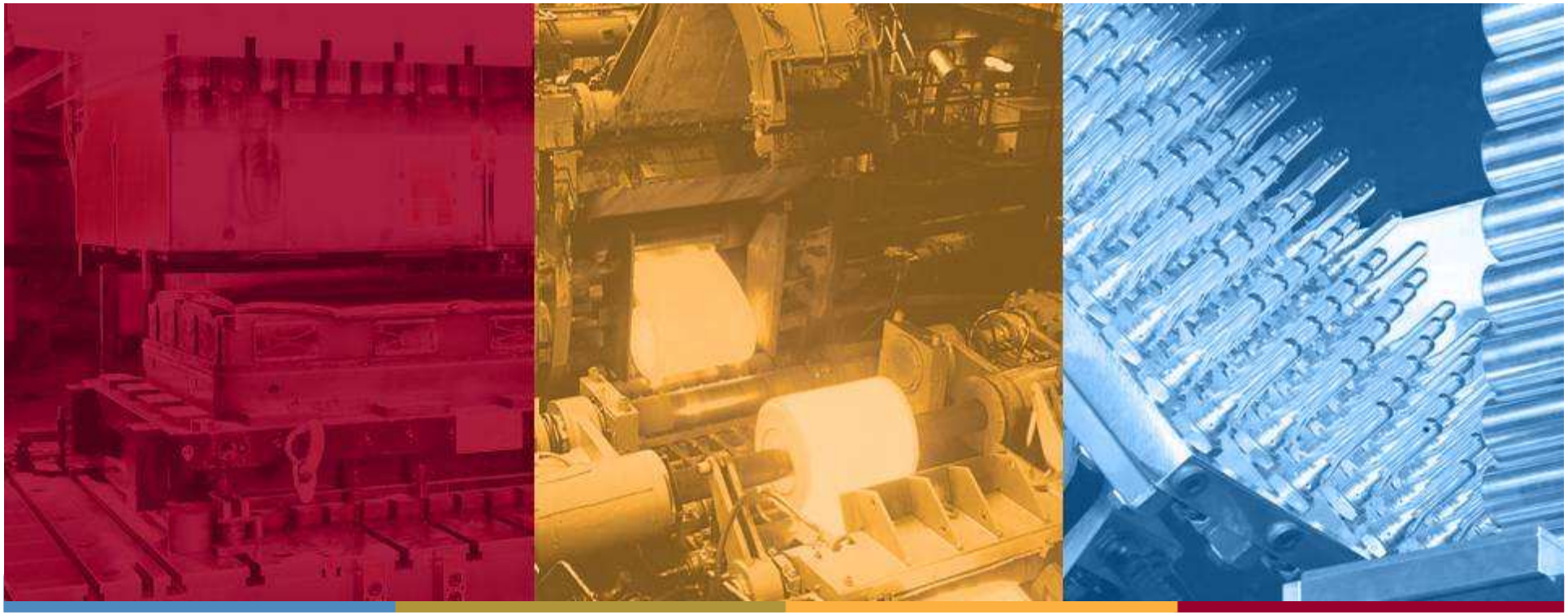
Moog Valve and Pump Configuration Software

Documentation for Software Version 2.0

October 2013



MOOG

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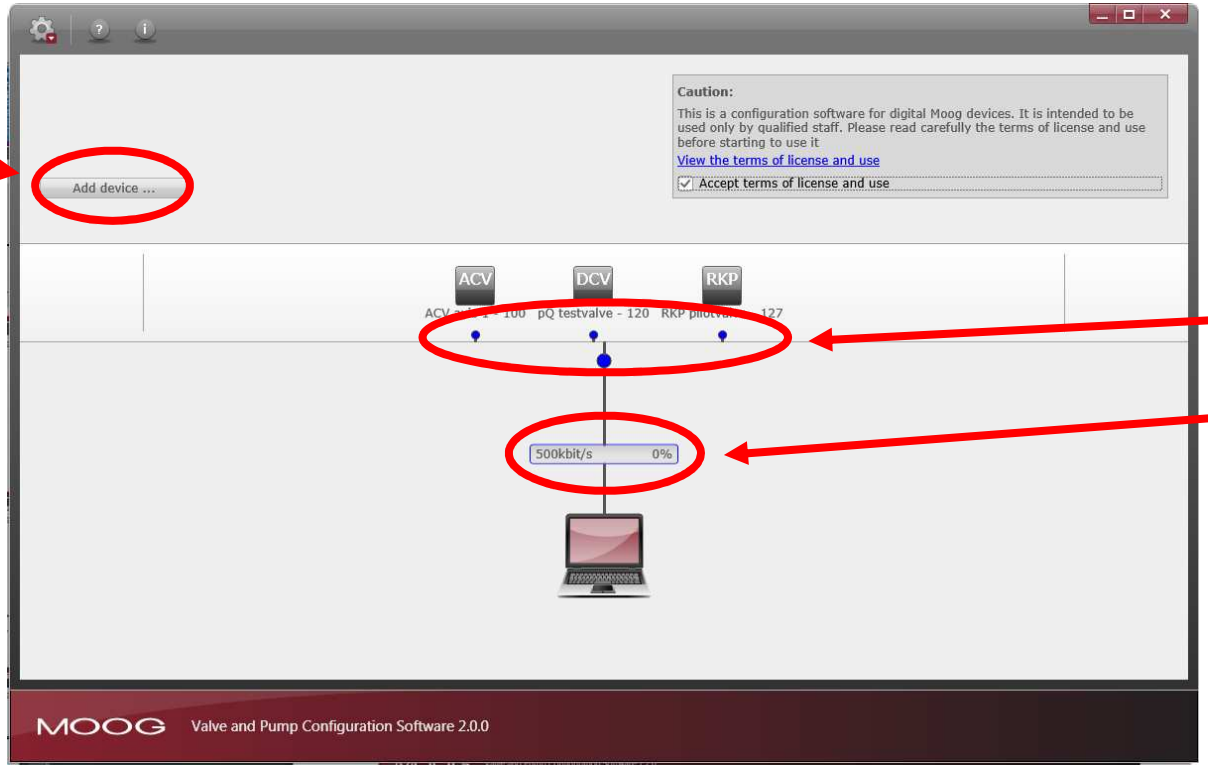
Agenda

- Startup screen
- Window layout
- Menu bar, Help and Info functions
- General handling
- Set point values
- Inputs section
- Operation modes
- Signal Conditioner
- Controller section
- Store / Restore settings
- Configuration files
- Tools section
- Function Generator
- Parameterization of special functions

Startup screen

- Fieldbus is scanned permanently. All connected CANopen devices are identified and displayed.
- Devices can be selected and configured by clicking an choosing “Select”
- Simulation mode: Devices can be added in offline mode by clicking “Add device”
- Currently supported languages: German and English

Possibility to add virtual devices



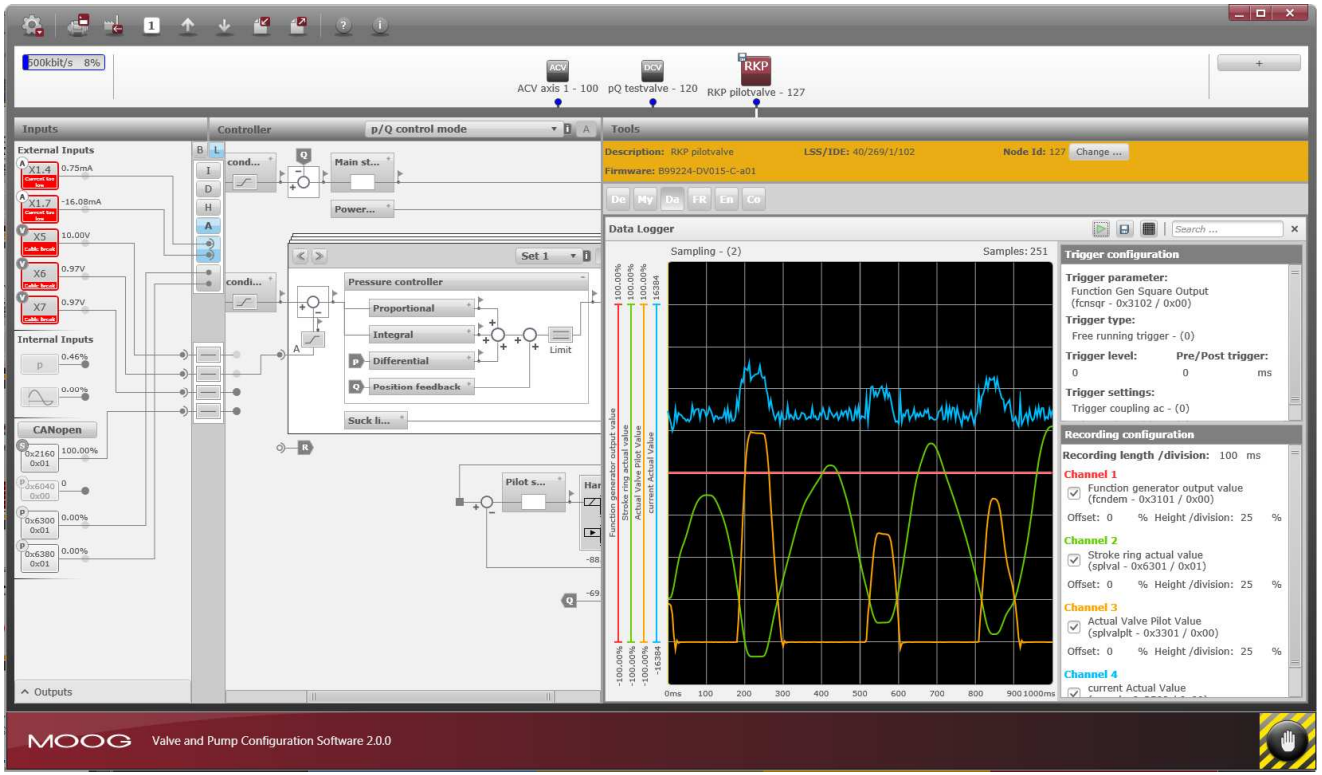
Device connection ok

IXXAT Interface identified correctly

Window layout

The window consists of 4 sections (sections are scalable in size)

- Top **Devices** Display and Selection of connected and virtual devices
- Left **Inputs** Display and Configuration of analog and digital inputs and outputs
- Middle **Controller** Display of controller structure and tuning of controller
- Right **Tools** Display of status information, errors, data logger etc.

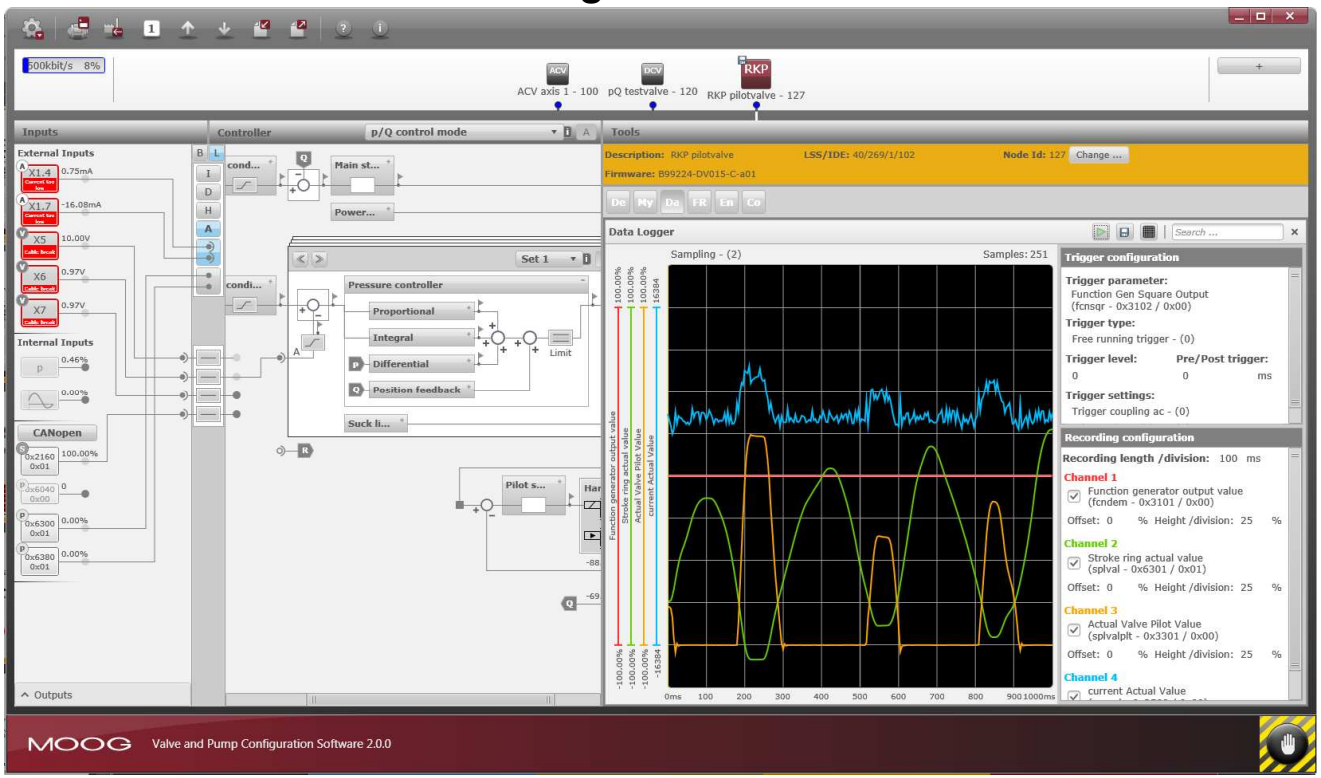


Window layout

Typical steps during commissioning:

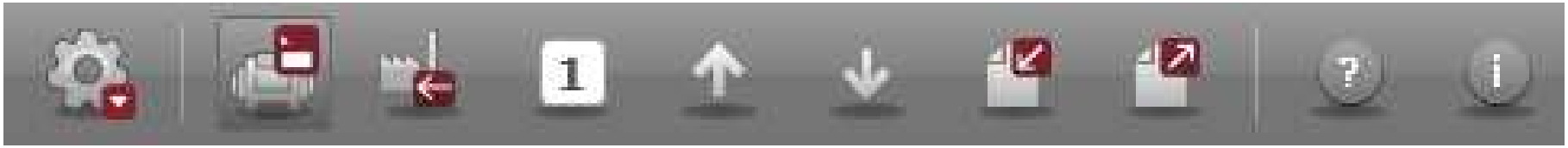
- 1. Configuration of external interfaces ➔ **Inputs** section
- 2. Selection of operation mode and controller ➔ **Controller** section
- 3. Diagnosis and Optimization ➔ **Tools** section
- 4. Switching between different devices ➔ **Devices** section

➔ **all relevant information visible at a glance in one window**



Menu bar

Overview



Settings (change language)

