Electronic amplifier type EV1D

Product documentation

Modular construction

Supply voltage U_B:	10...48 V DC
Output current I_A:	max. 2 A

D 7831 D
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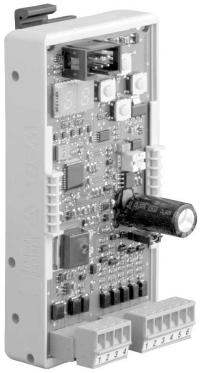
Contents

1 Overview of electronic amplifier type EV1D

Proportional amplifiers actuate proportional solenoid valves by converting an input signal into a corresponding control current.
The proportional amplifier type EV is available as a module for top-hat rail mounting or, alternatively, as a card for a card holder. Highly precise functions are possible thanks to the feedback measurement at the valve outputs.
The control parameters (I_{min}, I_{max}, dither, ramp times) are configured using pushbuttons or a potentiometer.



Electronic amplifier type EV1D

Features and benefits:

- Compact design
- Easy commissioning
- Functions tailored to HAWE products

Intended applications:

- For the actuation of proportional valves
- Switch cabinet installation in an industrial setting

2 Available versions, main data

Amplifier module

Order coding example:

EV 1 D1

D1 – Digital version

1 – Single-acting proportional solenoid

EV – Basic type

Amplifier module with card holder as complete module

Order coding example:

EV 1 D1 KM

KM – Module card holder

EV 1 D1 – Amplifier module

Assembly accessories

Order coding example:

KM 7831 010

KM 7831 010 – Module card holder

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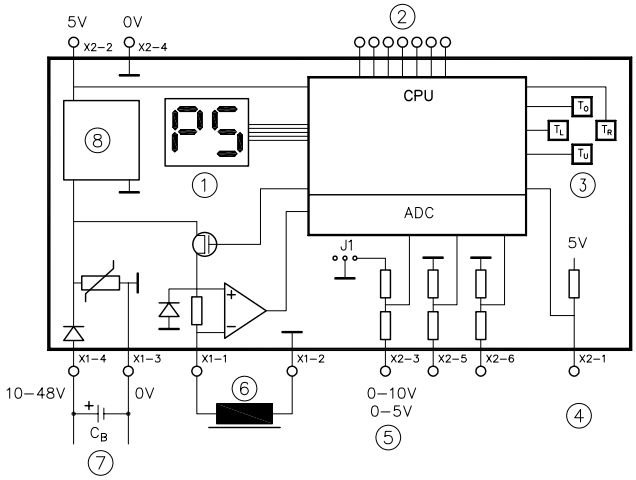
Block diagram



1 Led display
2 X3 programming interface
3 Keypad
4 Enable/switch-off
5 Target value
6 Proportional solenoid
7 Supply
8 Switching power supply 5 V

Note
With each module order, a card holder should also be ordered as an accessory.
This is the only way to ensure secure attachment on the 35 mm or 32 mm support rail. Due to the compact design, the module board does not feature any bores for a different type of attachment (e.g. on screw stilts).
The product can only be ordered as a complete module.

3 Parameters

3.1 General parameters

Nomenclature	Proportional amplifier for 12 V DC to 24 V DC
Design	Board (module) with connectors
Connection leads	• Max. 1.5 mm
Fastening	With a card holder (accessory) on 35 mm standard support rails or 32 mm support rails according to DIN EN 60715
Installation position	Any
Weight	▪ **Total: 80 g** ▪ Printed circuit board: 40 g ▪ Card holder: 40 g
Protection class	IP 00 according to DIN EN 60529, VDE 0470-1 or IEC 60529
Ambient temperature	-20°C...+60°C

3.2 Electrical Data

Supply voltage	U_B	10...48 V DC
Max. permissible ripple factor	w	10% ripple
Required filter capacitor	C_B	2200 µF per 1 A of coil current
Output voltage	U_A	U_B - 0.7 V DC, pulse-width modulated
Output current	I_A	max. 0...2 A short-circuit proof
Setting range		I_{min} = 0...2 A I_{max} = 0...2 A Factory default setting I_{min} = 0 A; I_{max} = 2 A
No-load current	I_L	max. 70 mA (own consumption)
Voltage ranges	U_{nom}	Can be optionally set as 0...5 V DC or 0...10 V DC Factory default setting 0...10 V DC
Reference voltage	U_{St}	5 V DC ±4% Nominal volume max. 5 mA (stable voltage for supplying the target value potentiometer)
Input resistance	R_e	>50 kΩ
Recommended potentiometer	P	2...10 kΩ
Ramp time rise-fall	t_R	0.1...10 s Increase and decrease time can be separately adjusted, factory default setting 0.1 s for both
Enable/disable input		TTL compatible or can be triggered with a contact
Dither frequency	f	20...100 Hz, factory default setting 50 Hz
Dither amplitude	l	1...99% of the output voltage, factory default setting 1%

