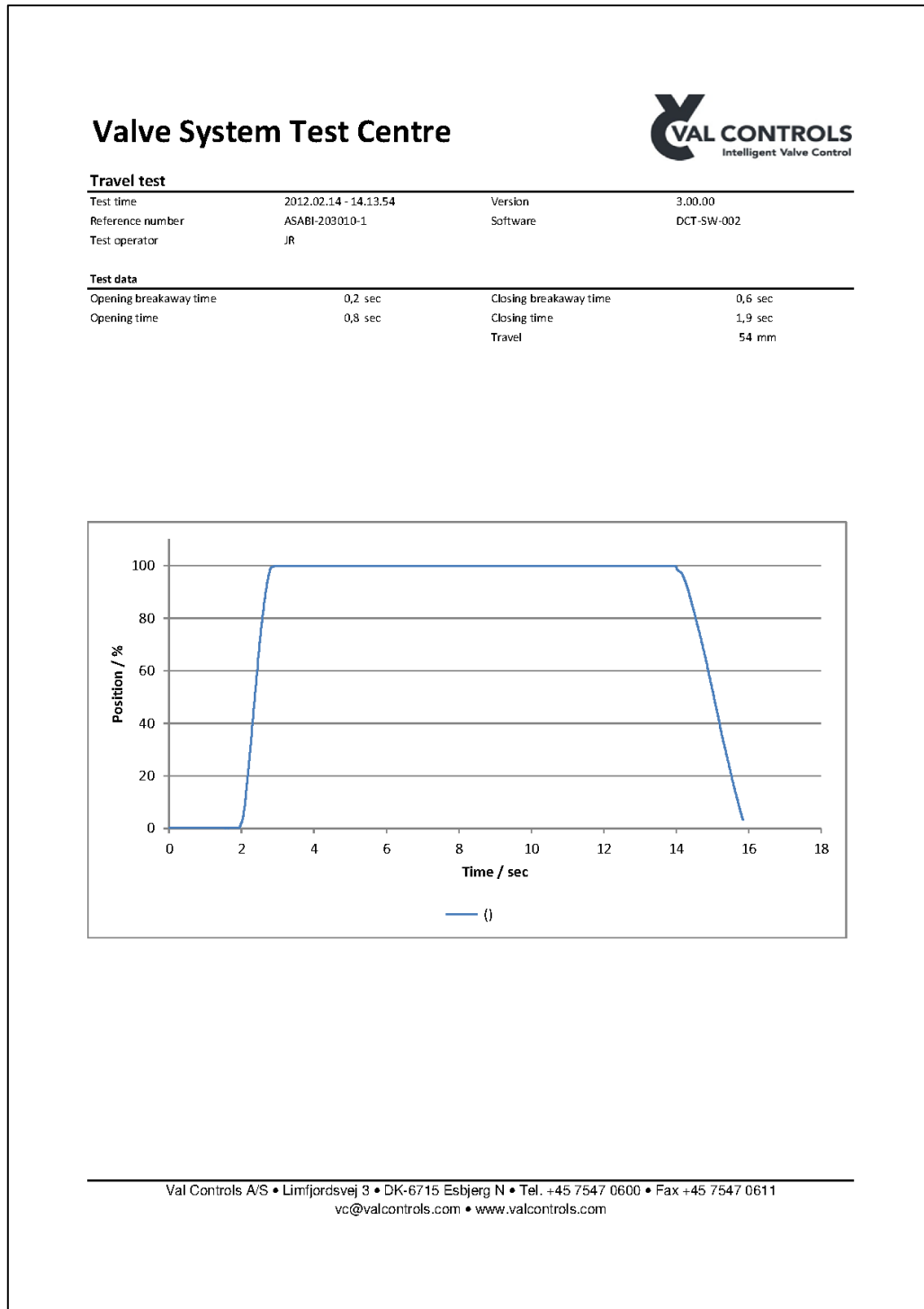
21 Terms and definitions

Below is shown the terms and definitions for the measured data.

1) Start pressure
2) SOV reaction time de-energising
3) Closing breakaway time
4) Closing breakaway pressure
5) Closing time
6) Closing stop pressure
7) Depressurising time
8) SOV reaction time energising
9) Opening breakaway time
10) Opening breakaway pressure
11) Opening time
12) Opening stop pressure
13) Pressurising time

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