Store parameters

Restore factory settings

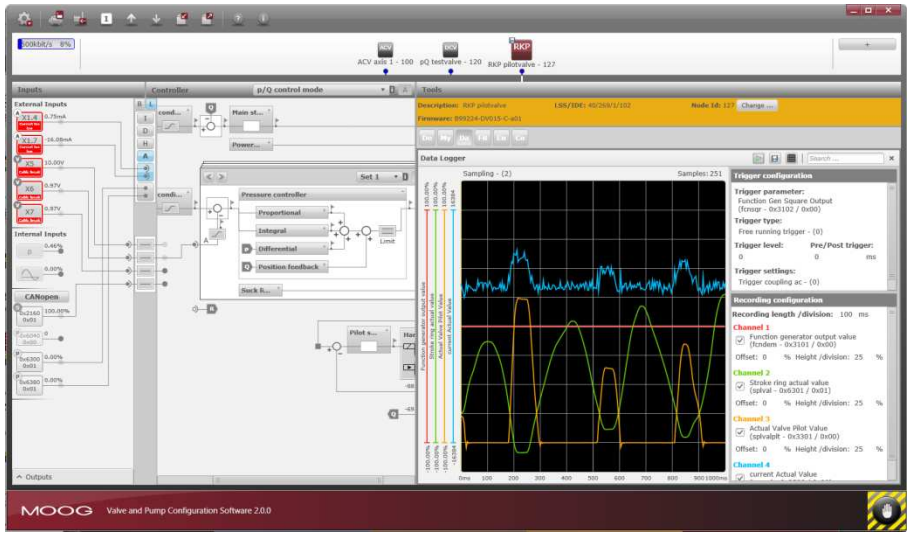
Access level

Read/Write parameters

Import/Export configuration file

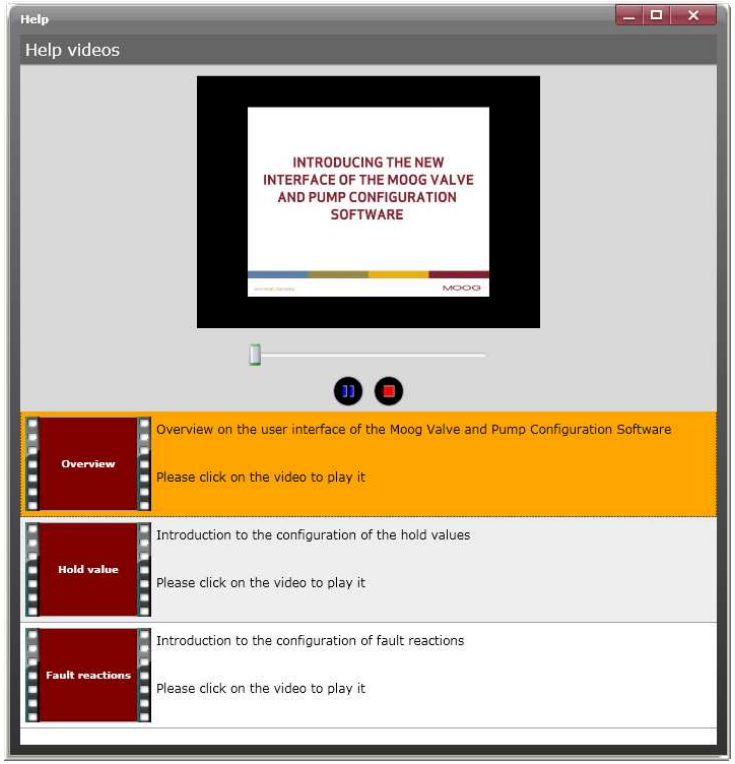
Help

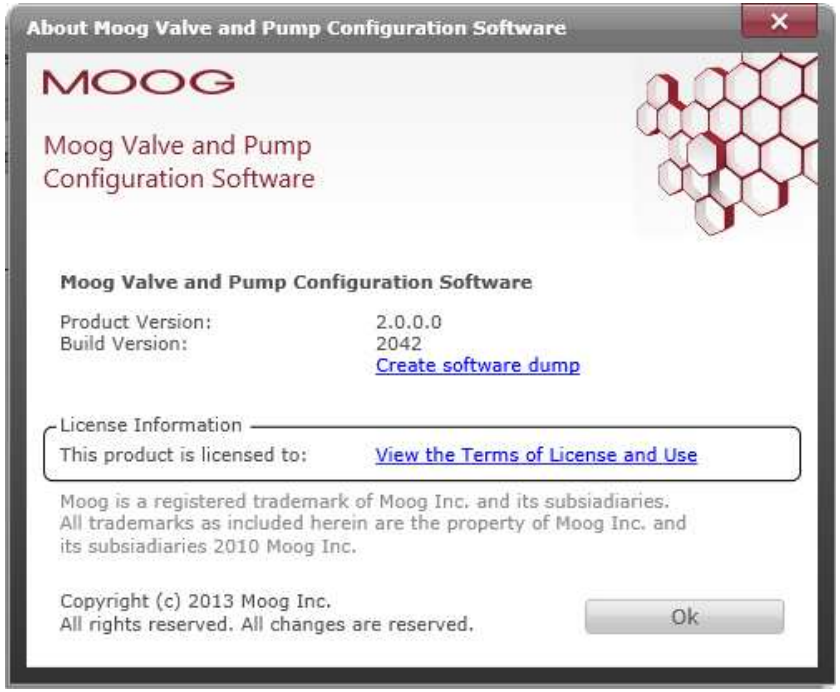
About



Help and Info functions

Screen casts / About



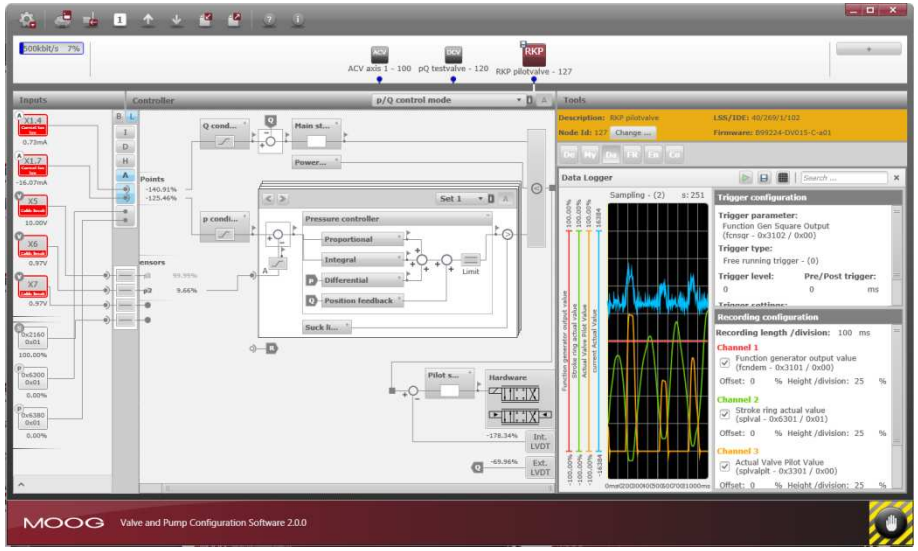


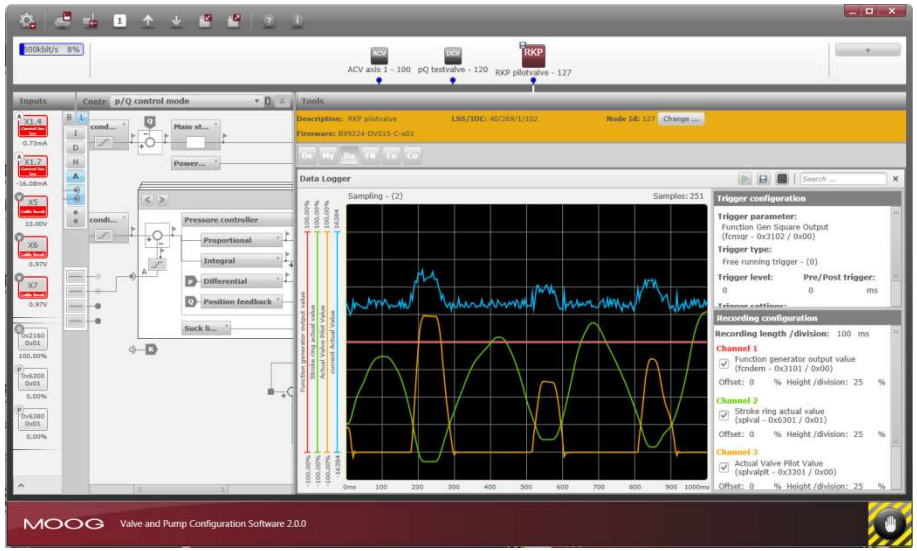
General handling

Window sections

double click on the specific area maximizes or minimizes the respective section

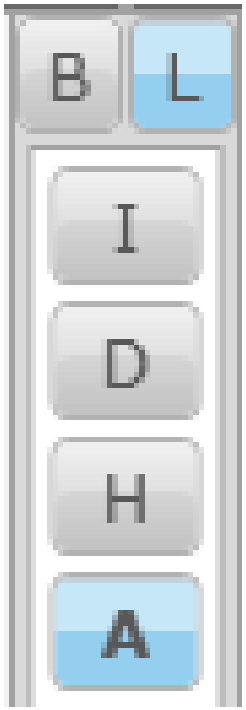
You can also scale the areas using the mouse





General handling

LocalMode, ControlWord



ControlWord (via Bus / locally)

- via Bus: ControlWord has to be send by CAN master
- locally: Control Word is set in valve parameters (e.g. as part of operation mode)

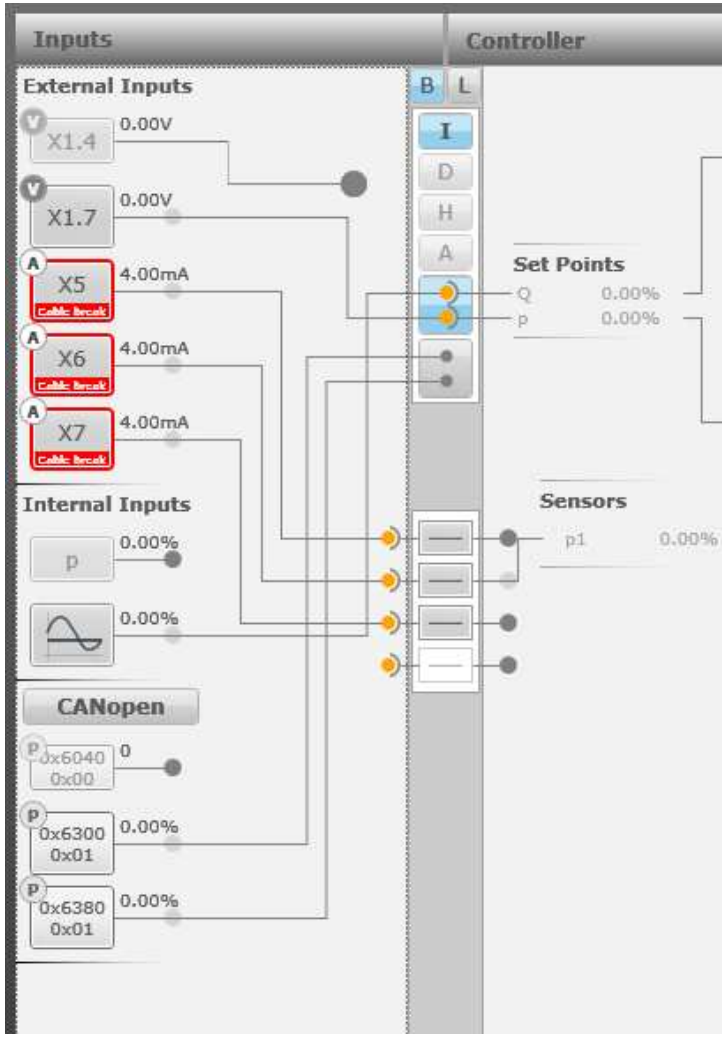
State machine

- **INIT**: failsafe, no pump funtion
- **DISABLED**: failsafe, e. g. result of a fault reaction
- **HOLD**: pump in predefined condition
- **ACTIVE**: normal operation

Current valve state is highlighted in blue

General handling

Signal routing

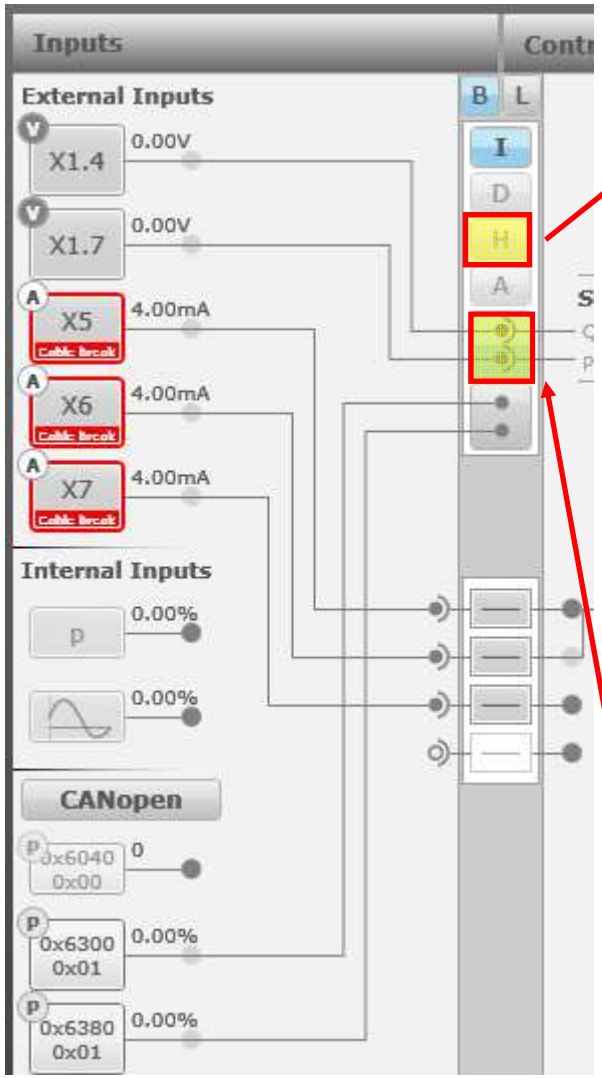


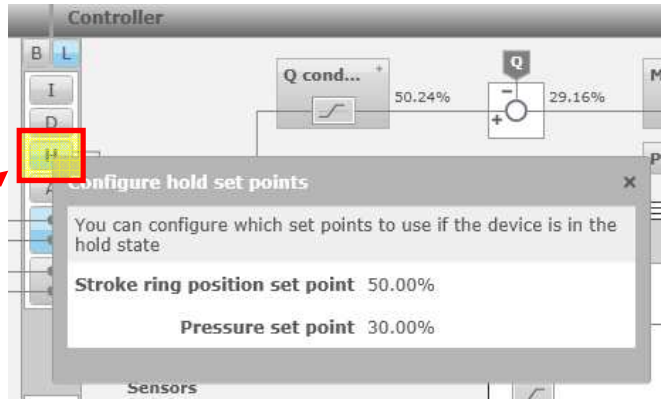
Functionality

- Signals can be connected/drawn with the mouse
- After selecting a signal, the program indicates automatically (yellow dots), which connections are possible