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3.3 Electro-magnetic compatibility (EMC)

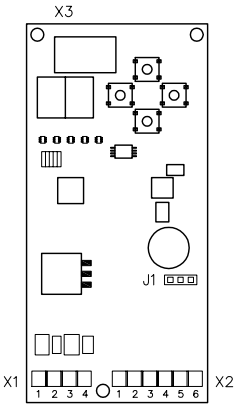
The EMC of the device was tested using an accredited testing laboratory (emitted interference according to DIN EN 61000-6-3 and immunity to interference according to DIN EN 61000-6-2 evaluation criterion "B"). The test set-ups only represent typical use. This EMC testing does not release the user from carrying out adequate prescribed EMC testing of their complete system (according to Directive 2004/108/EC). If the EMC of the complete system must be further amplified, the following measures can be tested and introduced:

- The required smoothing capacitor in accordance with Chapter 3.2, "Electrical Data" is not only needed to ensure the device functions correctly, but also to guarantee compliance with EMC guidelines (conducted emitted interference).
- The equipment should be installed in an metal cabinet (shielding)
- Supply lines, such as inputs and outputs to and from the device, should be as short as possible. If necessary they should be shielded and twisted in pairs (to reduce the antennae-like effect for increasing the immunity to interference).

4 Dimensions

All dimensions in mm, subject to change.

4.1 Printed circuit board



Proportional amplifier (card) EV1D

X1 + solenoid
X2 + solenoid
X3 Auxiliary inputs, programming interface

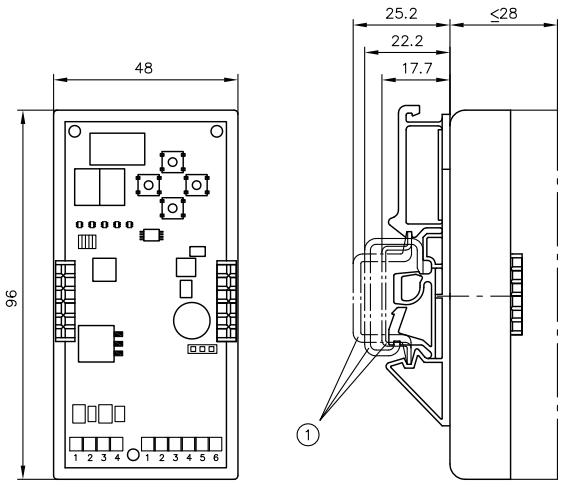
Terminal connections:

X1-1	+ solenoid
X1-2	- solenoid
X1-3	0 V power (GND)
X1-4	10-48 V supply voltage
X2-1	Enable/block input
X2-2	5 V output
X2-3	0...5 V / 0...10 V target value input
X2-4	0 V analogue (GND)
X2-5, X2-6, X3	Auxiliary inputs, programming interface

Jumper J1

10 V	5 V

4.2 Printed circuit board assembled in card holder



EV1D

1 Standard support rails

For a description of the printed circuit board, see Chapter 4.1, "Printed circuit board"

For assembly in the card holder, see Chapter 5, "Installation, operation and maintenance information"

5 Installation, operation and maintenance information

5.1 Information on setting

The card is parameterised using four buttons and a two-digit seven-segment display. All operations are performed using the buttons arranged in a square. In accordance with the normal installation position of the card (plug connections at bottom), the buttons are labelled top, bottom, right and left.

Parameters that can be adjusted by the user can be selected by navigating in a menu. These are shown in the display with their (standardised) values and can be modified at the push of a button. Adjusted parameter values are effective immediately once the modification is made, so that the user receives immediate feedback on the effects of the setting.

