Proportional Amplifier EBM-300308-DS-MOBI

- can control 3 directional valves (6 proportional solenoids)
- can be used with various demand signals
- can be used immediately; no programming needed
- output stages are protected against switch-off peaks

1 Description

1.1 General

The proportional amplifier EBM-300308-DS-MOBI can control three proportional directional valves. The card has input terminals for a voltage demand signal for each axis. An inductive joystick, type FGE, can be used as a demand-signal source, alternatively one potentiometer per axis can be used. Three different types of joystick can be selected by applying different reference voltages at an input. An integral ramp generator (demand-signal integrator) can be activated. When a step signal is applied to the input of the ramp generator, the output voltage changes linearly with time. This causes the respective output current to change in a similar linear manner until it reaches the value that corresponds to the new demand signal level. By using the ramp feature, a rapid change in the demand signal is translated into a gradual change in the output current. The ramp time is adjustable between 0 and 5 seconds for all three axes jointly. The current at the power outputs varies linearly with the voltage at the demand signal input (see diagram, sect. 8.1). For safety reasons, there is no output current until the demand signal rises to a minimum threshold value. With two trimming potentiometers for each axis, the minimum current (I_{min}) and maximum current (I_{max}) can be set for each axis independently. The output stages feature internal protection against switch-off spikes. The amplifier is provided with a 'Busy' output - the supply voltage to the electronics system is present at this output when current is flowing to any of the solenoids. The proportional amplifier can be enabled or disabled via an "Enable" input. If a variance between the output current and the required value exists for more than 1000 milliseconds, the output is disabled and will be re-enabled only after the respective axis has come to a standstill. This allows a cable break or short circuit to be detected. If only two proportional directional valves are to be used, but complemented by a seat-type directional valve, this option can be selected via an input. In this case, the input for the third axis controls this directional seat valve. To avoid operational problems, the nominal voltage of the solenoid coils should be matched to the power supply voltage.

1.2 Application example

The EBM-300308-DS-MOBI proportional amplifier is used for controlling three proportional directional valves (three axes / six solenoids) or two proportional directional valves and one seat-type directional valve. The three axes can be controlled independently of each other. The current compensation feature ensures that the output current is unaffected by fluctuations in the coil temperature or supply voltage.

Application possibilities:

- Agricultural machinery
- Municipal vehicles
- Forestry machines
- Construction machinery