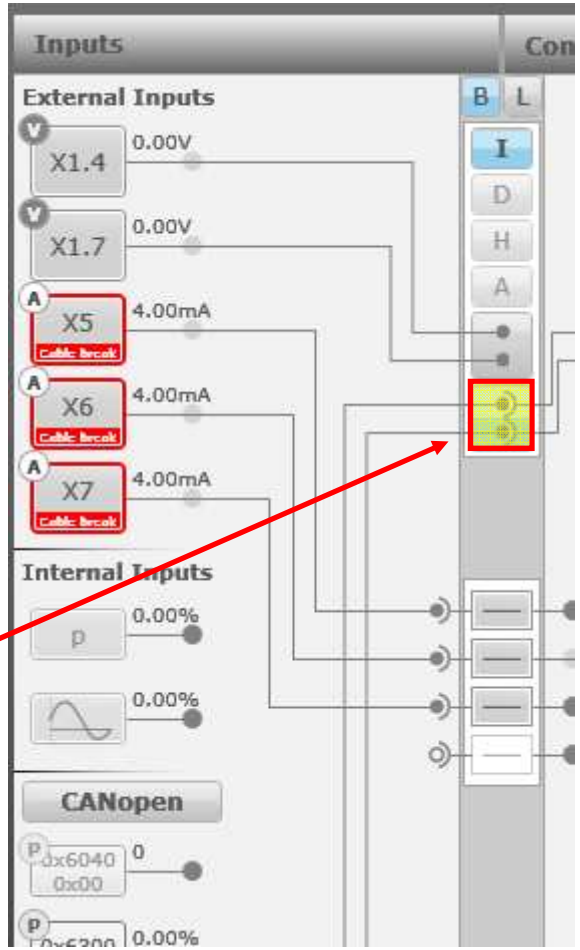
Set point values

Analog, Bus, HOLD-mode





right click on „HOLD“ opens the window to set HOLD-set points for flow and pressure



switches between:

- analog set points (11+PE connector, function generator)
- set point via bus (Index / Sub index of CAN-Parameter)

Inputs section

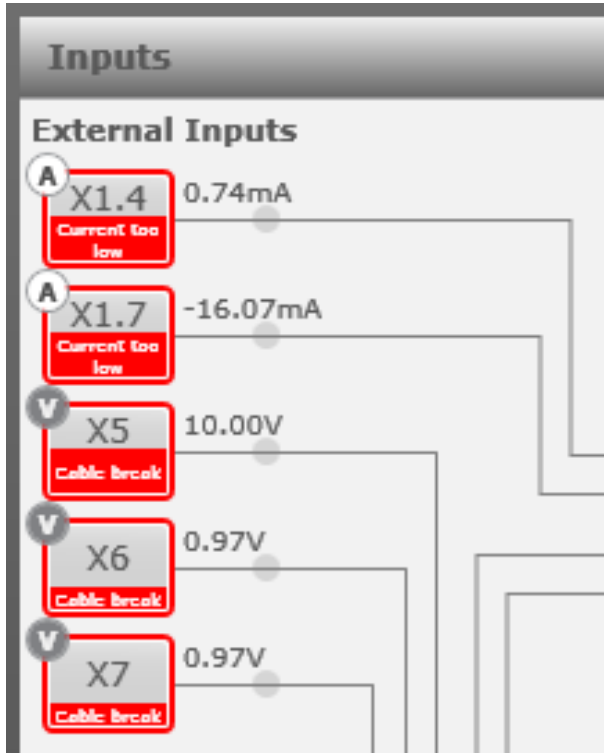
11+PE cable and analog input module

Pins on the 11+PE cable

- Pin 4: Q (set point for flow)
- Pin 7: p (set point for pressure)

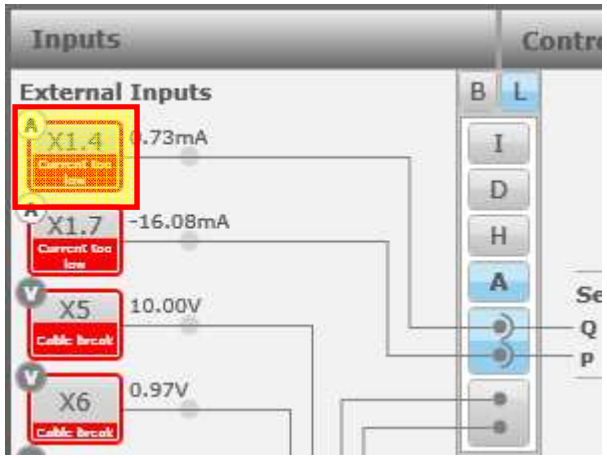
analog input module

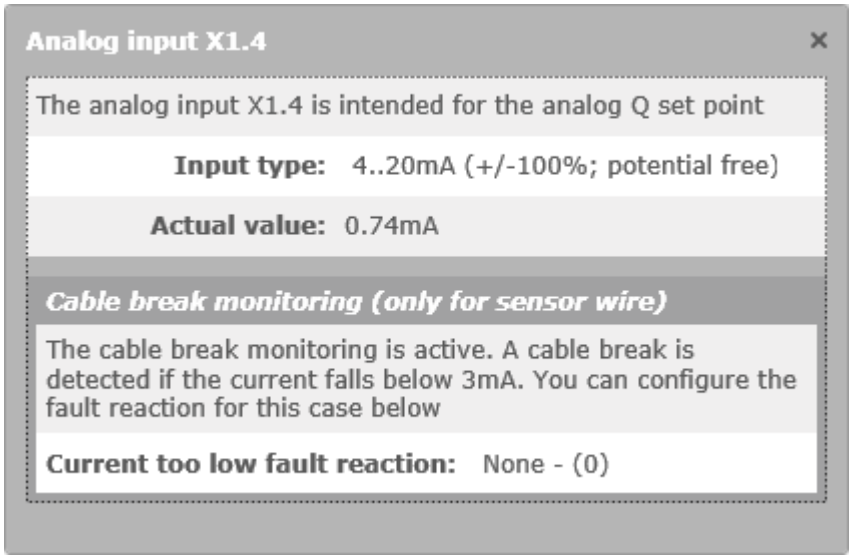
- X5: pressure transducer (additional)
- X6: pressure transducer (standard)
- X7: analog operation mode selection



Inputs section

Analog set points, configuration



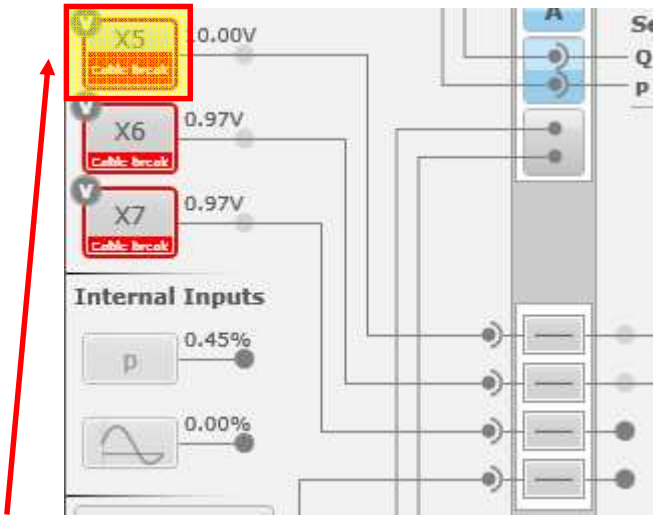


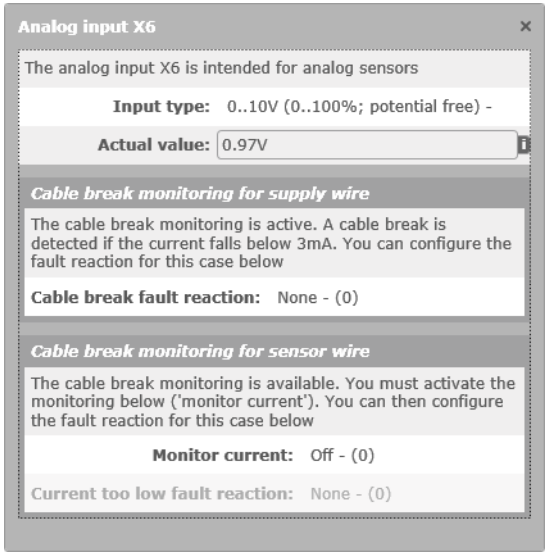
click on the specific input opens configuration window

- Select input signal type and signal range
- Information about actual value
- Select cable break configuration

Inputs section

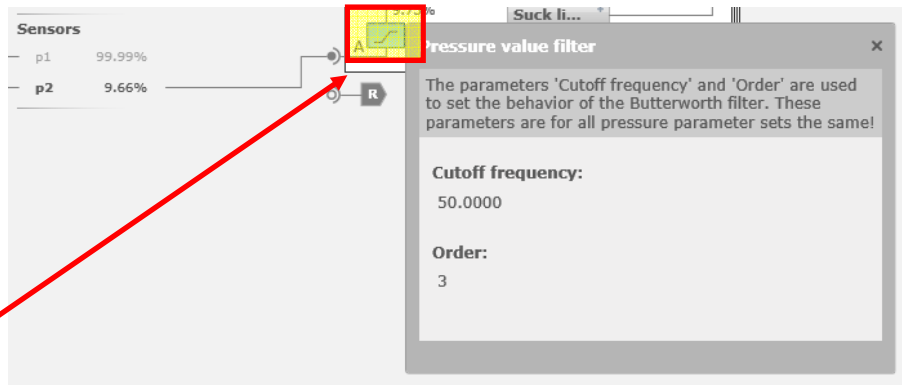
Transducer inputs, configuration





click on the analog input opens the configuration window

- Select input signal type
- Info: actual input value
- Select cable brake configuration

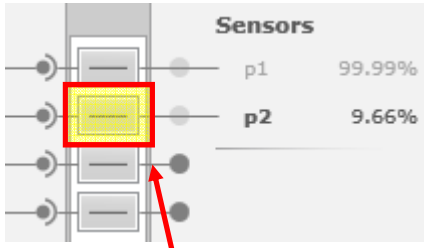


configuration of pressure filter in controller area

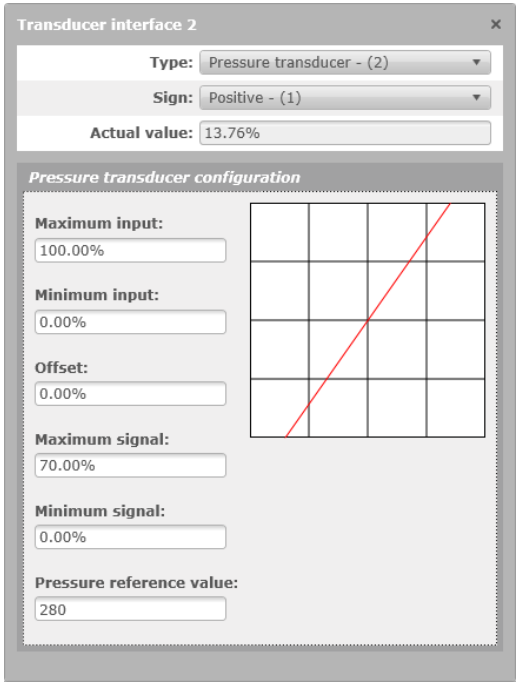
standard setting: Butterworth-filter, 50Hz, 3. order

Inputs section

Transducer interface scaling



click on the interface opens configuration window



Offset: zero adjustment (pump stopped, system without pressure)

Maximum Signal (MS): if 100% system pressure < transducer max value

Pressure Reference Value (PRV): pressure value at 100% system pressure

<u>example: transducer 0-400 bar, 100% system pressure → 280bar</u>

-> MS = 280/400 =0,7 → input: 70%

-> PRV = 280

Operation modes

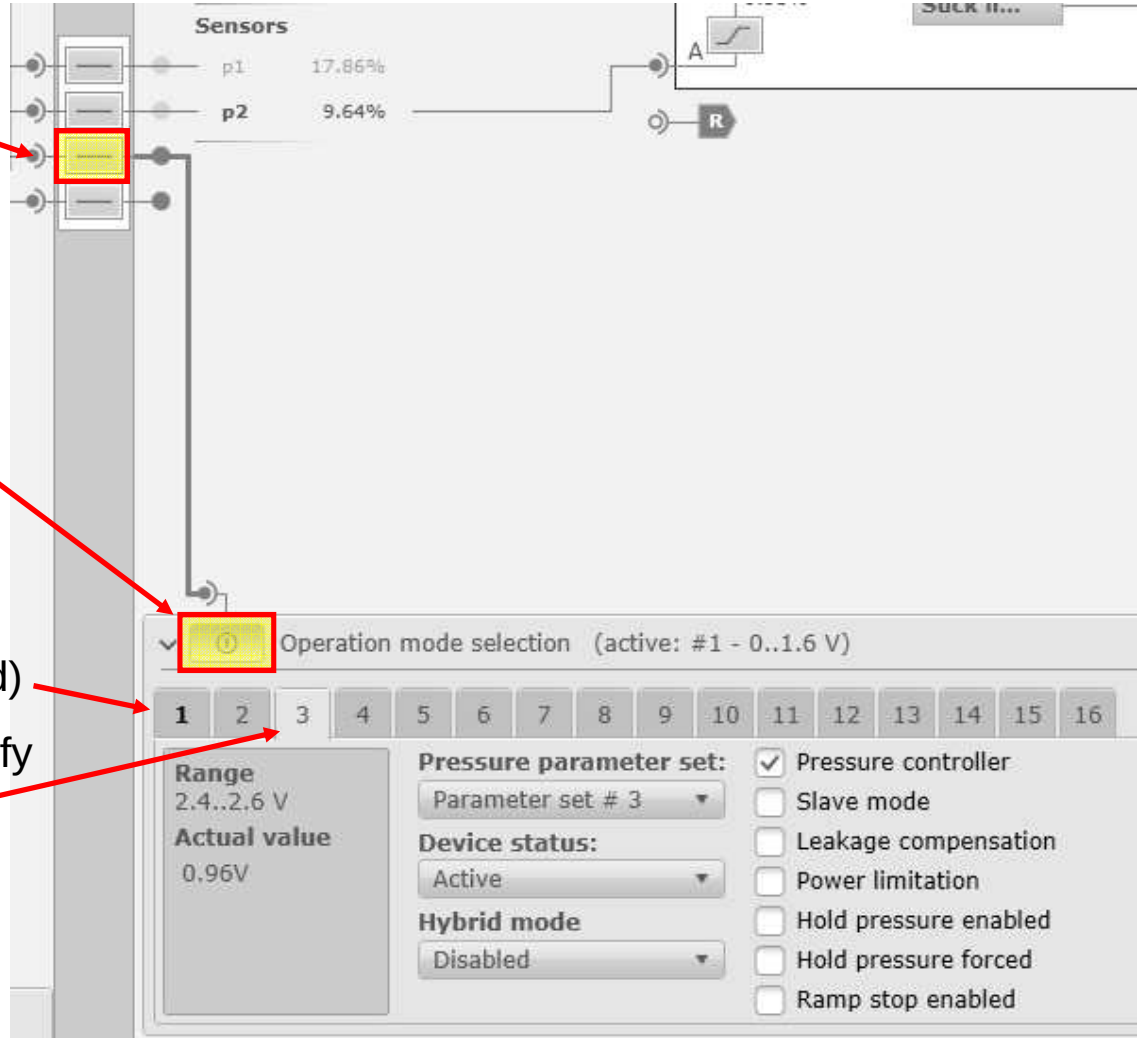
Activation, interface selection, operation mode selection

chosen interface for the operation mode selection

ON / OFF button for the operation mode selection

operation modes, example:

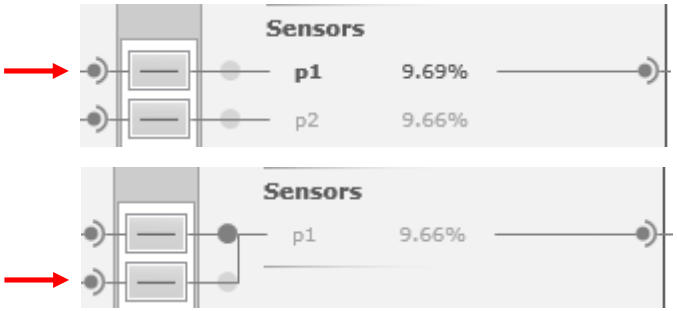
- operation mode 1 active (bold)
- operation mode 3 set to modify (foreground)



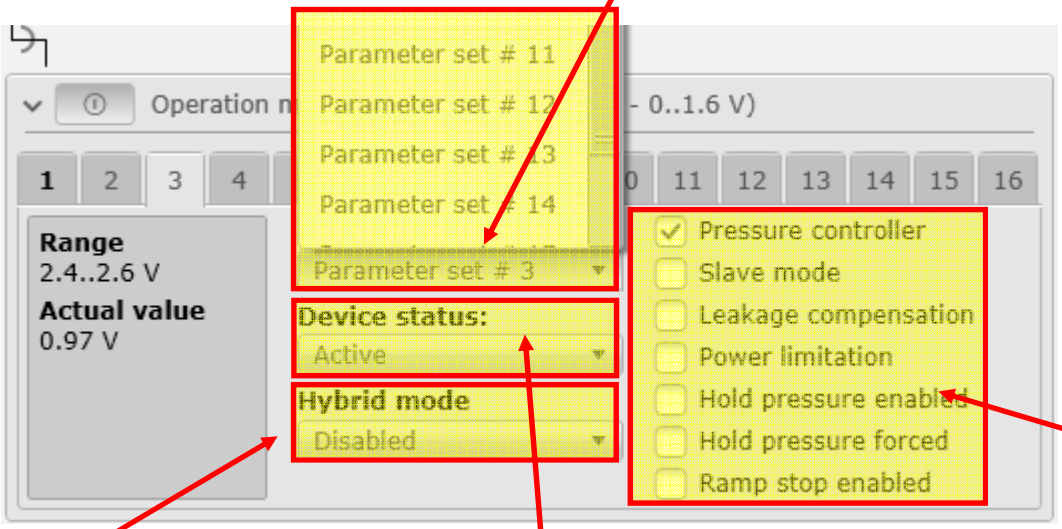
Operation modes

linked pressure transducer and pressure parameter set

Choose pressure transducer



every of the 16 pressure parameter sets can be linked to one of the 16 operation modes



16 operation modes

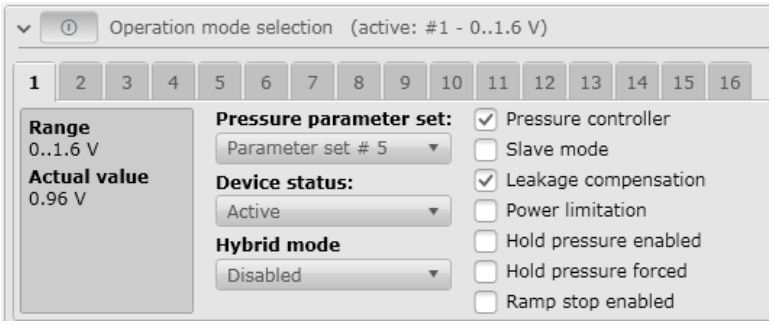
ControlWord bits

Hybrid mode

Valve state

Operation modes

ControlWord



example:

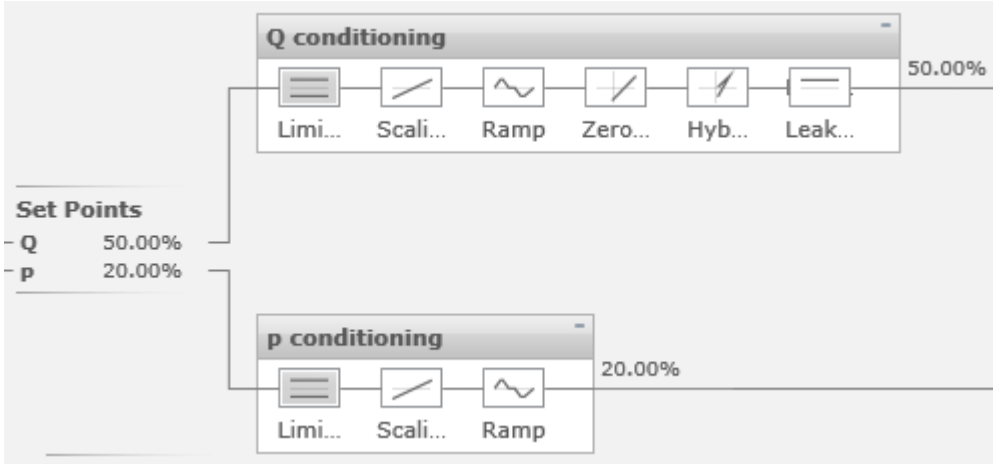
- valve is „ACTIVE“
- pressure controller ON
- leakage compensation ON

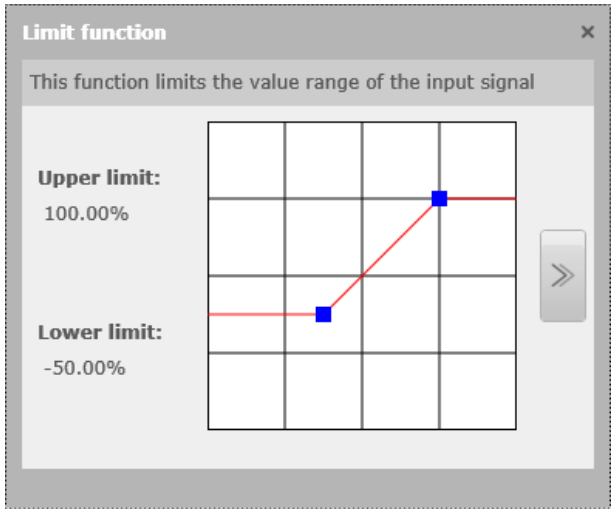
Control word values

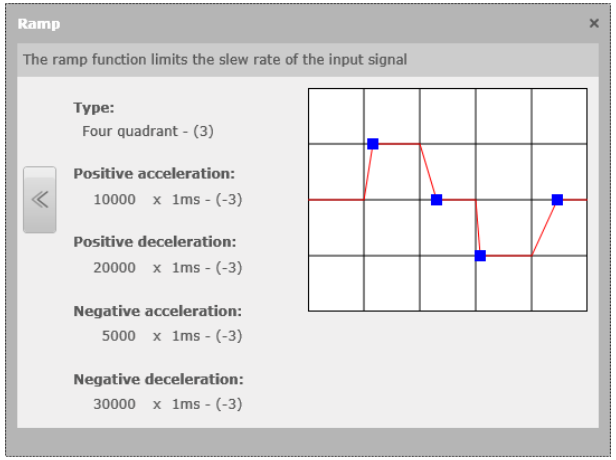
Bit	<ControlWord>	Description	Specification
0	Disabled (D)	These bits form the device control command. ⇨ Chapter "5.2.2.1 State transitions depending on the control word", page 26	DS 408 (mandatory)
1	Hold enable (H)		
2	Device mode active enable (M)		
3	Reset fault (R)		
4…7	Reserved	These bits are reserved for future use. They must be set to 0 in order to ensure upward compatibility.	Reserved
8	Pressure controller enabled (p/Q closed loop control-type only)	If bit 8 is activated, then the pressure controller is enabled in the p/Q control type. **Note:** This function is applicable only in the p/Q control type.	DS 408
9	Slave mode enable	This bit is used to enable the slave mode of the pump. ⇨ Chapter "7.2.9 Master/Slave operation", page 98	DS 408
10	Leakage compensation enable	This bit is used to enable/disable the leakage compensation. ⇨ Chapter "7.2.4.1 Leakage compensation", page 82	DS 408
11	Power limitation enable	Enables/disables the power limitation function. ⇨ Chapter "7.2.8 Power limitation", page 95	RKP-D specific
12	Reserved	See bits 4…7.	Reserved
13	Hold pressure enable	Enables/disables the local holding pressure switchover function. ⇨ Chapter "7.2.10 Local holding pressure switchover", page 102.	RKP-D specific
14	Hold pressure forced	Enables/disables externally forcing of the holding pressure switchover. ⇨ Chapter "7.2.10 Local holding pressure switchover", page 102	RKP-D specific
15	Ramp stop	If this bit is activated, ramp output is frozen. ⇨ Chapter "7.1 Demand Value Generator", page 55	RKP-D specific

Signal conditioner

Modify / adjust set point values







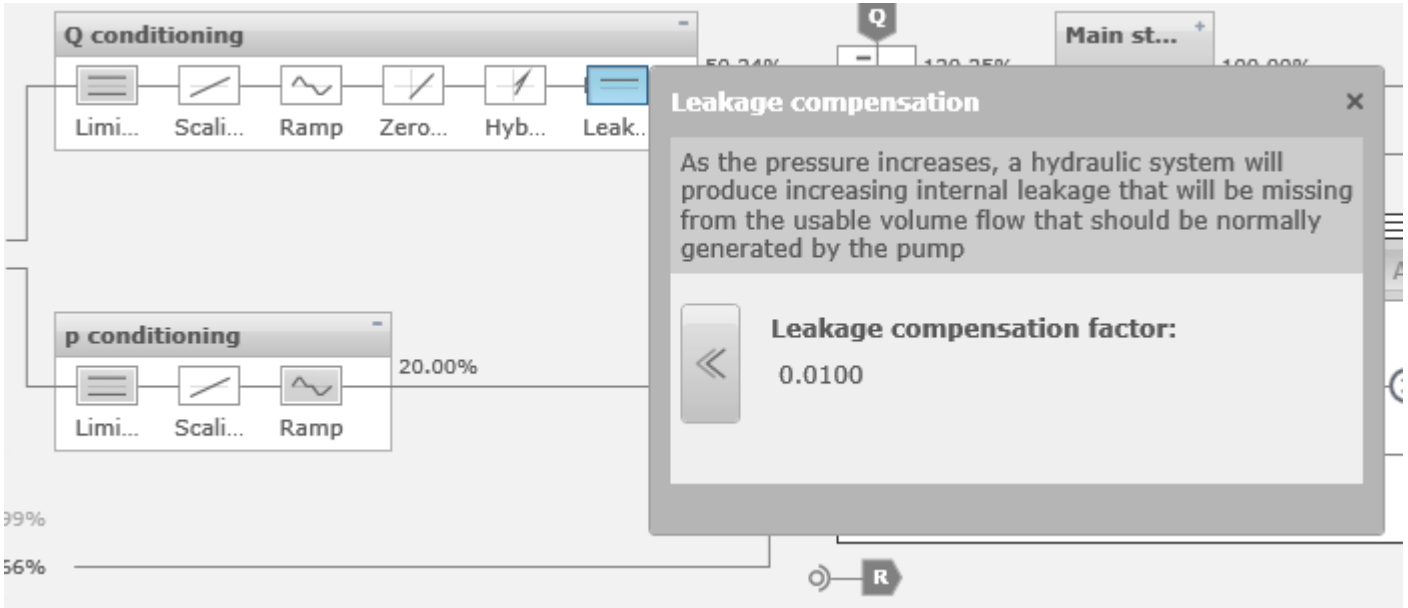
Example:

Q set point limit -50%

4-quadrant ramp for pressure

Controller section

Leakage compensation



Leakage compensation

adjustment possibility for leakage compensation to compensate linear pressure depending leakage

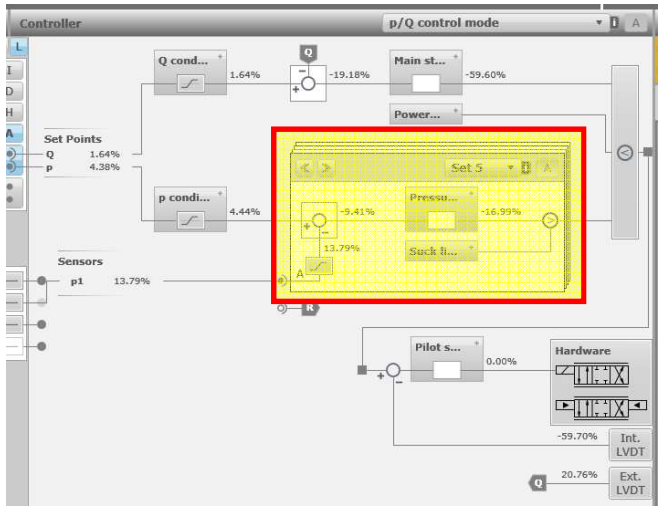
unit: %displacement/bar (default 0,01)

