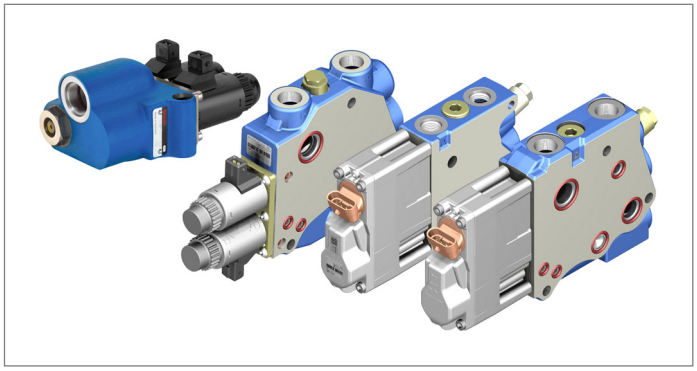
RE 66126/2023-04-20
Replaces: 2023-03-08

rexroth
A Bosch Company

Hitch control valves EHR5-OC, EHR5-LS, EHR11-EHS4, EHR24-EM2, EHR24-EHS4



- Control valves for electro-hydraulic hitch control (EHR)
- Maximum flow
  - EHR5: 60 l/min
  - EHR11-EHS4: 100 l/min
  - EHR24-EM2: 100 l/min
  - EHR24-EHS4: 140 l/min

Features

- Proportional valves
  - in flange design (EHR5)
  - in sandwich plate design (EHR11, EHR24)
- EHR24 can be combined with directional valves SB24 and SB34 for working hydraulics
- Type of actuation:
  - Electromagnetically proportional
  - Electro-hydraulic with on-board electronics (EHS)

Fields of application

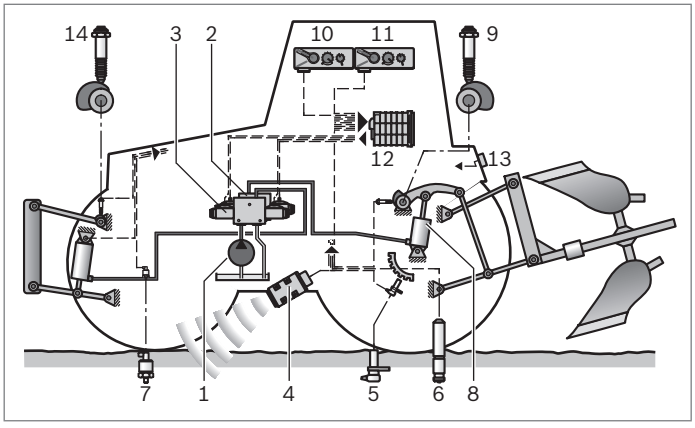
- Electro-hydraulic hitch control (EHR) for tractors and combine harvester cutting table control
- Control valves for position, tractive force, mix control, pressure and slip control, plus active vibration damping (transport mode)

Contents

EHR system functional description

A core function of tractors is the efficient and soil-preserving transmission of machine forces during field use.
The attachments required for field use are connected to the tractor's hitch and can be lifted or lowered using the hitch control. This hitch control plays an important role and is a standard feature on today's tractors. It gives farmers numerous useful functions for efficiently and conveniently managing their tasks.
Bosch Rexroth is the world market leader as a supplier, manufacturer and developer of the EHR system.
This includes proven and sophisticated components such as the control unit, control valve, control panel and sensor technology. These individual elements combine to form a rugged, user-friendly and extremely reliable working unit, even after years of use.
The hitch control design can be single-acting (sa) or double-acting (da). The pump pressure and proportional opening cross-section of the lift spool lift the attachment as gently or as rapidly as desired.
With the single-acting hitch control, the dead weight of the attachment helps lower the hitch, whereas incremental, proportional lowering is controlled by the lowering valve.
With the double-acting hitch control, lowering is actively supported by pump pressure. For instance, this allows for the uncoupled hitch to lower more quickly, the attachment to be pushed into the ground or the hitch to be released more easily. For double-acting hitch control, either a separate additional valve (HLS1) or a double-acting hitch valve (HLS2) can be used (for performance data, see page 26).

System components



1 Hydraulic pump
2 Rear hitch control valve
3 Front hitch control valve
4 Radar speed sensor
5 Speed sensor
6 Force sensor
7 Pressure sensor
8 Hitch cylinder
9 Position sensor
10 Rear control panel
11 Front control panel
12 Electronic control unit
13 Rear control rocker switch
14 Position sensor

Operating principle

The hydraulic pump (**1**) pumps oil to the control valve (**2**), which controls the hitch cylinders (**8**). These cylinders act on the lower links, which are used to lift, hold or lower attachments.
The setpoint value is entered on the control panel (**10**), then the actual values are measured by the sensors (**9**) and (**6**), and transmitted to the electronic control unit (**12**).
The offset resulting from the comparison of the setpoint to the actual values is processed by the control unit (**12**) and then transmitted to the control valve (**2**). The lifting and lowering valve is adjusted by two proportional solenoids.
The following operating modes are available:

Position control

The control variable in this mode is the position of the hitch. The position sensor (**9**), which is operated by a cam disk on the hitch, supplies the actual value.

Tractive force control

The control variable in this mode is the force on the lower links. When constant, tractor power utilization is optimal, such as when plowing on hilly ground or working with inhomogeneous soil. The actual value is measured by the force sensors (**6**). Tractive force is controlled by changing the working depth of the attachment (e.g. plow).

Mix control
In this mode, the offsets between position and tractive force are combined into an adjustable ratio on the control panel and processed as a control variable. Mix control reduces changes in working depth caused by different types of ground resistance, such as those encountered when just using traction force control.

Vibration damping
To reduce front axle load fluctuations when transporting heavy attachments and thereby improve steerability, the sensors (**6**) and (**9**) are used to measure the control variable. The electronic control unit (**12**) analyzes this variable and sends the appropriate electronic signals to the control valve (**2**).

Slip control
Slip control offers the following benefits:
- Less time and fuel consumption
- Less tire wear
- Soil preserved
- Less work for the driver
- No getting stuck

In this mode, actual travel speed (radar sensor (**4**)) and working speed (speed sensor (**5**)) are measured.

Pressure control
Achieve optimal farmland compacting with packers and the pressure control mode.
The output signals from the pressure sensor (**7**) are processed by the control unit (**12**) and transmitted to the control valve (**2**).

Front control
The setpoint values for front control are preset on the control panel (**11**). The actual values are measured by the sensors (**7**) and (**14**), and transmitted to the electronic control unit (**12**). Based on the offset resulting from the comparison of the setpoints to the actual values in the control unit, the flow rate of the control valve (**3**) is proportionally adjusted. Front control can be used to implement the position and pressure control functions.

External control
The position sensor mounted on the attachment transmits the electrical signals analyzed by the control unit (**12**) and control valve (**2**) so the attachment is kept at a defined position.

Rear control
The hitch can be lifted and lowered with a rocker switch on the rear of the tractor (**13**).

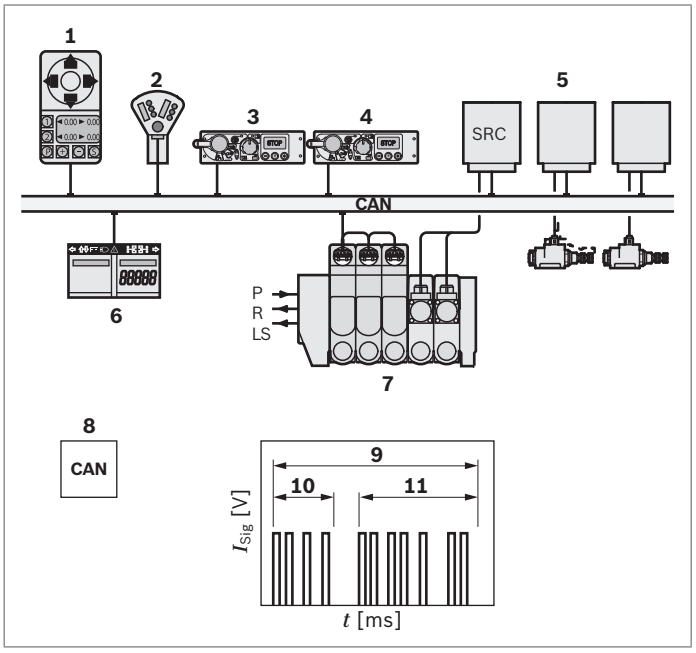
Startup interlock
Aside from its control and signal processing functions, the electronic control unit has various monitoring features. A startup interlock prevents the hitch from moving during startup. The interlock is released by switching the lifting switch from stop to transport. Initial movement is at reduced speed.
The maximum lifting height is also monitored.
A potentiometer can be used to preselect a limit.
Monitoring of the position sensor cable for interruption or short circuit shuts off the electronic control unit in case of a fault, which prevents the hitch from moving.

CAN bus in the tractor

With the increase in electronics in the field of agricultural tractors, the Controller Area Network (CAN) developed by Bosch has become an established means of data exchange among the individual devices.
This serial data bus connects devices with equal rights and coordinates the data exchange in the form of digital CAN messages.

CAN features

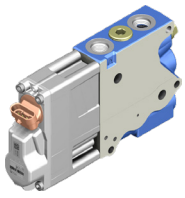
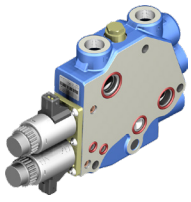
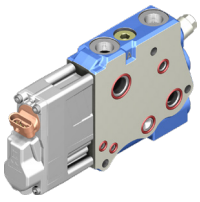
- Self-diagnostics and automatic repeat transmission in the event of damaged or incomplete messages
- Linking and thus simultaneous communication possible among several sensors, control units and display units
- Worldwide recognized standard, ISO 11898 and 11519-2 as well as SAEJ 1939
- Less cabling makes for a smaller installation area, lower costs and less susceptibility to faults
- High fault tolerance and high security of the interface
- Optimal diagnostics through output of error codes



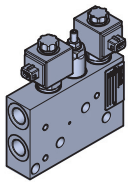
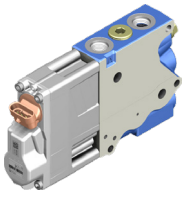
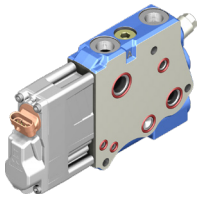
1 Control panel
2 Directional valves
3 Front EHR
4 Rear EHR
5 Electronic control units
6 Instrument cluster
7 Central modular control block
8 CAN signal
9 CAN message
10 ID
11 Signal

EHR valves overview

Single-acting (sa) valve design

EHR valves			**EHR5-OC/LS**	**EHR11-EHS4**	**EHR24-EM2**	**EHR24-EHS4**
Symbol			See page 8	See page 14	See page 17	See page 20
Image						
Lifting features			1 check valve	1 shut-off valve	1 check valve	1 shut-off valve
Flow variants	Lifting	[l/min]	20, 40, 60	60, 70, 80	50, 80, 100	80, 100, 120, 140
	Lowering	[l/min]	20, 60 at Δp = 15 bar	100 at Δp = 15 bar	65 at Δp = 15 bar	160 at Δp = 17 bar[1)] at Δp = 24 bar[2)]
Lowering load compensation			Electronic	Electronic	Electronic	Electronic
Lifting load compensation			Hydraulic	Hydraulic	Hydraulic	Hydraulic
Spool position control (position feedback)			–	●	–	●
Pilot pressure required			–	●	–	●
Load safety valve			–	●	●	●
Emergency hand button			o	–	o	–
Emergency lowering			o	o	o	o

Double-acting (da) valve design

EHR valves			**HLS1**	**EHR11-EHS4-HLS2**	**EHR24-EHS4-HLS2**
Symbol			See page 28	See page 33	See page 33
Image					
Flow variants[3)]	Lifting	[l/min]	Add-on sandwich plate for EHR5 and EHR24-EM2	60, 70, 80	80, 100, 120, 140
	Lowering	[l/min]		100 at Δp = 15 bar	140 at Δp = 25 bar
	Pushing	[l/min]	–	20	44, 55, 70, 80
Lowering support pressure variants[3)] (pushing pressure)		[bar]	20 ... 30	–	Approx. 13, 20, 30, 37
Rapid lowering of uncoupled hitch			●	●	●
Assisted uncoupling			●	●	●
Quick manual pushing while in motion (quick retract)			●	●	●

● = Available o = Optional – = Not available

1) With internal return flow
2) With external return flow
3) Depending on the pressure compensator setting and at max. spool deflection

Single-acting (sa) hitch control valves

Technical data

General				EHR5	EHR11-EHS4	EHR24-EM2	EHR24-EHS4
Design				Flange design	Sandwich plate design		
Weight	EHR valve section		kg	3.1	4.5	6.3	6.5
	EHR5-OC connecting plate		kg	1.5			
Installation position				Any	See data sheet 66176	Any	See data sheet 66174
Line connections				See page 9 and 12	See page 15	See page 18	See page 21
Ambient temperature range		ϑ	°C	–35 ... +80			

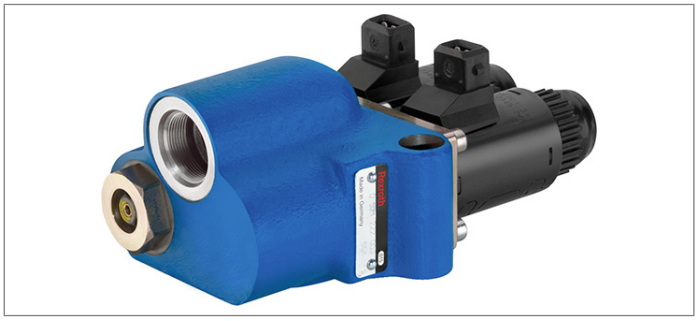
Hydraulic					EHR5	EHR11-EHS4	EHR24-EM2	EHR24-EHS4
Max. working pressure at port		**P**	p_{max}	bar	220	250	250	250
		A	p_{max}	bar	220	250	250	–
		B	p_{max}	bar	–	250	–	250
		Y	p_{max}	bar	220	–	250	250
		R, Rx	p_{max}	bar	–	20	20	20
		X	p_{max}	bar	–	50	50	50
		R1	p_{max}	bar	5, but less than load pressure	–	5, but less than load pressure	20
		R2	p_{max}	bar	10	–		20
Flow	Lifting	**P** → Hitch cylinder	$q_{v\ nom}$	l/min	20, 40, 60	60, 80	80, 100	80, 120, 140, 160
	Lowering	Hitch cylinder → **R**	$q_{v\ max}$	l/min	20, 60 at Δp = 15 bar	142	65 at Δp = 15 bar	160 at Δp = 17 bar[1] at Δp = 24 bar[2]
Max. load drop		**A**		cm^3/min	4[3]	4[3]	4[3]	2.4 with PRV (2 without PRV)[4]
Hydraulic fluid					Mineral oil (HL, HLP) according to DIN 51524, see data sheet 90220 Other hydraulic fluids on request, e.g. environmentally acceptable fluids per ISO 15380 as specified in data sheet 90221.			
Hydraulic fluid temperature range		Maximum	ϑ	°C	–30 ... +100	–35 ... +110	–30 ... +100	–35 ... +110
		Recommended[5]	ϑ	°C	+20 ... +90	+35 ... +80	+20 ... +90	+35 ... +80
Viscosity range		Maximum	ν	mm^2/s	10 ... 2000	7 ... 8000	10 ... 2000	7 ... 8000
		Recommended[5]	ν	mm^2/s	20 ... 100			
Maximum admissible degree of contamination of the hydraulic fluid, cleanliness level per ISO 4406 (c)					Level 22/19/16[6]	Level 20/18/15[7]	Level 22/19/16[6]	Level 20/18/15[7]

