Directley mounted CAN-controls for proportional directional spool valves type PSL/PSV

(valve bank design) acc. to D 7700-2, D 7700-3

Main parameter

Nomenclature:	Proportional directional spool valve acc. to the Load-Sensing-principle with directly mounted CAN-controls
Design:	Valve bank design
Oper. pressure	max. 420 bar
Flow rating	max. 200 lpm in total max. 120 lpm per section

For additional information:

- Proportional directional spool valve type PSL/PSV D 7700-2
- Proportional directional spool valve type PSL/PSV D 7700-3
- Programmable logic valve control type PLVC D 7845 M

1. General

These proportional directional spool valves serve to control both, the direction of movement and the load-independent, stepless velocity of the hydraulic consumers. In this way several consumers may be moved simultaneously, independently from each other at different velocity and pressure ratings, as long as the sum of the partial flows needed for this is within the total delivery supplied by the pump.

This actuation version with directly mounted CAN-actuation is a supplement to the already actuation variants described in D 7700-2, D 7700-3.
Advantages of this design:
- Easy electrical connection
- Integrated position transducer
- Readily calibrated at HAWE (I_{min}, I_{max}, etc.)
- Configurable valve characteristics (linearization, fine control range etc.)
- Adjustable ramps
- Improved response behavior
- Adjustable max. flow
- Diagnostic facility (fault detection, spool position etc.)

The electrical connection (power and CAN-Bus) between the valve sections is via internal lines.

Table of content

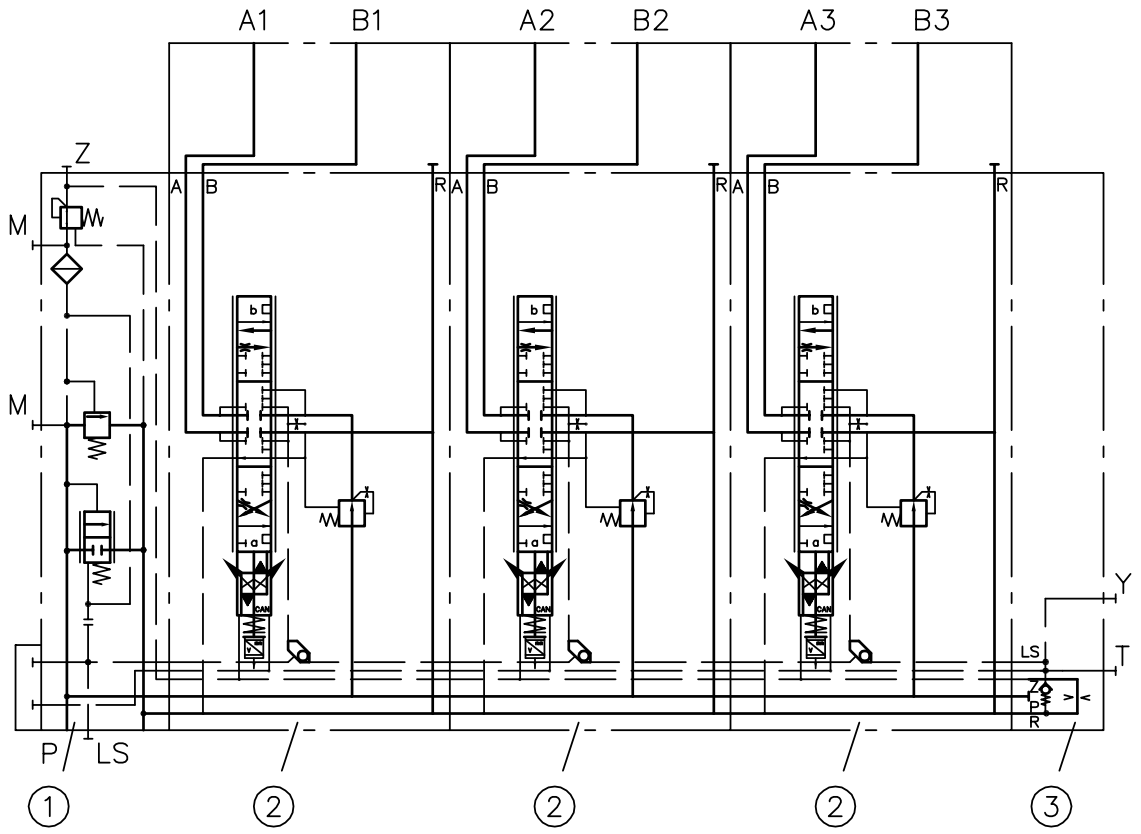
2. Layout, Main data

2.1 Type coding key

The type codings printed bold are detailed in this brochure. For all other details, see D 7700-2 or D 7700-3.

Order example:

PSV 31/D 170-2 ①
-A 2 J 25/25 /**EA CAN-C**/2 ②
-A 2 J 25/25 /**E CAN**/2 ②
-A 2 J 25/25 /**E CAN**/2 ②
-E 4-**AMP 12** ③ - ④
-0-PLVC/250 ⑤



① Connection block
② Valve section (with directly mounted CAN-controls)
③ End plate
④ Specification for the socket
⑤ Specification for the CAN-protocol

2.2 Actuation variants

Order example:
PSV 31/D 170-2
-A 2 J 25/25 /**EA CAN**-C/2
-A 2 J 25/25 /**E CAN**/2
-A 2 J 25/25 /**E CAN-C**/2
-E 4-**AMP**
-0-PLVC/250

Actuation

Electrical actuation		
Description	Electro-hydraulic	Combined with manual actuation
Coding	**E**	**EA**

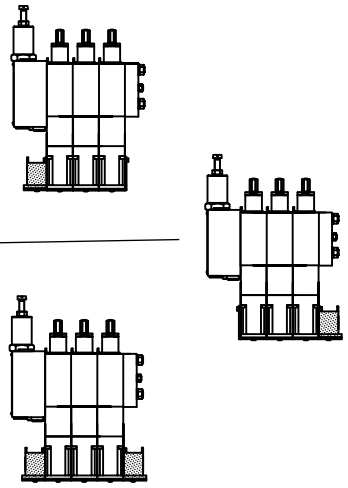
Suffix for CAN-controls

All directly mounted CAN-controls do come with transducer.
Basic rule for combinations:
There must be min. one socket (coding CAN-C or CAN-T) either at the first or last valve section

Directly mounted CAN-controls			
Description	CAN-knot incl. socket (at the first or last valve section)	CAN-knot incl. socket and terminating resistor 120 Ω (at the first or last valve section)	CAN-knot (all valve sections)
Coding	**CAN-C**	**CAN-T**	**CAN**

Possible combinations (examples)

CAN-C - CAN - ... - CAN - Socket at the first valve section
CAN-T - CAN - ...- CAN - Socket with terminating resistor at the first valve section
CAN - CAN - ...- CAN-C - Socket at the last valve section
CAN-C - CAN - ...- CAN-C - Socket at the first and last valve section



Socket

Description	4-pin socket (spec. AMP, with protective circuitry)	4-pin socket (spec. SAAB, with protective circuitry)
Coding	**AMP**	**AMS**
Terminal assignment	1 Power + 2 CAN-L 3 CAN-H 4 Power - / GND	1: CAN-L 2: Power + 3: Power - / GND 4: CAN-H
Suited plug	Co. AMP No. 282 764-1	Co. AMP No. 1-967 059-1

CAN-protocol

	- 0 (default) **- 1** (customer-specific)	
Description	Protocol Spec. for communication with type PLVC	Baud rate spec. in kBaud
Coding	- PLVC - CANopen - J1939	/125 **/250** (default) /500 /1000

3. Additional data

3.1 General and hydraulic

Type coding	PSL and PSV
Design	Directional spool valve, valve bank, all-steel design
Mounting	Valve bank: M8; see dimensional drawings in sect. 4
Installed position	Any
Hydraulic connection	P = Pressure inlet (pump) / lead-on R = Return A, B = Consumer ports U, W = Load-signal outlet at the indiv. spool valve section LS = Load-signal outlet e.g. connection of pump metering valve at PSV M = Pressure gauge port (pump side) Z = Pilot pressure port (20...40 bar inlet, 20 or 40 bar outlet) T = Control oil return port Y = Load-signal inlet port
Port dimensions	dep. on type coding, see D 7700-2, D 7700-3
Surface treatment	All surfaces corrosion-inhibiting, gas nitrided Actuation coding suffix E. CAN = nickel galvanized
Mass (weight) approx.	Connection blocks, valve sections, end plates, see D 7700-2, D 7700-3 Actuation coding suffix E. CAN = +0.3 kg
Pressure fluid	Hydraulic fluid acc. to DIN 51524 table 1 to 3; ISO VG 10 to 68 acc. to DIN 51519 Viscosity range: min. approx. 4 mm^2/sec; max. approx. 1500 mm^2/sec Optimal operation range: approx. 10 ... 500 mm^2/sec Also suitable are biologically degradable pressure fluids of the type HEPG (Polyalkylenglycol) and HEES (synth. Ester) at operation temperatures up to approx. +70°C. HETG (e.g. rape seed oil) or water based fluids e.g. HFA or HFC must not be used!
Temperature	Ambient: approx. -40 ... +80°C; Oil: -25 ... +80°C, pay attention to the viscosity range! Start temperature down to -40°C are allowable (Pay attention to the viscosity range during start!), as long as the operation temperature during consequent running is at least 20K higher. Biological degradable pressure fluids: Pay attention to manufacturer's information. With regard to the compatibility with sealing materials do not exceed +70°C. High temperatures accelerate the aging of electronic components.
Rec. contamination class	ISO 4406 18/14
Operating pressure	p_{max} = 420 bar; Ports P, A, B, LS, M, Y, U, W p_{min} = 50 bar The max. pressure achievable at the consumer side of the spool valves is lowered by the amount equivalent of the internal control pressure drop at the 3-way flow regulator of the PSL (see curve) Return port R(R1) ≤ 50 bar; port T pressure less with separate pipe (e.g. 8x1) to the tank, port Z approx. 20 (outlet); ≤ 40 bar (inlet)
Control circuit	For control pressure, see Q-I-characteristics. The internal control oil circuit is sufficiently protected against contamination caused malfunctions by means of a disk filter.
Flow	max. consumer flow acc. to the flow rate coding in the type coding
Flow metering	Adjustment in 1/1000-steps, linearity ensured via individual calibration of the CAN-knots with the correction factors being saved in the control software
Curves	see D 7700-2, D 7700-3

3.2 Electrical

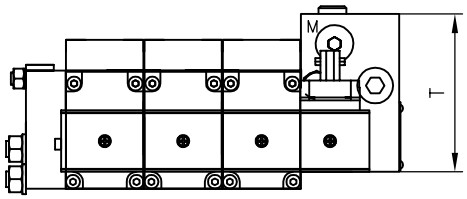
Supply voltage U_B	12 – 30 V DC
Current rating I_{max}	max. 10 A
Current consumption I_V	max 800 mA at U_B = 24 V DC (per valve section) max 1.5 A at U_B = 12 V DC (per valve section)
Socket	AMP = 4-pin AMP-JPT suited plug Co. AMP No. 282 764-1 AMS = 4-pin AMP-JPT suited plug Co. AMP No. 1-967 059-1
Protocol	Conforming CANopen protocol definition DS-301 device profile DSP-408 "Device profile fluid power technology proportional valves and hydrostatic transmissions"
Baud rate	see specifications in sect. 2.2
CAN-Addressing	Addressing via identifier, for description see sect. 5.3

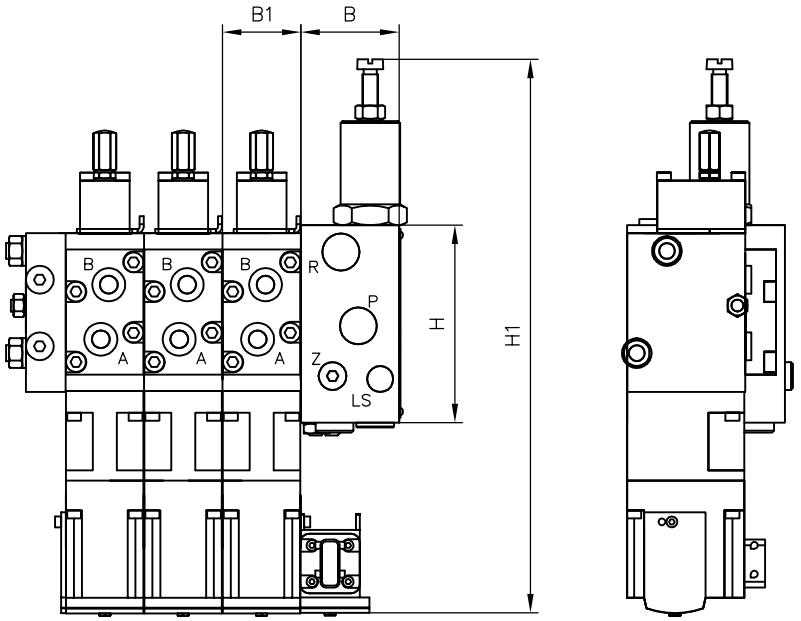
3.3 Certificates and environmental tests

EMV	E1-ECE-directive No. 10 revision 3 - 11 July 2008	
Protection class IP 67	DIN 40050-9	
Salt spray test	EN 60068-2-11	500 h
Shock test	EN 60068-2-29	25 g, 3-axis
Oscillation test	EN 60068-2-6	5..500 Hz, 2 mm amplitude (5..25 Hz), 5.0 g (25..500 Hz), 3-axis
Change of temperature test	EN 60068-2-14	-40°C - +85°C (1.5 K/min)
Cold test	EN 60068-2-1	-40°C
Damp/heat test, cyclic	EN 60068-2-30	95% moisture, 24 h
Dry/heat test	EN 60068-2-2	85°C, 16 h

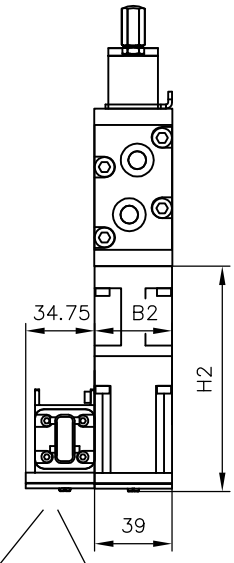
4. Dimensions

General

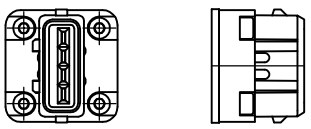


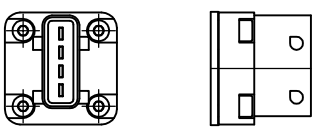


Actuation suffix **E.CAN-C, E.CAN-T**
Actuation suffix **E.CAN**



	B	B1	H	H1	H2	T	B2
PSL/PSV size 2	49.5	39.5	99.5	277	117.5	79.5	39.5
PSL/PSV size 3	49.5	49.5	110.. 123	303.5	127.5	80	49.5





Terminal assignment AMP-socket
- 4 Power - / GND
- 3 CAN-H
- 2 CAN-L
- 1 Power +

Accesory:
Line connector kit order No 6217 0180-00

Terminal assignment AMS-socket
- 1 CAN-L
- 2 Power +
- 3 Power - / GND
- 4 CAN-H

Accesory:
Line connector kit order No 6217 0180-00

5. Appendix

5.1 Safety notes

All installation, set-up, maintenance and repairs must be performed by authorized and trained staff. The use of this product beyond the specified performance limits, use of non specified fluids and/or use of not genuine spares will cause the expiration of the guarantee.

The **general operating manual for mounting initial operation and service of hydraulic components and systems** has to be observed!

5.1.1 Transport and storage

Like with all hydraulic components attention has to be paid on proper storage and suitable packing of the product.
The combination of hydraulic valve and electronic controls does not require any special care
The plastic socket must not be mechanically stressed therefore it must not be used as handle etc.!

5.1.2 Installation

The following notes, which prevent improper operating conditions have to be taken into account to ensure safe function and a long service life of the PSL/PSV CAN valve knot:

- Mounting of the valves nearby machine parts and sub-assemblies which generate great development heat (e.g. exhaust) has to be avoided.
- There must be sufficient distance to radio devices.
- An emergency-stop of the power supply has to be provided. The emergency-stop at the machinery must be easily accessible at for the operator. The manufacturer of the machine (the vehicle) has to ensure that the machine achieves a sure state after the emergency stop has been actuated
- One of the safeguarding mechanisms against bus interruptions, supported by the device, has to be employed. (Nodeguarding, Heartbeat)
- The power supply (line and fuse) must be dimensioned sufficiently to cope with the power demand. Each valve section has a max. current consumption of ca. 1.5 A at 12 V DC or 0.8 A at 24 V DC.
- The GND-line has to be dimensioned accordingly to the power supply line. The reference potential for all CAN users should vary as little as possible between the devices and be identical to the GND-connection for the power supply.
- All valve knots have to be disconnected to any electric welding work.
- All sockets of the valve bank have to be safeguarded against penetrating water by proper attachment with installing all necessary seals.
- Use only suited bus lines within the bus network. The lines should be twisted and shielded. The characteristic impedance must be approx. 120 Ω.
- Terminating resistors of 120 Ω have to be provided on both two ends of the CAN-Bus network.
- Valve electronics and the respective solenoid body are sealed and are screwed together. Therefore they should not be separated. Take care of proper sealing during reassembly when replacing the valve spool or valve body.
- A sufficient distance to sources of magnetic fields e.g. strong permanent magnets, eddy-current brakes, etc. has to be maintained
- When the bus and power supply lines are separated from the valve sections for servicing it is mandatory to use new lines and seals. Care has to be taken that the end cap is properly positioned. New lines are available at HAWE.

The following rules have to be observed during operation:

- Flawless operation of the controls is only guaranteed between -40°C to +85°C.
- Only emergency operation is available within a certain temperature range if the device detects internal overheating.
- The surface of the solenoid may become hot during operation – danger of burning!
- The power supply voltage must be within the specified range. Excessive or permanent deviations may harm the electronics.

5.2 Assembly and installation notes

5.2.1 Mounting

The mounting of the valve bank to the frame or machinery must be performed in such a way that no stress is induced.
It is recommended to mount the valve bank via 3 bolts with elastic washers between valve body and frame.

5.2.2 Piping

Only fittings with soft seals are to be used.
Do not exceed the specified torque ratings.

5.2.3 Seal kits

	Size 2	Size 3
Connection block	DS 7700-21	DS 7700-31
Valve section	DS 7700-22	DS 7700-32

5.2.4 Servicing of components

Valve sections or directly mounted CAN-controls can be only serviced at HAWE facilities.

5.3 CAN-Bus-controls

5.3.1 General

CAN-Bus (controller Area Network) is asynchronous, serial bus system where only two lines are needed for the data transmission. Twisted-pair cables with a characteristic impedance of 108 to 132 Ω are recommended as bus line (acc. to ISO 11898-2 "High speed medium Access Unit").
The following protocols are common for data transmission formats: CANopen 2.0 A & B and J1939, based either on 11 or 29 bits address data.

5.3.2 Lay-out of CAN-Bus systems

A linear network topology should be employed and tap lines avoided if possible. When tap lines are necessary, their length should not exceed the specifications in table 1.

Shielding of the CAN-line can be neglected when only low EMC-load is anticipated. The CAN-line should be shielded with proper GND connection in case of long lines or EMC-contaminated surroundings. A suitable alternative in cable booms is a twisted arrangement of the bus lines.
There must not be a potential shift between the individual CAN users. GND-lines of all CAN devices have to be sufficiently dimensioned and routed together to one single point.
The permissible current rating for the socket is 10A. Take care that this max current rating of the socket is not exceed, when the bus line is patched through a CAN PSL/PSV valve bank i.e. when there are an input socket as well as an output socket. In general it is better to provide a separate power supply line for high load consumers.

Transfer rate	Bus length	Max. length for tap lines
100 kbit/s	600 m	25 m
125 kbit/s	500 m	20 m
250 kbit/s	250 m	10 m
500 kbit/s	100 m	5 m
1000 kbit/s	<20 m	1 m

The power supply line and the CAN-Bus line is led from one to the next valve section via a internal line. The connection cable consists of four wires: Power supply (U_{bat}, GND) and CAN-Bus (CAN High, CAN Low). The recommended terminating resistor can be neglected at short tap lines.

5.3.3 Valve knots as Plug&Play slave with type PLVC

A Plug&Play-configuration can be used for CAN-knots to provide an extended output level with the HAWE controls type PLVC. These external valve outputs can be maintained via the operating system of the PLVC like the apparent valve outputs, without necessity of communication with the application program.

The following is mandatory for addressing to maintain Plug&Play-functionality:
The valves connected to the external outputs and controlled via CAN-Bus have to be addressed with CAN Node-IDs > 32, all other communication together with the corresponding monitoring and safety functions are maintained by the PLVC.

Individual valves are addressed with consecutive indices >2000. The indices of double valves can be calculated by 2000 + 2 • n (n = section No.).

Section No. n	PLVC ID	Knot ID	Ref. COB ID	Act. COB ID
1	2000	32	0x220	0x1A0
2	2002	34	0x222	0x1A2
3	2004	36	0x224	0x1A4
4	2006	38	0x226	0x1A6
5	2008	40	0x228	0x1A8
6	2010	42	0x22A	0x1AA
7	2012	44	0x22C	0x1AC
8	2014	46	0x22E	0x1AE
9	2016	48	0x230	0x1B0
10	2018	50	0x232	0x1B2

5.4 Basic lay-out

Components