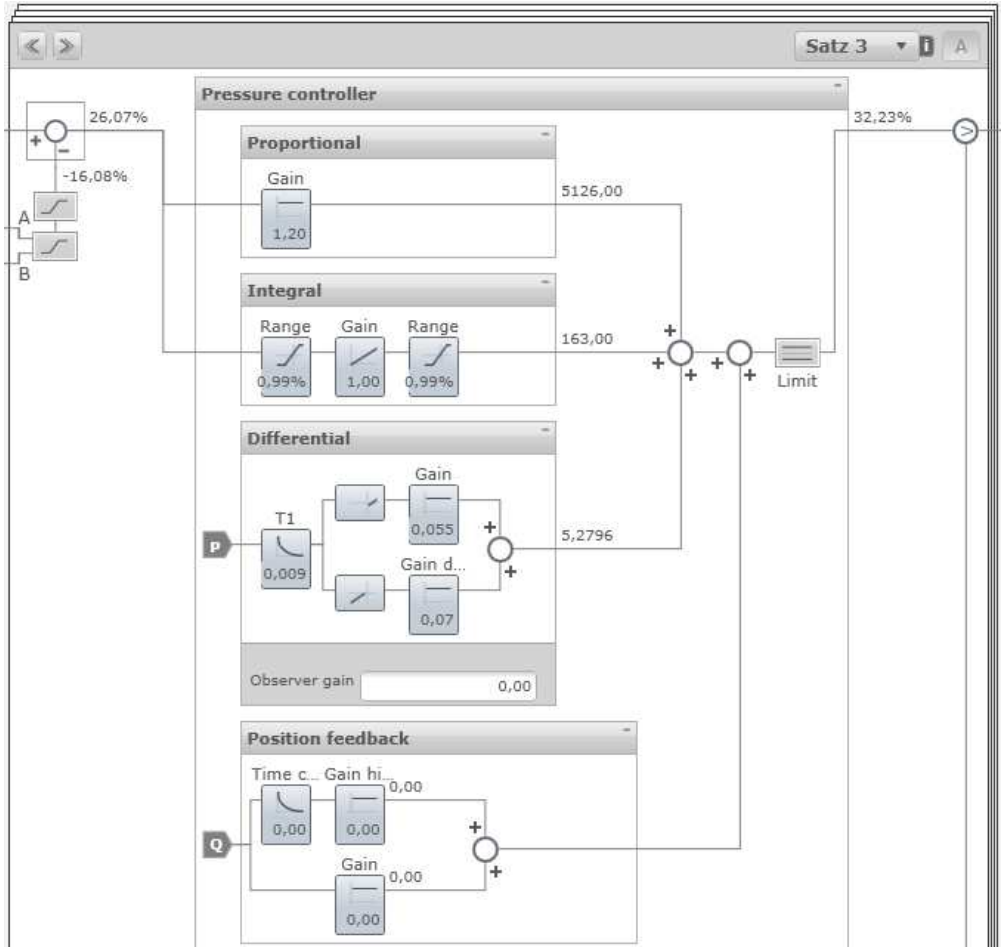
Controller section

Pressure controller

pressure controller:

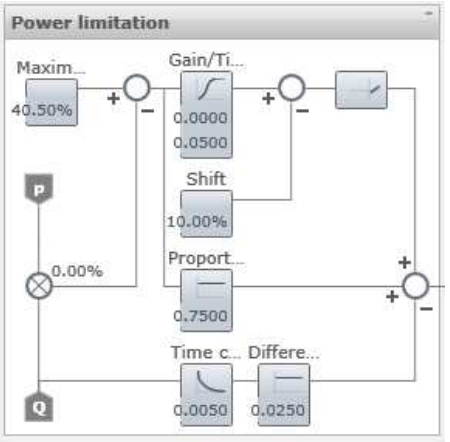
parameter input below the specific symbols





Controller section

Power limitation



power limitation:

parameter input directly below the specific controller block

Maximum: input value is percentage of the maximum output power

-> Calculation of maximum motor output power required !

Example: RKP 100, 1500 rpm, 400 bar, eta=90%, 45 kW motor

(maximum motor output power: 100% for Q and p based on valve configuration and efficiency)

$$\text{maximum motor output power} = \frac{\text{flow [l/min]} * \text{pressure [bar]}}{600 * \text{efficiency [\%]}}$$

$$\text{maximum motor output power} = \frac{150 \text{ [l/min]} * 400 \text{ [bar]}}{600 * 0{,}9} = 111{,}1 \text{ kW}$$

→ for a 45 kW motor the limit has to be set to 45 kW / 111,1 kW = 40,5%

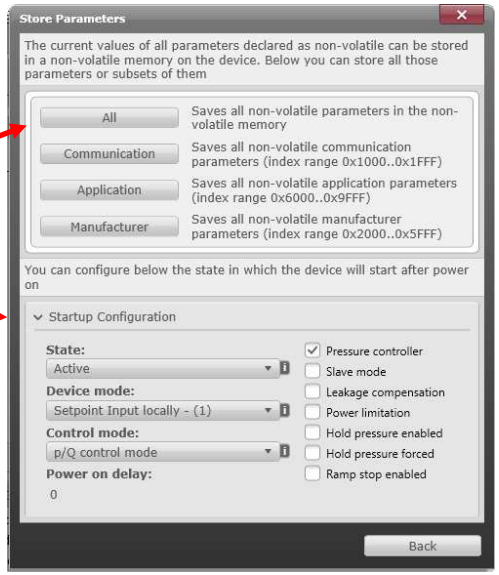
Store / Restore device settings

Store / restore settings and set start-up default

disk symbol indicates unsaved data

Store configuration

Parameters to store



default settings

- Valve state
- Control Word
- Device Mode
- Control Mode

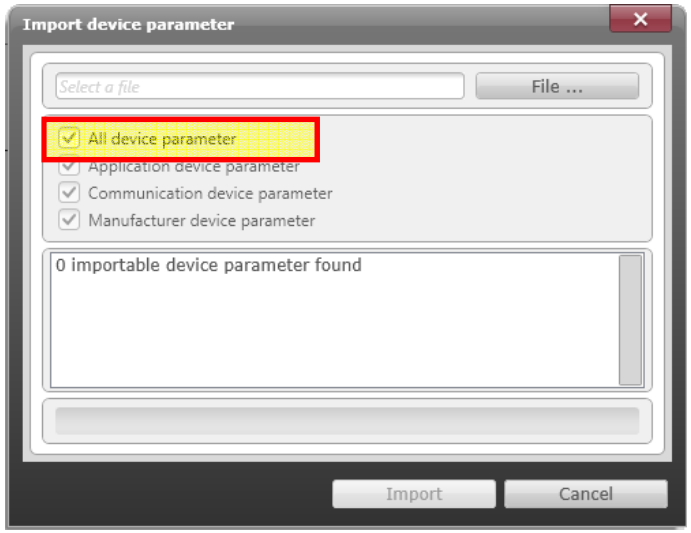
Restore sets valve back to factory settings

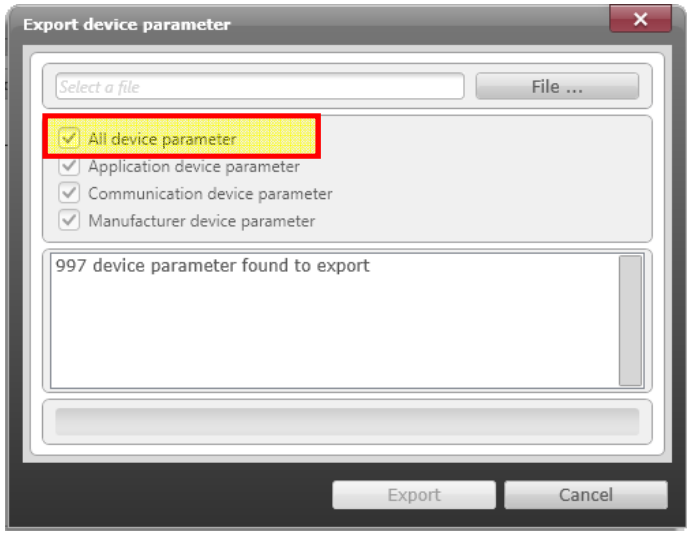
Configuration files

Import and export of configuration files

import configuration file from storage medium to valve - “load configuration file”

export configuration file from valve to storage medium - “save configuration file”





always select „All device parameter“

Tools section

General Settings

Device description: Device name

LSS information: manufacturer, ID, revision, serial number

Node-ID: possibility to change Node-ID

Firmware: displays current firmware version of the device

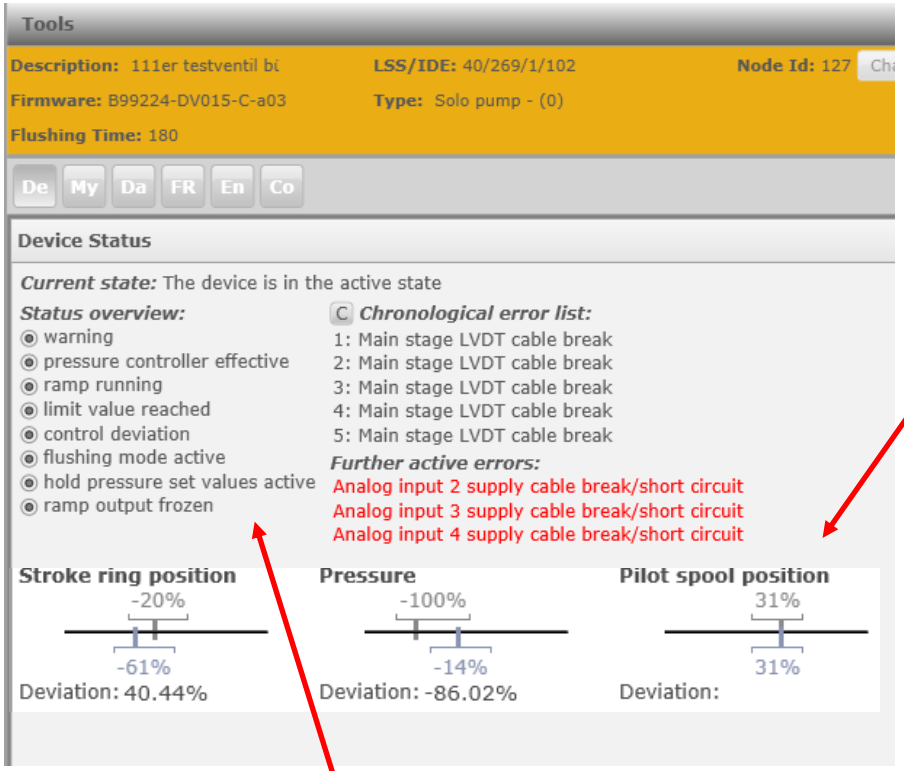
Master/Slave: Capability (Solo, Master, Slave)

Flushing time: flushing time for pumps with internal pressure supply

+ buttons to open/close additional areas

Tools section

Device Status

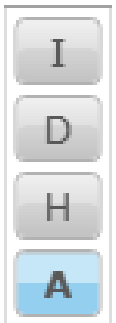


shows information about stroke ring, pressure and pilot valve

- set point value
- actual value
- deviation

StatusWord Information

- Device Status area
- Valve state info

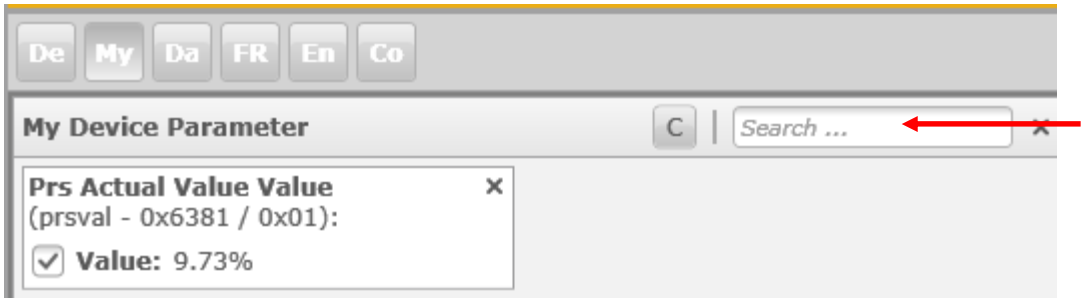


Values description

Bit	<StatusWord>
0	Disabled (D)
1	Hold activated (H)
2	Device mode active enable (M)
3	Ready (R)
4	Local control
5…7	Reserved
8	Pressure controller effective
9	Ramp running
10	Limit value reached
11	Control deviation
12	Reserved
13	Flushing mode active
14	Hold pressure set values active
15	Ramp output frozen

