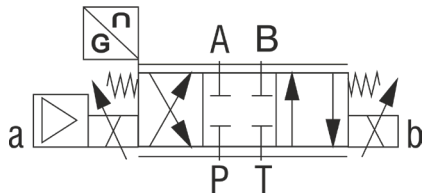


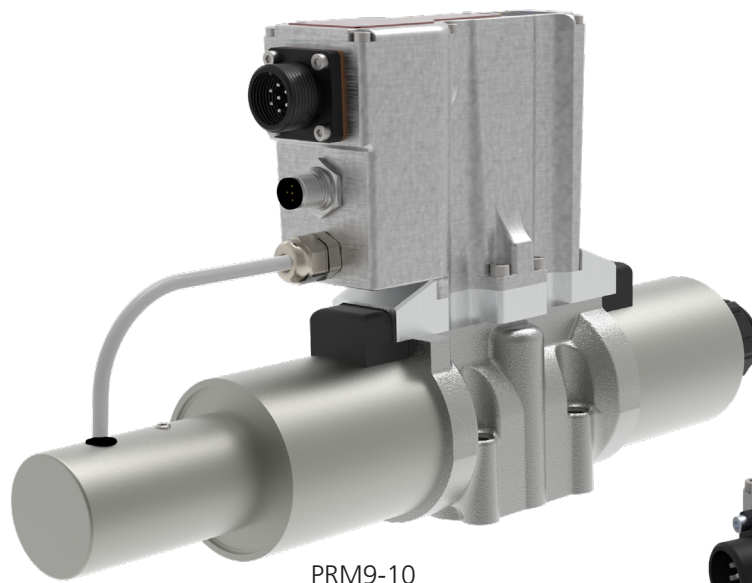
OPERATING INSTRUCTIONS

**PROPORTIONAL DIRECTIONAL CONTROL VALVE,
WITH DIGITAL ONBOARD ELECTRONICS AND INTERNAL FEEDBACK**

PRM9



EN



PRM9-10



PRM9-06

Important! Before operating this product, please read these instructions carefully.
Save the instructions for future reference.

If the operating instructions are lost, a replacement copy may be downloaded from the manufacturer's website
www.argo-hytos.com

The following is the authorised translation of original operating instruction PRM9 no. 15181_1cz_03/2025,
issued by the manufacturer:

ARGO-HYTOS s.r.o.
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ES PROHLÁŠENÍ O SHODĚ EU DECLARATION OF CONFORMITY EU-KONFORMITÄTSERKLÄRUNG		 A Voith Company
Výrobce / Manufacturer / Hersteller:	ARGO-HYTOS s.r.o.	
Adresa / Address / Adresse:	Dělnická 1306 CZ – 543 15 VRCHLABÍ Česká republika / Czech Republic / Tschechische Republik	
Identifikační číslo (DIČ)/ Ident. No. / Ident. Nr.:	CZ47452498	

F12-050.4

Výrobek / Product / Erzeugnis:

Proportionální rozváděč Proportional Directional Control Valve Proportional Wegeventil	PRM9-06 PRM9-10	06, 10	Hx 5129¹⁾, Hx 5130¹⁾
Název / Name / Bezeichnung	Typ / Type / Typ	Dn / Size / NG	Katalog / Datasheet

¹⁾ x definuje jazykovou verzi katalogu / x defines the language version of datasheet / x definiert die Sprachversion des Katalogs

Zamýšlené použití / Intended use of product / Verwendungszweck des Produkts:

Ventil určený pro řízení hydraulických obvodů. / The valve is intended for controll of hydraulic circuits. / Das Ventil ist zur Steuerung der hydraulischen Kreisläufen bestimmt.

Tímto prohlašujeme na svou výlučnou odpovědnost, že výše uvedený výrobek, na nějž se vztahuje toto prohlášení, splňuje relevantní požadavky níže uvedených směrnic a technických norem a je za podmínek obvyklého a určeného použití bezpečný.

We declare under our sole responsibility that the product mentioned above and covered this declaration, meets relevant requirements of following directives and technical standards and is safe under conditions of the usual and intended use. Wir erklären alleiniger Verantwortung, dass das oben genannte Erzeugnis, welches Gegenstand dieser Erklärung ist, die einschlägigen Anforderungen der folgenden Richtlinien und technischen Normen erfüllt. Das Produkt ist unter den Bedingungen einer bestimmungsgemäßen Verwendung sicher.

EU směrnice / EU Directives / EU-Richtlinien

2014/30/EU (EMC)	o harmonizaci právních předpisů členských států týkajících se elektromagnetické kompatibility on the harmonisation of the laws of the Member States relating to electromagnetic compatibility zur Harmonisierung der Rechtsvorschriften der Mitgliedstaaten über die elektromagnetische Verträglichkeit
2011/65/EU (RoHS)	o omezení používání některých nebezpečných látek v elektrických a elektronických zařízeních on the restriction of the use of certain hazardous substances in electrical and electronic equipment zur Beschränkung der Verwendung bestimmter gefährlicher Stoffe in Elektro- und Elektronikgeräten

Technické normy a předpisy / Technical standards / Technische Normen und Vorschriften:

(ČSN) EN ISO 12100:2011, (ČSN) EN ISO 4413:2011, (ČSN) EN ISO 9227:2023, (ČSN) EN 60529:1993, (ČSN) EN 60664-3 ed.2:2017, (ČSN) EN 60204-1 ed.3:2019, (ČSN) EN 61310-2:2008, (ČSN) EN 61000-6-4, ed.3:2019, (ČSN) EN 61000-6-2, ed.4:2019, (ČSN) EN 61000-4-2, ed.2:2009, (ČSN) EN 61000-4-3, ed.3:2006, (ČSN) EN 61000-4-4, ed.3:2013, (ČSN) EN 61000-4-5, ed.3:2015, (ČSN) EN 61000-4-6, ed.4:2014, (ČSN) EN 61000-4-8, ed.2:2010

Vrchlabí, 25.03.2025

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Konstruktionsleiter

Podpis /

Signature /

Unterschrift:



Operating instructions

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Glossary of technical terms used

- › **Windows** – IBM compatible desktop and laptop operating system
- › **LVDT** - Linear Variable Differential Transformer - transformer-based position sensing, provides contactless position feedback
- › **CANopen** – communication protocol
- › **SPRM9** – PC program for configuration and monitoring of PRM9 valve parameters
- › **Firmware** – the internal program of the electronics stored in its memory, it takes care of the basic functions
- › **PWM** – pulse width modulation - discrete modulation for analog signal transmission
- › **USB-C** – standard connector for data transfer and power supply via a single cable
- › **OBE** – onboard electronic - control electronics located directly on the valve

1. General technical information

1.1 Introduction

The PRM9 proportional directional control valve consists of a cast iron body, a special control spool, two centering springs with support washers, one or two proportional solenoids, a position sensor and integrated electronics with housing.

The PRM9 proportional directional control valve is available in two basic nominal sizes - Dn 06 and Dn 10.

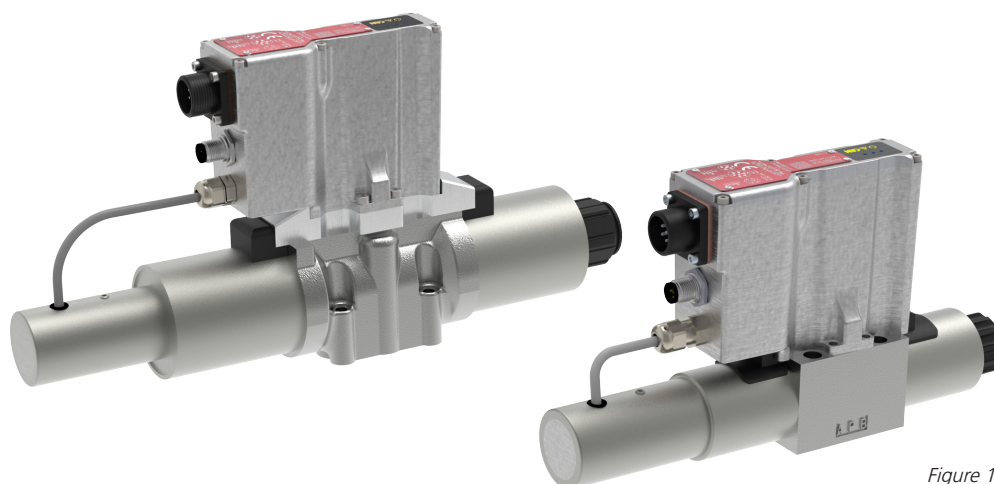


Figure 1-1: PRM9-06 and PRM9-10

The measuring system of the position sensor is based on the principle of a differential transformer (LVDT). The sensor core is mechanically connected to the spool. The digital control electronics are housed in an aluminium box mounted on the valve body. While the sensor is connected to the electronics by a cable, the electromagnets are connected directly, without the use of cables. For the basic electrical connection, a MIL-C5015 (6+PE) connector is used to provide power, control signal input and signal output from the spool position sensor. For connection to the CANopen bus, a 5-pole plug with M12x1 thread is used.

The digital electronic unit uses a pulse width modulated (PWM) signal to control the proportional solenoids.

The electronics are equipped with internal current feedback, the output current can be modulated by a dynamic lubrication signal if required.

Dynamic lubrication significantly reduces the effects of adhesion forces.

Further functional parameters can be easily set using the PRM9 software after connecting the valve to a PC via USB (PC) ↔ USB-C (valve) inputs.

The software is freely downloadable on the ARGO-HYTOS website.

1.2 Use of the directional control valves

Proportional directional control valves with integrated digital electronics are available in the following configurations (see datasheet for more information):

- › E02S02 - proportional directional control valve with internal feedback
- › E02S02-CA - proportional directional control valve with internal feedback and CANopen bus connection





In the E02S02 configuration, the proportional directional control valve can be used for flow direction and flow rate control (position and velocity control).

1.3 Limited warranty

The operation of the proportional directional control valve in any installation must be in accordance with the instructions and recommendations of the manufacturer ARGO-HYTOS s.r.o., as well as with the general safety regulations and other legal regulations in force in the country concerned.






The manufacturer shall not be held liable for any damage to property or personal injury caused by the operation of hydraulic systems equipped with ARGO-HYTOS proportional manifolds. The user will be ultimately responsible for non-compliance, improper handling or incorrect interpretation, including in a legal sense.

1.4 List of signal words and warning signs used in the text

	DANGER	Signal word combined with a warning sign used to signify that a dangerous situation which could result in death or serious injury is imminent.
	WARNING	Signal word combined with a warning sign used to signify the occurrence of a potentially dangerous situation that could result in death or serious injury if not avoided.
	CAUTION	Signal word combined with a warning sign used to signify a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.
	INFO	A signal word drawing attention to important advice and information.

1.5 Risks and limitations of product use

The valve must only be installed and commissioned by a trained and authorised person.

	DANGER	The valve is designed for DC power supply in the range of 9 - 32 V DC. Do not connect the valve to AC voltage of any value and to DC voltages outside the permitted range. Destruction of the product, damage to property and health are at risk or fire.
	WARNING	When the power supply for the electronics is switched on, the control signal will be active for a short interval (1 - 2 s). Care must be taken to ensure that in this case the control signal does not cause undesired valve operation.
	WARNING	Some parts of the valve may be hot during operation. When using valves in applications with high demands on safety requirements, precautions must be taken to immediately disconnect the power source or control signal in the event of a malfunction. The valve will then automatically return to the centre position (spring centred). The resulting channel connection in the centre position depends on the valve spool and therefore it is necessary to check that the selected spool is suitable for the application.
	CAUTION	Permissible range of ambient temperature for operation the valve electronics is -40 °C ... +80 °C.
	INFO	Argo-Hytos s.r.o. shall not be liable for any damages caused by improper use of the electronics or by actions contrary to these Operating instructions.

1.6 Basic Setting

Proportional directional control valve with digital electronics OBE are pre-configured or fully configured by the manufacturer depending on the design and can therefore be used immediately. In the E02S02 configuration, the directional control valve is fully functional and virtually no intervention is required to set the electronics parameters.

2. Technical Description

2.1 Basic Parts

Figure 2-1 shows the PRM9 proportional directional control valve and its basic components.

The directional control valve consists of:

- › a body with an inserted valve spool (1)
- › proportional solenoids (2)
- › spool position sensor (3)
- › digital control electronics (4)

The basic parts are the same for each configuration offered by the manufacturer, but the difference is in their use for that configuration.