However, final and permanent adoption requires confirmation (at the push of a button). If this does not take place, the adjustment is aborted after 10 seconds and all settings are as they were prior to the attempted adjustment.

The following sections provide details on operation and the menu structure.

Menu structure

The menu can be used to select, query and change user parameter settings. The changes that are made are effective immediately (as is the case when setting a potentiometer), but subsequent confirmation of the change is required in order to adopt parameters in the permanent memory of the card.

Operating modes

A distinction is made between the two operating modes "normal operation" and "parameterisation mode". In normal operation, the card displays its current target value and any error messages. For switching from normal operation to parameterisation mode, see

Navigation

The right and left buttons are used to navigate in the menu. The right button is generally used to go deeper into the menu, whereas the left button is used to go up one level (back). The up and down buttons are used to increase and reduce values.

Display

The user interface is an LED display featuring two digits. This display shows the following:

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- Current target value in percent
- Parameter values
- Parameter numbers
- Error codes

The normal state is the operating state, i.e. a target value in the form of a control voltage is stored on the card and this is output as current via a valve coil. In the normal state, the current target value is shown in the display. If an error occurs during operation (see Chapter 5.3, "Error management"), the display alternates (approx. every 1.5 s) between this and the current target value. If the card is being parameterised, the target values and the error messages are hidden until the parameterisation is complete.

Jumper

Jumper J1 can be used to reconfigure the input voltage range of the card from 0...5 V to 0...10 V.

Minimum currents, maximum currents (P0, P1)

Minimum currents (P0), maximum currents (P1) The card is set to the working range of the corresponding valve using I_{min} and I_{max}, i.e. parameters P0 and P1. I_{min} denotes the electric current as of which the oil flow is deployed in the valves. I_{max} denotes the current value at which the desired maximum current value is reached and the valve is fully opened. Input voltage is then mapped to output current I_A using the equation:

$$I_A = I_{min} + \left(I_{max} - I_{min}\right) \cdot \frac{U_{in}}{U_{ref}} .$$

In this regard, U_{in} denotes the target value specified as input voltage and U_{ref} denotes the corresponding reference voltage that can be configured using a jumper. Also note the standardisation in 20 mA increments, which results in maximum values of 1980 mA.

Ramp times (P2, P3)

If the user wishes to limit the increase or drop in current, this can be done using the ramp parameters P2 (T_{up}) and P3 (T_{down}). The parameter P2 (T_{up}) specifies the minimum duration of the transition from I_{min} to I_{max}, whereas P3 (T_{down}) defines the fastest possible drop. An increment in the display corresponds to 100 milliseconds (ms), meaning that ramp times of a maximum of 9.9 seconds (s) can be specified.

Dither amplitude, dither frequency (P4, P5)

An adjustable alternating amplitude, "dither", is superimposed on the PWM signal of the valve output. Both the frequency and the amplitude of this alternating signal can be adjusted. The dither frequency is selected by specifying its period duration (T_d) using parameter P5. The corresponding amplitude is set with P4.

User parameters

Parameter	Designation		min	max	Default	Standardisation
P0	Minimum current	I_{min}	0	99	0	20 mA/increment
P1	Maximum current	I_{max}	0	99	50	20 mA/increment
P2	Ramp time, up	T_{up}	1	99	10	100 ms/increment
P3	Ramp time, down	T_{down}	1	99	10	100 ms/increment
P4	Dither amplitude	l	1	99	0	%
P5	Dither frequency (dither period)	f	20 (50)	100 (10)	50 (20)	Hz (ms)

Note

Note that the parameter values can only be modified in discrete steps using the keypad. Conversion factors that match physical values to the respective increments are stated under "Standardisation".

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5.2 Setting instructions

Changing the parameters

☑ The amplifier is in normal operation.

1. Press and hold the "right" button.

✓ P0 is shown in the display. The amplifier is now in parameterisation mode.

2. Use the "up" and "down" buttons to select a parameter from P0...P4.
3. Press the "right" button to select the displayed parameter.

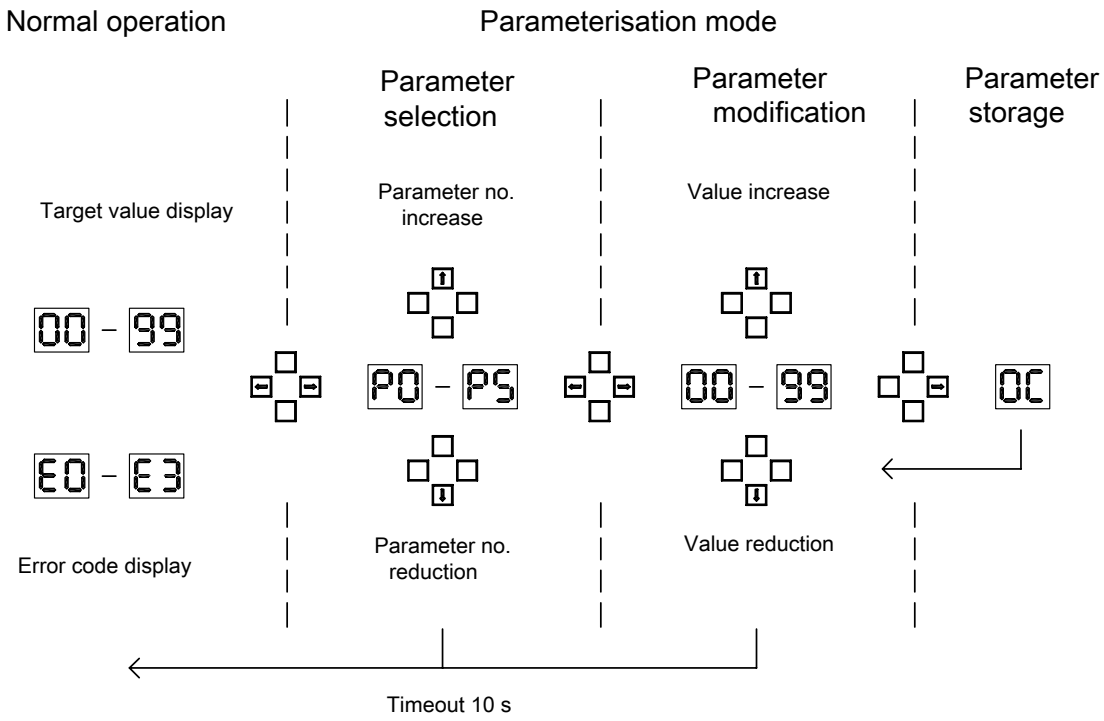
✓ The current standardised numerical value of the parameter is displayed. For the meaning of the numerical value and the parameters, see

Note
Modifications are effective immediately once the value is changed. However, permanent adoption of the values must be confirmed first.

4. Press the "up" or "down" button to modify the value.
5. Press and hold the "right" button to confirm the value.

✓ The amplifier acknowledges the adoption of the parameter by briefly displaying the value 0C

Note
If modified parameters should not be saved, the change can be discarded by pressing the "left" button.
The amplifier switches back to normal operation.



5.3 Error management

Any error states detected by the card are displayed in the operating state (not during parameterisation) by means of an error code. In this case, the display alternates between the received target value and the highest current error code. The display returns to the normal state when there are no more errors.

The umbrella term "error" is used below to denote all exceptional states detected by the card. This includes messages that are purely informative. A notification between E0 – E3 is shown in the display, with higher numbers indicating a more serious meaning.

5.3.1 Overview of error codes

Error code	Meaning	Measures
E0	External deactivation	Enable deactivation input
E1	Run dry, coil current too low	Check connected coil and cabling
E2	Overcurrent, coil current too high	Check connected coil and cabling, exchange amplifier card
E3	EEPROM error	Exchange amplifier card

5.3.2 Error codes

See Chapter 5.3.1, "Overview of error codes" for brief details on the error codes and possible causes.

E0 – external deactivation

The card is deactivated via the external switch-off input. Once the deactivation signal is received, the output is switched off and the message "E0" is issued. This is performed regardless of the ramp settings. The deactivation and the message are cancelled as soon as the switch-off input is enabled once again.

E1 – run dry, coil current too low

The card cannot set the specified target value on the coil. The PWM output is fully interconnected, but currents below the required target value are measured.

Possible error causes:

- The supply voltage is too low
- Connection of a coil with excess resistance (for this supply voltage)
- Interrupted connection to coil
- Defective coil
- Defect in the output stage of the amplifier card

E2 – overcurrent, coil current too high

There is a short-circuit in the coil circuit. Check whether the coil features winding closures and therefore insufficient resistance. Otherwise, there is a defect in the output stage of the amplifier card and the amplifier card must be exchanged.

E3 – EEPROM error

Internal error in the amplifier card. The data in the parameter memory is no longer consistent. The card switches off automatically and must be exchanged.

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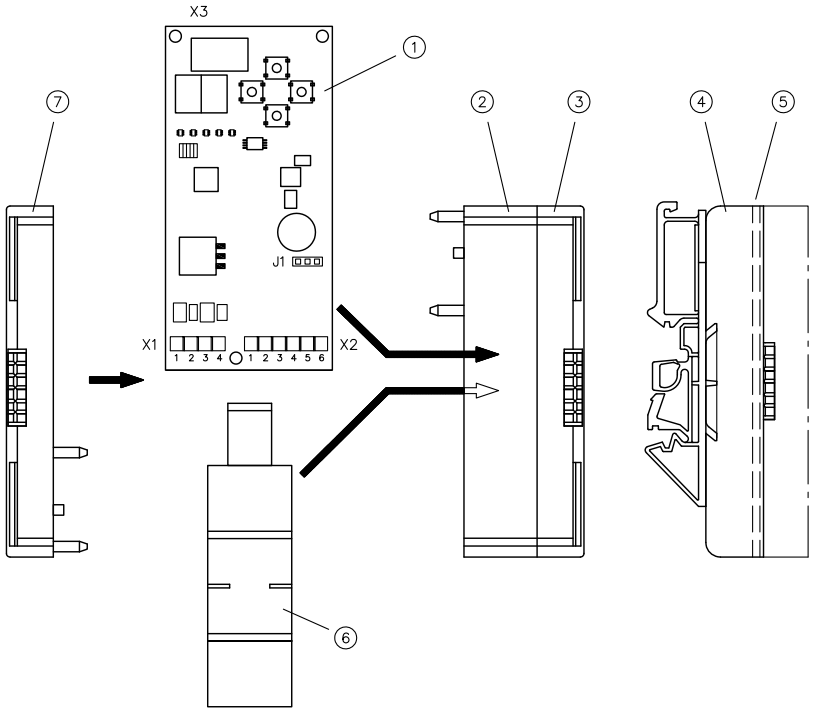
5.4 Assembly of the module on the card holder



1 Board (printed circuit board)
2 Centre section
3 Side part, right
4 Rear guide slot for support rail terminal
5 Circumferential location slot for board (printed circuit board)
6 Support rail terminal
7 Side part, left

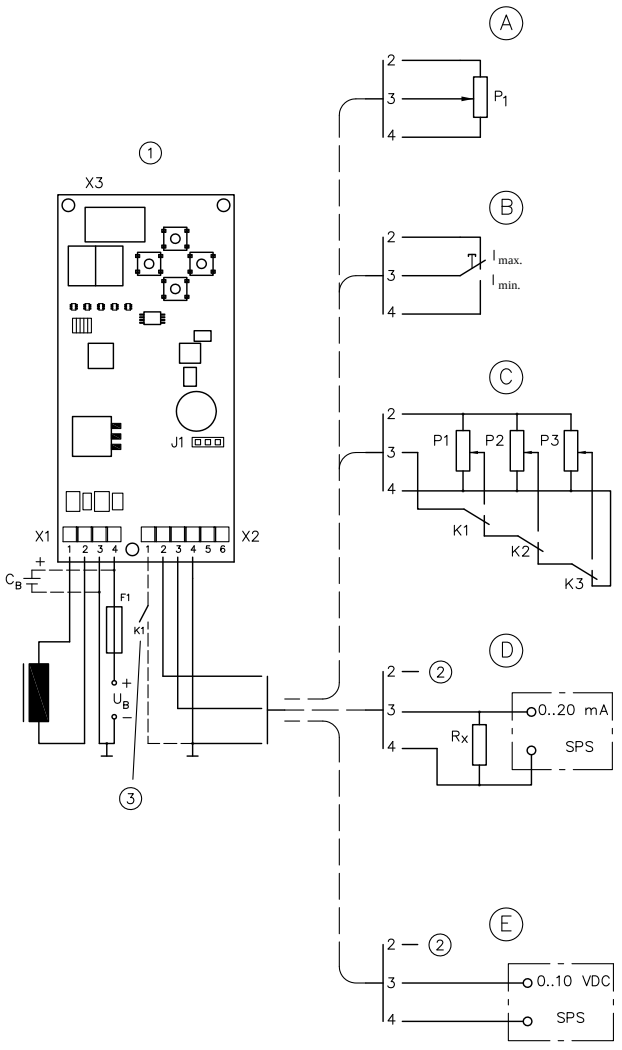
Quick guide

1. Fit together the card holder centre section (2) and one of the two side parts (3) or (7).
2. Push the support rail terminal (6) into the rear trapezoidal guide slot (4)
3. Push the printed circuit board (1) into the circumferential location slot (5)
4. Insert the remaining card holder side part (3) or (7)

✓ The module is now assembled in the card holder.

6 Typical circuits

6.1 Actuation of hydraulic valves using a proportional solenoid



1 Dither frequency
2 Not used
3 Enable/block

Example A	Operation with external target value potentiometer F1 = medium time-lag fuse; for nominal value see "Setting instructions" in Chapter 5, "Installation, operation and maintenance information" CB = smoothing capacitor P1 = target value potentiometer 10 kΩ, min. 0.1 W Jumper J1 5 V DC
Example B	Operation with target value changeover switch for both configured target values I_{min} and I_{max} F1 = as in example A Jumper J1 5 V DC
Example C	Operation with priority-dependent target value changeover switch for four target values (relay circuit) Functional example: Rapid traverse mode 1 - K 1 → P1 Rapid traverse mode 2 - K 2 → P2 Creep mode - K3 → P3 Stop - K1 → K2 → K3 → ⊥ F1 = as in example A Jumper J1 5 V DC
Example D	Operation with external target value, power source from PLC, CNC or PC **Note** Pay attention to the maximum load of the power source. F1 = as in example A Rx = 250 Ω/0.5 W Jumper J1 5 V DC
Example E	Jumper J1 10 V DC

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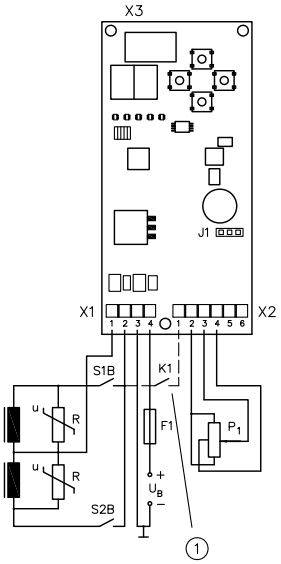
6.2 Actuation of hydraulic valves with twin or two individual proportional solenoids for alternating operation



1 Enable/block

This requires a remote-controlled potentiometer P1 with a centre tap and, for the purpose of side recognition, two reversers SB1 and SB2 – which must be coupled to the centre tap – for solenoid coils 1 and 2.

Example F:	Actuation of a proportional directional spool valve type PSL or PSV according to D 7700 ff.
F1	As in example a
P1	Potentiometer with fixed centre tap, 2x5 kΩ
R	Varistor for 31 V, e.g. SIOV S05K25 or SIOV S10K25 from Siemens (against impaired function or overvoltage)
S1B and S2B	Reversers are components of the joystick for an axis

Jumper J1		
	10 V	5 V

Further information

Additional versions

- Proportional amplifier type EV1M3: D 7831/2
- Proportional amplifier type EV22K2: D 7817/1
- CAN node type CAN-IO: D 7845 IO
- Programmable logic valve control with Profibus type PLVC 21: D 7845-21
- Programmable logical valve control type PLVC 41: D 7845-41
- Programmable logic valve control type PLVC 8: D 7845 M

Application

- Proportional directional spool valve, type PSL and PSV size 2: D 7700-2
- Proportional directional spool valve, type PSL, PSM and PSV size 3: D 7700-3
- Proportional directional spool valve, type PSL, PSM and PSV size 5: D 7700-5
- Directional spool valve type NSWP 2: D 7451 N
- Clamping module type NSMD: D 7787
- Directional seated valve type EM and EMP: D 7490/1

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HAWE Hydraulik SE
Streitfeldstraße 25 | 81673 München | Postfach 80 08 04 | 81608 München | Germany
Tel +49 89 379100-1000 | Fax +49 89 379100-91000 | info@hawe.de | www.hawe.com