Tools section

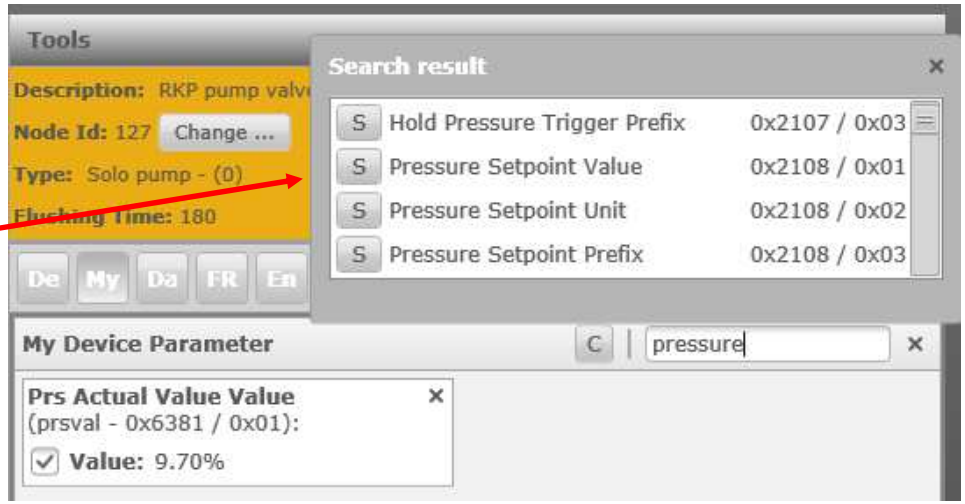
My device parameter



Input field to search for parameters

in this area, every parameter can be added for observation

If more parameters suit your search term, a list is displayed



Tools section

Datalogger

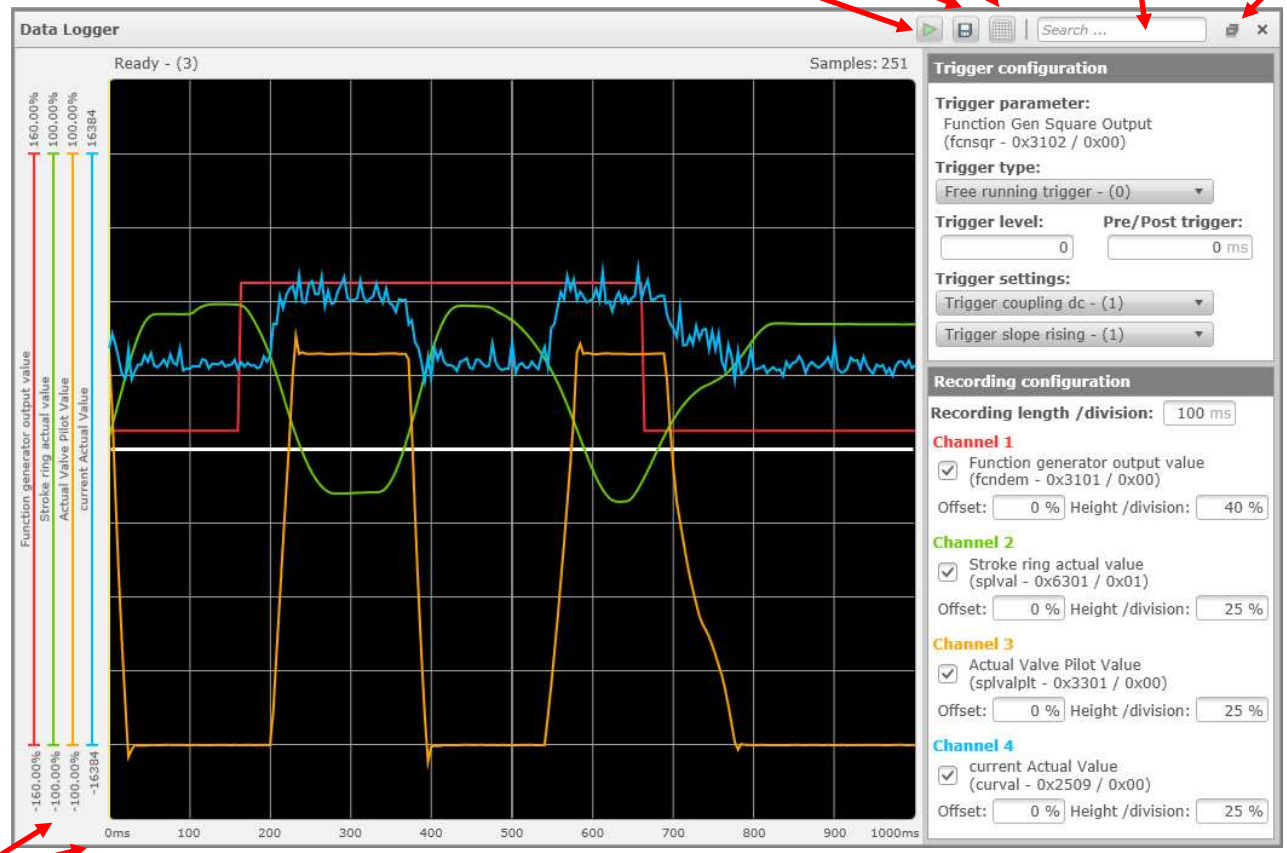
change background color

search for parameter name

save data

start/stop recording

start separate window



trigger configuration area

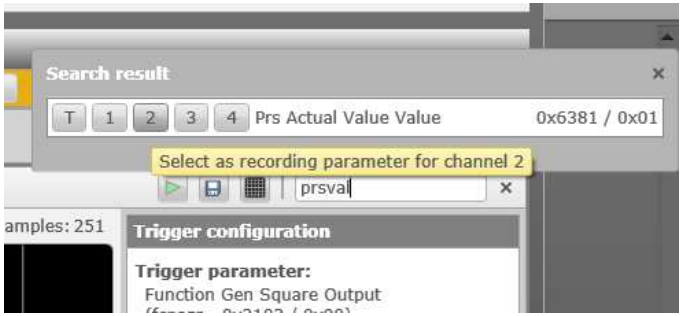
signals and scaling configuration

Scales for X- and Y-axis

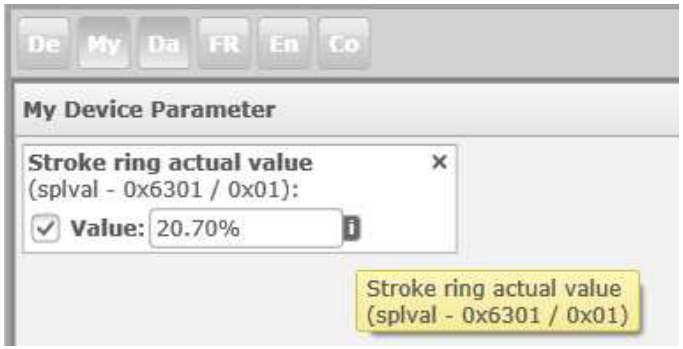
Tools section

Datalogger

left click on information section of the signal you want to record and draw it to the specific data logger channel



enter parameter name in search field and select on which channel you want to record the signal



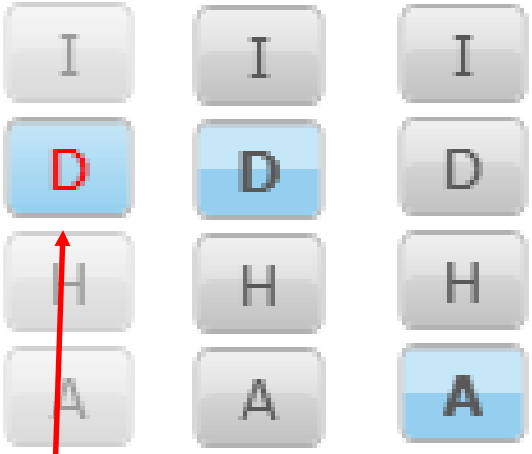
Left click on information section of a parameter displayed in your parameter list and draw it to the specific data logger channel

Tools section

Faults, fault configuration

Example: cable break detection for main stage LVDT

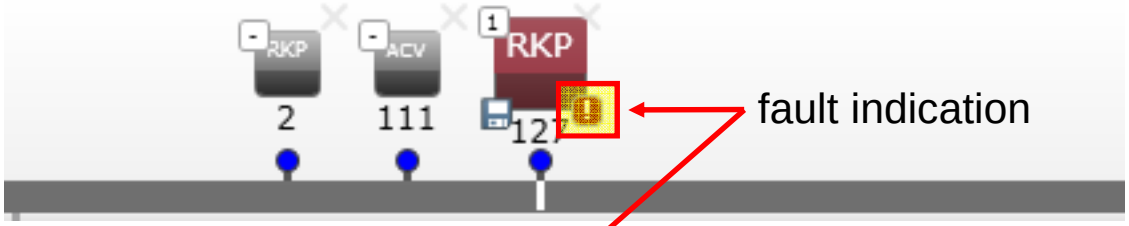
fault reaction: Fault Disabled



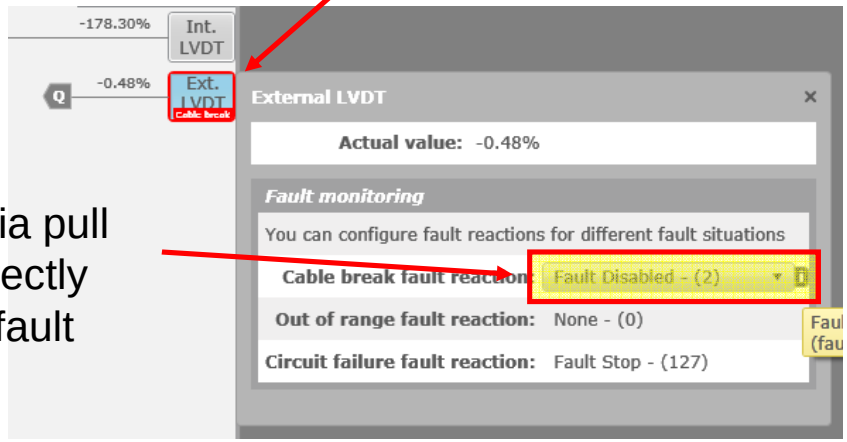
Click: switch to ACTIVE

valve is back in AVTIVE state

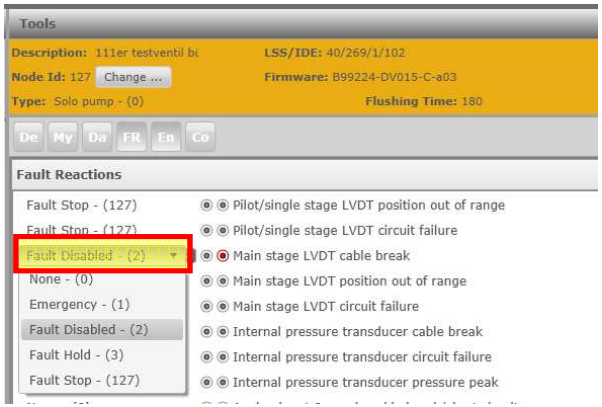
Click: acknowledge fault



fault indication



configuration via pull down menu directly at the specific fault

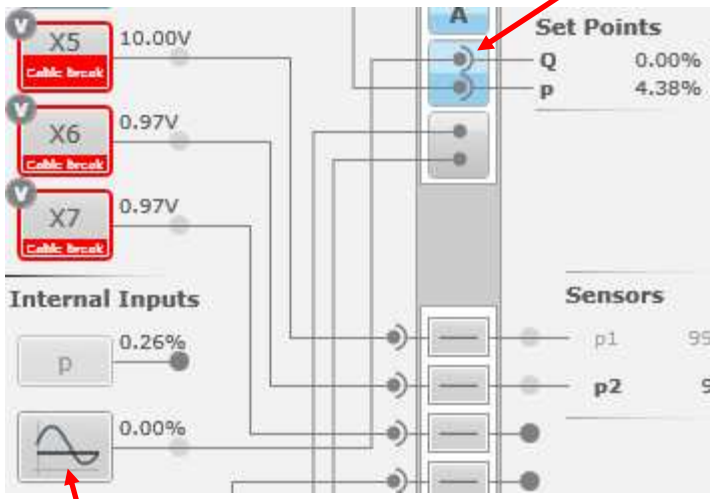


fault reaction configuration list in the Tools area available

Function generator

Configuration

connect e.g. as Q set point signal



click opens configuration window

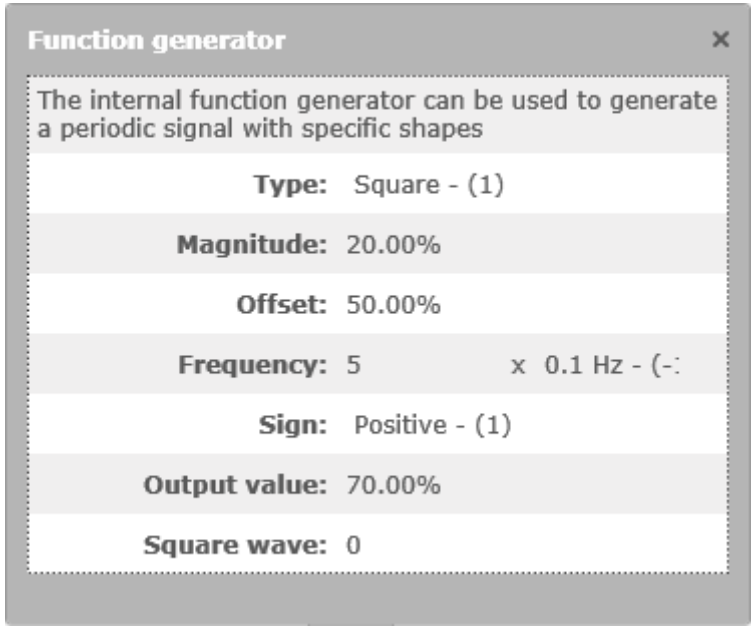
example

Square function

Magnitude: 20%

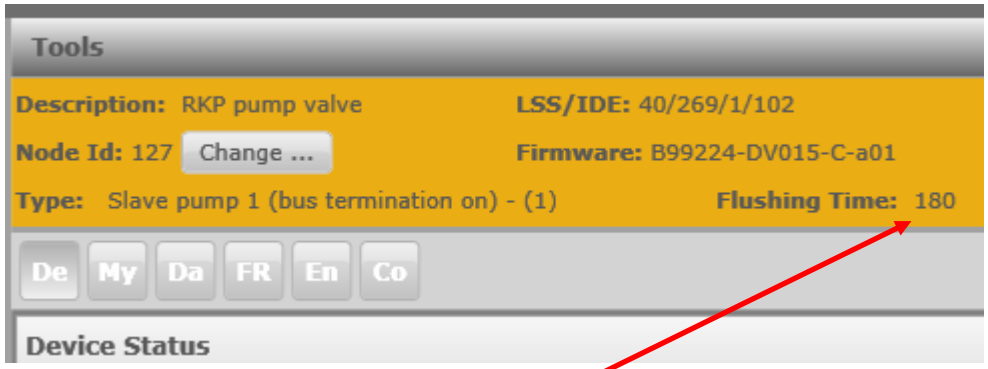
Offset: 50%

Frequency: 0,5 Hz (5 x 0,1 Hz)



Parameterization of special functions

Flushing function

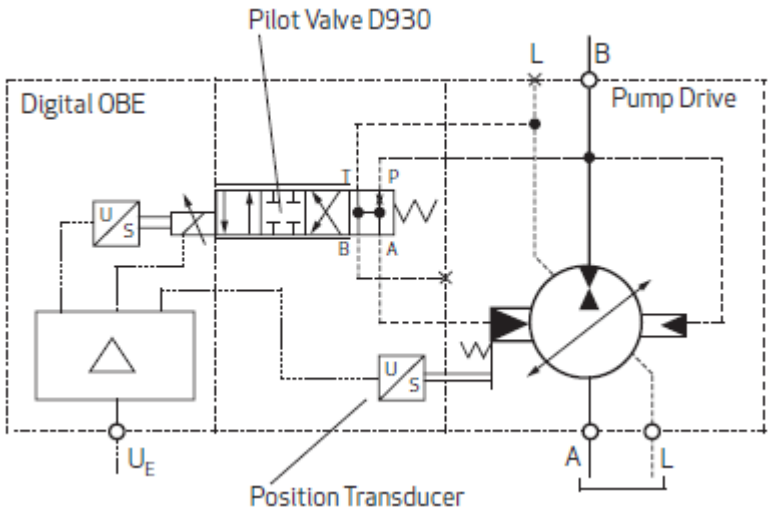


Internal Flushing Function

This special function is included in RKP-D models with an internal pressure supply (controller D1, D4, D5 and D8). The RKP-D monitors changes in the set points of pressure (p) and volumetric flow rate (Q). If one of the setpoints is < 1% for 3 minutes, the pilot valve is switched off, goes to its fail-safe-position, and flushes the RKP-D housing. This limits the temperature of the RKP-D. Housing temperatures up to 90°C (195°F) are acceptable and do not damage the RKP-D. To deactivate the flushing function, both set points have to be >1%.