1) With internal return flow
2) With external return flow
3) At 125 bar, ν = 35 mm^2/s
4) At 125 bar, ν = 33 mm^2/s, ϑ = 50°C, t_{wait} = 10 s, t_{meas} = 60 s
5) Any operation outside the recommended ranges may affect service life and function.
6) We recommend a filter with a minimum retention rate of $\beta_{25} \geq 75$
7) We recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$

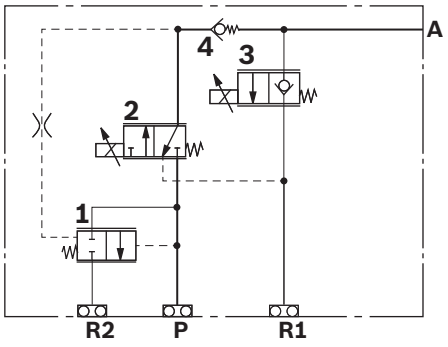
Electric			**EHR5**	**EHR11-EHS4**	**EHR24-EM2**	**EHR24-EHS4**
Supply voltage	U	V	12	12 vehicle electrical system ISO 167502, code A	12	12 vehicle electrical system ISO 167502, code A
Maximum control current	I_{max}	A	3.35	–	3.35	–
Connector version			Jet connector, 2-pin	AMP Superseal, 4-pin	Jet connector, 2-pin	AMP Superseal, 4-pin
Type of protection			IP64 (IP69K[8)])	IP66, IP67, IP69K[9)]	IP64 (IP69K[8)])	IP66, IP67, IP69K[9)]
Control EHS4			–	See data sheet 66176	–	See data sheet 66174

8) If plug-in connector with single-wire sealing installed
9) With assembled and locked plug-in connector

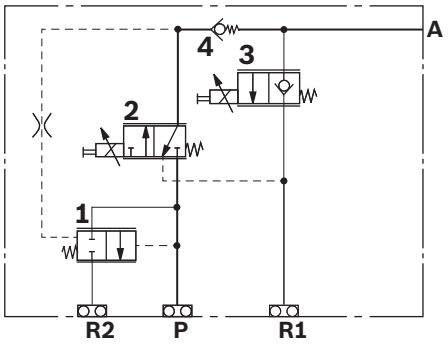
EHR5-OC control valves



▼ **Symbol 1a**



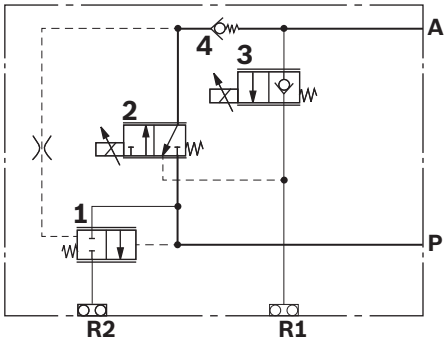
▼ **Symbol 1b**



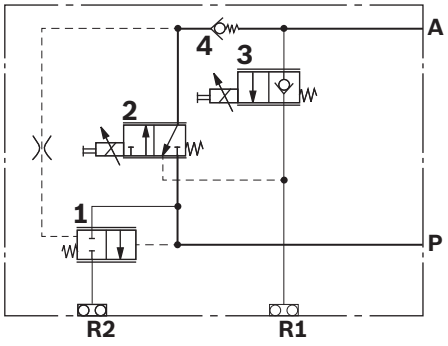
1 3-way pressure compensator
2 Lifting module
3 Lowering module
4 Check valve

Ports EHR5-OC	
P	Pump port
A, A'	Consumer port (cylinder)
R1	Return flow consumer (cylinder)
R2	Return flow

▼ **Symbol 2a**



▼ **Symbol 2b**



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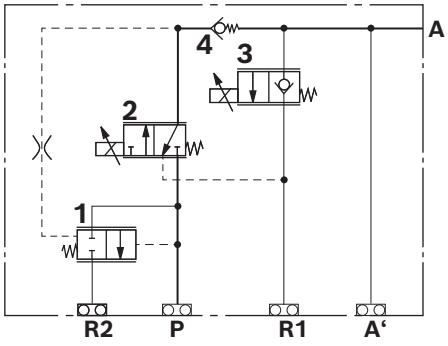
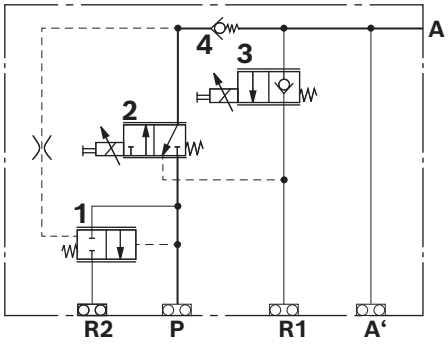
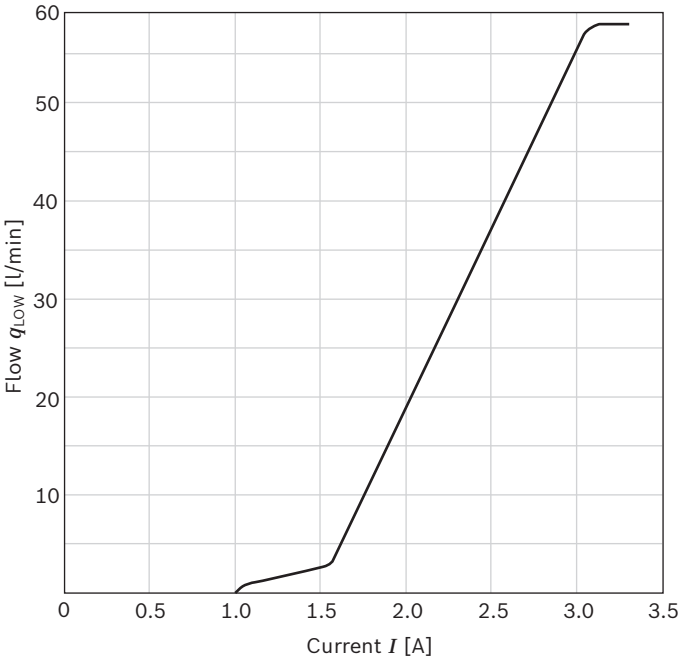


▼ **Symbol 3b**

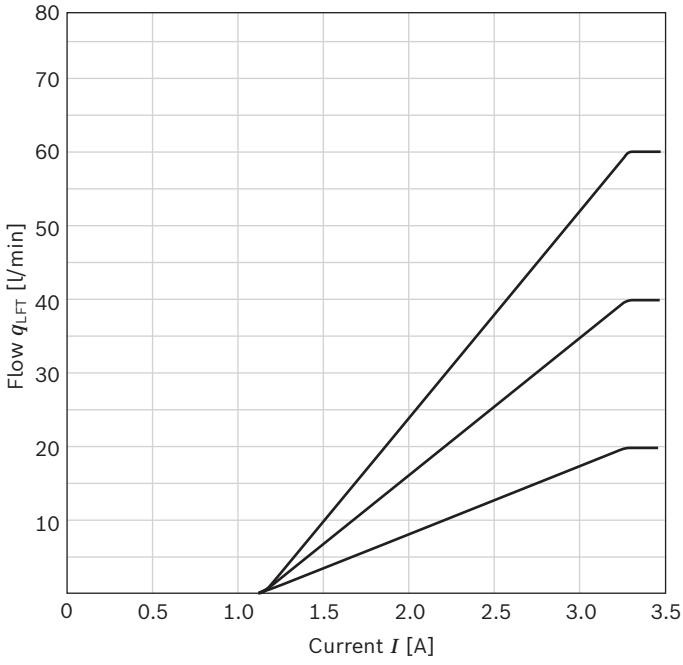


Characteristic curves

▼ **Lowering characteristic curve**



▼ **Lifting characteristic curve**



Notice
Characteristic curves measured at Δp **A** → **R** = 15 bar;
ϑ = 50°C.

Available variants

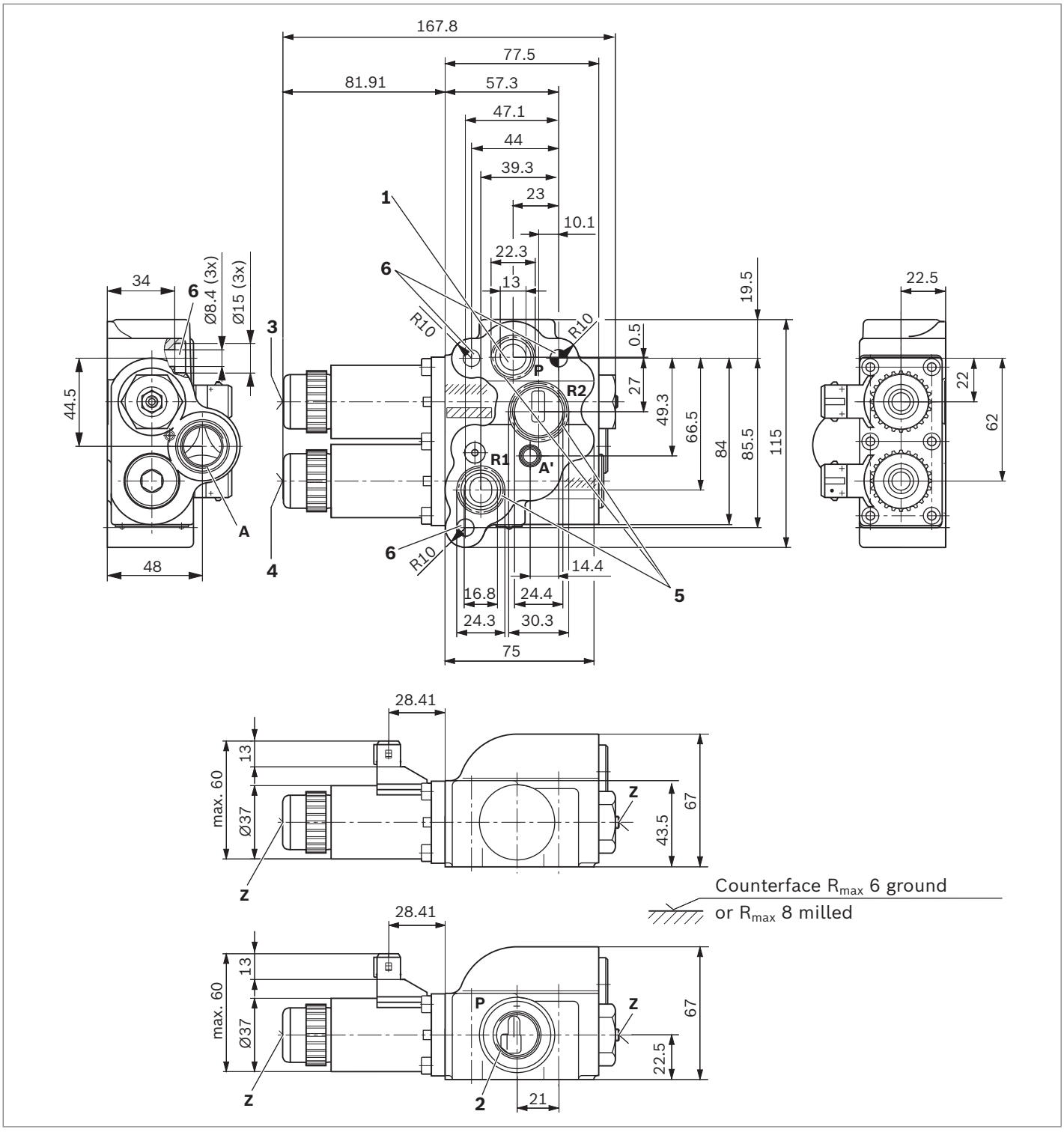
Material number	Drawing number	Line connections: A	A' in flange (max. 25 l/min)	P	Thread design [1]	Lowering q_{SN} [l/min]	Lifting q_{HN} [l/min]	Emergency hand button	Solenoid plug location	Symbol [2]
0521222002	RA50159547	M22 × 1.5	–	M22 × 1.5	II	60	40	With	①	1b
0521222009	RA50158630	M22 × 1.5	–	M22 × 1.5	II	60	40	With	②	1b
0521222014	RA50156355	M22 × 1.5	–	M22 × 1.5	II	60	40	Without	① + ④	1a
R917007846	RA50032980	M22 × 1.5	–	M22 × 1.5	II	60	60	With	①	1b
R917008798	RA50121937	M22 × 1.5	–	M22 × 1.5	II	60	60	With	②	1b
0521222006	RA50158629	M22 × 1.5	–	Flange	I	60	60	With	①	2b
0521222011	RA50158632	M22 × 1.5	–	Flange	I	20	60	With	②	2b
R917005088	RA50158629	M22 × 1.5	–	Flange	II	60	60	With	①	1b
R917007147	RA50159545	M22 × 1.5	●	Flange	II	60	60	With	①	3b
R917009921	RA52138648	M22 × 1.5	–	Flange	I	60	60	Without	① + ④	2a
R917006652	RA50167012	7/8 - 14 UNF	–	Flange	II	60	60	Without	① + ④	1a

① = as shown, see page 10
② = lifting and lowering solenoid rotated 90°
④ = lifting and lowering solenoid plug with different coding

1) See page 34
2) See page 8

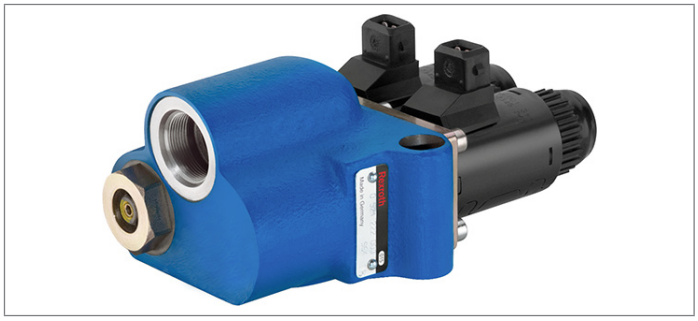
Dimensions

▼ EHR5-OC

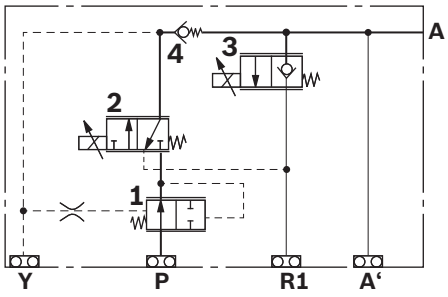


1 Flange port P
2 Threaded port P
3 Lifting
4 Lowering
5 O-ring included in the scope of delivery
6 Three mounting holes; M_A = 25^{+6} Nm