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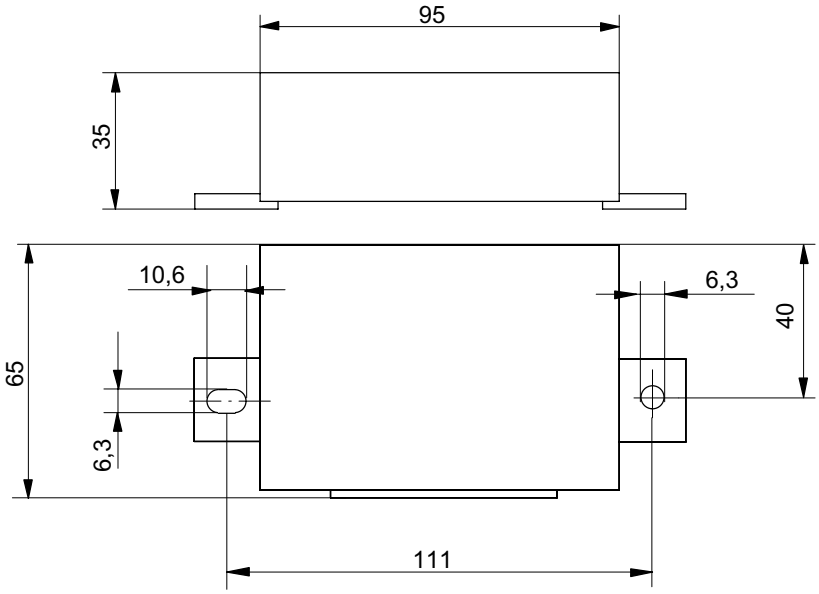
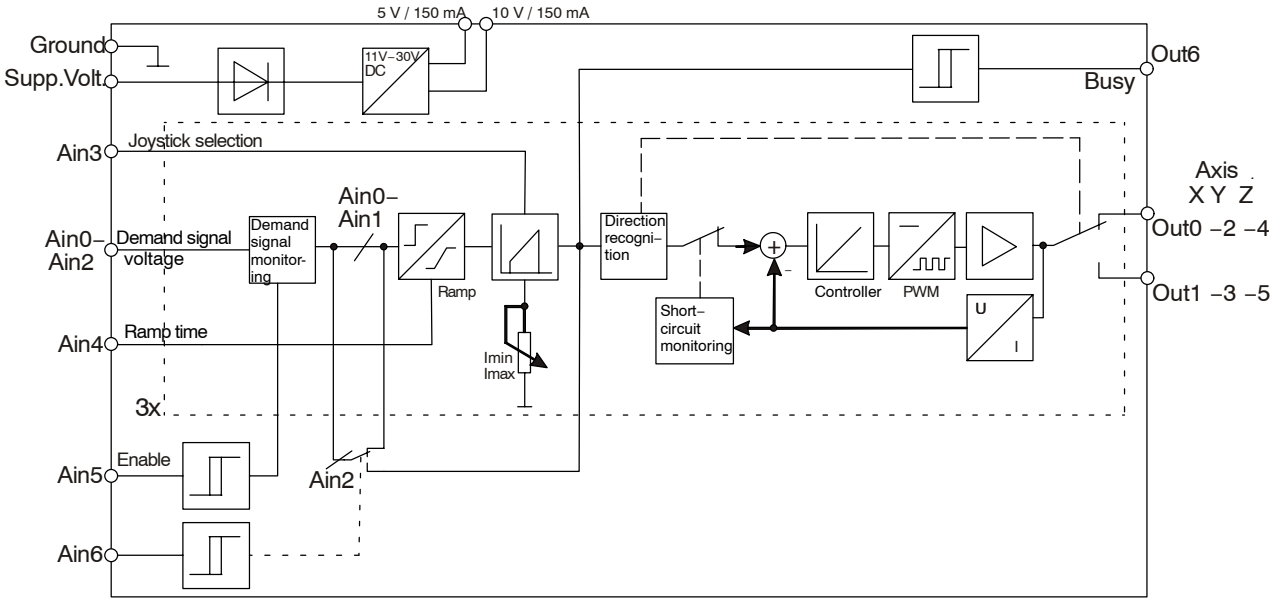
2 Technical data

General Characteristics	Unit	Description, value
Power supply	V DC	12 … 30 smoothed DC. Ripple < 10%
Special features		Power supply input is protected against reverse polarity
Reference voltage	V DC	5 V max. 150 mA 10 V max. 150 mA
Demand signal voltage from demand-signal source Ain0 - Ain2	V DC	2,5 V +/- 2,3 V FGE type 1 4,5 V +/- 1,0 V FGE type 2 4,5 V +/- 4,0 V FGE type 3
Adjustable min. current per axis (I_{min})	A	0,2 ... 1,2
Adjustable max. current per axis (I_{max})	A	0,8 ... 2,5
Max. permissible current per axis	A	2,5
Dither frequency	Hz	200
Busy output Out6		Low: 0 V High: U_{KL30} (Busy) / I_{max} 2,5 A
Enable input Ain5		Low: 0 V (Enable) High: U_{KL30} (Disable)
Joystick selection Ain3		0,0 V < = U_{Ain3} < 0,5 V -> type 1 0,5 V <= U_{Ain3} < 5,5 V -> type 2 5,5 V <= U_{Ain3} <= U_{KL30} -> type 3
Ramp time for 100% Ain4		U > = 0,0 V -> no ramp function U > = 5,0 V -> 1 sec U > = 10,0 V -> 5 sec
Control of third axis, proportional or on/off Ain6		U = 0,0 V or not connected -> third axis controls a prop. directional valve U = 10,0 V -> third axis controls a directional seat valve
Plug connection		Tyco junior power timer 22-pin
Protection class		IP53
Operating temperature	° C	-40 ... +80
Dimensions		(95 x 65 x 35) mm
Cable lengths and cross sections		For 1 mm² the max. cable length is 100 meters

3 Dimensions



4 Block diagram



5 Functions

5.1 Joystick selection

The user can select from three different types of joysticks:		
Voltage at Ain3	Demand signal voltage from demand-signal source	Example for joysticks
0,0 V < = U_{Ain3} < 0,5 V	type 1 2,5 V +/- 2,3 V	FGE*-MT1V***G**JS3
0,5 V <= U_{Ain3} < 5,5 V	type 2 4,5 V +/- 1,0 V	FGE2-**-G12/JS4
5,5 V <= U_{Ain3} <= U_{KL30}	type 3 4,5 V +/- 4,0 V	FGE1-**G**JC1

5.2 Ramp function

A ramp function can be activated by wiring the input Ain4. A step change in the demand signal causes a linear change of the solenoid current.	
Voltage at Ain4	Ramp time for 100%
U_{Ain4} = 0,0 V	no ramp function
U_{Ain4} = 5,0 V	1 sec
U_{Ain4} = 10,0 V	5 sec
When voltages between the specified values are applied, the ramp time is calculated accordingly:	
Voltage at Ain4	Ramp time for 100%
0,0 V <= U_{Ain4} < 5,0 V	~ 0 sec - 1 sec
5,0 V <= U_{Ain4} < 10,0 V	~ 1 sec - 5 sec

5.3 Selecting the type of output circuit for the third axis

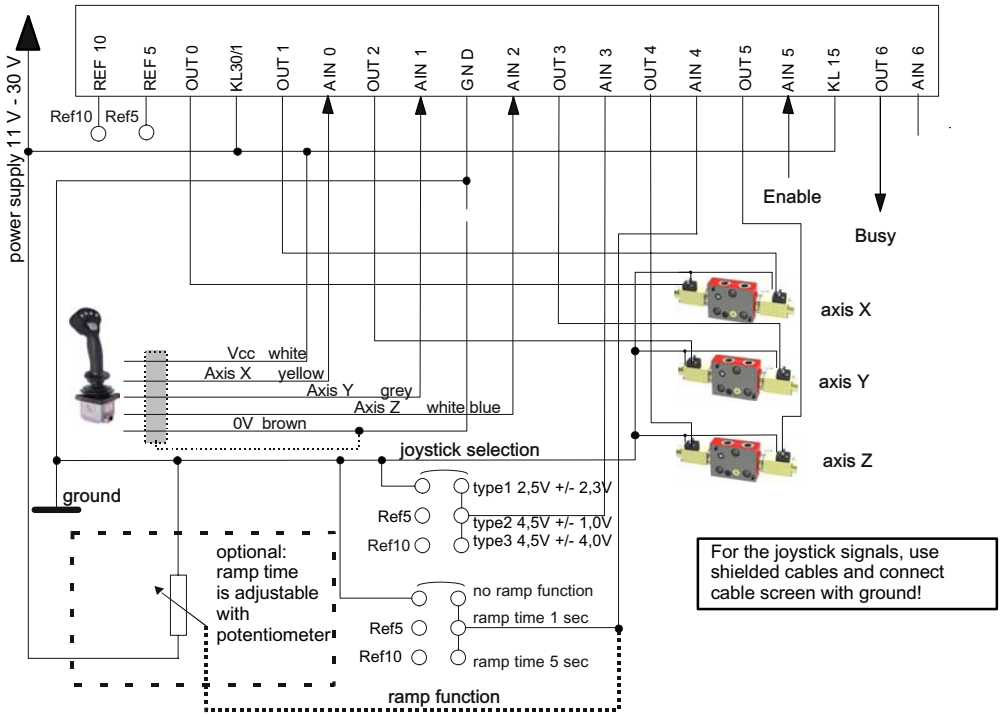
There is a choice between proportional directional valve and seat-type on/off directional valve	
Voltage at Ain6	Function
U = 0,0 V or not connected	proportional
U = 10,0 V	directional seat valve

5.4 Additional functions

- To activate the module, connect the terminal KL 15 (module enable) to the power supply (KL 30).
- The busy output rises to the supply-voltage level as soon as any proportional output is energised.
- If the enable input is at the supply-voltage level, the proportional outputs are disabled.

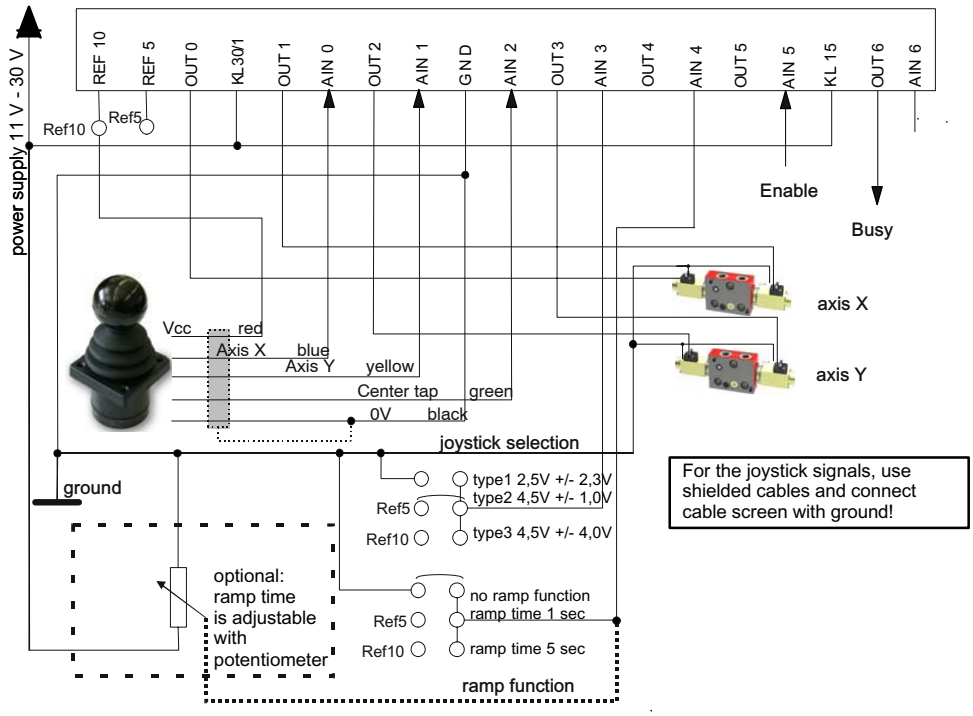
6 Connection diagram

6.1 Connecting a type 1 joystick, e.g. FGE*-MT1V***G**JS3



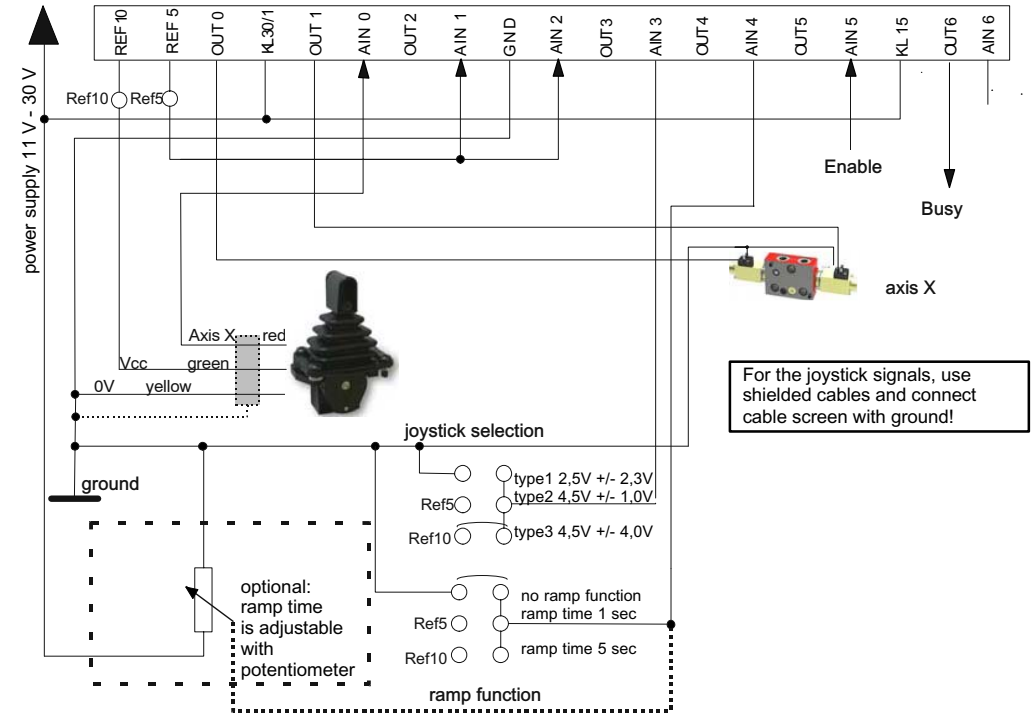
If only two axes are used with this joystick model, connect the free analogue input in parallel with the analogue input of another axis.

6.2 Connecting a type 2 joystick, e.g. FGE2-**-G12/JS4



When connecting a type 2 joystick, connect the analogue input for the unused axis to the centre tap.

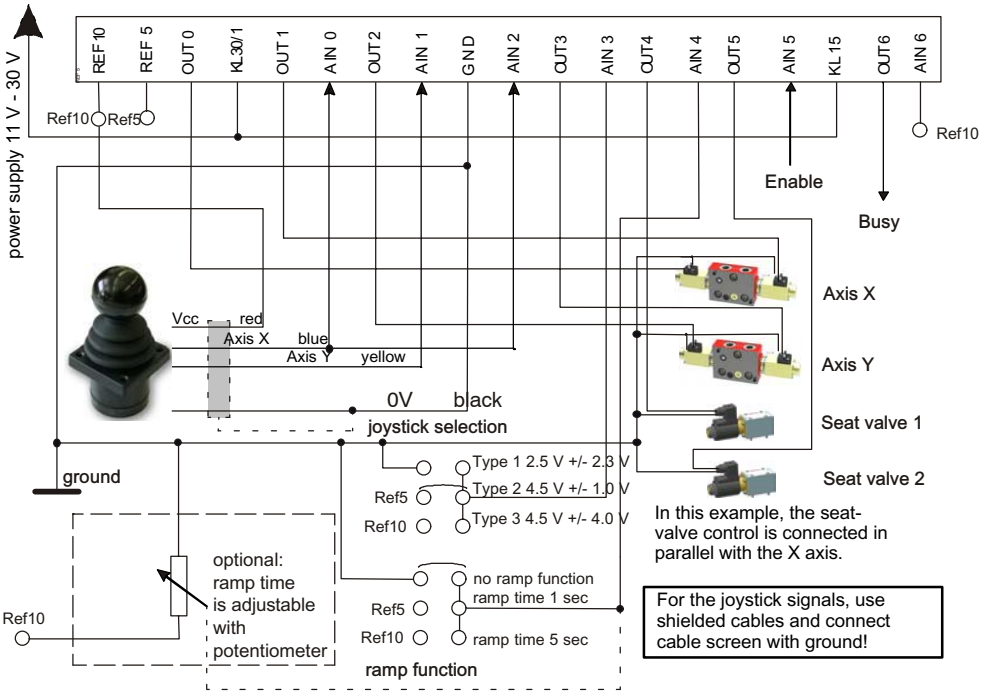
6.3 Connecting a type 3 joystick, e.g. FGE1-**G**JC1



When connecting a type 3 joystick, connect the analogue inputs for the unused axes to the 5 V reference voltage.

6.4 Connection example: FGE2-**-G12/JS4 joystick with two seat-type directional valves

In the following connection example, the two outputs OUT4 and OUT5 are used for operating seat valves. For this purpose, the input Ain6 is connected to the 10 V reference voltage. In this example, the input Ain2 has been connected with the input Ain0 (X axis). If the joystick is now moved in the positive direction of the X axis, the seat valve 1 (OUT4) will also be operated. If it is moved in the negative direction, however, seat valve 2 (OUT5) will be operated.



7 Pin assignment

Pin	Signal	
1	CAN-H	not used
2	REF 10	reference voltage 10 V
3	CAN-L	not used
4	REF 5	reference voltage 5 V
5	OUT 0	output proportional valve 1, X-axis
6	KL30/1	power supply
7	OUT 1	output proportional valve 2, X-axis
8	AIN 0	analogue input X-axis
9	OUT 2	output proportional valve 1, Y-axis
10	AIN 1	analogue input Y-axis
11	GND	ground
12	AIN 2	analogue input Z-axis
13	OUT 3	output proportional valve 2, Y-axis
14	AIN 3	analogue input joystick selection
15	OUT 4	output proportional valve 1, Z-axis
16	AIN 4	analogue input ramp time
17	OUT 5	output proportional valve 2, Z-axis
18	AIN 5	enable signal
19	KL 15	ignition (module-enable, connect with KL30/1)
20	OUT 6	busy output
21	AIN 6	selection of the third axis: proportional or seat-type directional valve
22	AIN 7	not used

8 Initial start-up

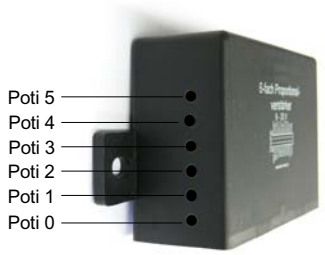
Connect the proportional amplifier in accordance with the connection diagram.

Connect the proportional amplifier in accordance with the connection diagram. To select the joystick type, set the input Ain3 to the appropriate level. To adjust the ramp time, set the input Ain4 to the appropriate level or connect it to a potentiometer. After the power supply is switched on, the minimum and maximum currents for each axis can be set by means of the 6 potentiometers.

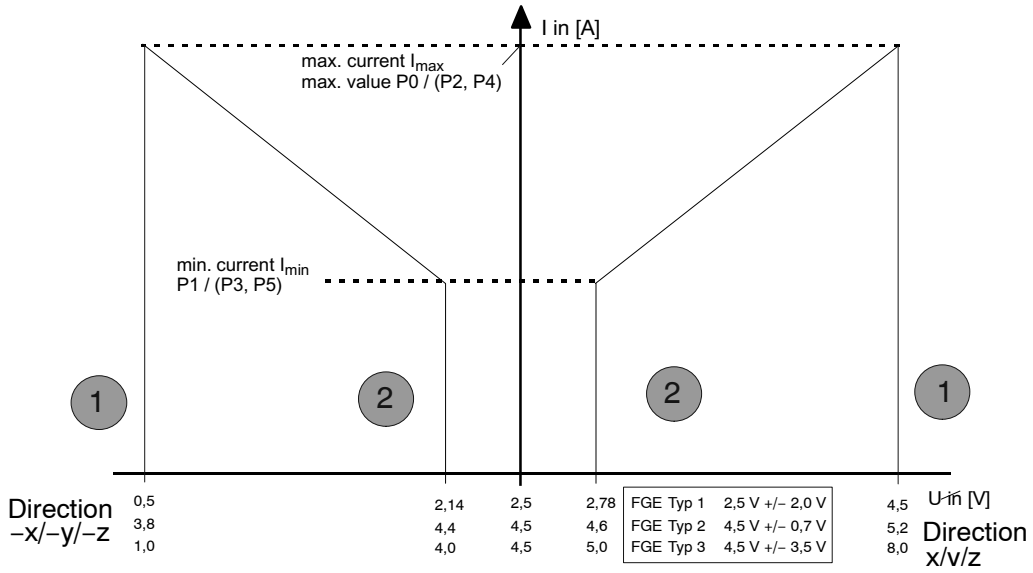
1. Turn the potentiometers for the minimum currents I_{min} to their left end-stop and the potentiometers for the maximum currents I_{max} to their right end-stop.
2. Move the joystick just far enough in one axis direction to energise the solenoid. Then turn the I_{min} potentiometer up until the required minimum current is reached (adjustment range: 200 mA – 1200 mA).
3. Now deflect the joystick fully and set the required maximum current I_{max} with the respective potentiometer (adjustment range: 800 mA – 2500 mA).
4. Repeat steps 1 - 3 for all axes.

If the potentiometer value for I_{min} is greater than the value for I_{max}, then the I_{max} value will automatically be used for I_{min}.

Poti 5	I_{max} axis Z
Poti 4	I_{min} axis Z
Poti 3	I_{max} axis Y
Poti 2	I_{min} axis Y
Poti 1	I_{max} axis X
Poti 0	I_{min} axis X



8.1 Set-value characteristic



1	Switch-off due to broken cable / short circuit
2	Hydraulic working range

8.2 Energisation of the outputs

Proportional directional valve	Joystick deflection	X axis	Y axis	Z axis
When the joystick is moved, the outputs Out0 - Out5 are energised as follows:	$U > U_{middle}$	Out1	Out3	Out5
	$U < U_{middle}$	Out0	Out2	Out4
Directional seat valve	**Voltage at Ain2**			**Z axis**
	$U_{Ain2} > 2,8$ V (FGE Typ 1) $U_{Ain2} > 4,6$ V (FGE Typ 2) $U_{Ain2} > 5,0$ V (FGE Typ 3)			Out5
	$U_{Ain2} < 2,2$ V (FGE Typ 1) $U_{Ain2} < 4,4$ V (FGE Typ 2) $U_{Ain2} < 4,0$ V (FGE Typ 3)			Out4

9 Ordering code

Model	Code	Part number
Proportional amplifier	EBM-300308-DS-MOBI	100034752

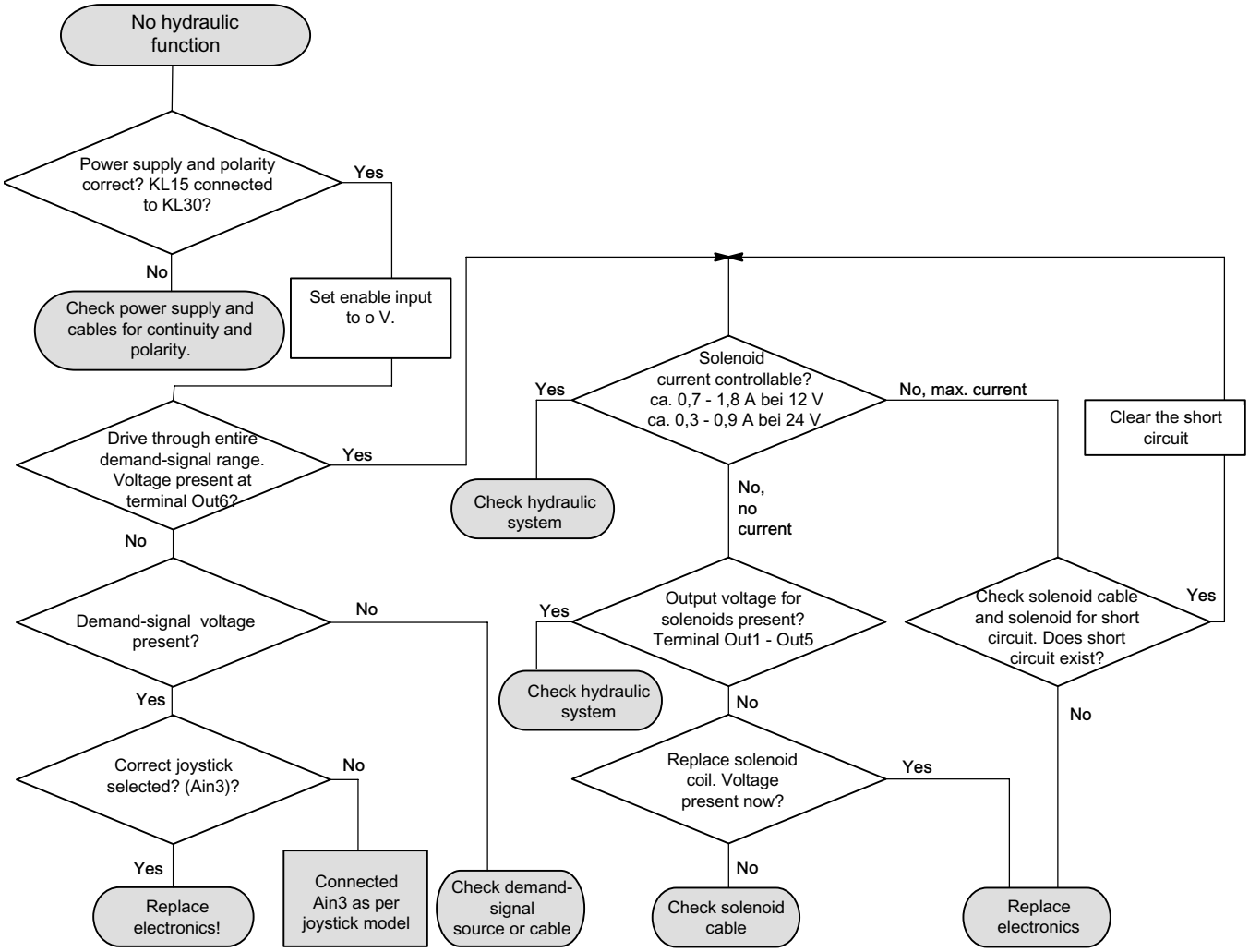
9.1 Accessories

Various types of joysticks or potentiometers are available for generating the demand signals. To connect the solenoids, type GDM 309 solenoid plugs or AMP can be used, depending on the model. In the event of proportional valve malfunctions that are caused by long power leads, use connector plugs type GDM 209D.

Type	Connection diagram	Data sheet	Ordering code	Note
Joystick FGE1-**G**JC1	6.3	100-P-700051	100020513	model for 1 axis
Joystick FGE*-**-G12/JS4	6.2	100-P-700051	100016362	model without gate, for 2 axes
Joystick FGE2-**-G12/JS4	6.2	100-P-700051	100018348	model with gate, for 2 axes
Joystick FGE*-*2T***/J2A7	6.1	100-P-700051	100031751	model with 2 buttons in the cylindrical handle, for 1 axis
Joystick FGE*-33-G**/JS3	6.1	100-P-700051	100232813	model with cylindrical handle, one rocker switch and an enable switch, for 1 axis
Joystick FGE*MA3HA1VG**/JS3	6.1	100-P-700051	100031668	model with multi-function handle, 4 buttons, one rocker switch on front and one on back, for 2 axes
Joystick FGE*-MT1V***G**/JS3	6.1	100-P-700051	100029699	model with multi-function handle, 4 buttons, one switch on front, for 2 axes
Solenoid plug GDM309		100-P-70010	100064970	
Solenoid plug GDM209D		100-P-70010	100014130	
Plug, AMP 22-pin			100235935	22-pin plug with crimp contacts for connecting the EBM-300308-DS-MOBI proportional amplifier

10 Fault Finding

Unless otherwise specified, terminal Gnd (earth) is the reference point



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