Standard setting: 180 s

If you enter a value of 0, the flushing function is deactivated (default setting for pumps with external pressure supply)



Parameterization of special functions

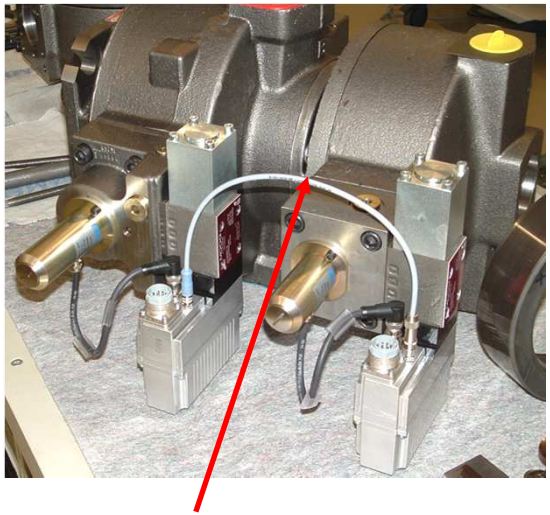
Master / Slave mode

2 or more pumps deliver to the same hydraulic circuit

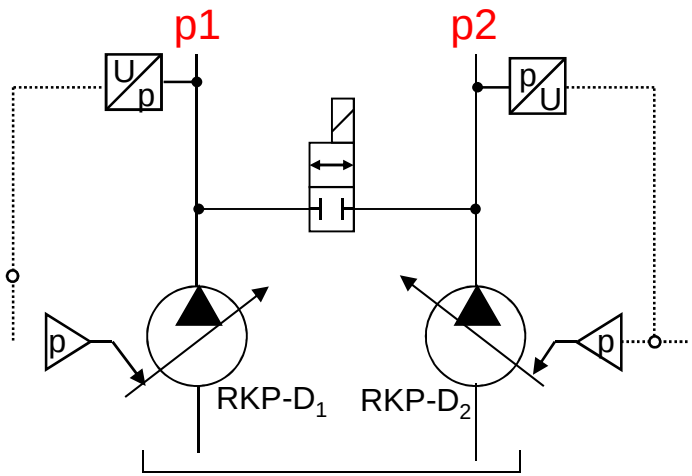
Only the master pump makes the flow and / or pressure control according to the set point signal for Q and p

All slave pumps „follow“ the stroke ring signal of the master pump in pure Q-mode

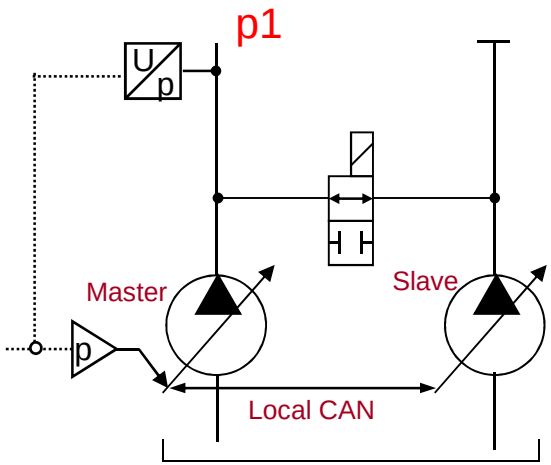
example: 4 pumps on 2 motors



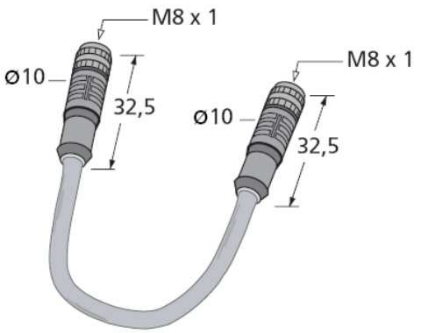
Local CAN Cable necessary



2 x Solo-Mode



Master-Slave-Mode



Moog (Ordering No C43395-001)

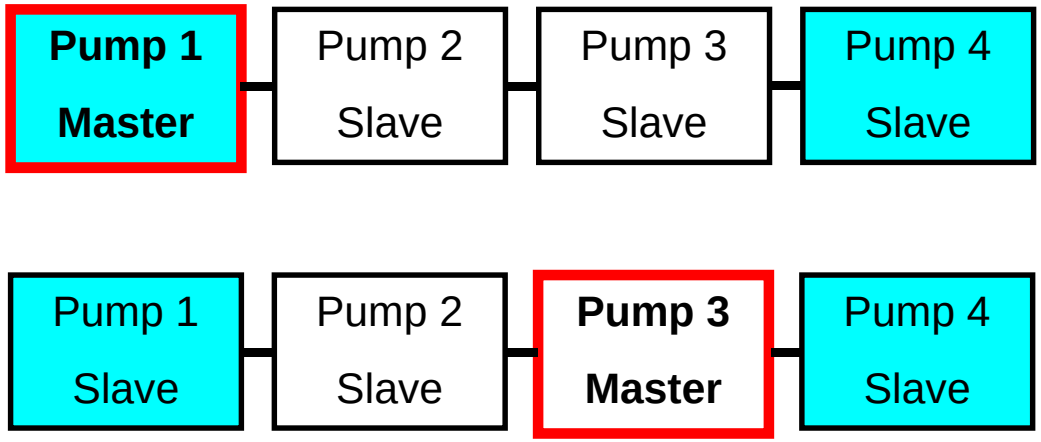
Escha (Type 8031233)

Parameterization of special functions

Master / Slave operation: configuration of Master pump

Example: configure pump as Master with bus termination ON

Independent from Master or Slave-configuration, the bus terminators have to be set at the beginning and at the end of the localCAN network



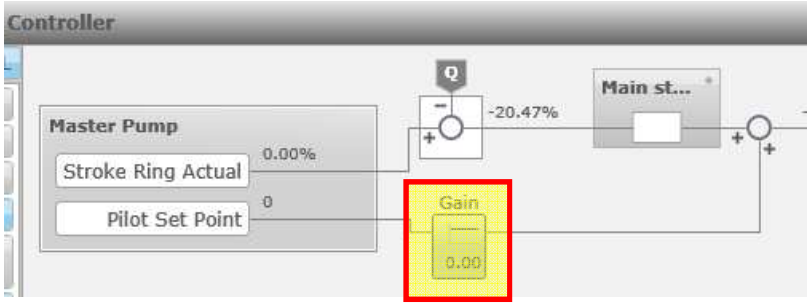
Parameterization of special functions

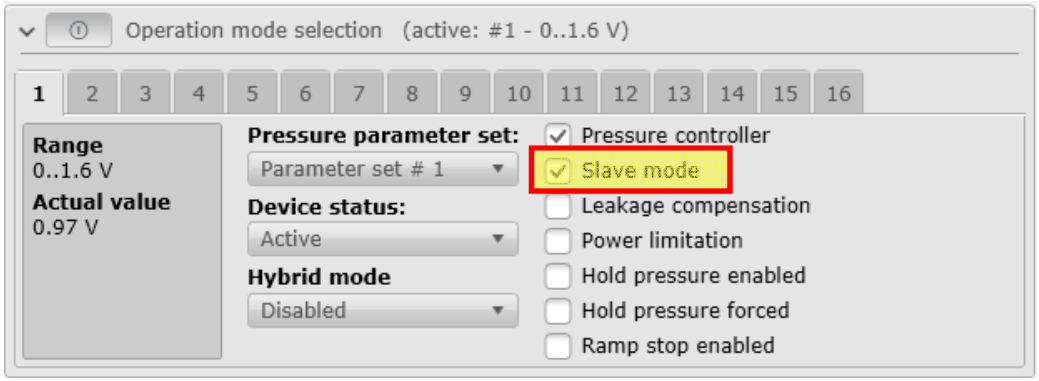
Master / Slave operation: configuration of Slave pump

Example:

Configure pump as Slave with bus termination ON

Activate „Slave enable bit“ in ControlWord of first operation mode





Adjustment possibility to additionally value the pilot valve signal of the Master pump

Parameterization of special functions

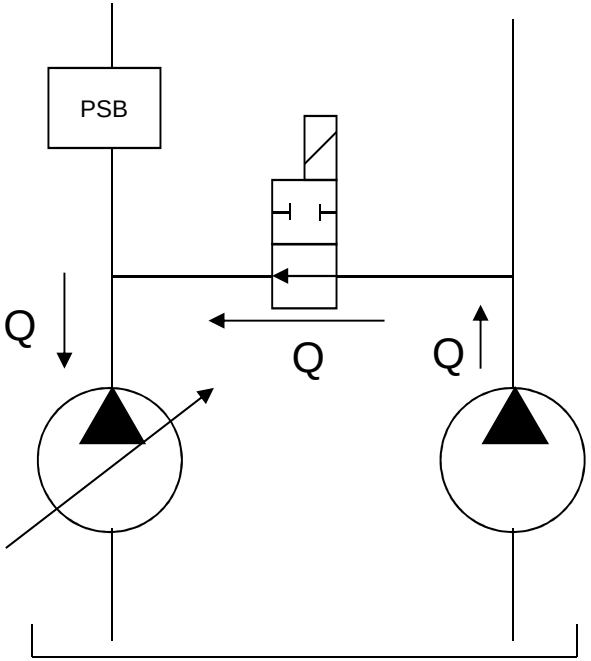
Hybrid operation mode

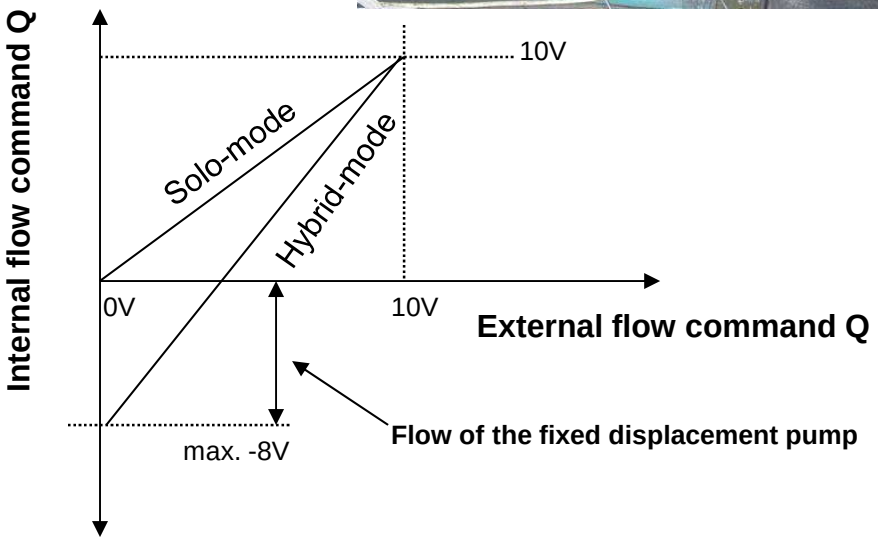
Combination of RKP and fixed displacement pump (e.g. gear-pump)

Control journal optimised for negative flow

Rescaling of Q-demand value is done by the software

Flow ratio RKP/constant pump max. 100:80



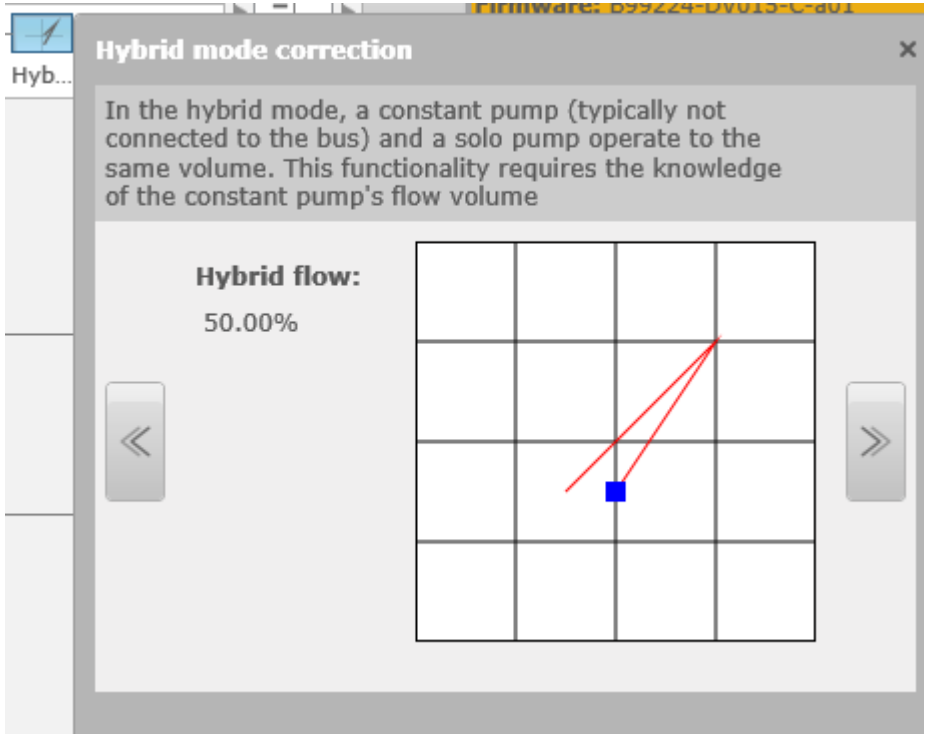


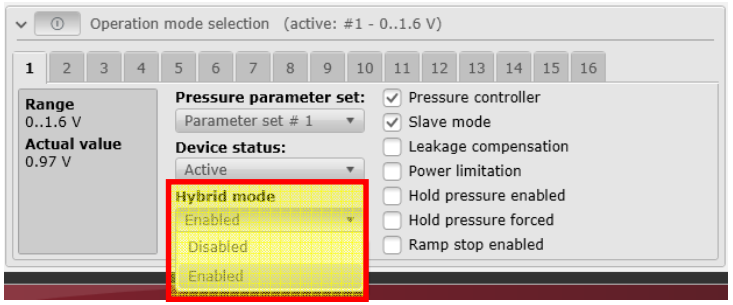
Parameterization of special functions

Hybrid operation mode

example: activate „hybrid operation“ in 1. operation mode, flow ratio of fixed displacement pump is 50% of RKP maximum flow

- „Hybrid Flow“ input is done in the set point conditioner
- activate hybrid operation in pull down menu of 1. operation mode