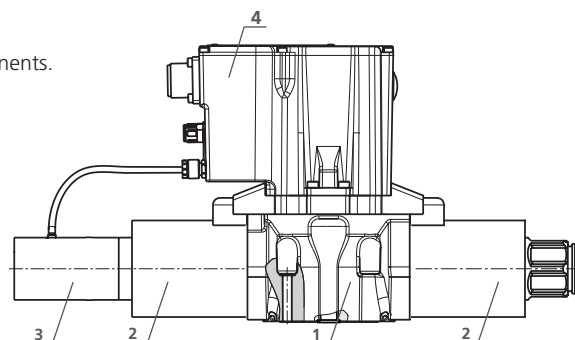


Figure 2-1: Proportional directional control valve PRM9

2.2 Technical Parameters

Basic parameters of proportional directional control valve			
Valve size	Dn	06 (D03)	10 (D05)
Mounting dimensions		DIN 24 340 a ISO 4401	
Max. operating pressure at ports P, A, B	bar (PSI)	350 (5100)	
Max. operating pressure at port T	bar (PSI)	160 (2300)	210 (3050)
Pressurized fluid		mineral oil (HM, HV) according to DIN 51524	
Fluid temperature range NBR	°C (°F)	-30 ... +80 (-22 ... +176)	
Fluid temperature range FPM	°C (°F)	-20 ... +80 (-4 ... +176)	
Ambient temperature max.	°C (°F)	-40 ... +50 (-40... +122)	
Operating viscosity range	mm²/s (SUS)	20... 400 (98... 1840)	
Specified fluid cleanliness level		Class 21/15 according to ISO 4406: 1987, recommended filter capacity β10 ≥ 75	
Nominal flow rate Q _N at Δp=10 bar (145 PSI)	l/min	5, 8, 15, 30	30, 60
	(GPM)	(1.32, 2.11, 3.96, 7.93)	(7.93, 15.85)
Basic parameters of electronics			
Supply voltage with polarity inversion protection	V DC	9 ... 32*	
Input: command signal	V	±10; 5±5; 2,5±2,5; 0...5; 0...10; Ucc/2±10; Ucc/2±5	
	mA	±10; 12±8; 10±10; 0...20; 4...20; -10...+10	
Monitoring signal	V	±10 (max. 20 mA)	
Output current to solenoids	A	2x PWM output stages up to 4 A	
Resolution of the A/D converter	bit	12	
PWM frequency	kHz	15	
Cycle time	µs	50	
Parameter setting: By SPRM9 parametrization software. Connection via USB ⇔ USB-C cable			
General information			
Protection degree		IP65 & IP67	
Shock & vibration		Sinus 10 g, max. ampl. 0.75 mm, 10-2000 Hz, Shock 30 g, half sinus 11ms	
Electromagnetic compatibility (EMC)		DIN EN 61000-4-2 DIN EN 61000-4-3 DIN EN 61000-4-4 DIN EN 61000-4-5 DIN EN 61000-4-6 DIN EN 61000-4-8	

3. Design of Valves

3.1 Configuration E02S02 (Direct acting proportional directional control valve with internal spool position feedback)

The proportional directional control valve in the E02S02 configuration (with internal position feedback), see Figure 3-1, can be used to control the direction of flow and the flow rate of oil (position or velocity control) depending on the spool valve option used. As a result of the internal position feedback, the valve has better dynamic response, lower hysteresis and higher sensitivity than a comparable valve without internal feedback.

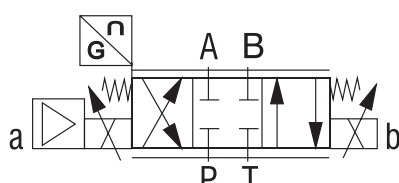


Figure 3-1: Proportional directional control valve with two coils in E02S02 configuration

4. Valve Installation

The valves are designed for installation according to ISO 4401. Installation should be carried out in accordance with the manufacturer's instructions in the documentation included in each valve package.

5. Electrical Connection

The digital electronics are protected by an aluminium housing, which has excellent heat conduction properties. The coils are connected via the appropriate connector to the digital electronics box. The power supply, the setpoint signal and the monitoring signal are connected using a standard MIL connector, while the CANopen connection is made using M12x1 connectors. In addition, the electronics include an optical feedback (LED), which mainly describes the operating status. Details are shown in Figure 5-1.

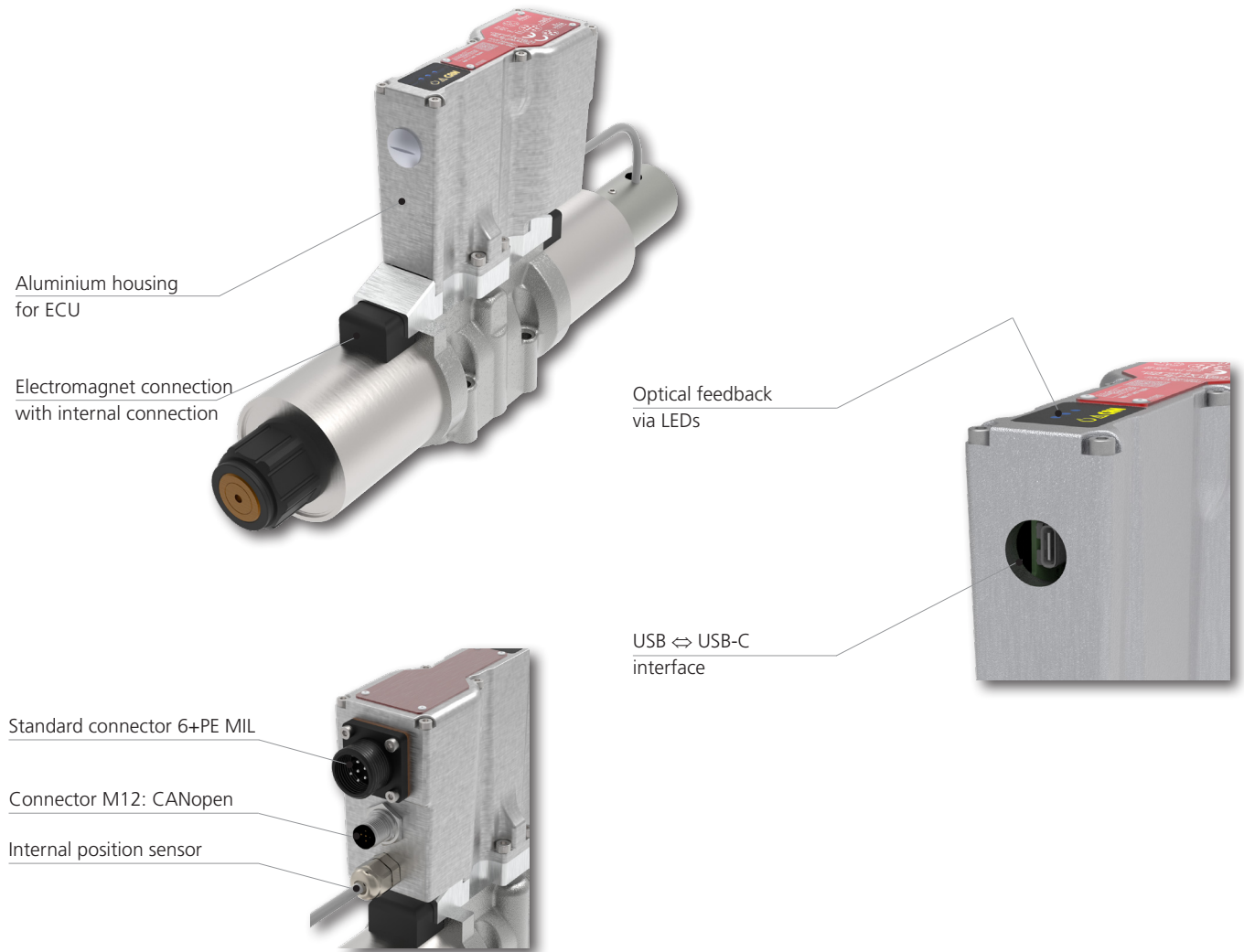


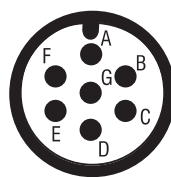
Figure 5-1: Electrical/electronic connection of PRM9 electronics

5.1 Connection of Power Supply and Command Signal to the Valve Electronics

The supply voltage and the setpoint signal are connected to the valve using the 6+PE MIL plug (EN 175201-804) shown in Figure 5-2. The MIL plug is not included with the proportional directional control valve. The pin assignment can be seen in Figure 5-3 (plug assignment).





Figure 5-2: connector



PIN	Technical data
A	Supply voltage 24 V
B	GND (power supply)
C	GND (monitor)
D	Control signal
E	GND (control signal)
F	Monitor
G	Grounding (PE)

Figure 5-3: PIN assignment (electronics)

	DANGER	The electronics are designed for DC power supply in the range of 9-32 V DC. Do not connect the electronics to AC voltages of any value and to DC voltages outside the permitted range. Destruction of the product, damage to property and health, or fire may result.
	WARNING	Connect the connectors to the valve only when the power supply is switched off and the control signal is zero.

Input resistance for control signal:

Voltage signals	$\geq 100 \text{ k}\Omega$ (± 10 ; 5 ± 5 ; $2,5 \pm 2,5$; $0 \dots 5$; $0 \dots 10$; $U_{cc}/2 \pm 10$; $U_{cc}/2 \pm 5$)
Current signals	$\leq 500 \text{ }\Omega$ (± 10 ; 12 ± 8 ; 10 ± 10 ; $0 \dots 20$; $4 \dots 20$; $-10 \dots +10$)

5.2 Connection of the valve electronics to and PC

A computer can be connected to the valve electronics using a standard USB-C <-> USB-A cable.

No driver is required for operation, the Windows operating system includes everything.

To ensure proper operation of the valve, the main power to the valve must first be turned on and then the USB cable must be connected.

This connection allows the valve parameters to be set using the appropriate software, which can be downloaded from the ARGO-HYTOS web portal.

The cable is not included and must be ordered separately.



Figure 5-4: USB-C <-> USB-A cable



Figure 5-5: USB-C connector on the valve

	INFO	If necessary, you can use the USB-C <-> USB-C cable and connect the valve on the computer side via the USB-C connector instead of USB-A, the communication will be done in the standard way.
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5.3 CANopen Connection

The CANopen connection (only in the E02S02-CA configuration) is made with a 5-pin connector with code A, M12x1.

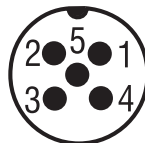
An example of the corresponding socket is shown in Figure 5-6. The socket and cable are not included and must be ordered separately.

The corresponding socket fitting is shown in Figure 5-7.

(The factory default speed is 500 kbit/S and Node ID A, can be changed in SPRM9).



Figure 5-6: CANopen connector



PIN	Technical data
1	nc
2	nc
3	CAN GND
4	CAN HIGH
5	CAN LOW

Figure 5-7: CANopen Connectors PIN assignment (electronics)

5.4 Warnings, errors, status messages and LED signalling

The electronics in the PRM9 valve are equipped with signal LEDs that indicate the current operating status of the electronics or the valve. Depending on the valve design, there are two or three LEDs for the CANopen bus version.



Figure 5-8: Signalling LEDs

Table 5-1 describes the possible LED display cases and thus the valve states. There are three types of messages:

- › **Error** - the current to the coils is switched off, the valve is moved to the middle position where it waits until the conditions for the error are no longer present. If the error is corrected during operation, the valve switches to normal mode after approximately 10 s. The error condition is indicated visually by LEDs and the specific cause of the error condition is listed in the S-PRM9 application.
- › **Warning** - the valve electronics warns of a non-standard situation, the valve function is not affected and the valve continues to operate. The warning is indicated visually by LEDs and the specific cause of the warning is listed in the S-PRM9 application.
- › **Status** - informs about the current status of the valve or about system operations.


LED 1 Colour RGB	LED 2 RED	LED 3 CAN BUS	Description	Message Type
white	on	on	firmware is booting	status
flashes RGB cyclically	flashes cyclically	flashes cyclically	Bootloader upload firmware IO	status
4 Hz blue	off	off	Bootloader upload firmware CONTROL	status
4 Hz magenta (red + blue)	flashes	according to CAN	error upload CONTROL	error
green	off	off	no errors, normal operation, no bus active	status
green	off	on	no errors, CANopen OPERATIONAL	status
orange (green + red)	off	according to CAN	temperature >70 °C	warning
2 Hz orange (green + red)	on	according to CAN	temperature >80 °C	error
blue	2 Hz	according to CAN	solenoid A high current	error
magenta (red + blue)	2 Hz	according to CAN	solenoid B high current	error
blue	1 Hz	according to CAN	solenoid A disconnected	error
magenta (red + blue)	1 Hz	according to CAN	solenoid B disconnected	error
2 Hz red	1 Hz	according to CAN	command signal error AIn	error
1 Hz red	1 Hz	according to CAN	position sensor error	error
2 Hz red	on	according to CAN	supply voltage error out of range	error
red	on	according to CAN	general error	error

Table 5-1 Error messages and their signalling

LED 1 Colour RGB	LED 2 RED	LED 3 CAN BUS	Description	Message Type
2 Hz red	2 Hz	according to CAN	multiple errors at the same time	error
2 Hz red	off	according to CAN	multiple warnings at the same time	warning


Table 5-2 LEDs in case of multiple errors

In case of multiple errors or warnings, you need to connect to the valve using the S-PRM9 app. The status window, see Figure 8-18, will display all current errors and warnings.

	INFO	In an error condition, the valve is disabled and does not respond to the input control signal, the cause of the error must be corrected to get the valve working again. In the event of a warning, the valve continues to operate and its function is not affected.
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5.5 Commissioning

When the power supply is connected, the "Power" LED lights up twice in white for about 2 s. The valve electronics are triggered. Then the LED colour changes to green and the valve enters the operating mode. If this does not happen, the LED combination shown in 5.5 will appear and indicate a fault condition.

	DANGER	When commissioning the proportional directional control valve, the necessary safety instructions must be strictly observed. To prevent uncontrolled system behavior, all power and hydraulic circuits must be checked before supply voltage is applied. In cases of emergency, all measures must be taken to enable the system to be shut down.
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5.6 Normal operation

The valve is configured by the manufacturer according to the type key for immediate use.
By default, an analog input of 0 ...10 V for single magnet or ± 10 V for double magnet is predefined.
For CANopen, the default setting is NODE ID 1 and a baud rate of 500 kbit/s.
The password for the Technician connection from the PC application is **1234** (can be changed).

	WARNING	When the power supply for the electronics is switched on, the control signal will be active for a short interval (1 - 2 s). Care must be taken to ensure that in this case the control signal does not cause undesired operation of the directional control valve.
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6. Target user group

All the above activities related to this product, especially installation and parameter setting, require technical expertise and experience in hydraulic and electrical engineering. The minimum required level of competence in electrical engineering is level 6 according to Decree No 194/2022. This level is generally defined as performing various activities that require an understanding of technical factors and contexts. This may lead to the need for correct interpretation (e.g. tolerances, operating methods) or the application of various non-repetitive procedures. This may require the performance of checks, simple analysis and diagnostics, and the ability to react to changes in an operational manner. Teamwork is often necessary. Following persons are prohibited from performing any activities related to this product:

- › minors (the exception is practical training of pupils under the professional supervision of a teacher)
- › without established professional competence
- › under the influence of alcohol and/or drugs
- › patients whose medical condition could affect safety (reduced attention and ability to react in time, excessive fatigue)
- › under the influence of drugs that have a demonstrable effect on attention

7. Integrated Digital Electronics

7.1 Electronics Block Diagram

The block diagram shows the basic structure of digital integrated electronics. The interfaces on the outside and their nature can be understood from the representation. More details about the electrical connections can be found in Chapter 5 "Electrical connection".

Č.	Technical data	Description																								
1	Command signal	<table> <tr> <th>Voltage [V]</th><th>Current [mA]</th><th>Resolution 12 bit</th></tr> <tr> <td>± 10</td><td>± 10</td><td></td></tr> <tr> <td>5 ± 5</td><td>12 ± 8</td><td></td></tr> <tr> <td>$2,5 \pm 2,5$</td><td>10 ± 10</td><td></td></tr> <tr> <td>$0 \dots 5$</td><td>$0 \dots 20$</td><td></td></tr> <tr> <td>$0 \dots 10$</td><td>$4 \dots 20$</td><td></td></tr> <tr> <td>$U_{cc} / 2 \pm 10$</td><td>$-10 \dots +10$</td><td></td></tr> <tr> <td>$U_{cc} / 2 \pm 5$</td><td></td><td></td></tr> </table>	Voltage [V]	Current [mA]	Resolution 12 bit	± 10	± 10		5 ± 5	12 ± 8		$2,5 \pm 2,5$	10 ± 10		$0 \dots 5$	$0 \dots 20$		$0 \dots 10$	$4 \dots 20$		$U_{cc} / 2 \pm 10$	$-10 \dots +10$		$U_{cc} / 2 \pm 5$		
Voltage [V]	Current [mA]	Resolution 12 bit																								
± 10	± 10																									
5 ± 5	12 ± 8																									
$2,5 \pm 2,5$	10 ± 10																									
$0 \dots 5$	$0 \dots 20$																									
$0 \dots 10$	$4 \dots 20$																									
$U_{cc} / 2 \pm 10$	$-10 \dots +10$																									
$U_{cc} / 2 \pm 5$																										
2	Spool position signal processing																									
3	A/D transducer																									
4	Overcurrent protection																									
5	Final stage PWM	max. 4 A ($f=15$ kHz)																								
6	Analog output (monitoring signal)	± 10 V																								
7	USB-C communication port																									

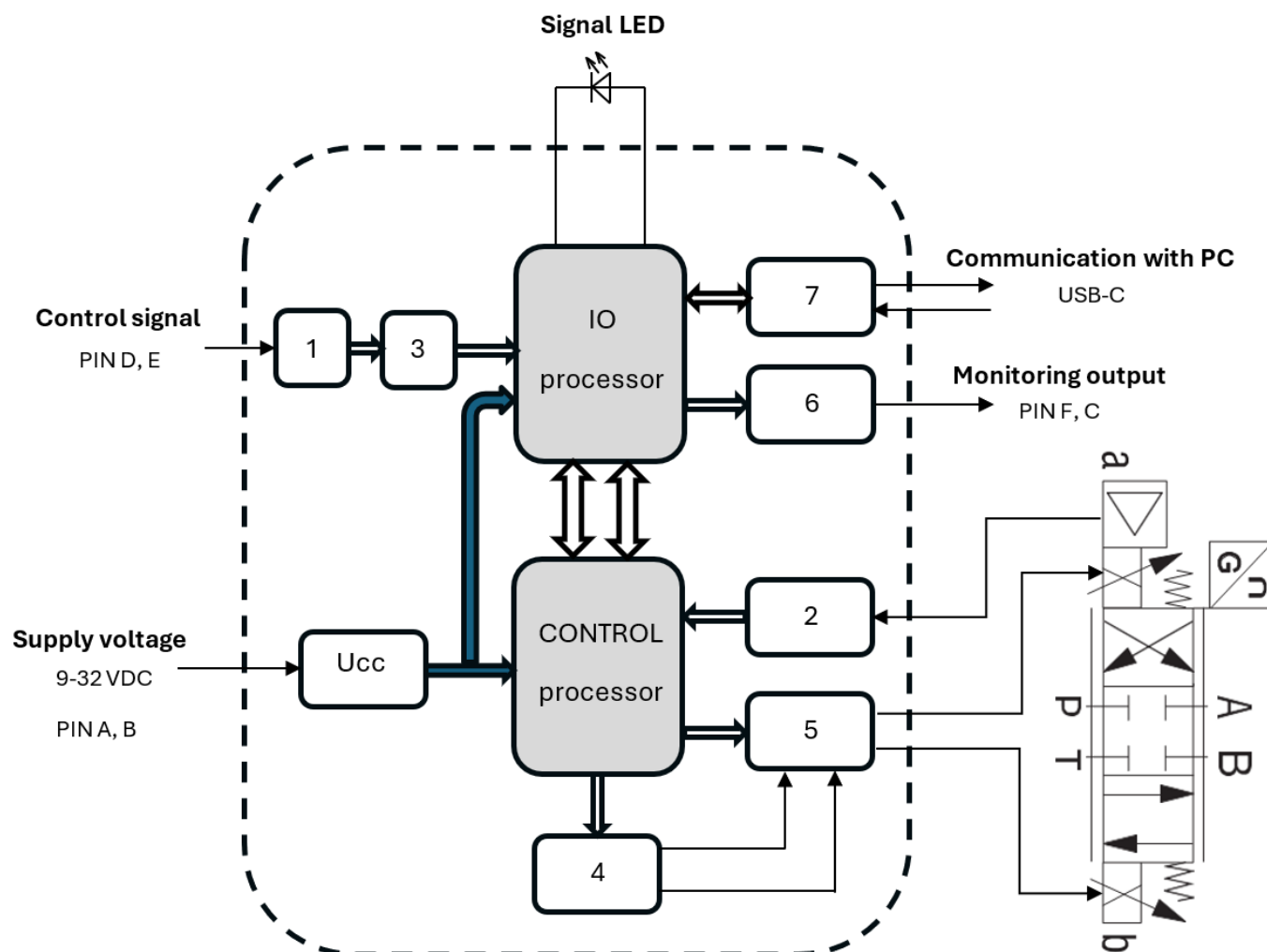


Figure 7-1: Block diagram of digital integrated electronics

8. Configuration software

This chapter covers the basic steps required to implement the software to configure the PRM9 digital integrated electronics, from software setup to valve parameter settings. We recommend reading this manual before setting the parameters, if you are unsure, contact ARGO-HYTOS. Appropriate operator qualification is a prerequisite for carrying out this activity.

8.1 General information

The SPRM9 software allows you to configure the integrated digital electronics of the PRM9 valve series to suit your application via PC and USB connection. The following characteristics of the software should be mentioned:

- › SPRM9.exe is a directly executable file without the need for a separate installation
- › Configure parameters using a graphical or tabular interface
- › Storage of configured operating parameters in a *.json file
- › Work in online mode (direct data transfer to the electronics - "live") and offline mode
- › Online display of signal values using oscilloscope function or overview window

8.2 Hardware requirements

Minimum hardware requirements:

Processor: AMD/Intel compatible 1GHz or faster

Main memory **≥2GB**

Free HD space **≥200 MB**

Contrast display with a minimum resolution of 1024x768, optimally 1280x720

Windows 7 operating system and higher

8.3 Software start

The SPRM9 software can be downloaded from the web portal at www.ARGO-HYTOS.com. The download portal (see Chapter 9) is located in the proportional valves. After saving the file, the software can be used immediately without prior installation by running  SPRM9.exe.

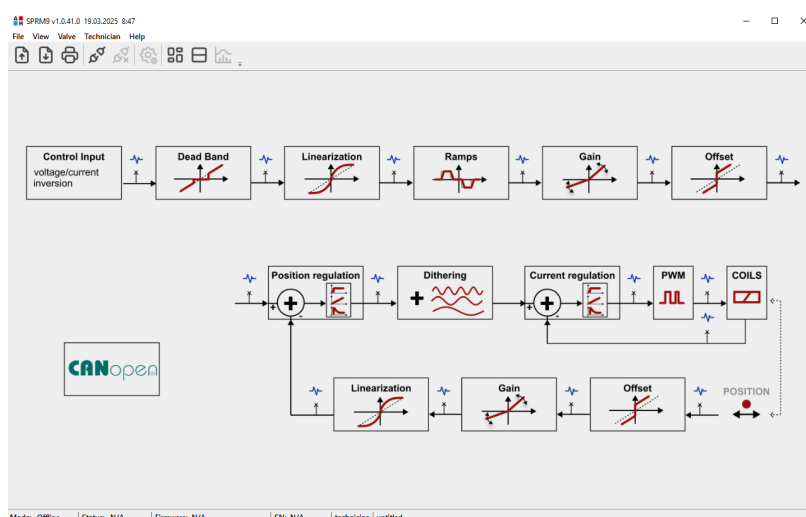
8.4 Basic configuration of the parameterization software

Figure 8-1 shows the basic structure of the program. The programme is divided into the following areas.

Figure 8-1: Basic configuration

- Main menu (8.6)
- Toolbar (8.7)
- Main desktop (8.8)

- Status bar (8.12)




Most of the information/actions can be accessed through different routes.

The following sections describe the capabilities and content of the SPRM9 software, which is divided into the areas listed below.

8.5 Connection to the valve

To go online, you need to connect the valve to power and connect it to your PC with a USB-C cable.

It is then possible to go online via the icon  or the menu Valve- Connect to valve and read data from the valve.

The valve contains two levels of access:

Technician - see chapter 8.5.1., default password **1234**

User - see chapter 8.5.2., access without password

The login window can be seen in Figure 8-2.

After entering the password, or passwordless access, the data from the valve is read and the valve goes into on-line mode.

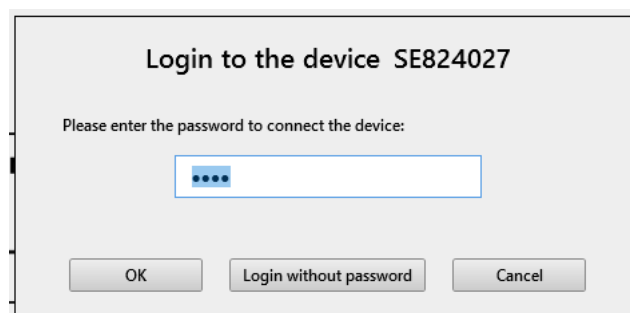



Figure 8-2: Basic configuration

	INFO	If changes have been made to the program in off-line mode, these changes will be overwritten by the settings from the valve when going on-line. If you want to keep the settings from off-line mode, you must save them to a file before connecting to the valve.
---	------	--

8.5.1 Access level - Technician

The default password for the Technician level is **1234**. After logging in, the Technician item is available in the main menu and the status bar shows the Technician access. The password for the technician can be changed via the **Technician - Change Technician Password** menu.

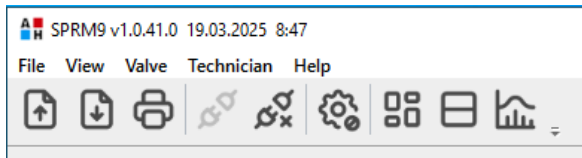


Figure 8-3: Main menu to Technician access

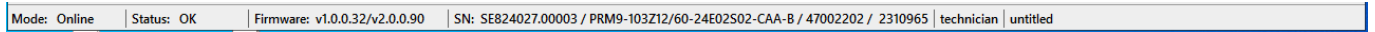


Figure 8-4: Status bar for Technician access

The technician can define the access level and parameter change options for the User level, see Figure 8-5.

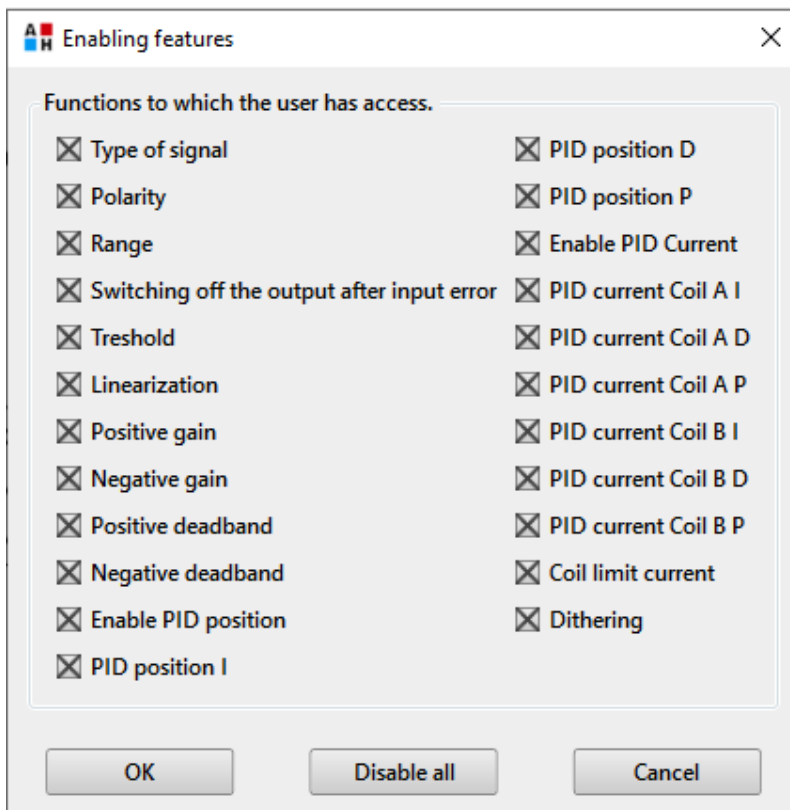


Figure 8-5: Enable features for the User access level

If all the boxes are checked, the User (passwordless access) has the same options to make changes as the Technician. Unchecking individual boxes prohibits the User from making changes to parameters in individual function blocks. The User will always see the set parameters but will not be able to change them. By unchecking all the checkboxes, the User will not be able to change any valve parameters except for the ramp functions, these are always available to everyone.

8.5.2 Access level - User

If you do not enter any password, or enter by clicking the "Login without password" button, see Figure 8-2, you will enter the User access level. The user has the right to change only the items allowed by the technician as shown in Figure 8-5, forbidden parameters can be displayed but not changed. Only the ramp functions, are always accessible.

The user can measure and display values on the oscilloscope, see chapter 8.11. or manually operate the valve, see chapter 8.10.2.

	INFO	The access levels, the Technique password, and the definitions of enabled functions for the User are stored in the valve, not in the application. Custom access definitions can be created for each valve, and each valve carries the User access rights and Technician password.
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8.6 Menu bar

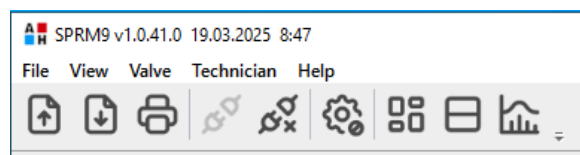


Figure 8-6: Main menu for Technician access

The main menu is located at the top of the program, as shown in Figure 8-6, and contains the following drop-down menus:

File	The "File" item allows you to handle *.json records containing data files with complete parameters.
› Open:	Allows you to load a *.json parameter file
› Save As:	Allows you to save the parameter file under the name
› Print	Prints the parameter settings and the current valve status
› Exit:	Exits the program
View	The "View" item allows you to change the thumbnails/views on the main desktop
› Block diagram:	Displays a block diagram of the respective valve type on the main desktop
› Parameter Table:	Display all variable parameters in table form on the main desktop
› Oscilloscope:	Real-time display of individual values/variables. Access is only in online mode
› Language change:	Program language selection - English, Czech
Valve	The "Valve" item allows the exchange of information with the valve / valve electronics
› Connect to valve:	The program connects to the valve and retrieves data from it
› Disconnect from valve:	The program terminates communication with the valve and disconnects
› Restart valve:	Restart the valve electronics
› Firmware Update:	Function to update the firmware of the control electronics in the valve.
Help	General information
› Help:	Access to the manual
› Home:	Direct access to the ARGO-HYTOS home page (if internet connection is available)
› O programu	Manufacturer and contact information

Inputs	
State: OK	
ain_setp: -0,04 V	inv_setp: -0,4%
thr_setp: 0,0%	nolin_setp: 0,0%
ramp_setp: 0,0%	gain_setp: 0,0%
off_setp: 0,0%	
V12P: +13,28 V	V12M: -14,98 V
McuUcc: +3,30 V	VIn: +18,31 V
add_pos: +0,2%	reg_pos: -9,6%
reg_cur_a: -1,6%	reg_cur_b: -11,9%
pwm_a: 0,0%	pwm_b: 0,0%
cur_a: 0,0A	cur_b: +0,4A
ain_sen: -12,9%	inv_sen: +12,9%
off_sen: +0,4%	gain_sen: +0,7%
nolin_sen: +0,7%	
mcu_temp: 37,7°C	

Figure 8-7: Message window for valve status

8.6.1 Measurement points and status information

The block diagram of the valve contains measuring points informing about the valve status or the calculated value of the action variable after passing through the respective block. The meaning of the individual measuring points is given in the following table.

Status	Unit	Description
Control signal processing		
ain_setp	V, mA	Directly measured value of the control signal at the input connector (pin D and E)
inv_setp	%	Control signal value after polarity and range inversion
thr_setp	%	The value of the control signal after passing through the threshold conversion block
nonlin_setp	%	Control signal value after linearization
ramp_setp	%	Control signal value after ramp function
gain_setp	%	Control signal value after gain
off_setp	%	Control signal value after zero offset, final adjusted control signal within $\pm 100\%$
Signal processing from the position sensor		
ain_sen	%	Position signal from the sensor
inv_sen	%	Position signal after inversion
off_sen	%	Position signal after adding offset
gain_sen	%	Position signal after amplification
nolin_sen	%	Position signal after linearization, final adjusted position signal within $\pm 100\%$
Current and position controllers		
add_pos	%	Control deviation of the desired and actual position of the spool, result of the calculation $\text{off_setp} - \text{nonlin_setp}$
reg_pos	%	Output from position regulator
reg_cur_a	%	Output from current regulator for coil A
reg_cur_b	%	Output from current regulator for coil B
pwm_a	%	Flow of pwm signal to coil A
pwm_b	%	Flow of pwm signal to coil B
cur_a	A	Current magnitude into coil A
cur_b	A	Current magnitude into coil B
Status information of the valve electronics		
V12P	V	Voltage magnitude in the positive branch of the power supply for processors
V12M	V	Voltage magnitude in the negative branch of the power supply for processors
McuUcc	V	Voltage magnitude for control circuits
VIn	V	Supply voltage magnitude at the input connector (pin A and B)
mcu_temp	°C	Processor temperature










Table 8-1 Meaning of measuring points and status information

8.7 Toolbar



Figure 8-4: Toolbar

The toolbar provides quick access to the main functions, which are explained in more detail below.

	Reading the parameter record (*.json) See also main menu: File / Open
	Save parameter record (*.json) See also main menu: File / Save
	Print the current parameter record See also main menu: File / Print
	Going online mode See also main menu: Valve / Connect to valve
	Switch to offline mode. See also main menu: Valve / Disconnect from valve
	Restart the valve electronics. Only possible in online mode.
	Display the valve design and access its parameters using the block diagram on the main desktop. See also main menu: Display / Block diagram
	Listing of valve parameters and access to them using a table. See also main menu: Display / Parameter Table
	Switch to oscilloscope view. See also main menu: Display / Oscilloscope Real-time display of individual values. Access is only possible in online mode.

8.8 Main desktop

Depending on the selection, the following actions can be performed on the main desktop of the configuration software:

- › Configure valve parameters
 - » Flow chart (graphical approach)
 - » Table (Table with list of parameters)
- › Oscilloscope (real-time data display)
- › CANopen configuration window (only in the valve version with CANopen. See CANopen manual (number, link))



8.9 Configuration of the valve parameters

There are two options for displaying and changing valve parameters:

- › Block diagram, graphically oriented, shown in Figure 8-9.
- › See Figure 8-17 for a list of parameters, which is shown in a table.

Block diagram

The blue points in the block diagram represent the measurement points (see Table 8-1). When the valve is online and one of these points is pressed, the valve goes into the oscilloscope function view where the real-time value can be monitored.

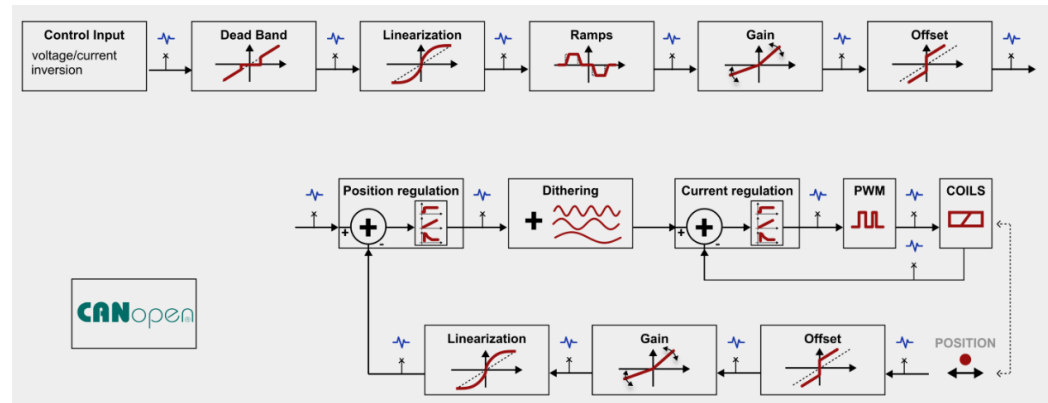


Figure 8-9: Display in the form of a flowchart using E02 as an example

The E02 design corresponds to a directional control valve with internal position feedback.

The valve is available with one coil on both sides A&B, only one coil on side A and only one coil on side B.

However, the basic structure of the block diagram is almost identical and differs only in the details of the icons and windows below. However, the logic of the influencing parameters is the same and therefore not all designs of this type of valve will be shown here. Here, a two-coil configuration is used.

Symbol	Parameter list	Short description
	Command signal: Signal type	Command signal type selection. Voltage or current input, range inversion, polarity inversion. Input signal error
	Control signal: Dead zone	Setting the threshold value. The control signal is ignored up to the set value, the valve remains in the middle position. It is essentially used for noise suppression around the zero value.
	Control signal: Linearization	The linearization of the control signal allows an influence on the characteristics of the valve, e.g. setting of a software-supported fine control range.
	Control signal: Upward ramps Downward ramps	The predetermined value corresponds to the linear delay of the forwarded signal to a command step by 100% up or down.
	Control signal: Amplifier (Gain)	The function allows to set a velocity of rising of the output control signal with increasing input command signal in the range $0 < \text{gain} \leq 4$
	Control signal: Offset	The function allows you to set the default position of the characteristic by moving it in the vertical direction. This function can be used to eliminate the proportional directional control valve from the insensitivity around zero caused by due to the positive enclosure of the spool.
	Position controller: P, I, D	P: Proportional part of the position controller I: Integration part of the position controller D: Derivative part of the position controller
	Current controller: P, I, D	P: Proportional part of the position controller I: Integration part of the position controller D: Derivative part of the position controller

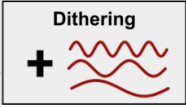


	Dithering Dither frequency Dither amplitude	Sets the amplitude / frequency of the excitation current of the coil superimposed to the direct current. They directly affect the sensitivity and hysteresis of the valve
	Coil A: Current limit Coil B: Current limit	Defines the maximum output current at the respective coil.
	-	Measuring points. When you hover the cursor over a measurement point, its name is displayed.

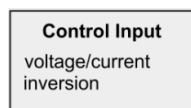
Table 8-1: Brief description of the icons and naming of the parameter values E02

Detailed description of basic configuration windows

After a brief description of the block diagram and its symbols, this chapter focuses on the individual blocks in more detail. This explanation refers to a valve with two coils. The configuration windows may differ according to the designs used, but the description of the basic parameters still remains valid.

8.9.1 Signal type, range and polarity of the command signal

Symbol:



Measuring point

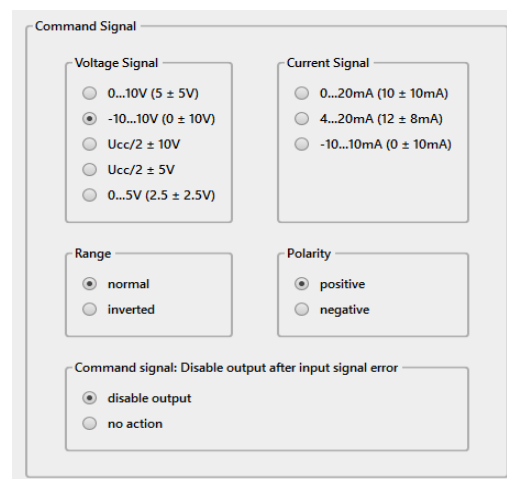



Figure 8-10: Command signal type, range and polarity

Command signal type

Figure 8-10 shows a list of voltage and current command signal options for a two-magnet valve. The menu automatically adjusts to the type of valve - single-magnet or two-magnet design. The command signal is set by the manufacturer to $\pm 10 \text{ V}$ or $0 \dots 10 \text{ V}$ for the single magnet design. An input of $0 \dots 5 \text{ V}$ for a single magnet or $2.5 \pm 2.5 \text{ V}$ can be used to control from a 5 V DC reference output directly from the valve.

	CAUTION	Selected types of command signal will make the directional control valve work even if the command signal is zero, when selecting the control, it is necessary to take this into account and take the necessary safety measures or select another type of input command signal. Note the following options $10 \pm 10 \text{ mA}$, $5 \pm 5 \text{ V}$, $2.5 \pm 2.5 \text{ V}$, $-10 \dots +10 \text{ V}$.
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Polarity of the command signal

The electronics of the valve is equipped with galvanically isolated signal ground, so it does not depend on the correctly connected polarity of the control signal, the wires on pins D and E of the main connector can be reversed and the valve can be controlled with the opposite polarity, e.g. instead of the $4 \dots 20 \text{ mA}$ signal, it can be controlled with the $-4 \dots -20 \text{ mA}$ signal. The polarity-negative option is used for this purpose.





Command signal range

Indicates which of the coils is excited by a positive and which by a negative signal. In a valve with two control solenoids, inverting the control signal changes the orientation of the movement of the piston rod of the controlled cylinder or the direction of rotation of the shaft of the controlled hydraulic motor. If in a single-magnet valve the original signal caused the valve to open, the inverted signal causes the valve to close.

Disable output after input signal error

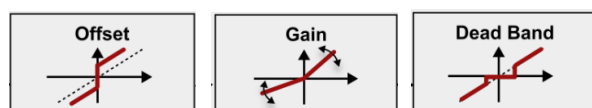
When Disable Output is selected, the current to the coils will be disconnected when the input analog command signal is significantly overshoot or undershoot.

When the control signal returns to a valid value, current to the coils will be restored. When No Action is selected, current to the coils will be maintained when the input analog command signal is exceeded or undershot and will be limited on the setting value of maximum current.

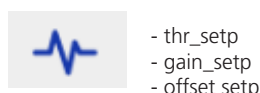
	INFO	For symmetrical control signals ($\pm 10\text{ V}$, $\pm 10\text{ mA}$), the polarity and range of the control signal have the same function. If both are activated, the functions cancel each other and the valve operates as in the basic setting.
	INFO	The valve is resistant to poor input signal setting, range, polarity or type. In the event of a bad setting, it will display an error message and will not operate outside the allowed range.
	INFO	When the control signal is outside the specified range, the valve signals an error and, depending on the setting, either maintains the current to the coil corresponding to the last valid value of the command signal or disconnects the current to the coil. See option "Disable output after input signal error"
	INFO	The ratiometric inputs $U_{cc}/2 \pm 10\text{ V}$ and $U_{cc}/2 \pm 5\text{ V}$ are primarily used for analog joystick applications. Select the appropriate input range according to the supply voltage level.

8.9.2 Threshold, gain and zero shift of the setpoint signal

Block symbol for threshold, zero offset and gain



Measuring point



Configuration window:

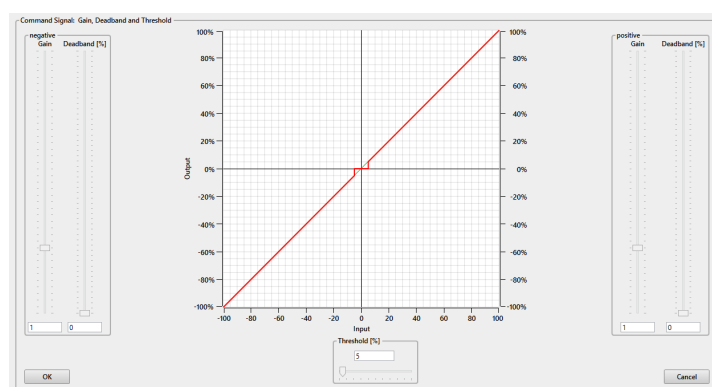



Figure 8-11: Threshold, gain and zero shift of the setpoint signal

Threshold value (dead zone, threshold)


The threshold setting (deadband) is used to suppress noise components around the zero point of the control signal. The threshold is given as a percentage of the control signal. Control signals that are less than the selected threshold are not processed, which means that there is a zero signal before the threshold. If the threshold is exceeded, the control signal is sent at a 1:1 ratio. This suppresses control around the zero point due to noise components. As shown in Figure 8-11, the threshold is 5%, which means that all signals less than 5% will not be processed, and that signals greater than 5% will be processed.

	INFO	This parameter is important to ensure precise and stable control of hydraulic systems. If the threshold is set too high, the valve may respond slowly or not at all to small signal changes. Conversely, if the threshold is set too low, the valve may be too sensitive and cause system instability.
---	------	--

Negative and positive amplification (gain)


The **gain** parameter of a hydraulic valve indicates the gain or sensitivity of the valve to the control signal. In practice, this means how much change in flow or pressure occurs in response to a change in the control signal. A high gain means that even a small change in signal will cause a large change in flow or pressure, while a low gain means that the change will be smaller.

The function allows you to adjust the rate of increase of the valve opening as the input control signal increases in the range $0 < \text{gain} \leq 4$.

	INFO	Gain is an important parameter when setting and tuning hydraulic systems as it affects the stability and accuracy of the control. Too high gain can cause instability and oscillation of the system, while too low gain can lead to slow and inaccurate response.
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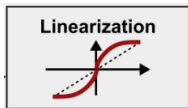
Zero shift (offset)

Zero offset, often referred to as insensitivity band compensation, is used in valves to electronically limit overlap by repositioning the hydraulic-mechanical zero position in the direction of the control edges. Offset, often referred to as dead-zone compensation, is used to electronically reduce the positive overlap of a gate valve by moving the hydraulic-mechanical zero in the direction of the control edges. This means that when changing from one edge to the other, the valve gate jumps over the coverage area. The extreme values must be selected so that the valve continues without positive overlap in order to prevent an unwanted drop in flow. In the event of an electrical supply failure, the gate valve shall automatically move to the initial mid position by the action of the centering springs.

	INFO	Offset is important for accurate adjustment and calibration of hydraulic systems because it allows compensation for various factors such as mechanical tolerances, wear or temperature changes. Proper offset adjustment can improve system performance and stability.
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8.9.3 Linearization of the setpoint signal

Block symbol



Measuring point



Configuration window:

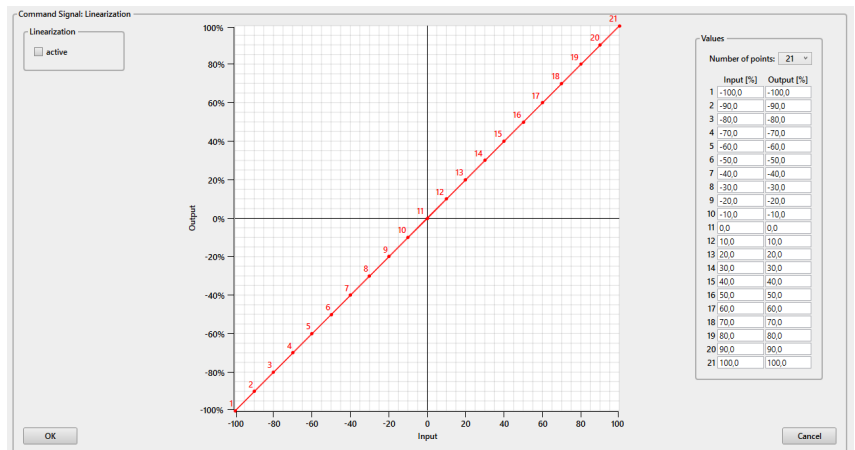
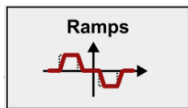


Figure 8-12: Linearization of the setpoint signal

Linearization allows the valve characteristics to be changed over the entire range of the control signal. The only restriction on the changes is that the output signal must increase monotonically over the control signal. The number of linearization points can be varied freely, with a minimum of three and a maximum of twenty-one. The linearization curve starts to apply when the "active" checkbox is checked.

8.9.4 Ramp function

Block symbol



Measuring point



Configuration window:

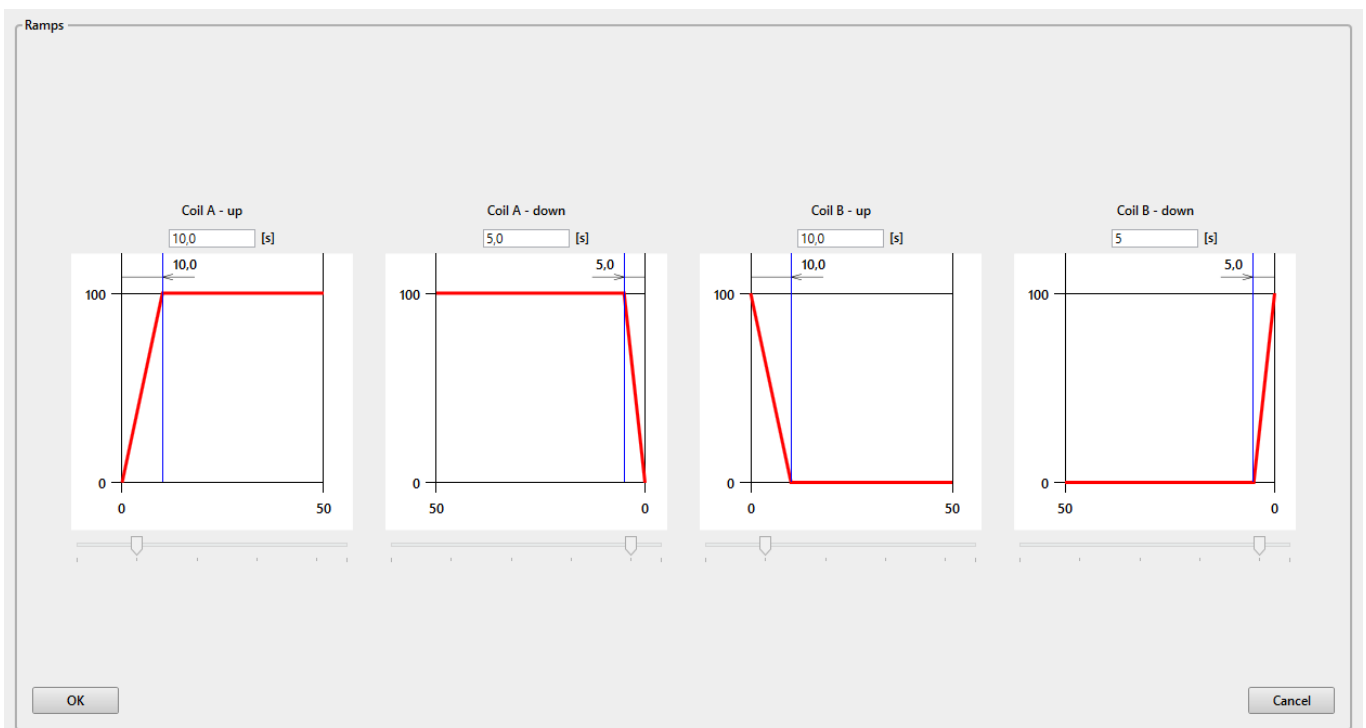




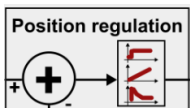
Figure 8-13: Ramp function configuration window

The ramp function allows you to establish a fixed and temporarily linear relationship between the change in the control signal of the desired value in the form of a jump and the attainment of the desired value using the ramp shape. This function can be used to suppress jerking and discontinuous processes, thereby preventing hydraulic shocks. The ramp setting time is always related to 100% of the jump of the control signal setpoint. A lower jump size means a partial ramp time. The ramp-up time sets the time for the signal behind the ramp function to rise from 0% to 100% for a 100% step increase in the signal entering the ramp function. The ramp-down ramp sets the time for the signal behind the ramp function to drop from 100% to 0% for a 100% step-down of the signal entering the ramp function. The maximum ramp time is 45 seconds.

	INFO	Ramp functions in hydraulic valves are important for controlling the speed and smoothness of hydraulic movement actuators such as cylinders or motors. These functions allow the flow of hydraulic fluid to be gradually increased or decreased, ensuring smooth and controlled movement.
	INFO	The ramp function is the only block that can be changed in all access levels, it is independent of the rights setting see chapter 8.5.1

8.9.5 Position control

Block symbol



Measuring point



Configuration window:

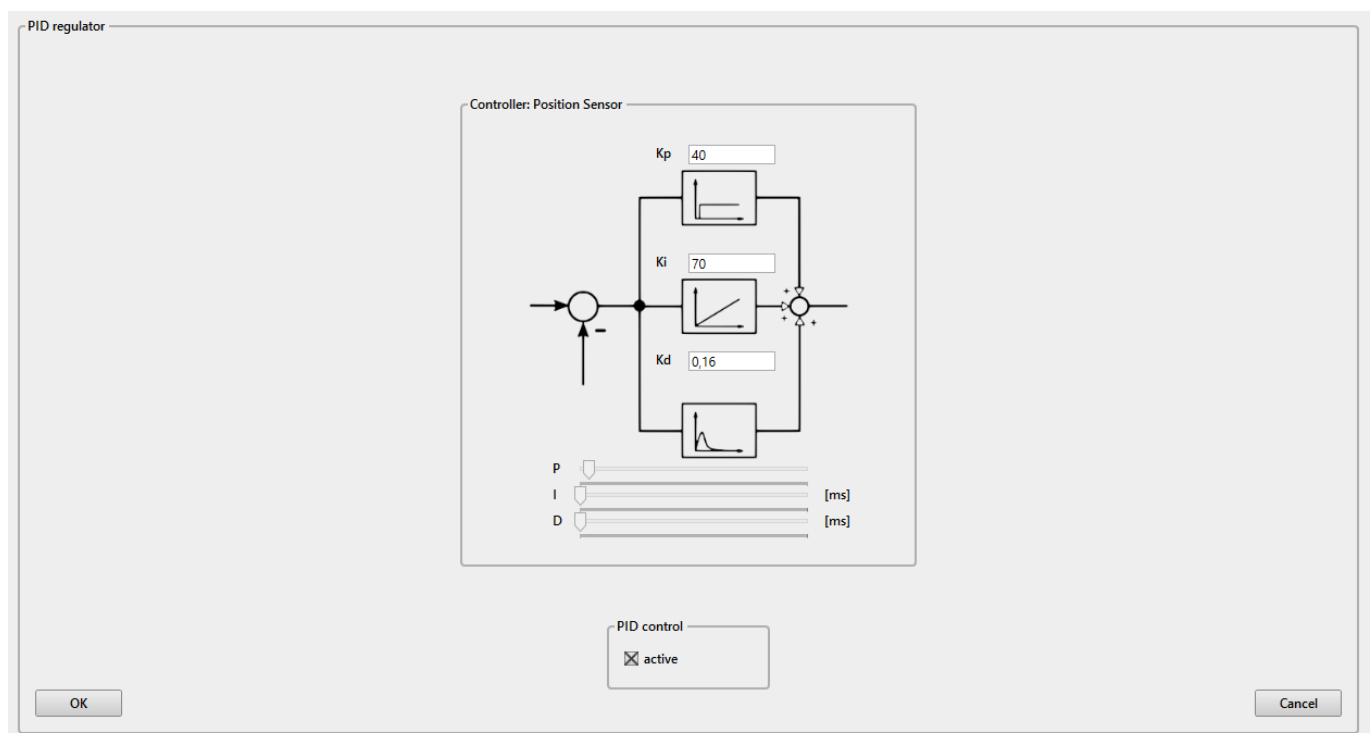


Figure 8-14: Position controller configuration window





The individual parameters - proportional member (K_p), integration member (K_i), derivative member (K_d) - can be set independently and can be modified numerically and graphically, as can be seen in the configuration window.

The E02 valve variant is a cascade control circuit with two circuits, with current control being subordinate to internal position control. As this is a cascade control, it should be emphasised that the control circuits directly influence each other and only suitably qualified persons can adjust their parameters.

The basic principles of the PID controller and, in general, the cascade structure are well known and can therefore be taken from the literature. Therefore, this issue will not be discussed further here. In addition, the user is provided with a simple but feasible method for determining the controller parameters depending on the application. As written, this is a simple but feasible method, but it does not claim to achieve an absolute optimum controller setting. Reference is also made here to the general literature.

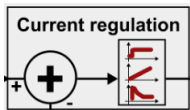
Simple method for setting controller parameters:

- › First set the parameters K_i , K_d to zero and the proportional term to a small value.
- › If the control loops are stable, the jump of the setpoint is determined and the response of the control loop is monitored. The selected controller setting could tend to follow the setpoint jump and therefore deviation compensation must be performed. If this is not the case, please check the polarity setting and/or signal type or range.
- › If deviation compensation is performed, the proportional term K_p is continuously increased in the next step until the control variable overflows. Then the proportional term is returned to the last value that was before the control value was exceeded.
- › A similar procedure is followed for the integration constants K_i . Here, however, a small overshoot of the controlled variable is allowed.
- › The last factor is the derivative term. The procedure is the same as before. The derivative term should lead to a slight overshoot of the controlled variable due to the cancellation of the selected K_i setting, thus achieving the desired control behavior.
- › If the procedure outlined here has been successfully implemented, it is possible to further reduce the control time by increasing the initial value of K_p and then the value of K_i as required.
- › If the duration of the overshoot is significantly detrimental to the control time due to the derivative term and due to the selected K_i term, it is recommended to decrease K_p , K_i and K_d .

	WARNING	When the PID control is switched off, unexpected behaviour of the device may occur, even the set maximum current to the coil may be exceeded for a long time. Care must be taken to ensure that unwanted or unsafe device behaviour does not occur.
	CAUTION	Incorrect setting of the PID parameters will have a negative impact on the valve behavior, properties and capabilities. Extreme caution should be exercised and parameters should not be changed haphazardly.
	INFO	The factory setting of the regulator is made with stability and best functionality of the valve in mind. For most applications there is no need to change the controller parameters.
	INFO	If the position controller is deactivated, the electronics enter open loop control mode and supply the coils with a current directly proportional to the control signal.

8.9.6 Current regulation

Block symbol



Measuring point



- reg_cur

Configuration window:

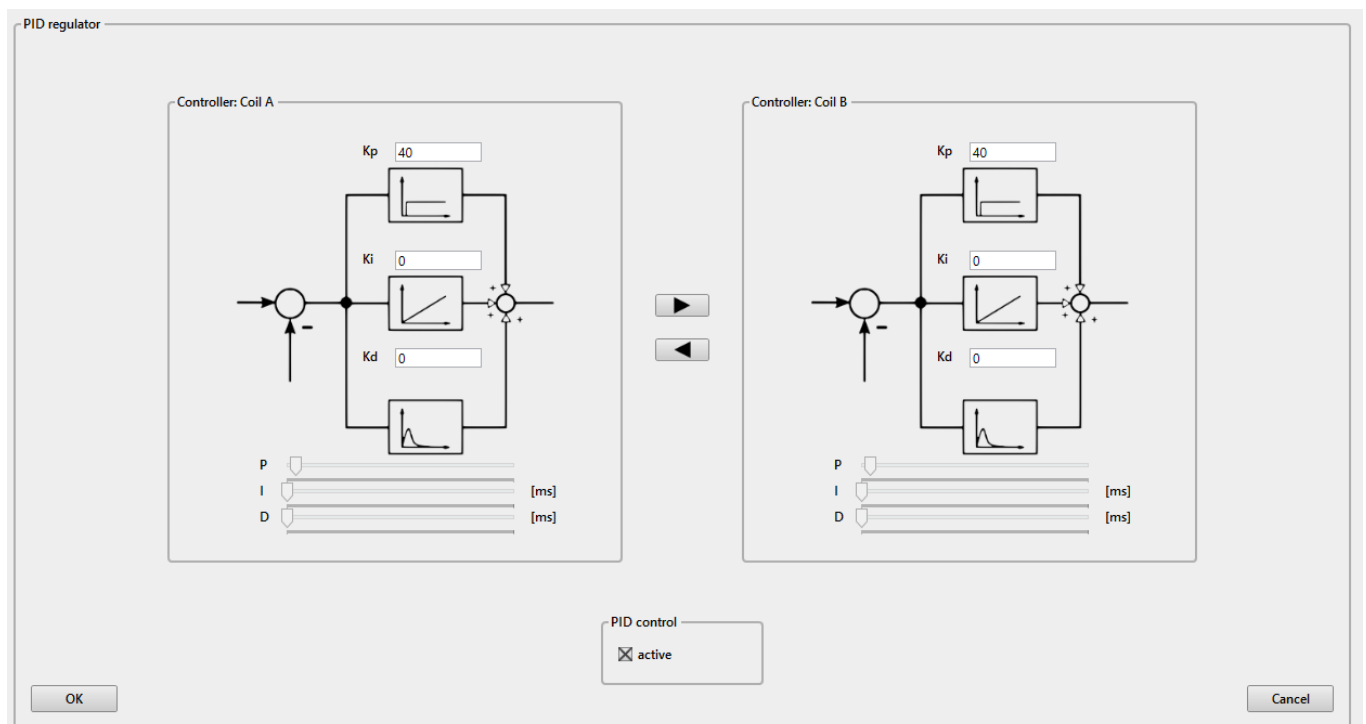




Figure 8-15: Current Controller Configuration Window

The valve electronics are equipped with two separate PID current controllers, each controlling one coil. In standard mode, the current controllers are slaved to the position controller. The factory setting of the controller is made with the best valve performance in mind. If required, the position controller can be deactivated and the current controllers take full control of the currents to the coils.

	WARNING	Unexpected device behaviour can occur when PID control is switched off, even the setpoint can be exceeded for a long time. maximum current to the coil. Care must be taken to ensure that unwanted or unsafe device behaviour does not occur.
	CAUTION	Incorrect setting of the PID parameters will have a negative impact on the valve behavior, properties and capabilities. Extreme caution should be exercised and parameters should not be changed haphazardly.

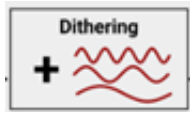
8.9.7 Current limitation and dither setting

Block symbol

Current limiter



Dither



Measuring point



- current

Configuration window:

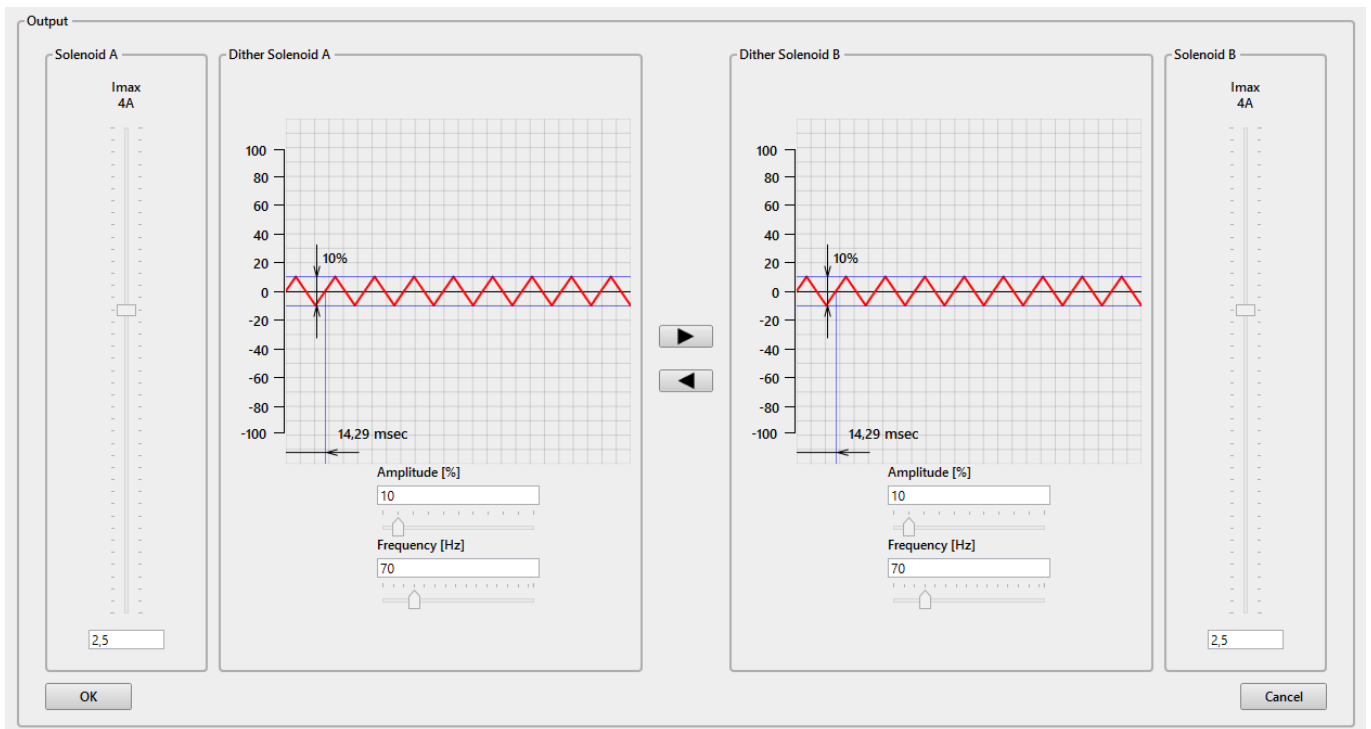




Figure 8-16: Current limiter and dither settings

Current limiter

The current limiter can be used to preset the maximum current of coil A or coil B, depending on the application and valve configuration. Reducing the maximum current value below the maximum allowable current value will also reduce the power limit of the valve and also affect its dynamic characteristics. The maximum current value must not exceed the value indicated on the spool casing. The maximum electronic current is 4 A per coil.

	WARNING	Do not set more current than the limit current of the coil used, overheating of the coils, damage and fire may occur.
	INFO	The electronics have a maximum current to the coil limited to 4A effective value, therefore the maximum current in operation may be exceeded briefly, in peak periods, typically when dynamic lubrication with high amplitude and low frequency is switched on.

Dither

The dynamic lubrication amplitude and frequency allows the valve spool to move on the order of micrometers, which affects friction and influences valve hysteresis and response sensitivity. When changing the value of amplitude and frequency, it is necessary to take into account the fact that at high amplitude and frequency, the valve performs a constant oscillation which may cause vibrations to continue in the hydraulic system and therefore be visible. If, on the contrary, the amplitude is too low or the selected frequency is too high, the hysteresis increases and the sensitivity of the response decreases. The frequency can be set from 10 to 300 Hz and the amplitude from 0 to 100% of the maximum coil current, separately for each coil.

8.10 List of parameters

Parameter Table

Inputs
State: OK

ain_setp: -0,05 V inv_setp: -0,5%
thr_setp: 0,0% nolin_setp: 0,0%
ramp_setp: 0,0% gain_setp: 0,0%
off_setp: 0,0%
V12P: +13,28 V V12M: -14,98 V
McuUcc: +3,30 V Vin: +18,31 V
add_pos: -0,1% reg_pos: -17,3%
reg_cur_a: -1,3% reg_cur_b: +5,6%
pwm_a: 0,0% pwm_b: +5,6%
cur_a: 0,0A cur_b: +0,3A
ain_sen: -12,4% inv_sen: +12,4%
off_sen: -0,1% gain_sen: -0,2%
nolin_sen: -0,2%
mcu_temp: 37,6°C

Manual control
Off Static Square Triangle Sinus

Output controls proceeds normally according to the set configuration.

#	Description	Value	Unit	*
1	Command signal: Type of signal	-10...10V (0 ± 10V)		
2	Command signal: Polarity	positive		
3	Command signal: Range	normal		
4	Command signal: Disable output after input signal error	disable output		
5	Command signal: Threshold	1,0	%	
6	Command signal: Enable Linearization	zakázáno		
7	Command signal: Linearization	21 points		
8	Upper signal: Ramp up	0,00	s	
9	Upper signal: Ramp down	0,00	s	
10	Lower signal: Ramp up	0,00	s	
11	Lower signal: Ramp down	0,00	s	
12	Command signal: Positive Gain	1,00		
13	Command signal: Negative Gain	1,00		
14	Command signal: Positive Deadband	0	%	
15	Command signal: Negative Deadband	0	%	
16	Position Sensor: Enable PID control	povoleno		
17	Position Sensor: P (Controller)	40,00		
18	Position Sensor: I (Controller)	70	s ⁻¹	
19	Position Sensor: D (Controller)	0,16	s	
20	Coils A,B: Enable PID control	povoleno		
21	Coil A: P (Controller)	40,00		
22	Coil A: I (Controller)	0	s ⁻¹	
23	Coil A: D (Controller)	0	s	
24	Coil B: P (Controller)	40,00		
25	Coil B: I (Controller)	0	s ⁻¹	
26	Coil B: D (Controller)	0	s	
27	Coil A: Dithering frequency	70	Hz	
28	Coil B: Dithering frequency	10	Hz	

Choice of signal on monitoring wire
0V

OK Cancel

Figure 8-17: Parameter table window

The window contains four important subwindows allowing complete monitoring, control and setting of valve parameters:

- Measured values – 8.10.1.
- Manual control – 8.10.2.
- List of parameters – 8.10.3.
- Analog Output Signal Selection – 8.10.4.

8.10.1 Measured values

Inputs
State: OK

ain_setp: -0,05 V inv_setp: -0,5%
thr_setp: 0,0% nolin_setp: 0,0%
ramp_setp: 0,0% gain_setp: 0,0%
off_setp: 0,0%
V12P: +13,28 V V12M: -14,98 V
McuUcc: +3,30 V Vin: +18,31 V
add_pos: +0,1% reg_pos: -21,6%
reg_cur_a: -1,0% reg_cur_b: +30,3%
pwm_a: 0,0% pwm_b: +30,3%
cur_a: 0,0A cur_b: +0,4A
ain_sen: -12,6% inv_sen: +12,6%
off_sen: +0,1% gain_sen: +0,2%
nolin_sen: +0,2%
mcu_temp: 37,6°C

Displays the current valve status and error messages. See Table 5.1 for error messages.


Displays the current measured values. For the meaning of the individual measuring points, see. Table 8-1

Figure 8-18: Measured values subwindow

	INFO	The measured value window gives the exact current status of the valve information about faults, measured values of supply voltage and temperature. Most of the parameters can also be displayed on the oscilloscope, see chapter 8.11.
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8.10.2 Manual control

The SPRM9 allows you to control the connected valve directly without changing the control signal. Once activated, it is possible to change the control signal for a single magnet in the range 0 ... 100% or -100% ... +100% for a double magnet. The control can be performed by manually entering a constant value or by using the built-in signal generator.

	CAUTION	In manual control, the electronics do not respond to the analog control input signal.
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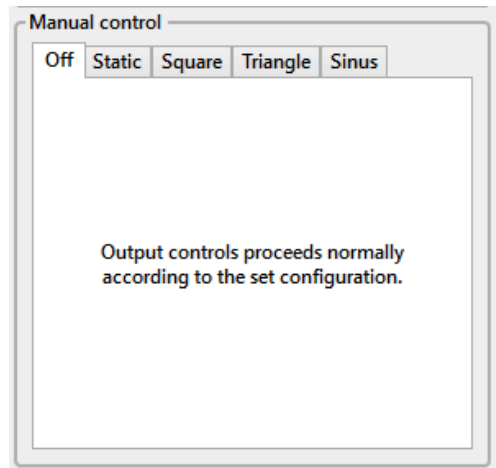


Figure 8-19: Manual control is disabled, the valve is controlled by the input control signal

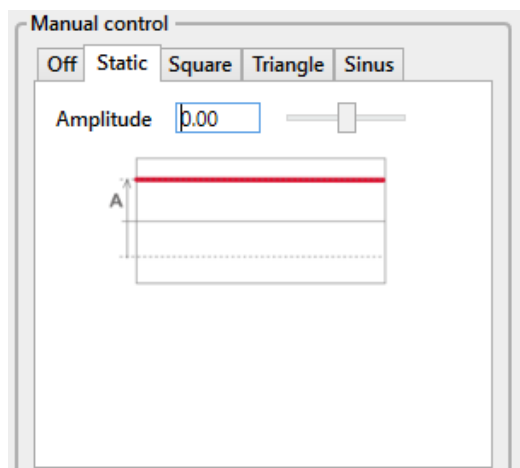


Figure 8-20: Manual control is switched on, the valve is controlled by the set opening value

Static control - used to set a constant permanent value of the control signal in the range of $\pm 100\%$ for two-magnet and 0-100% for one-magnet.

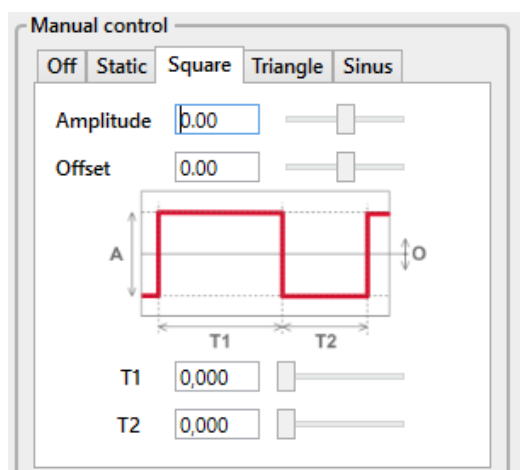


Figure 8-21: Manual control is on, the valve is controlled by a rectangular flow

Rectangular control signal waveform - generates on/off signal with adjustable amplitude of 0-100% of control signal, selectable on and off times from 0.05 s - 100 s. With the Offset function, the waveform can be shifted in the Y-axis direction by $\pm 100\%$.

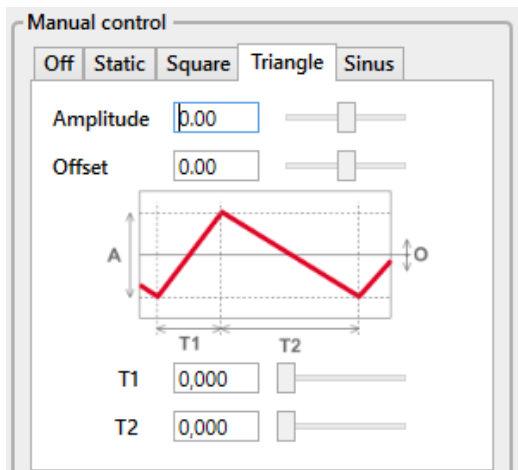


Figure 8-22: Manual control is switched on, the valve is controlled by a triangular waveform

Triangular control signal waveform - generates a triangular signal with 0-100% control signal amplitude setting and selectable rise and fall times from 0.05 s - 100 s. The Offset function can be used to move the waveform in the Y-axis direction by $\pm 100\%$.

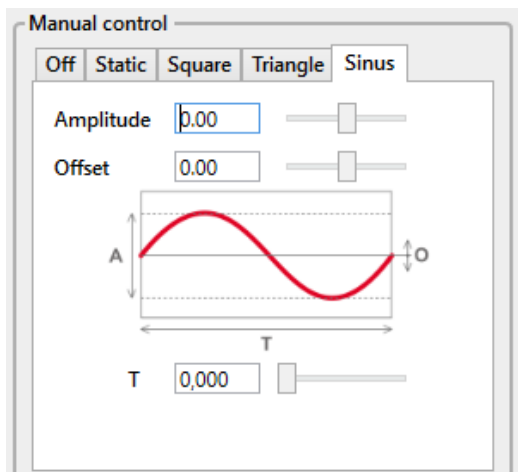


Figure 8-23: Manual control is on, valve is controlled by sine wave

Sinusoidal waveform of the control signal - generates a sinusoidal waveform of the control signal with an amplitude of 0-100% of the control signal. The duration of one period can be selected from 0.05 s - 100 s. Using the Offset function, the waveform can be shifted in the Y-axis direction by $\pm 100\%$.

	<p>WARNING</p>	<p>All necessary safety guidelines must be observed before the manual control is put into operation. The valve will also stop responding to the input control signal and care must be taken to ensure that the switchover does not inadvertently or unsafe behaviour of the equipment.</p>
	<p>INFO</p>	<p>By varying the offset and amplitude combinations in the generated functions, the range of the desired input value can be exceeded by over 100%. Even if the desired value exceeds 100%, the limit current to the coils will never be exceeded. This property can be used, for example, to obtain a trapezoidal waveform from a triangular signal by appropriate choice of offset and amplitude.</p>

8.10.3 Parameter sheet

#	Description	Value	Unit	*
1	Command signal: Type of signal	-10...10V (0 ± 10V)		
2	Command signal: Polarity	positive		
3	Command signal: Range	normal		
4	Command signal: Disable output after input signal error	disable output		
5	Command signal: Threshold	1,0	%	
6	Command signal: Enable Linearization	zakázáno		
7	Command signal: Linearization	21 points		
8	Upper signal: Ramp up	0,00	s	
9	Upper signal: Ramp down	0,00	s	
10	Lower signal: Ramp up	0,00	s	
11	Lower signal: Ramp down	0,00	s	
12	Command signal: Positive Gain	1,00		
13	Command signal: Negative Gain	1,00		
14	Command signal: Positive Deadband	0	%	
15	Command signal: Negative Deadband	0	%	
16	Position Sensor: Enable PID control	povoleno		
17	Position Sensor: P (Controller)	40,00		
18	Position Sensor: I (Controller)	70	s ⁻¹	
19	Position Sensor: D (Controller)	0,16	s	
20	Coils A,B: Enable PID control	povoleno		
21	Coil A: P (Controller)	40,00		
22	Coil A: I (Controller)	0	s ⁻¹	
23	Coil A: D (Controller)	0	s	
24	Coil B: P (Controller)	40,00		
25	Coil B: I (Controller)	0	s ⁻¹	
26	Coil B: D (Controller)	0	s	
27	Coil A: Dithering frequency	70	Hz	

Figure 8-24: Parameters sheet

The parameter setting options presented within the block diagram can also be performed in the parameter list. All parameters are listed depending on the valve configuration. After double-clicking on the desired parameter, a window appears that represents the limits of the parameter and contains a field for setting an individual value.

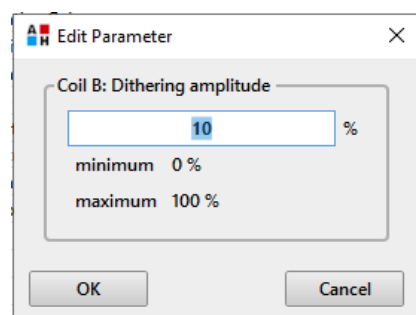


Figure 8-25: Setting the parameter value

8.10.4 Analog Output Signal Selection

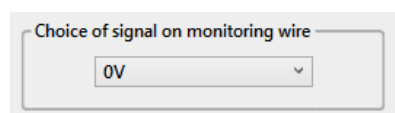


Figure 8-26: Signal selection on analog output

The valve offers the option of analog output on pin F and C of the main connector. The output voltage is proportional to the value at the selected measurement point, see Table 8-1. Selecting 0 V disables the output and selecting 5 V sets the output to a reference voltage of 5 V.

	WARNING	The maximum current load of the analog output is 20 mA.
	INFO	The 5 V reference can be used to control the valve with a potentiometer. For a single-magnet, the 0...5 V input must be selected, for a two-magnet valve an input of 2.5±2.5V (see chapter 8.9.1)
	INFO	To display the current position of the slide valve on the analog output, you need to select the measuring point nolin_sen .

8.11 Oscilloscope

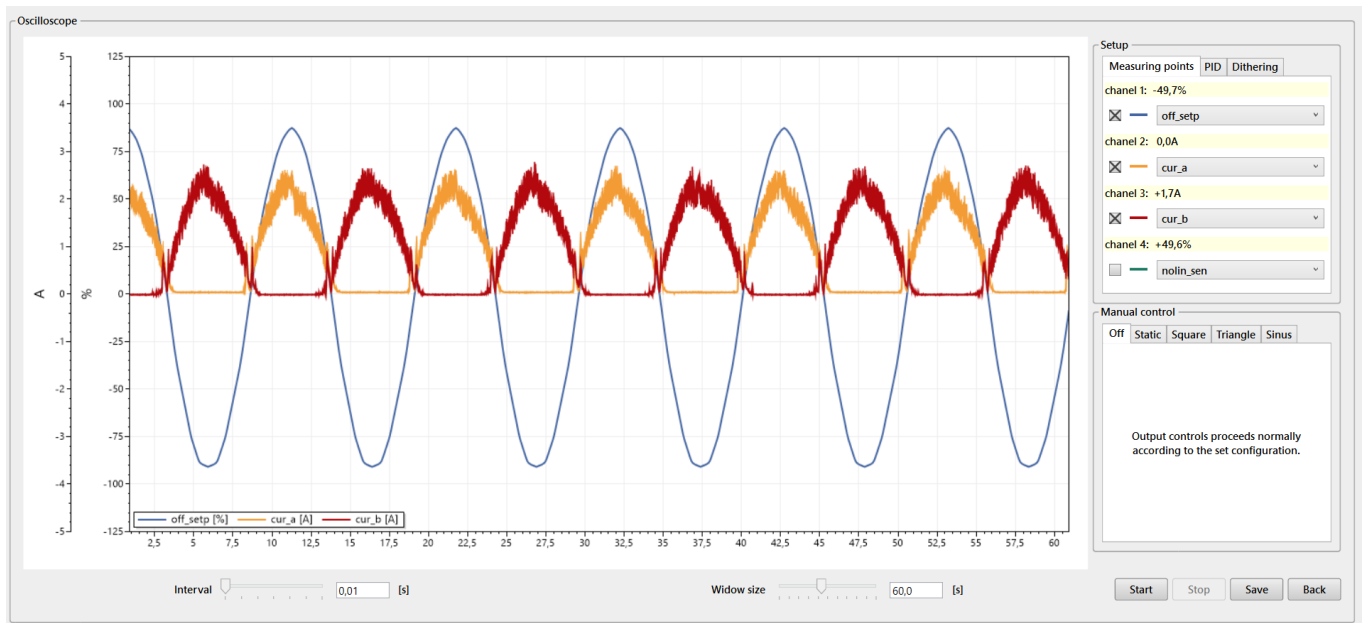


Figure 8-27: Oscilloscope for real-time data display

The oscilloscope can be used to view the valve's internal data online. The oscilloscope can be accessed via the icon on the toolbar (see chapter 8.6) or via the menu Display - oscilloscope, see chapter 8.5. The oscilloscope is structured as follows: playback window (left), measurement point activation panel (top right), manual control (bottom right) and control panel (bottom). The interval describes the refresh rate and the window size determines the length of the displayed signal waveform. Recording is controlled by Start/Stop. Recorded waveforms can be saved to a file either as a Figure or as data in *.csv format for further processing. The meaning of each measurement point is explained in Table 8-1. PID and Dithering are also part of the setup tab. These items are used to directly change the PID controller and dynamic erasing parameters so that the changes induced by adjusting these parameters can be immediately observed on the oscilloscope. Manual control is described in chapter 8.8.2.

8.12 Status bar



Figure 8-28: "Status line"

The status bar displays the main status information with respect to the following points: (in Figure 8-21 from left to right):

- > Communication mode description
- > Description of the status of the valve electronics
- > Information about the firmware version used
- > Valve design information
- > Technician/user access level
- > Information about the parameter data file used

8.13 Firmware updates

From the **Valve - Firmware Update** menu it is possible to update the firmware of the valve electronics. The application connects to the update server and selects the appropriate firmware for the hardware according to the type of electronics. If a newer version exists, it prompts for an update. After pressing the Start Update button, the firmware is automatically downloaded. The firmware has two parts, the IO part and the Control part, both parts are updated simultaneously. During the firmware update all LEDs on the electronics will flash and will continue to flash until the recording is complete. All electronics settings remain unchanged, the update does not change user settings. At the end of the update, the application will issue information about the successful or unsuccessful update. In case of a failed update, check if your device is connected to the internet and the connection is of sufficient quality. The size of the update package that needs to be downloaded is approximately 500 KB. In the event that an internet connection is not available, it is possible to update the firmware from a file. Contact Argo-Hytos technical support for the current firmware file.

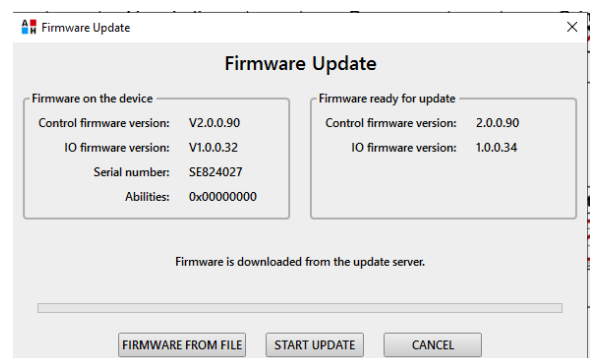






Figure 8-29: "Firmware updates"

	CAUTION	After closing the "Firmware Update" window, the valve always goes off-line, you need to reconnect to the valve via the Connect to valve icon or via the menu Valve - Connect to valve .
	INFO	Do not exit or minimize the application during the update process. Each action will terminate the update and you will need to start over. If the update is interrupted and you try to connect again, the electronics will say it has no firmware and the update will start again.
	INFO	Firmware updates do not delete or change user settings.
	INFO	For the latest firmware file, if the valve cannot be updated from the Internet, contact Argo-Hytos Technical Support.

9. Repairs carried out by qualified personnel

Only the manufacturer is allowed to repair the product, the user can only change the parameters via the SPRM9 application.

Hardware repairs are not allowed and the device must be handed over to the manufacturer for repair.

If a defect is found in the valve, please contact ARGO-HYTOS. Opening of the valve by a third party is prohibited and will result in forfeiture of the claim. In the event of a claim, please provide the type key, SAP number and serial number of the valve; this will ensure that the claim is processed promptly. Valve repair or maintenance may only be carried out by suitably qualified persons.

10. Product maintenance

The product is maintenance-free and does not need any maintenance during its operation if these instructions are followed.

11. Supplied accessories, spare parts and consumables

A. Accessories

No accessories are supplied with the device.

B. Spare parts

Spare parts are supplied with the device, see data sheet CZ 8010.

C. Special tools, equipment and materials

No special tools are required for installation and operation.


D. Consumables

The equipment does not require any consumables for its operation.

12. Activities after the expiry date of the product

The SPRM9 application is not installed, deletion is done by deleting the folder in which the application is located.


The application settings are stored in the folder "C:\Users\<user>\AppData\Local\SPRM9\config.xml", which can also be deleted after the application is finished. Physical disconnection of the valve may only be carried out by a trained person with knowledge of electrical engineering at least level 6, according to decree no. 194/2022.

	WARNING	The necessary safety guidelines must be followed exactly before the valve is taken out of service. To prevent uncontrolled behaviour of other equipment, all electrical equipment must be secured before disconnecting and hydraulic circuits.
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At the end of the product's useful life, disposal must be carried out in accordance with the applicable legislation. The product consists of parts that are separately recyclable after sorting.

In terms of the applicable waste legislation, e-waste is hazardous waste and is subject to a special disposal regime. It is forbidden to throw electrical waste into containers intended for the collection of municipal waste. The product may be handed in to e-waste collection points.

13. Contact details for manufacturers, distributors, service, repair and claims departments

	ARGO-HYTOS s.r.o. Dělnická 1306 • CZ - 543 01 VRCHLABÍ • Czech Republic Tel. +420 499 403 111 • E-mail: info.cz@argo-hytos.com
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