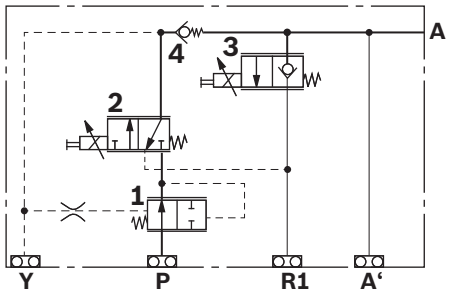
EHR5-LS control valves



▼ **Symbol 1a**



▼ **Symbol 1b**

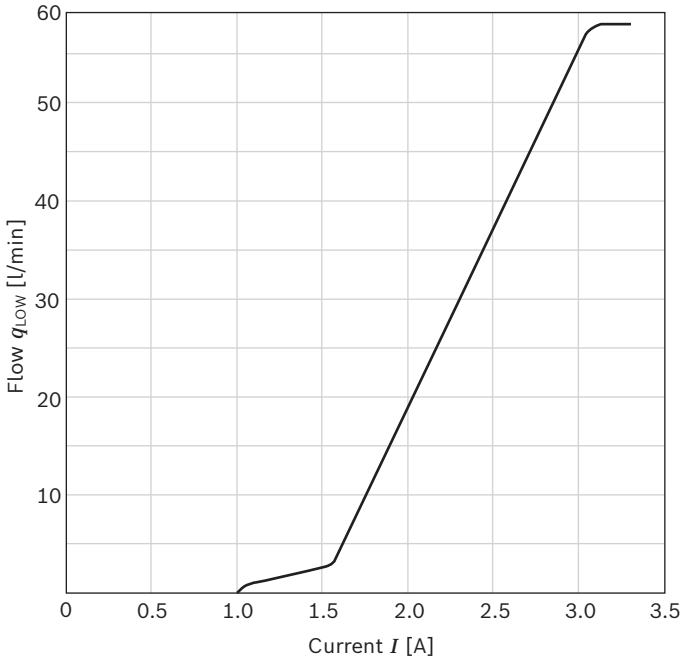


1 3-way pressure compensator
2 Lifting module
3 Lowering module
4 Check valve

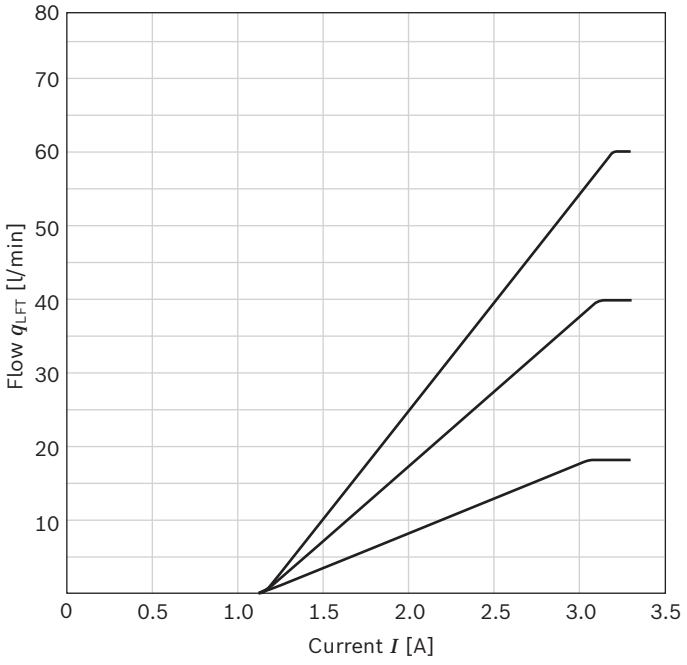
Ports EHR5-LS	
P	Pump port
A, A'	Consumer port (cylinder)
R1	Return flow consumer (cylinder)
Y	Control port for control pump

Characteristic curves

▼ **Lowering characteristic curve**



▼ **Lifting characteristic curve**



Notice
Lowering characteristic curve measured
at Δp **A** → **R** = 15 bar; ϑ = 50°C

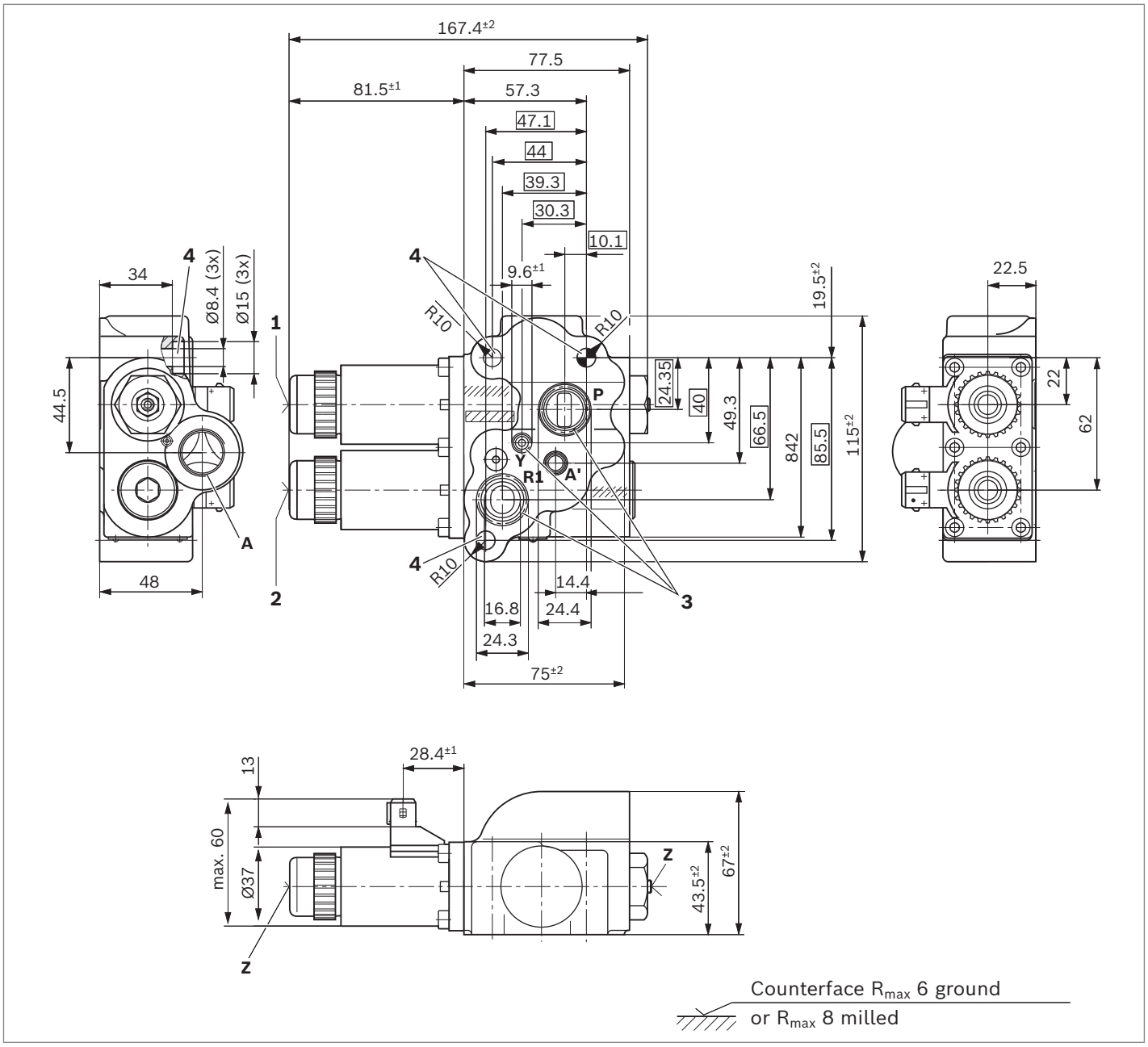
Available variants

Material number	Drawing number	Line connections: A	A' in flange (max. 25 l/min)	P	Thread design, see page 34	Lowering q_{SN} [l/min]	Lifting q_{HN} [l/min]	Emergency hand button	Solenoid plug location	Symbol, see page 11
0521222100	RA50158633	M22 × 1.5	●	Flange	I	60	60	With	①	1b
0521222101	RA50158633	M22 × 1.5	●	Flange	II	60	60	With	①	1b
R917006510	RA50166977	M22 × 1.5	●	Flange	II	60	60	With	②	1b
R917008250	RA50008243	M22 × 1.5	●	Flange	II	60	60	Without	①	1a
R917008251	RA50021445	M22 × 1.5	●	Flange	II	60	60	Without	②	1a

① = as shown, see page 13
② = lifting and lowering solenoid rotated 90°
③ = lifting and lowering solenoid rotated 60°
④ = lifting and lowering solenoid plug with different coding

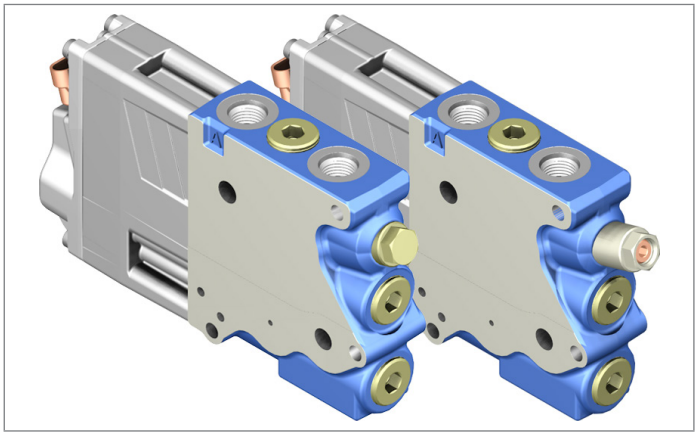
Dimensions

▼ **EHR5-LS**



1 Lifting
2 Lowering
3 O-ring included in the scope of delivery
4 Three mounting holes; M_A = 25+6 Nm

EHR11-EHS4 control valves

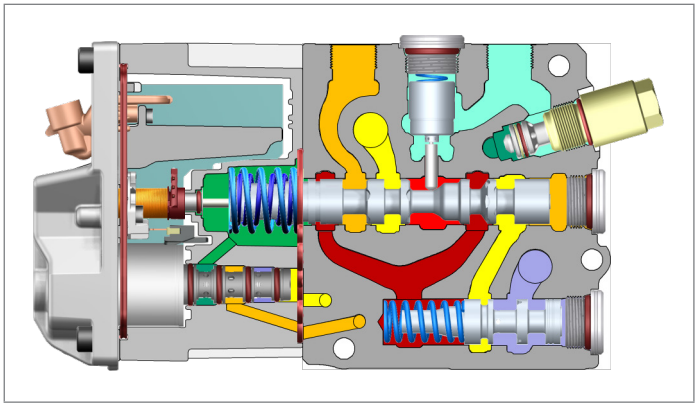


EHS: Pilot-operated, electro-hydraulic actuating unit (CAN bus)

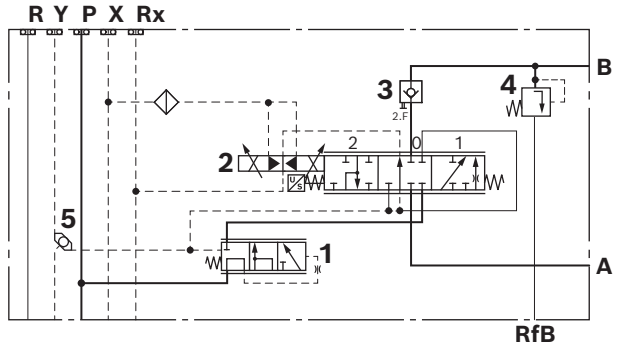
Functional description

The EHR11-EHS4 is a pilot-operated electro-hydraulically actuated control valve with three spool positions and on-board electronics. The control spool is actuated via a 4/3 directional pilot control valve which pressurizes the chambers for deflection of the control spool. The control spool position is guided back by means of a position transducer on the control electronics. The electronics regulate the position of the control spool via the current of the pilot control valve depending on the setpoint value of the spool deflection and provide the required flow at the consumer port **B** (lifting). The EHR24-EHS4 control valve is fitted with a mechanical shut-off valve in port **B**. For further information, see data sheet 66176.

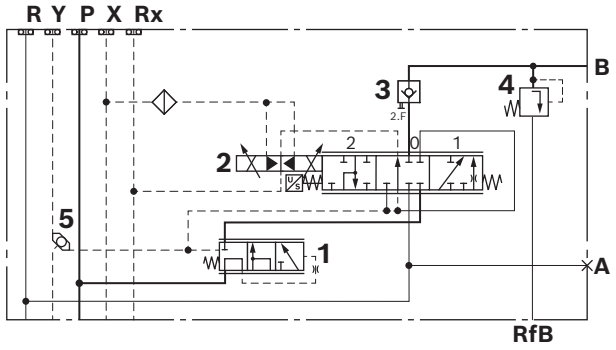
▼ **EHR11-EHS4 with one shut-off valve in port B**



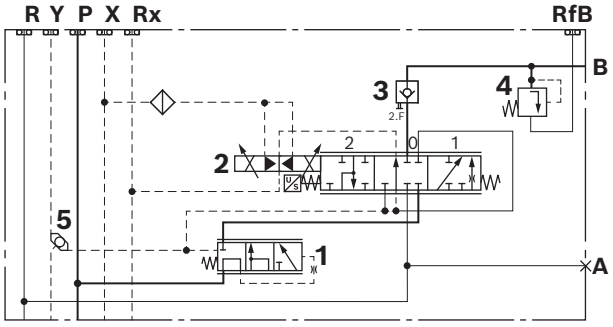
▼ **Symbol 1: RfB on O-ring opposite side, external consumer return**



▼ **Symbol 2: RfB on O-ring opposite side, internal consumer return**



▼ **Symbol 3: RfB on O-ring side, internal consumer return flow**



Ports EHR11-EHS4	
P	Pump port
A	Consumer port for lowering return oil flow, fitting tightening torque M_A = 125+13 Nm
B	Consumer port for lifting (cylinder), fitting tightening torque M_A = 125+13 Nm
R	Return flow
RfB	Pressure relief valve return flow
X	Pilot oil supply
Rx	Pilot oil return
Y	Control port for control pumps

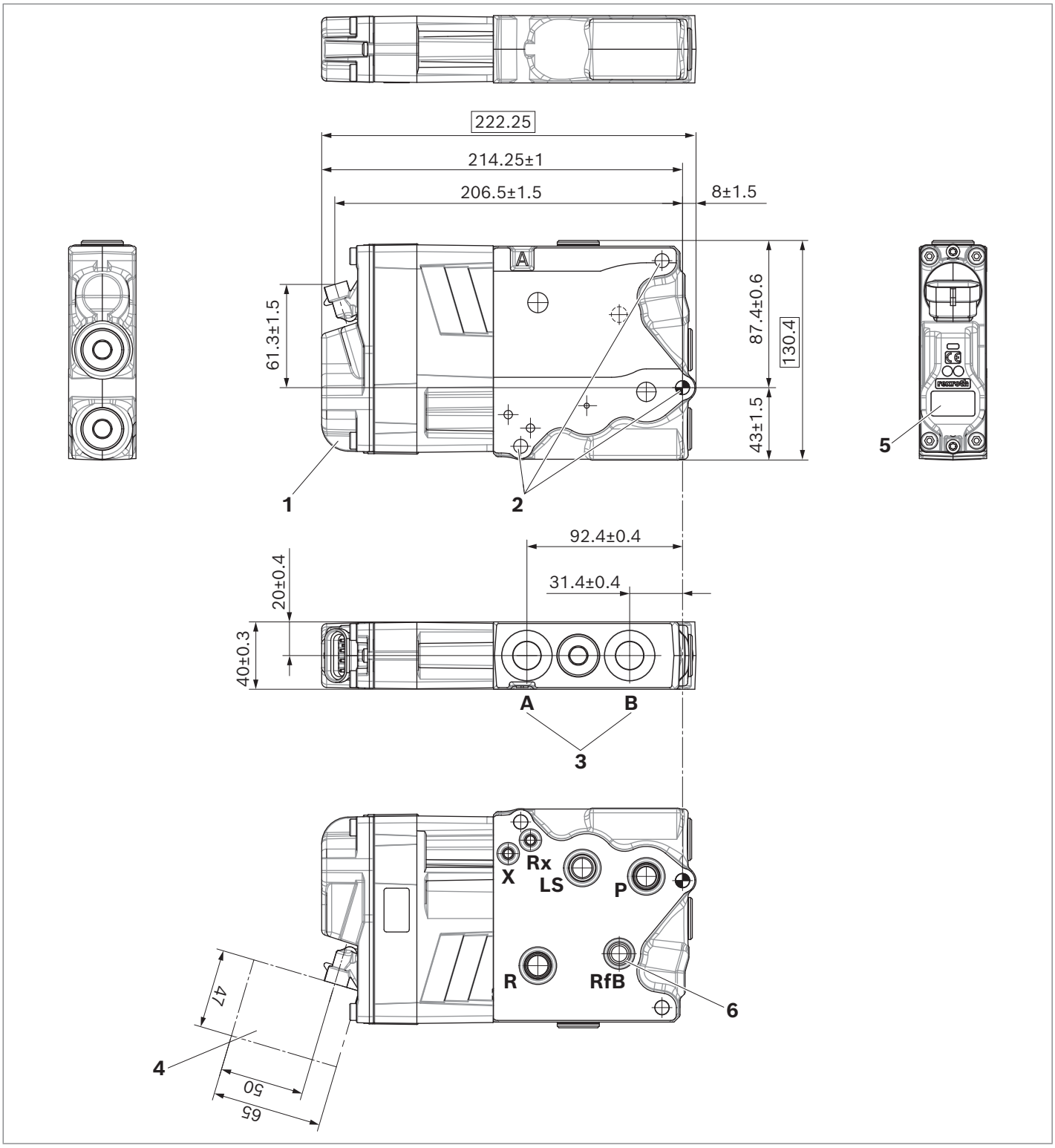
1 3-way pressure compensator
2 Electro-hydraulic actuation
3 Check valve
4 Secondary pressure relief valve
5 Shuttle valve

Available variants

Material number	Line connections: A, B	Thread design, see page 34	Lowering q_{SN} [l/min]	Lifting q_{HN} [l/min]	Consumer return flow	Emergency lowering	Secondary PRV [bar]	PRV return flow	Symbol
On request	M18 × 1.5	II	140	80	External	Without	230±13	O-ring opposite side	1
R917014032	M18 × 1.5	I	140	80	Internal	Without	230±13	O-ring opposite side	2
R917012672	M18 × 1.5	II	140	80	Internal	Without	230±13	O-ring side	3

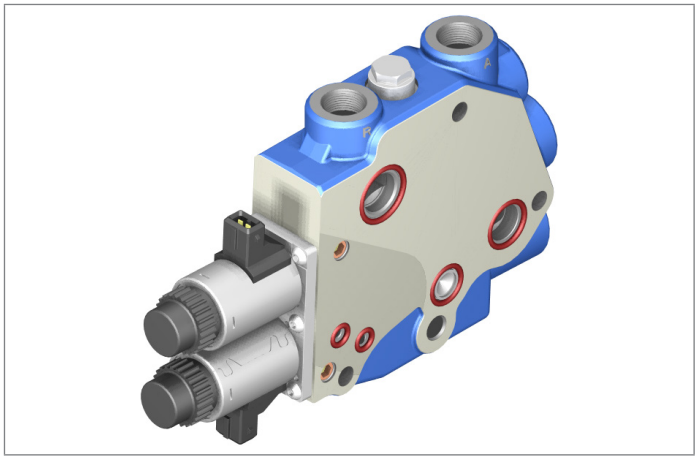
Dimensions

▼ EHR11-EHS4



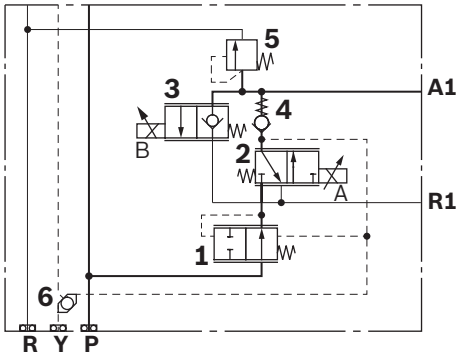
1 Electro-hydraulic actuation (actuating unit EHS4)
2 Three holes drilled through for mounting
3 Consumer ports **A**, **B** in thread design M18 × 1.5
4 Connector removal dimension
5 Name plate
6 Connection of RfB optionally on O-ring side or O-ring opposite side

EHR24-EM2 control valves

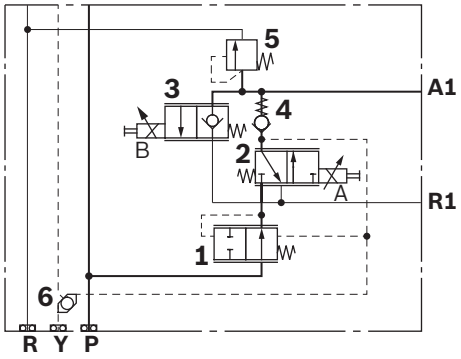


EM2: direct electromagnetic actuation, proportional

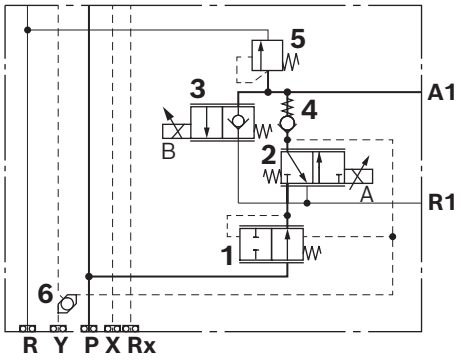
▼ **Symbol 1a**



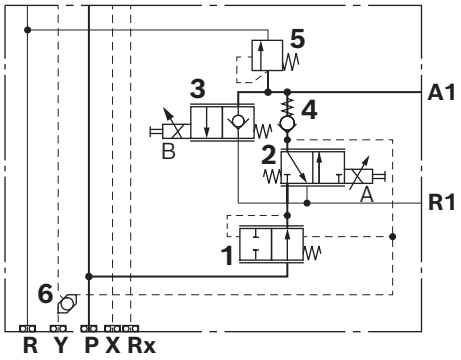
▼ **Symbol 1b**



▼ **Symbol 2a**



▼ **Symbol 2b**

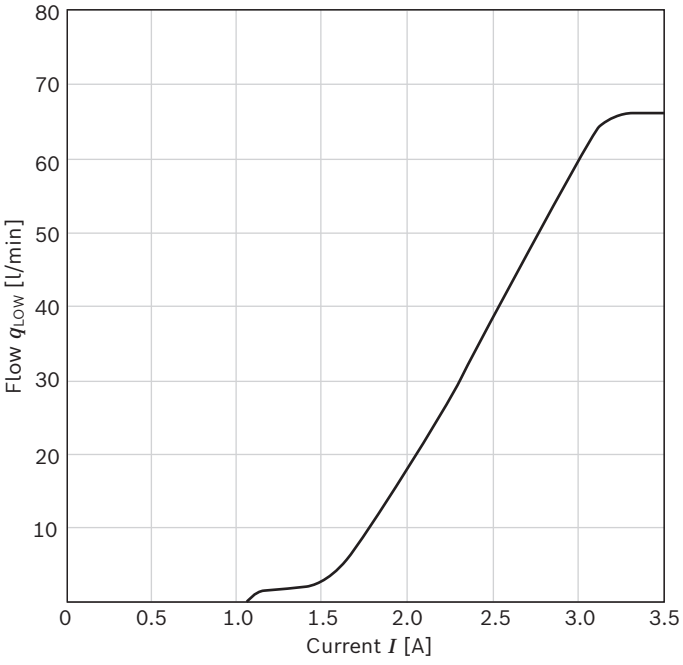


1 3-way pressure compensator
2 Lifting module
3 Lowering module
4 Check valve
5 Secondary pressure relief valve
6 Shuttle valve

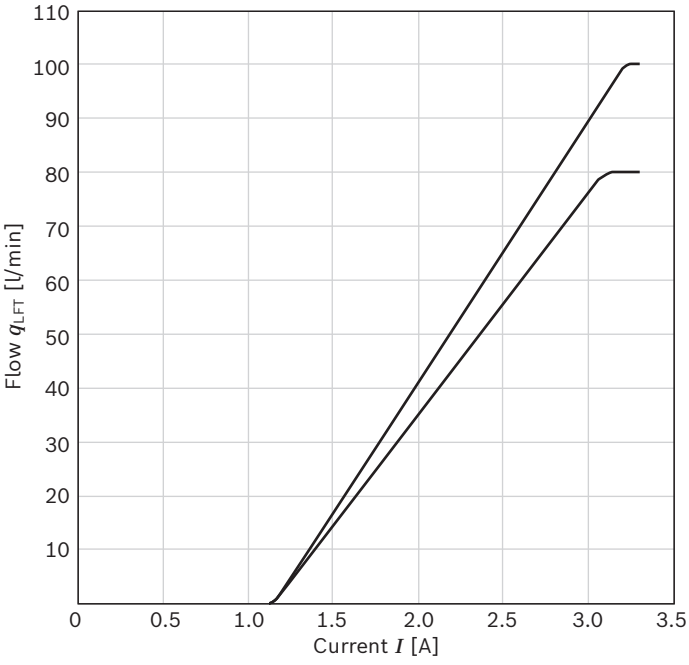
Ports EHR24-EM2	
P	Pump port
A1	Consumer port (cylinder), fitting tightening torque M_A = 125^{+13} Nm
R	Return flow
R1	Return flow, lowering flow rate, fitting tightening torque M_A = 125^{+13} Nm
Rx	Pilot oil return
X	Pilot oil supply
Y	Control port for control pumps

Characteristic curves

▼ **Lowering characteristic curve**



▼ **Lifting characteristic curve**



Notice
Lowering characteristic curve measured at Δp **A** → **R** = 15 bar; ϑ = 50°C.

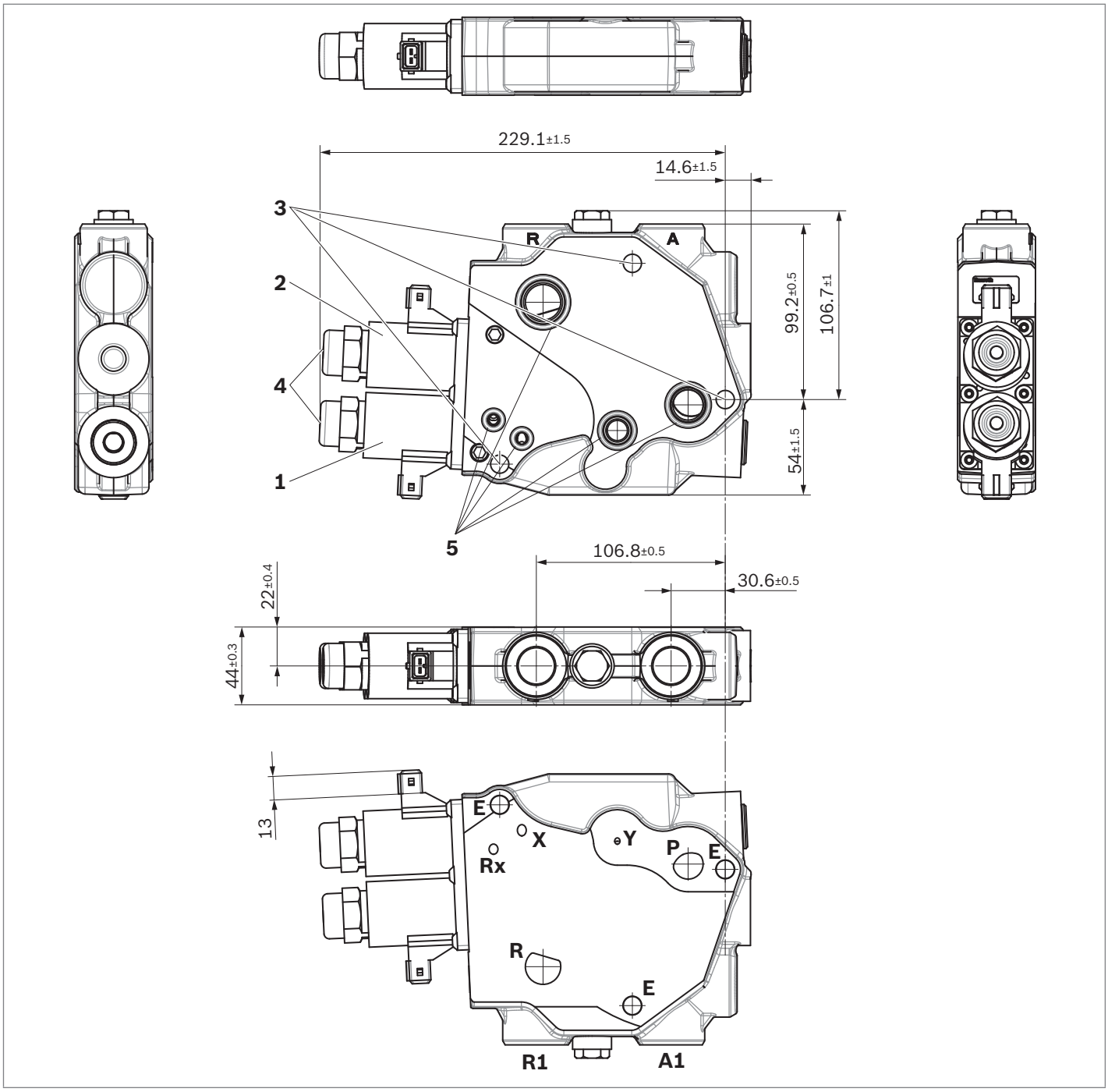
Available variants

Material number	Line connections:			Lowering	Lifting	Emergency hand button	Solenoid plug location	EHS hole (X1, RX)	Symbol, see page 17
	A1	R1	Thread design, see page 34	q_{SN} [l/min]	q_{HN} [l/min]				
R917011404	M22 × 1.5	M22 × 1.5	II	65	80	With	①	With	2b
R917013071	M22 × 1.5	M22 × 1.5	II	65	100	With	①	With	2b
R917012702	M22 × 1.5	M22 × 1.5	I	65	80	With	①	With	2b
R917012922	M22 × 1.5	M22 × 1.5	I	65	100	With	①	With	2b

① = as shown

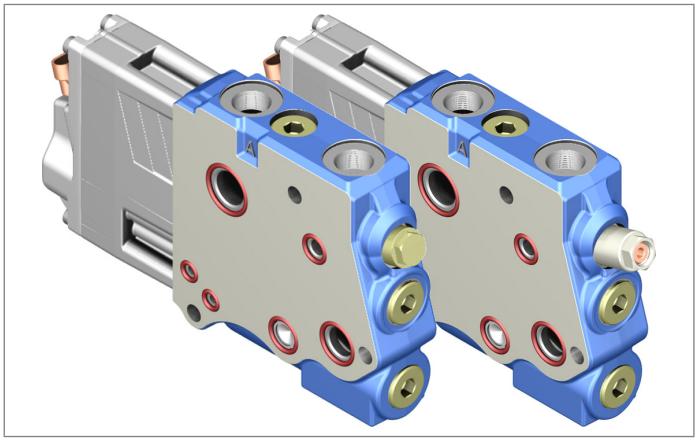
Dimensions

▼ **EHR24-EM2**



1 Solenoid A (lifting)
2 Solenoid B (lowering)
3 Three continuous mounting holes;
tightening torque for tie rod lubricated/non-lubricated:
M_A = $25.5^{+2.5}$ / 30^{+3} Nm; min. tie rod property class 10.9
4 With emergency hand button
5 O-ring included in the scope of delivery

EHR24-EHS4 control valves

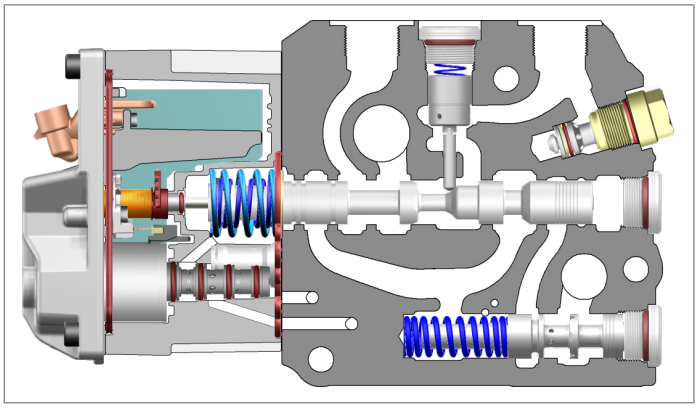


EHS: Pilot-operated, electro-hydraulic actuating unit (CAN bus)

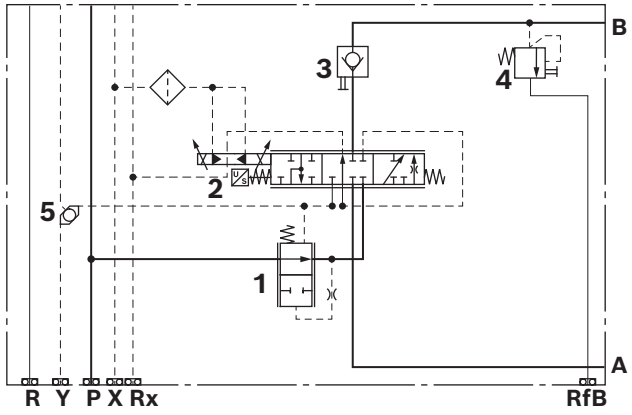
Functional description

The EHR24-EHS4 is a pilot-operated electro-hydraulically actuated control valve with three spool positions and on-board electronics. The control spool is actuated via a 4/3 directional pilot control valve which pressurizes the chambers for deflection of the control spool. The control spool position is guided back by means of a position transducer on the control electronics. The electronics regulate the position of the control spool via the current of the pilot control valve depending on the setpoint value of the spool deflection and provide the required flow at the consumer port **B** (lifting). The EHR24-EHS4 control valve is fitted with a mechanical shut-off valve in port **B**.
For further information, see data sheet 66171/66174.

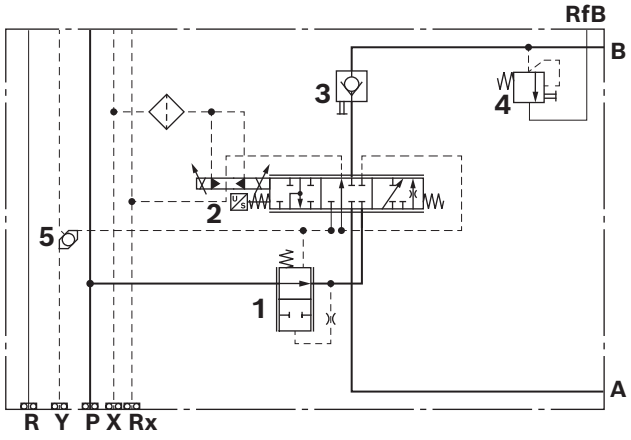
▼ **EHR24-EHS4 with one shut-off valve in port B**



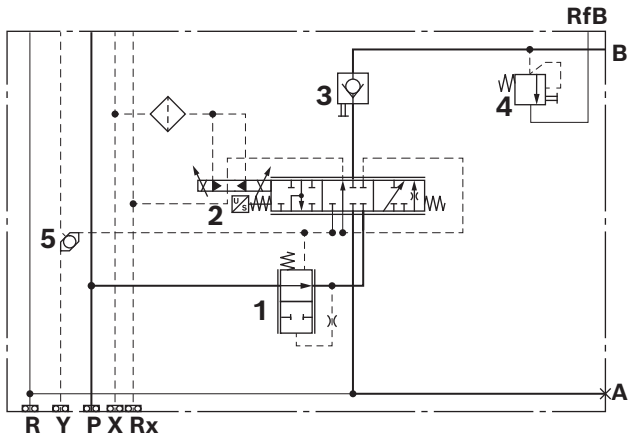
▼ **Symbol 1: RfB on O-ring side, PRV with emergency lowering, external consumer return (standard)**



▼ **Symbol 2: RfB on O-ring opposite side, PRV with emergency lowering, external consumer return flow**



▼ **Symbol 3: RfB on O-ring opposite side, PRV with emergency lowering, internal consumer return flow**



Ports EHR24-EHS4	
P	Pump port
A	Consumer port for lowering return oil flow, fitting tightening torque M_A = 125^{+13} Nm
B	Consumer port for lifting (cylinder), fitting tightening torque M_A = 125+13 Nm
R	Return flow
RfB	Pressure relief valve return flow
X	Pilot oil supply
Rx	Pilot oil return
Y	Control port for control pumps

1 3-way pressure compensator
2 Electro-hydraulic actuation
3 Check valve
4 Secondary pressure relief valve
5 Shuttle valve

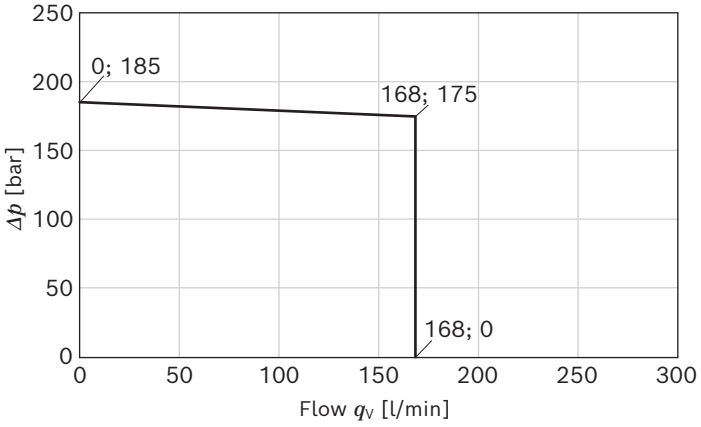
Available variants

Material number	Line connections: A, B	Thread design, see page 34	Lowering q_{SN} [l/min]	Lifting q_{HN} [l/min]	Consumer return flow	Emergency lowering	Secondary PRV [bar]	PRV return flow	Symbol
R917012377	M22 × 1.5	II	160	140	External	With	240±13	O-ring side	1
R917011883	M22 × 1.5	II	160	140	External	With	240±13	O-ring opposite side	2
R917012378	M22 × 1.5	II	160	120	Internal	With	240±13	O-ring opposite side	3

Switching capacity limits

The maximum switchable return flow is dependent on the load pressure level. The flow forces at the spool have a limiting effect here.
The values represented refer to the pilot pressure 17 bar.

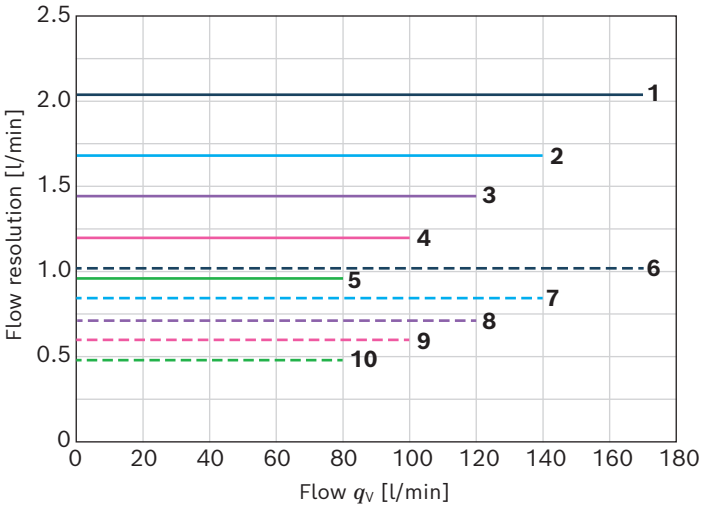
▼ **Characteristic curve return flows, switching capacity limits**



Flow resolution

The characteristic curves apply to standard variants with maximum characteristic curve rise.
Other tolerances can occur for special versions or special spool versions.
With lower characteristic curve rises and reduced maximum flow, the resolution can be increased to a limited extent (target: sensitive deflections at low flows).

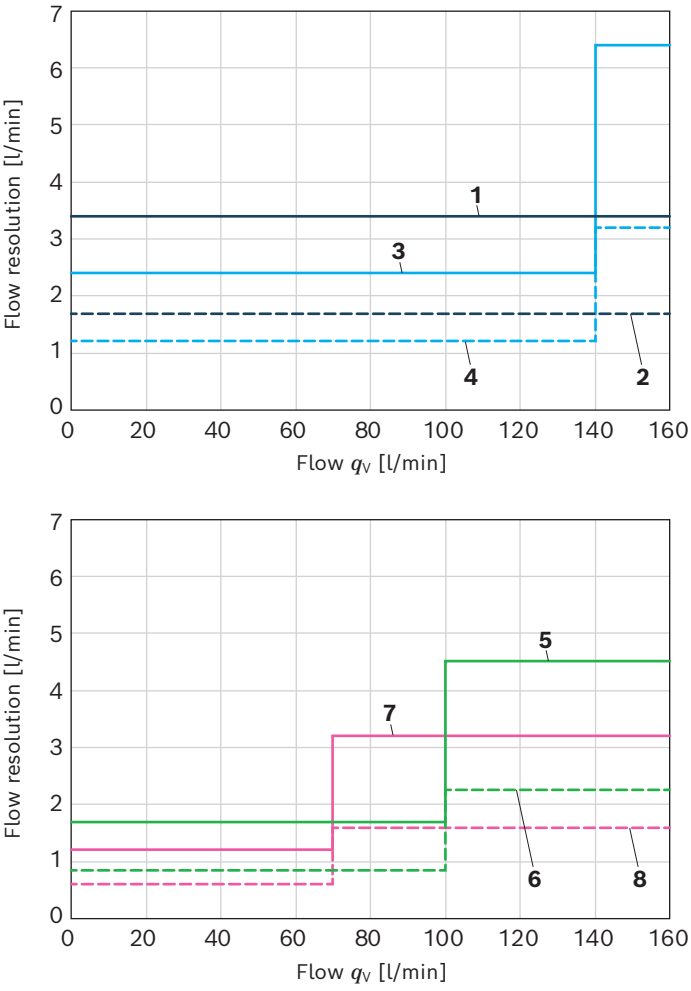
▼ **Flow resolution characteristic curves in the inlet P → B**



1 q_{nom} = 170 l/min (maximum)
2 q_{nom} = 140 l/min (maximum)
3 q_{nom} = 120 l/min (maximum)
4 q_{nom} = 100 l/min (maximum)
5 q_{nom} = 80 l/min (maximum)
6 q_{nom} = 170 l/min (typical)
7 q_{nom} = 140 l/min (typical)
8 q_{nom} = 120 l/min (typical)
9 q_{nom} = 100 l/min (typical)
10 q_{nom} = 80 l/min (typical)

Reading example:
A 120 liter valve has a typical resolution of 0.72 l/min (**8**) or a maximum resolution of 1.44 l/min (**3**) per CAN setpoint step.

▼ **Flow resolution characteristic curves in the return flow P → R**



1 Δq (maximum) at load pressure = 200 bar
2 Δq (typical) at load pressure = 200 bar
3 Δq (maximum) at load pressure = 100 bar
4 Δq (typical) at load pressure = 100 bar
5 Δq (maximum) at load pressure = 50 bar
6 Δq (typical) at load pressure = 50 bar
7 Δq (maximum) at load pressure = 25 bar
8 Δq (typical) at load pressure = 25 bar

maximum = tolerance limit
typical = typical resolution

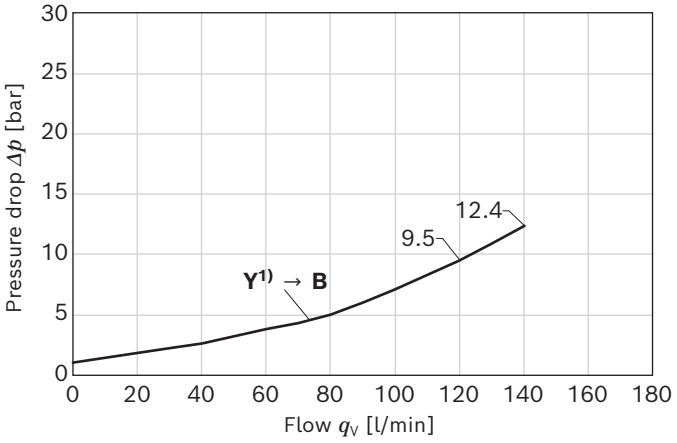
Temperature drift of flow
The temperature dependence of the flow is compensated electronically in the temperature range 30°C to 90°C.

Pressure drift of the flow of P → B
Pressure drift of the flow (pressure increase due to parallel operation) is compensated by the individual pressure compensator.

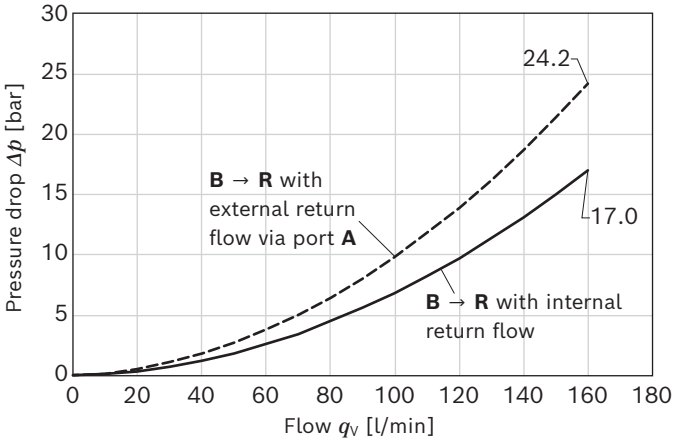
Flow resistances (typical values)

EHR24-EHS4, 1 shut-off valve

▼ **Position 1 (lifting)**



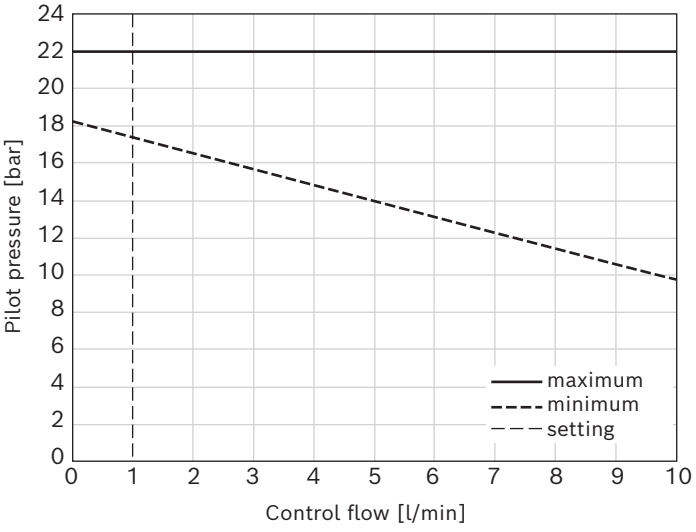
▼ **Position 2 (lowering)**



Pilot pressure
p_X = 17 to 22 bar
(setting point for control flow 0.8 to 1.2 l/min)

The pilot pressure in accordance with the diagram must be available alone to the EHS valves, since the full valve performance is otherwise not guaranteed.

▼ **Characteristic curve for pilot pressure**



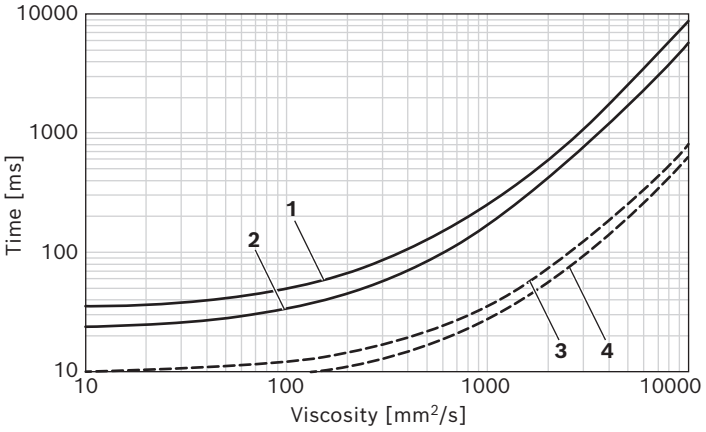
Pilot oil cleanliness
Special attention must be paid to the purity of the oil for the pilot oil supply; additional pilot oil fine filters must be used if necessary.

1) Δp between Y-channel (see sectional view on page 20) and port B

Actuating time / dynamics

Base frequency in relation to spool stroke approx. 14 Hz for setpoint change from 0 to 100%

▼ **Characteristic curve for step function**

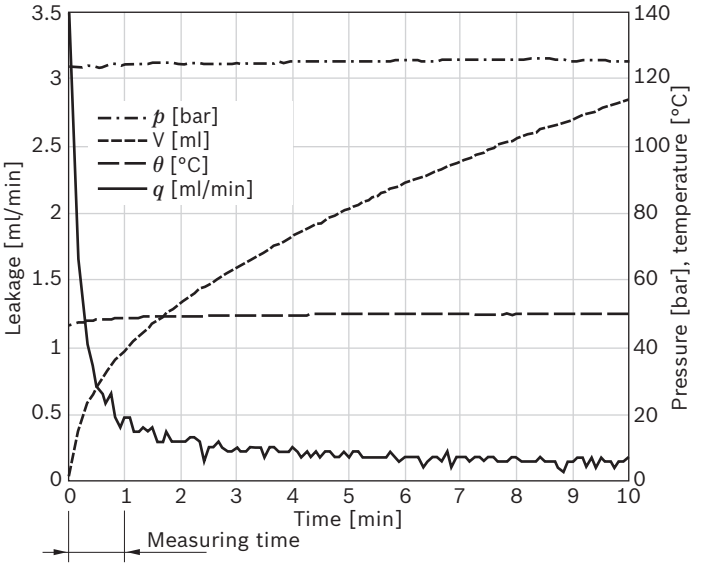


1 Actuating time: Neutral after lowering
2 Actuating time: Neutral after lifting
3 Delay time: Neutral after lowering
4 Delay time: Neutral after lifting

Internal leakage

Leakage at consumer port EHR24-EHS4 with 1 shut-off valve	
B → **R** in position 0:	2.4 ml/min

▼ **Typical development of leakage, chronological sequence of leak at shut-off valve**



Notice

- Shut-off valve leakage values measured with p = 125 bar, ν = 30 mm²/s, ϑ = 50°C, $t_{\text{waiting time}}$ = 15 s, $t_{\text{measuring time}}$ = 60 s.
- Leakage **P** → **R** measured with p = 200 bar.

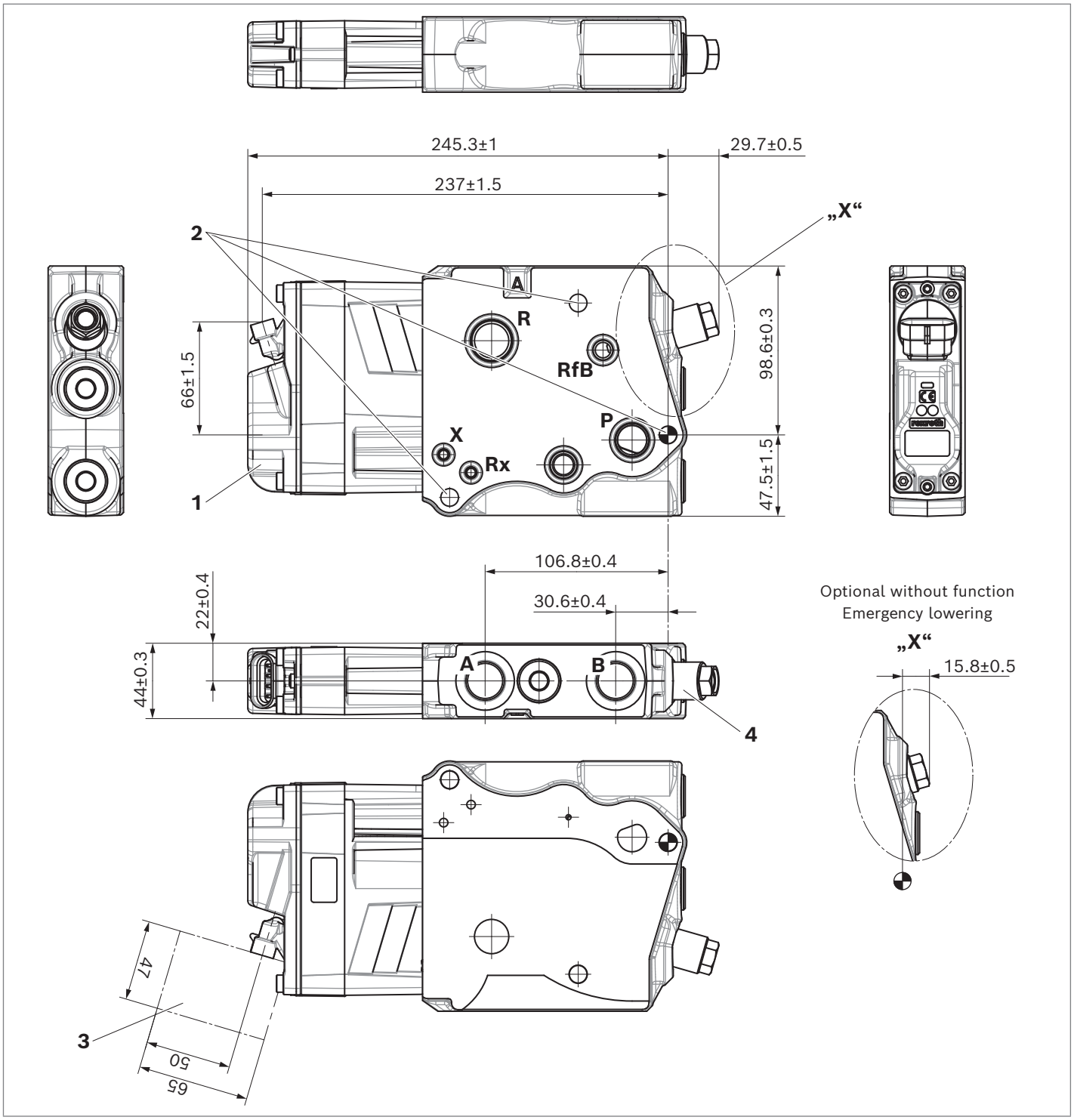
Further information

- Pilot oil supply
- Installation position
- Electronic functions
  - CAN control
  - Error code/diagnosis
  - Characteristic curve forms
  - Time ramps

See data sheet 66174

Dimensions

▼ **EHR24-EHS4**



1 Electro-hydraulic actuation (actuating unit EHS)

2 Three continuous mounting holes; tightening torque for tie rod lubricated/non-lubricated: M_A = 25.5+2.5 / 30+3 Nm; min. tie rod property class 10.9

3 Connector removal dimension

4 Notice regarding emergency lowering function:
The emergency lowering function can be activated by screwing in the hexagon socket head cap screw. Note that first an idle stroke of approx. 300° to 500° must be actuated, then manual lowering begins. During the transition between idle stroke and manual lowering, there is no noticeable change in torque, especially at high load pressures.

Double-acting (da) hitch control valves HLS (hitch lowering support)

The HLS is a patented extension of the EHR system for replicating a simple double-acting hitch. It allows for active, pressure-assisted lowering of the hitch. No special setting or activation of the system is required. The HLS is activated by the EHR control system and controls the active lowering of the hitch at a defined pressure.

- **HLS1:** Separate add-on sandwich plate used in connection with EHR5 or EHR24-EM2.
- **HLS2:** By means of a 5-position spool, the “double-acting” function can be integrated directly in the EHR11-EHS4 and EHR24-EHS4.

Application

- Rapid lowering of (uncoupled) hitch even at cold temperatures
- Simplified attachment coupling
- Quick manual pushing even while in motion

Technical data

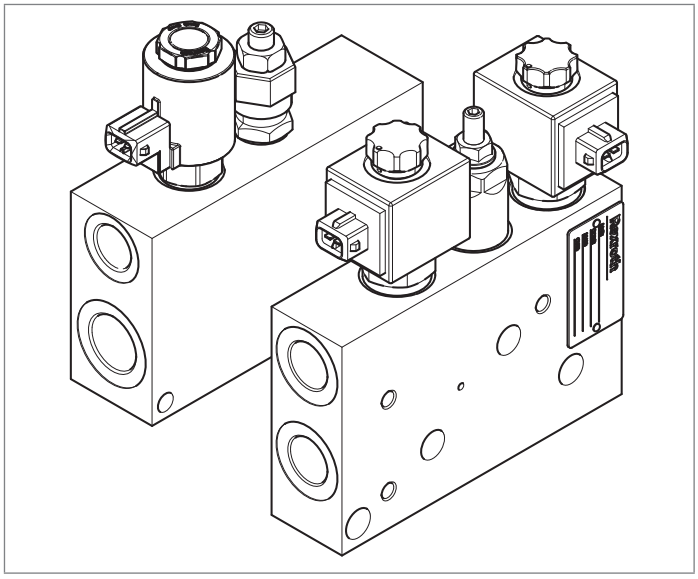
General				**HLS1**	**HLS2**	
Use				Separate add-on sandwich plate for EHR5, EHR24-EM2	Integrated function in	
					EHR11-EHS4	EHR24-EHS4
Design				Pipeline installation, flange design	Flange design	
Weight			kg		4.5	6.5
Installation position				Any	See data sheet 66176	See data sheet 66174
Line connections				See page 28	See page 34	
Ambient temperature range		ϑ	°C	–35 … +80		
Hydraulic				**HLS1**	**HLS2**	
Max. working pressure at port	**P**	p_{max}	bar	250	See page 6	
	R	p_{max}	bar	30 bar pressure-tight. Return flow pressure should still be avoided so the hitch is not pushed down unintentionally.		
	C	p_{max}	bar	50		
	Y	p_{max}	bar	220		
Lowering support pressure variants[1] (pushing pressure)		p	bar	20 … 30	–	13, 20, 30, 37
Pushing flow[1]		$q_{v\ nom}$	l/min	–	20	44, 55, 70, 80
Hydraulic fluid				Mineral oil (HL, HLP) according to DIN 51524, see data sheet 90220 Other hydraulic fluids on request, e.g. environmentally acceptable fluids per ISO 15380 as specified in data sheet 90221.		
Hydraulic fluid temperature range	Maximum	ϑ	°C	–30 … +100	–35 … +110	
	Recommended[1]	ϑ	°C	+20 … +90	+35 … +80	
Viscosity range	Maximum	ν	mm²/s	10 … 2000	7 … 8000	
	Recommended[1]	ν	mm²/s	20 … 100		
Maximum admissible degree of contamination of the hydraulic fluid Cleanliness level per ISO 4406 (c)				Level 22/19/16[2]	Level 20/18/15[3]	
Electric				**HLS1**	**HLS2**	
Supply voltage		U	V	12	12	
Maximum control current		I_{max}	A	1.7 … 1.2	–	
Power consumption		P	W	20	–	
Resistance at 20 … 25°C		R	Ω	7.2	–	
Connector version				AMP Junior Timer, 2-pin	AMP Superseal, 4-pin	
Type of protection				IP67	IP66, IP67, IP69K	

1) Depending on the pressure compensator setting and at max. spool deflection

2) We recommend a filter with a minimum retention rate of $\beta_{25} \geq 75$

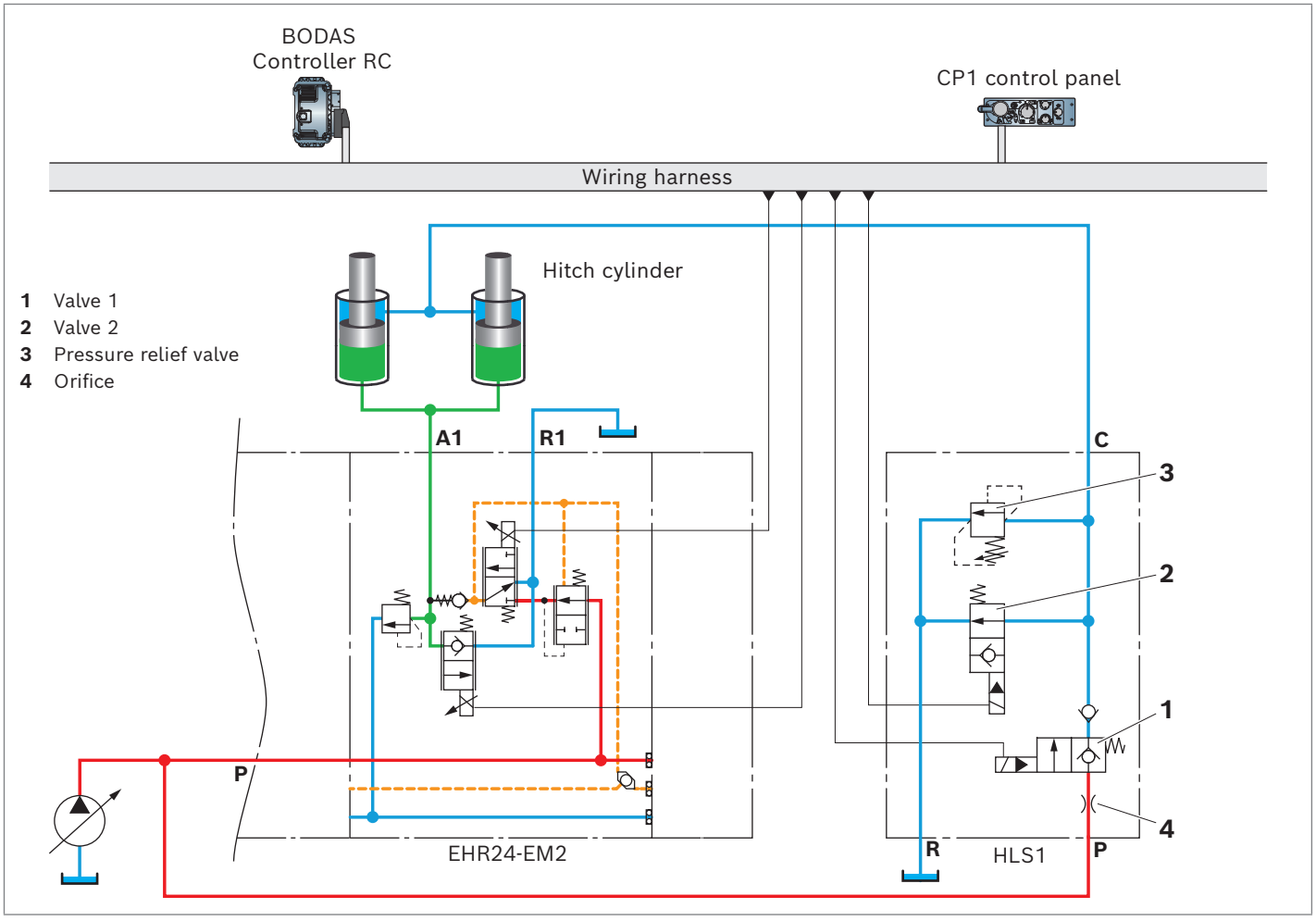
3) We recommend a filter with a minimum retention rate of $\beta_{10} \geq 75$

HLS1 for EHR5 and EHR24-EM2



The add-on sandwich plate **HLS1** is used for the function “double-acting” for the EHR5 or EHR24-EM2.

▼ **System structure with HLS1 (example)**



Functional description

Valve 1 (**1**) is not actuated, so it is kept closed by the springs. Pump pressure is locked. Valve 2 (**2**) is not actuated, so it is kept open by the springs. The consumer port is connected to the reservoir return flow by this valve. This allows the familiar EHR control with EHR5 or EHR24-EM2 control valve and appropriate control electronics.

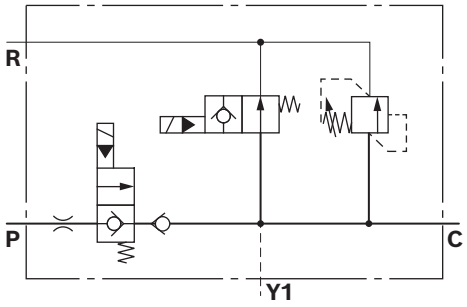
Pressure-assisted lowering

Activating the rapid engagement function on the EHR control panel or pressing one of the external lowering buttons at the rear actuates valves 1 and 2. This establishes a connection between the pressure line **P** and the rod side of the cylinder (port **C**) while valve 2 closes the connection between the cylinder and the reservoir.

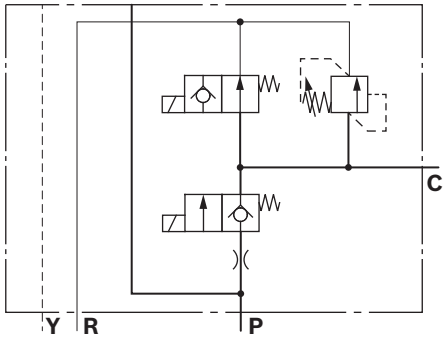
The rod side of the cylinder is then pressurized by the pump and limited to the pressure (approx. 20 to 30 bar) set in the pressure relief valve (**3**). This limits the force with which the hitch is lowered/pushed into the ground. The orifice (**4**) limits the flow rate coming from the pump. If hilly ground causes the hitch to be pushed up, the fluid can flow out through the pressure relief valve, limiting the pressure to the set value.

When the lowering valve in the EHR5 or EHR24-EM2 is opened, the outgoing flow and, with it, the hitch cylinders are proportionally lowered under pressure at the speed set at the control panel for the throttle When the rapid engagement function is ended or the button at the rear is pressed, valves 1 and 2 shut off and the system returns to its “normal” state.

▼ **Symbol 1: HLS1 for pipeline installation**



▼ **Symbol 2: HLS1 with EHR5-LS flange figure**



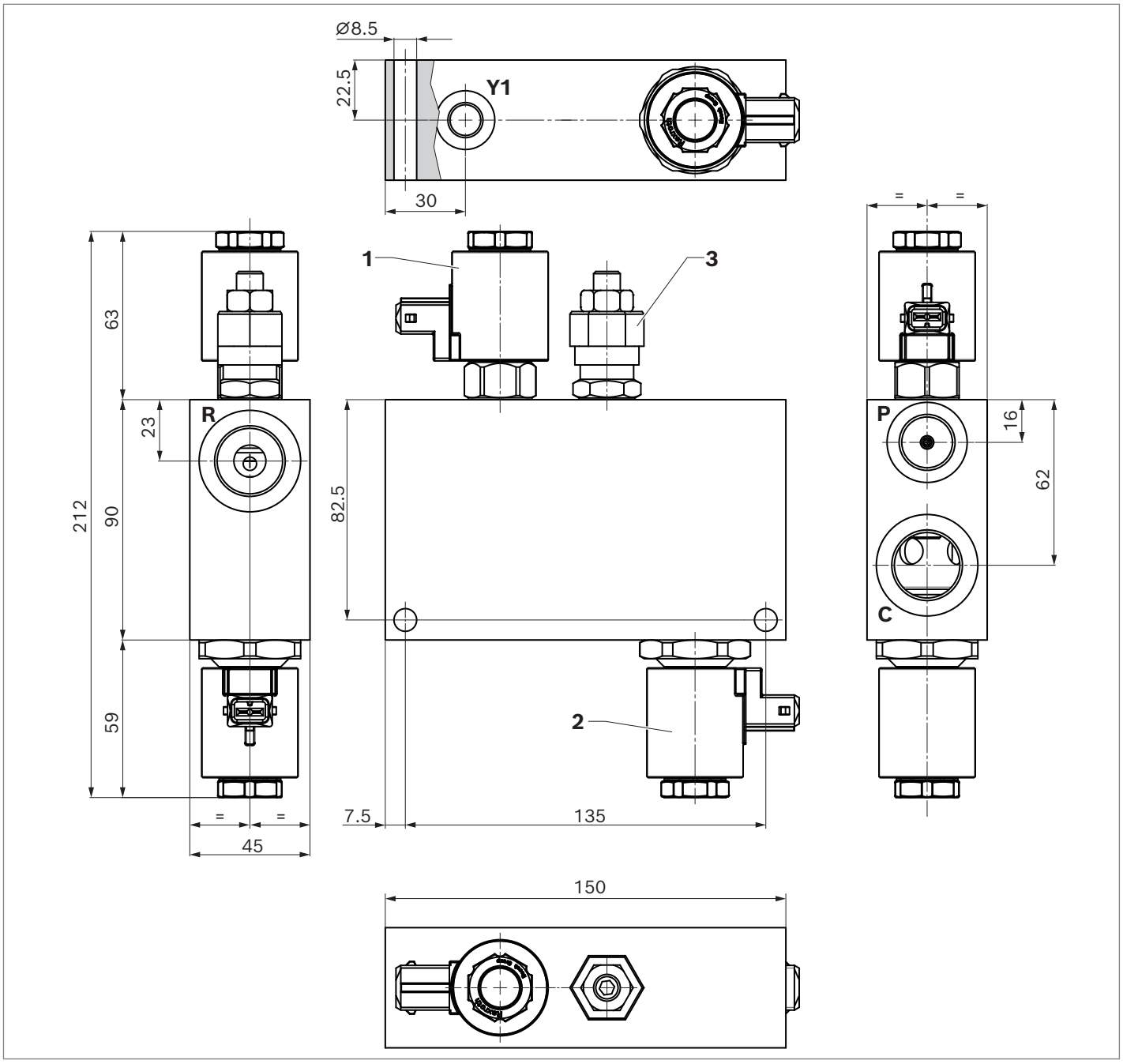
Ports HLS1	
P	Pump port
C	Consumer port (cylinder), fitting tightening torque M_A = 125^{+13} Nm
R	Return flow
Y	Control port for control pump
Y1	Optional control port for control pump (or plugged)

Available variants

Material number	**Drawing number**	**Line connections:**					**Symbol,** see page 28
		P	**R**	**C**	**Y**	**Thread design,** see page 34	
R930068307	R930068307_AGZ	M18 × 1.5	M22 × 1.5	M22 × 1.5	–	I	1
R930082094	R930082094_AGZ	M22 × 1.5	M22 × 1.5	M22 × 1.5	M22 × 1.5	I	2

Dimensions

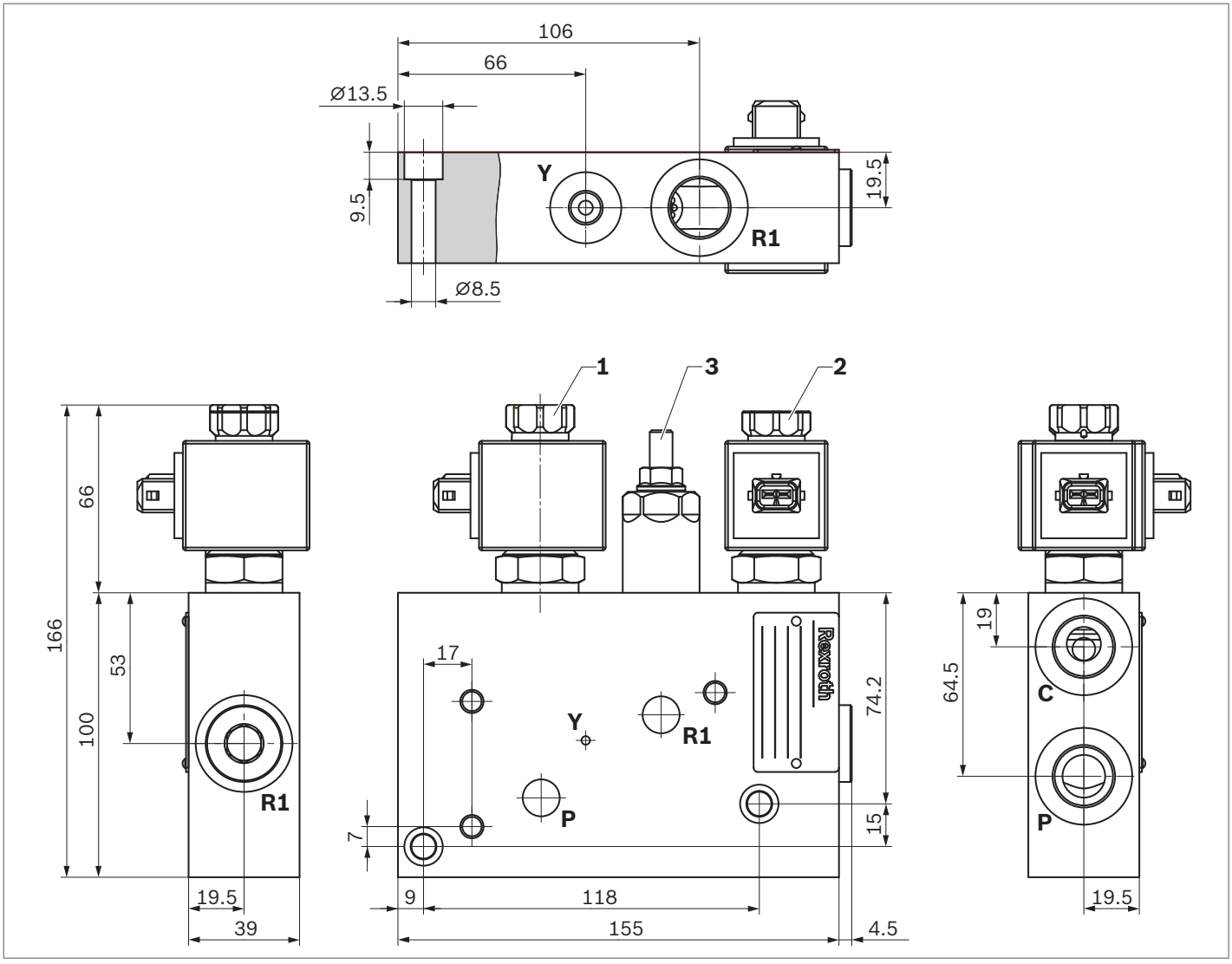
▼ **HLS1 for pipeline installation**



1 Valve 1
2 Valve 2
3 Pressure relief valve

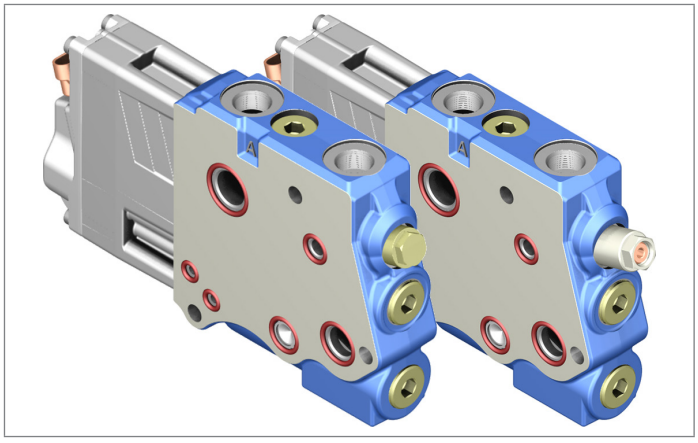
1) Any operation outside the recommended ranges may affect service life and function.

▼ **HLS1 with EHR5-LS flange figure**

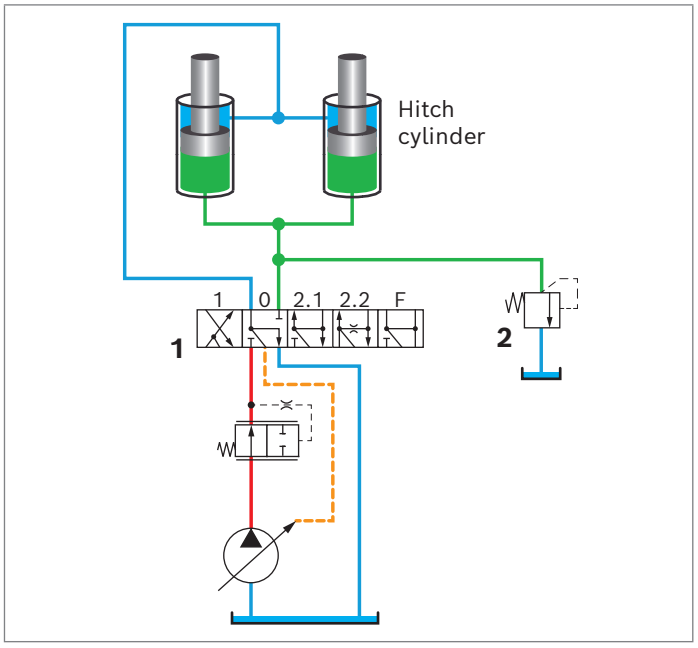


1 Valve 1
2 Valve 2
3 Pressure relief valve

HLS2 for EHR11-EHS4 and EHR24-EHS4



▼ **System structure (example)**



1 5-position spool
1: Lifting active
0: Neutral
2.1: Single-acting lowering
2.2: Double-acting lowering (pushing)
F: Float mode
2 Pressure relief valve

By means of a 5-position spool, the “double-acting” function can be integrated directly in the EHR24-EHS4.

Application

- Rapid lowering of (uncoupled) hitch even at cold temperatures
- Simplified attachment coupling
- Quick manual pushing even while in motion

Benefits

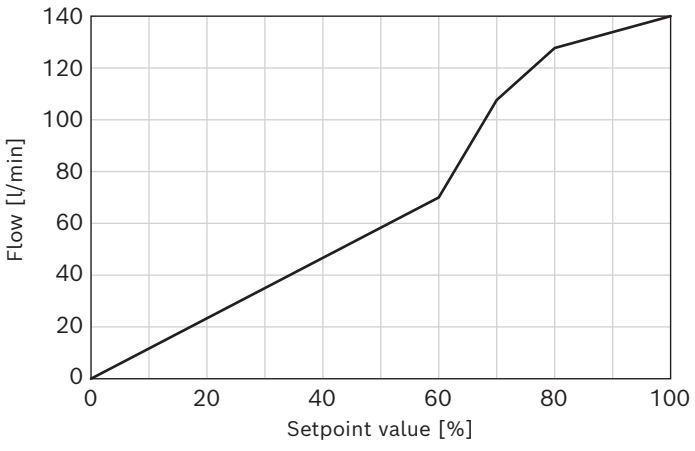
- Fixed maximum pushing pressure setting due to spool geometry and pressure compensator spring depending on spool deflection (setpoint specification)
- No unsafe conditions present
- No pressure control and pressure monitoring necessary
- No pressure sensor necessary

Notice
During da actuation (only short-term in operation), there is loss in flow.

Functional description

- **Single-acting:**
  The lowering setpoint range from 0 to 100% is divided between the two ranges lowering and pushing.
  The hitch performs single-acting lowering in the setpoint range of 0 to 60%. However, single-acting lowering can also be deflected by more than 60%, provided that the cylinder ratio is stored in the software. This ensures that no unintentional pushing is carried out.
  From a setpoint range above 60%, the flow is directed into the cylinder port **A** and supports the lowering process (= fast lowering empty hitch).
  This results in a total max. lowering oil flow of approx. 140 l/min at 18 bar load pressure.

▼ **Lowering B → R via setpoint value**

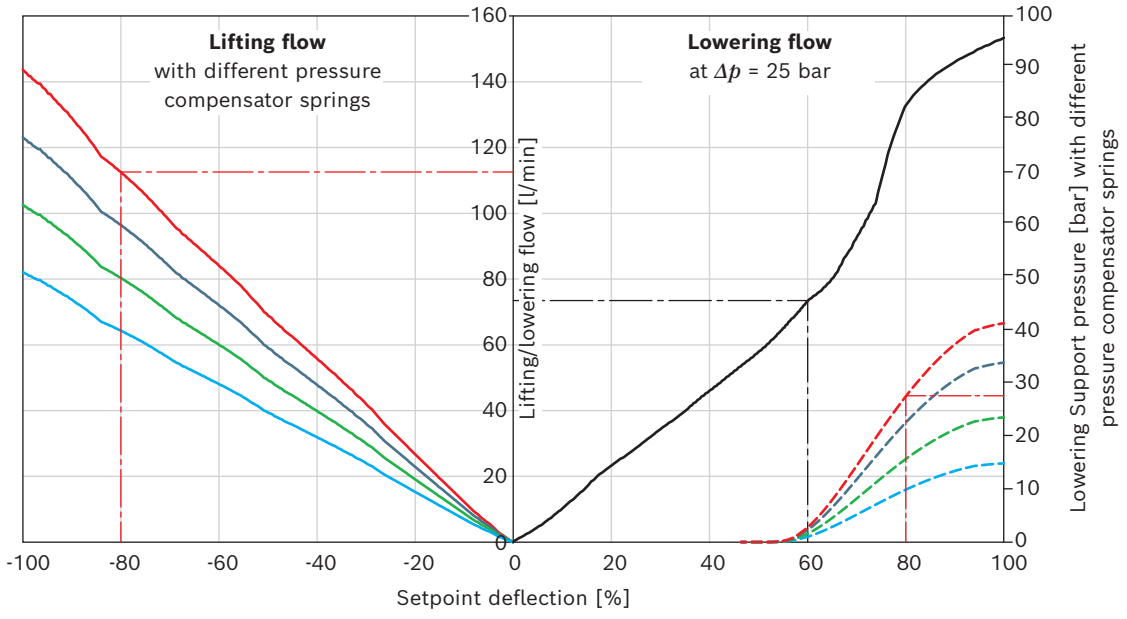


▶ **Double-acting:**
The lowering setpoint range from 0 to 100% is divided between the two ranges lowering and pushing.
The hitch performs single-acting lowering in the setpoint range between 0 and 60%.
From a setpoint range above 60%, the control spool operates in da range / in pushing range.
In the pushing range (set point >60%),
there are two states:

– 1. If the attachment has not yet reached the bottom, the flow is directed into the cylinder port **A** and supports the lowering process (= fast lowering empty hoist). Depending on the setpoint specification, a different flow (= pushing flow) occurs.

– 2. In the first moment after the attachment has arrived on the bottom or is resting on the bottom, there is no more oil flow in the direction of the cylinder port **A**.
The flow is then directed to the reservoir via the orifice in spool position 2.2 and forms a flow resistance up to the cylinder port **A**.
The higher the selected setpoint value, the higher the flow and flow resistance. This flow resistance corresponds to the “lowering support pressure” or “pushing pressure”.

▼ **Flow via setpoint deflection of control spool, EHR24-EHS4-HLS2 with control spool R917013677**



Lifting flow
P→B 140 l/min, spring R917010340
P→B 120 l/min, spring R917010346
P→B 100 l/min, spring R917010339
P→B 80 l/min, spring R917010345

Lowering flow
B > **R** 25 bar

Lowering support pressure (pushing pressure)
Spring R917010340
Spring R917010346
Spring R917010339
Spring R917010345

Example with pressure compensator spring R917010340
(see dash-dot lines in diagram)**:**

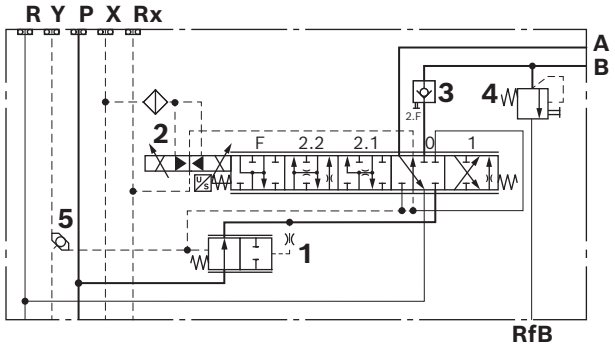
▶ With a setpoint deflection of approx. –80%, this results in a lifting flow of approx. 115 l/min
▶ A setpoint deflection of approx. 80% results in a lowering support pressure or pushing pressure of approx. 28 bar
▶ The lowering flow is independent of the pressure compensator spring. A setpoint deflection of approx. 60% results in a lowering flow of approx. 72 l/min.

Different pressure compensator springs can be used to select the maximum flow and different maximum lowering support pressure variants (pushing pressure).

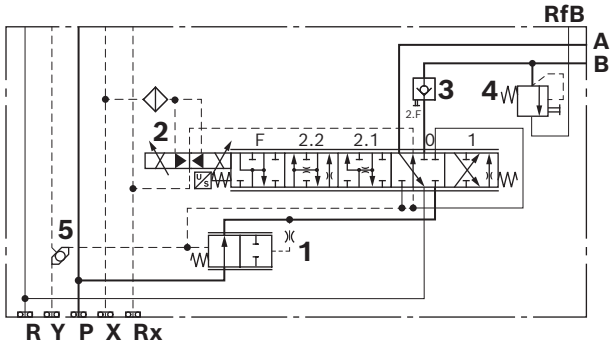
▼ **Available pressure compensator springs**

Flow			
Lifting [l/min]	**Pushing, approx. [l/min]**	**Max. pushing pressure [bar]**	**Mat. no.**
140	80	37	R917010340
120	70	30	R917010346
100	55	21	R917010339
80	45	13	R917010345

▼ **Symbol 1: EHR11-EHS4-HLS2**



▼ **Symbol 2: EHR24-EHS4-HLS2**



1 3-way pressure compensator
2 Electro-hydraulic actuation
3 Check valve
4 Secondary pressure relief valve
5 Shuttle valve

Available variants EHR24-EHS4-HLS2

Material number		**On request**	**On request**
Line connections	**A, B**	M22 × 1.5	M22 × 1.5
	Thread design, see page 34	II	II
Max. lowering	l/min	160	160
Max. lifting	l/min	140	120
Pushing, approx.	l/min	80	70
Max. pushing pressure	bar	37	30
Consumer return flow		Internal	Internal
Emergency lowering		With	With
Secondary PRV	bar	230±13	230±13
PRV return flow		O-ring opposite side	O-ring opposite side
Symbol	See above	1	2

Available variants EHR11-EHS4-HLS2

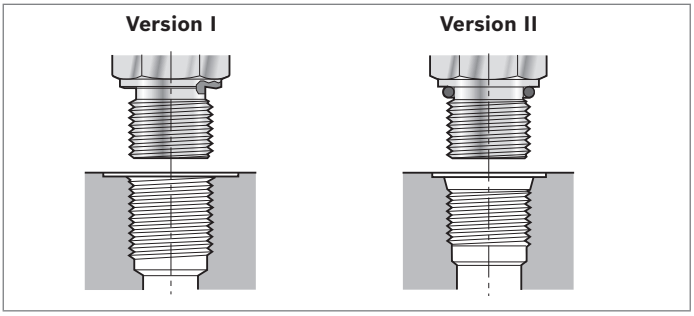
On request.

Dimensions

- EHR11-EHS4-HLS2: as EHR11-EHS4, see page 16
- EHR24-EHS4-HLS2: like EHR24-EHS4, see page 25

Line connections

Design of consumer ports A and B



Version I

- DIN 3852-1 (metric thread)
  - For seal ring sealing

Version II (preferred version)

- EN ISO 6149-1 (metric thread)
  - No female thread characterization
  - For O-ring sealing

Abbreviations

This documentation uses the following abbreviations:

Abbreviation	Meaning
CAN	Controller Area Network
da	Double-acting
PRV	Pressure relief valve
EHR	Electro-hydraulic hitch control
EHS	Pilot-operated electro-hydraulic actuating unit
HLS	Hitch lowering support
LS	Load-sensing
OBE	On-board electronics
sa	Single-acting

Spare parts

For spare parts, visit www.boschrexroth.com/spc

Contact partners for accessories and spare parts

Accessories and spare parts are available:

- From the vehicle manufacturer (specialist dealer).
- From the system manufacturer.
- From your Bosch Rexroth specialist dealer.

Bosch Rexroth sales partners can be found on the Internet at https://addresses.boschrexroth.com

If you have questions regarding spare parts, please contact your local Rexroth Service partner or the service department of the control block manufacturer's plant.

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Related documentation

Document type	Title	Document number
Instruction manual	EHR5 and EHR23 control valves for mobile applications	66125-B2
	Load-sensing control block SB11	66177-B
	Load-sensing control block SB24/34	66170-B
Data sheet	Load-sensing control block SB24/34	66170
	Load-sensing directional valves SB24-EHS3, SB34-EHS3	66171
	Load-sensing directional valves SB24-EHS4, SB34-EHS4	66174
	Load-sensing directional valves SB24-M	66172
	Plates for load-sensing control block SB24/34	66173
	Mineral oil-based hydraulic fluids	90220
	CP1 control panel	95255
	CP2 control panel	95256
	RC4-5 series 30 BODAS controller	95205
	BODAS controller RC10-10, series 31	95206
	RC28-14/30, RC20-10/30 and RC12-10/30 BODAS controllers	95204
Repair manual	Control block assembly SB24/34	66170-10-R
	Control block assembly SB11	66177-10-R
	Repair of control valves EHR5-OC and EHR5-LS	66125-30-R
	Repair of control valves EHR11	66177-30-R
	Repair of control valves EHR24-EM2, EHR24-EHS4	66170-30-R

Videos

Title	Link
Electrohydraulic Hitch Control – EHC [en]	https://www.youtube.com/watch?v=XOu0720yt-Y
Electrohydraulic Hitch Control EHC-8 for 3 Point Hitch [en]	https://www.youtube.com/watch?v=JkszpPcKba8
Double-acting hitch control	https://www.youtube.com/watch?v=FwhEPZ5Chdc
EHR expansion stage: Hitch lowering support HLS	https://www.youtube.com/watch?v=dHzJJdB2j5E
EHR expansion stage: Pressure relief control PRC	https://www.youtube.com/watch?v=EwjrxoNzNV0
EHR expansion stage: Automatic Hitch Control (AHC)	https://www.youtube.com/watch?v=2d7zOUiTto0
History of the EHR [en]	https://www.youtube.com/watch?v=ImZCdtdhCgU

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