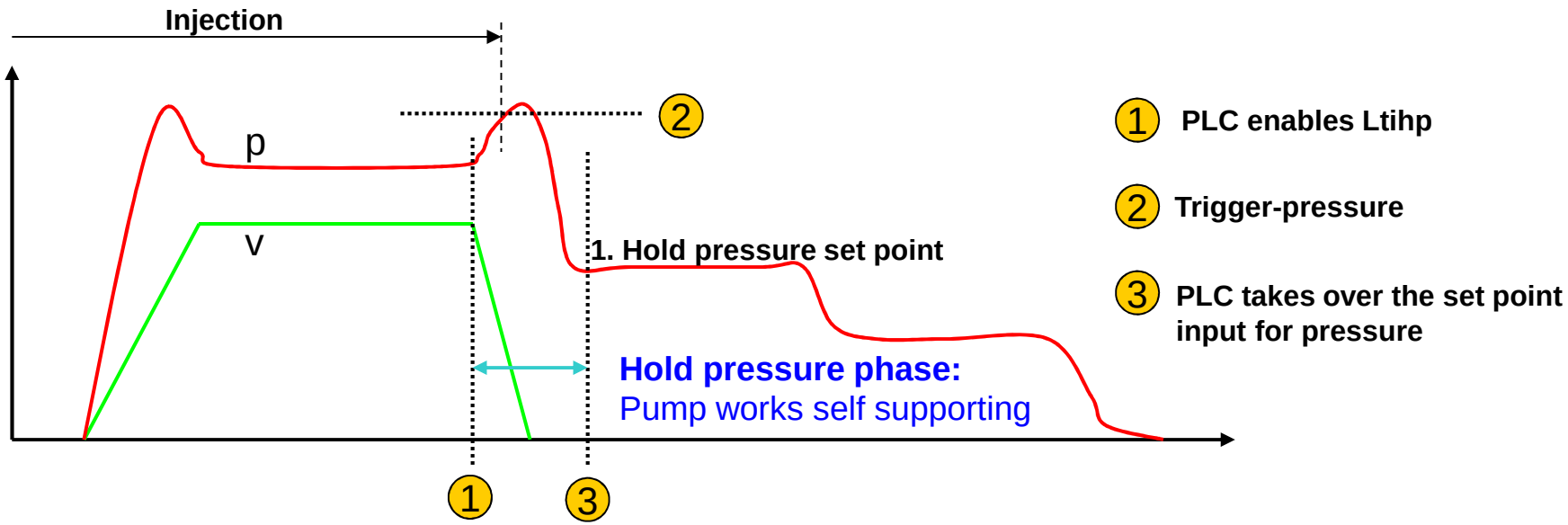


Parameterization of special functions

Local transition into hold pressure

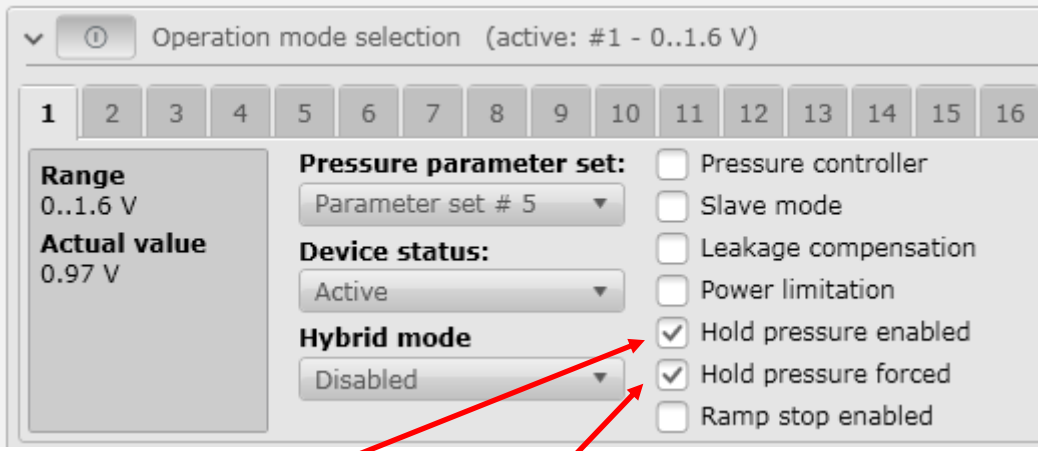
Special feature: Local transition into hold pressure with RKP-D in CAN-bus mode:

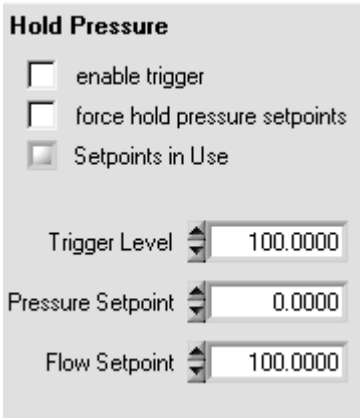
- Injection moulding machines require high repeatability for the switchover point from speed control to hold pressure control
- Jitters on the CAN bus influence this repeatability
- RKP-D has a build-in „transition into hold pressure“-functionality which is managed by the pump itself



Parameterization of special functions

Local transition into hold pressure





„enable trigger“ and **„force set points“** are set in the ControlWord, set point values and trigger level have to be adjusted in the parameter search list

the parameter names are:

- Trigger Level: **hldtrg**
- set point value for pressure: **hldprsset**
- set point value for flow: **hldsplset**

Parameterization of special functions

Motor speed dependent adaption of pressure controller

Variant: analog input of motor speed

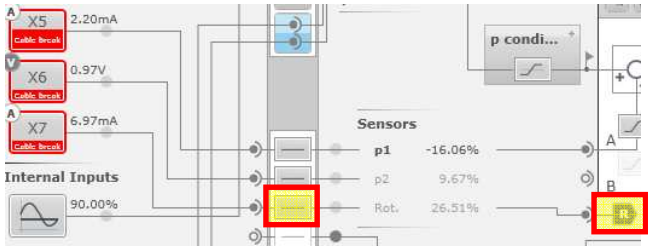
Transducer input X7: input for motor speed actual value

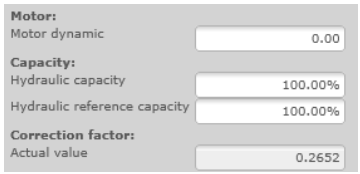
Configuration of the “general interface”

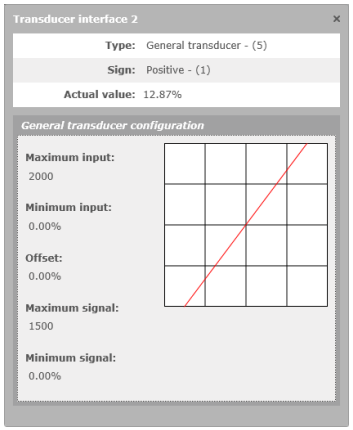
Link interface to rotation input “R”

Check resulting calculation factor **„cmpprsrpm“**

Possibility to adjust motor dynamics (time for rotation change)







2000

Max. rpm at 100% signal input on X7 (e.g. 10 V)

General rule

With rising motor speed, lower values in the P and D part of the controller are necessary and vice versa

1500

Reference rpm for the controller setup

Example

$$\text{factor} = \text{analog value} \times \frac{\text{max rotation speed}}{\text{reference rotation speed}}$$

2,5 V → calculation factor = 2,5 x 2000 / 1500 =0,333 → motor speed 500 rpm

7,5 V → calculation factor = 7,5 x 2000 / 1500 =1 → motor speed 1500 rpm

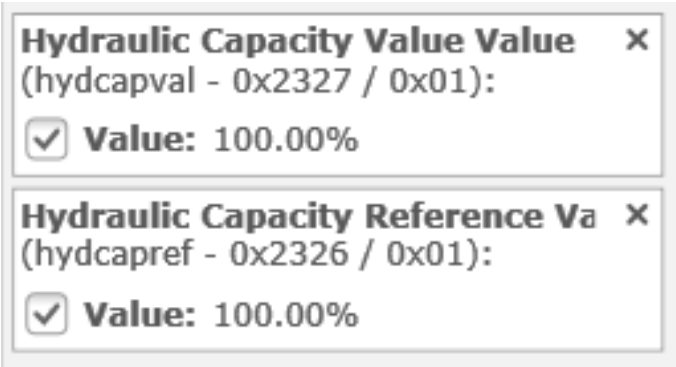
10 V → calculation factor = 10 x 2000 / 1500 =1,333 → motor speed 2000 rpm

Parameterization of special functions

Hydraulic capacity dependent adaption of pressure controller

Functionality

Similar to the change of motor speed, there is a new factor for the hydraulic capacity available which causes an automatic adjustment of the pressure controller to adept to the changed system configuration

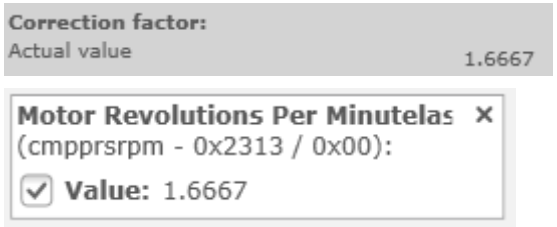


notice

Only one factor can be set on the valve

recommendation: setting reference capacity to 10% enhances the total range (input limit is 200%)

In the controller and tools area, the resulting actual factor for rotation speed and hydraulic capacity can be monitored



cmpprsrpm

General rule

With rising hydraulic capacity, higher values in the P and D part of the controller are necessary and vice versa

Parameterization of special functions

Robust pressure controller

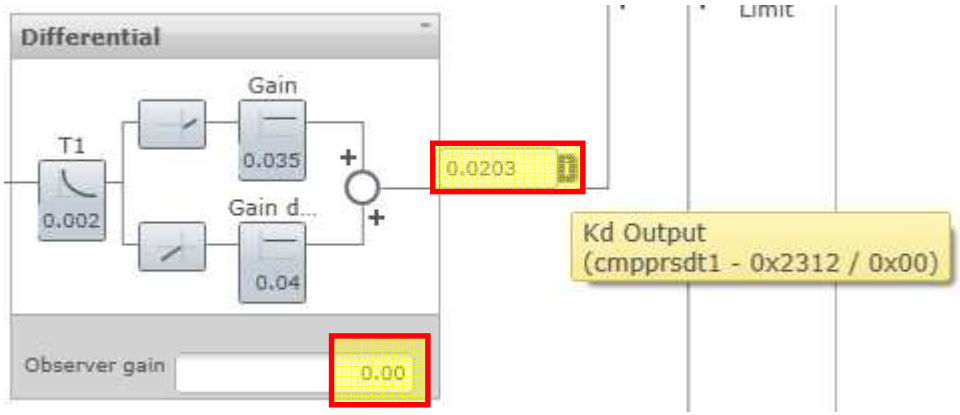
Functionality

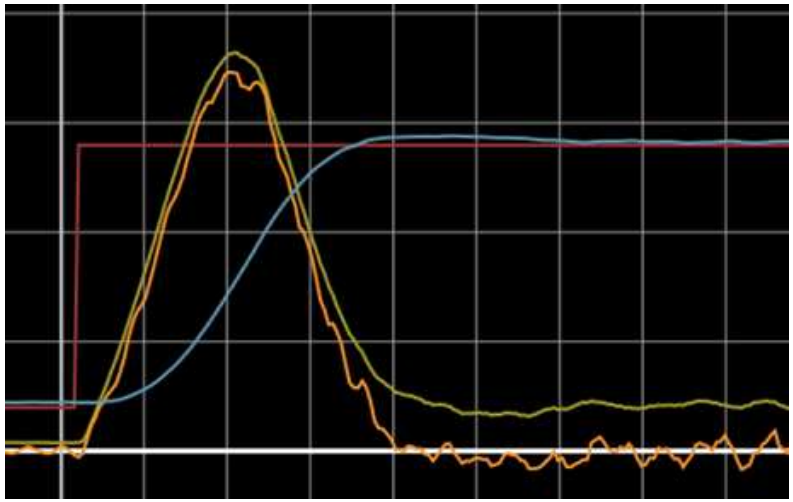
Evaluation of the stroke ring signal in the pressure signal differentiation block

Optimal adjustment of the factor

Setup a test function to apply a rectangular pressure set point signal change in a closed system and observe the result

Adjust feed forward parameter in that way, that output signal of the differentiation block (yellow: flag 12, **„cmpprsdt1“**) is in phase with the stroke ring signal (green **„splval“**)





Parameterization of special functions

Pressure signal via 2 interfaces

Functionality

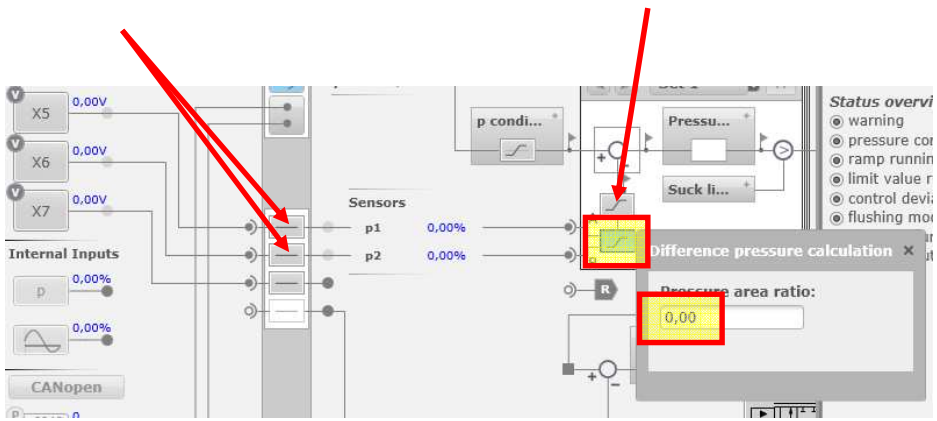
Pressure signal for controller input can be calculated by using 2 pressure transducers, each on one side of the cylinder-surface (press application)

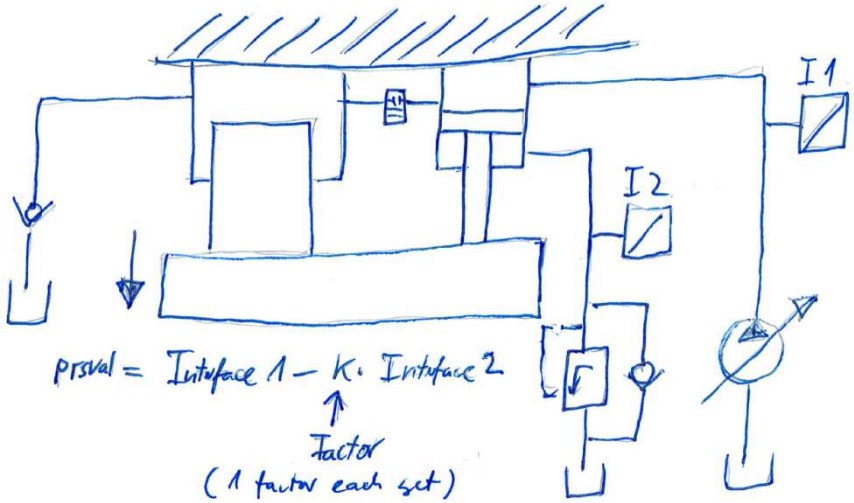
For both cases (with and w/o rapid speed cylinder) differential pressure can be calculated with the specific area ratio factors → force control

Adjustment

use 2 transducers / 2 interfaces

area factor (1 each set)





Thank you for your attention

For further information please contact:

Name:
Email:
Phone: