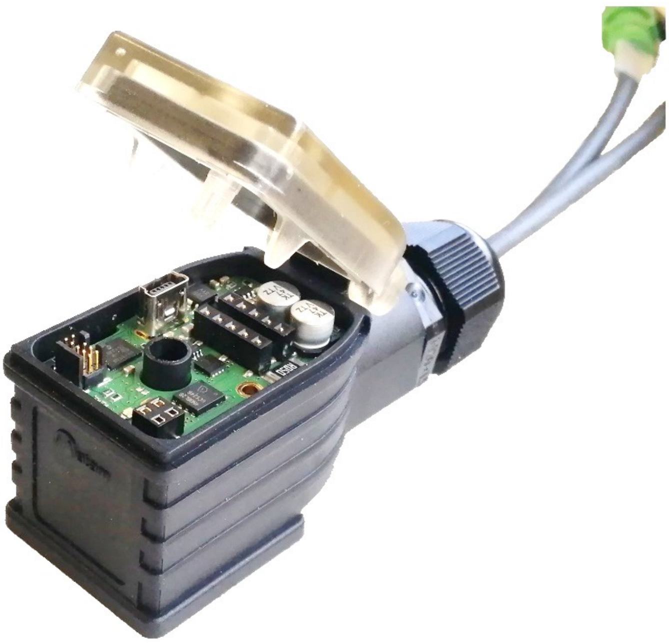
WEST

Technical Documentation

PAM-392-P

Plug Amplifier
for all typical directional control valves



Electronics
Hydraulics meets
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Electronics

Table of contents

1 General Information

1.1 Order number

PAM-392-P - Power amplifier for proportional valves with +/-10 V or 4… 20 mA input

Alternative products

PAM-199-P	-	Power amplifier for proportional directional, pressure or throttle valves with +/-10 V or 4... 20 mA setpoint input
PAM-199-P-ETC	-	Power amplifier for proportional directional, pressure or throttle valves with EtherCAT interface
PAM-199-P-PFN	-	Power amplifier for proportional directional, pressure or throttle valves with Profinet IO interface
PAM-199-P-PDP	-	Power amplifier for proportional directional, pressure or throttle valves with Profibus DP interface

1.2 Scope of supply

The scope of delivery includes the module with connected valve plug via a cable, a central screw M3x42 with O-ring and an NBR seal.

Interface cables and any other parts required must be ordered separately.

This documentation can be downloaded as a PDF file from www.w-e-st.de.

1.3 Accessories

WPC-300 - Start-Up-Tool (downloadable from our homepage – products/software)

A USB 2.0 cable with type A and type mini B plugs can be used for parameterization.

1.4 Symbols used

General information

Safety-related information

1.5 Legal notice

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The data and characteristics described herein serve only to describe the product. The user is required to evaluate this data and to check suitability for the particular application. General suitability cannot be inferred from this document. We reserve the right to make technical modifications due to further development of the product described in this manual. The technical information and dimensions are non-binding. No claims may be made based on them.

1.6 Safety instructions

Please read this document and the safety instructions carefully. This document will help to define the product area of application and to put it into operation. Additional documents (WPC-300 for the start-up software) and knowledge of the application should be taken into account or be available.
General regulations and laws (depending on the country: e. g. accident prevention and environmental protection) must be complied with.

These modules are designed for hydraulic applications in open or closed-loop control circuits. Uncontrolled movements can be caused by device defects (in the hydraulic module or the components), application errors and electrical faults. Work on the drive or the electronics must only be carried out whilst the equipment is switched off and not under pressure.

This handbook describes the functions and the electrical connections for this electronic assembly. All technical documents which pertain to the system must be complied with when commissioning.

This device may only be connected and put into operation by trained specialist staff. The instruction manual must be read with care. The installation instructions and the commissioning instructions must be followed. Guarantee and liability claims are invalid if the instructions are not complied with and/or in case of incorrect installation or inappropriate use.

CAUTION!
All electronic modules are manufactured to a high quality. Malfunctions due to the failure of components cannot, however, be excluded. Despite extensive testing the same also applies for the software. If these devices are deployed in safety-relevant applications, suitable external measures must be taken to guarantee the necessary safety. The same applies for faults which affect safety. No liability can be assumed for possible damage.

Further instructions

- The module may only be operated in compliance with the national EMC regulations. It is the user’s responsibility to adhere to these regulations.
- The device is only intended for use in the commercial sector.
- When not in use the module must be protected from the effects of the weather, contamination and mechanical damage.
- The module may not be used in an explosive environment.
- The device must be disposed of in accordance with national statutory provisions.

2 Characteristics

This compact and inexpensive power amplifier has been developed for controlling directional control valves with two solenoids. This amplifier in type A connector housing is mounted directly on the valve.

The device is designed for a typical input signal of +/- 0…10 V or 4 ... 20 mA.

The output current is regulated and therefore independent of the supply voltage and the solenoid resistance.

The parameterization can be done via the programming adapter ULA-310 by LIN bus or optionally via a USB type Mini 2.0 socket integrated in the device.

The power output stage of this module can be adapted to proportional valves of different manufacturers.

The output stage is monitored for cable breakage, is short-circuit proof and switches off the power output stage in the event of a fault.

RAMP, MIN and MAX, the DITHER (frequency and amplitude) and the PWM frequency are programmable. In addition, the valve characteristic can be linearized over 10 corner points. For example, a linear behavior between input signal and output pressure can be achieved for pressure valves.

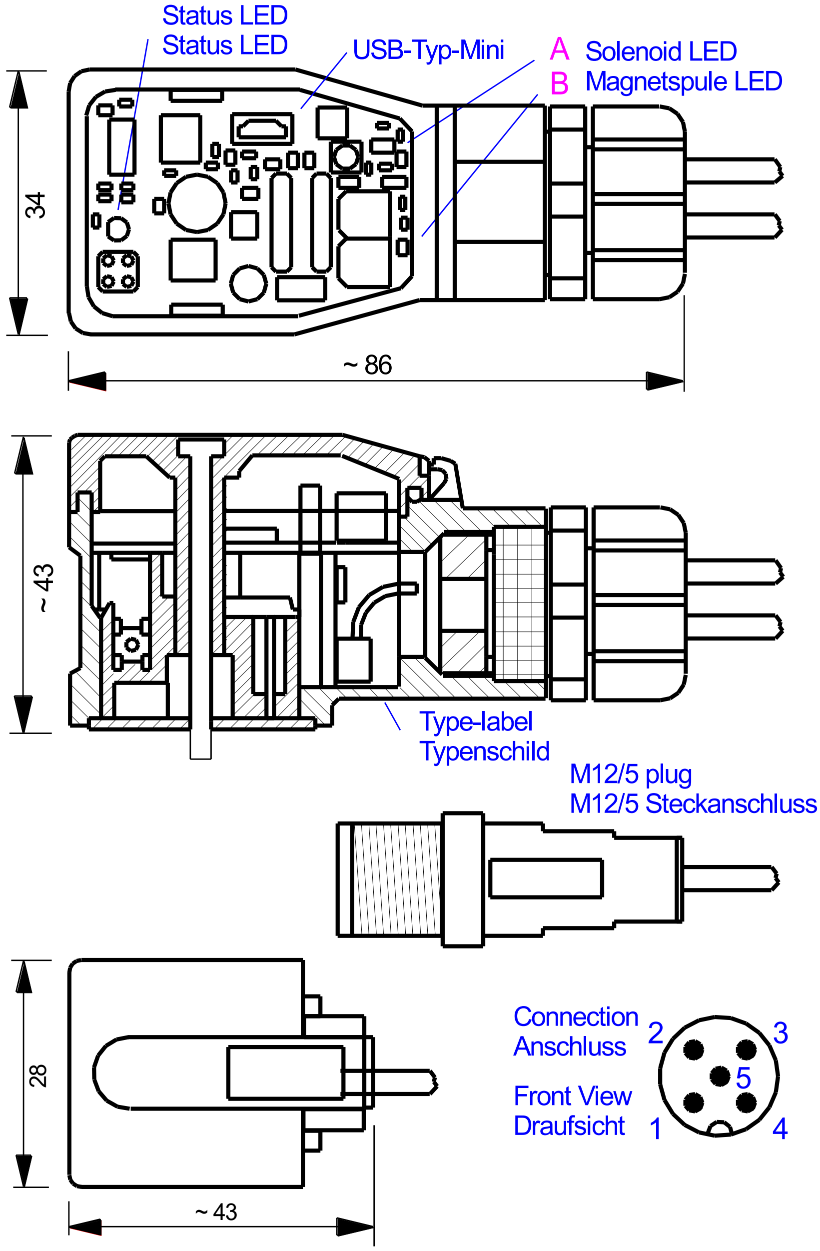
Typical applications: Control of directional control valves that require flexible adjustment.

All typical proportional valves of the various manufacturers can be controlled (BOSCH REXROTH, BUCHER, DUPLOMATIC, PARKER ...).

Features

- Power amplifier for proportional valves in a DIN EN 175 301-803 A plug housing
- Control of directional control valves, compact housing with M12 connector
- Second valve connector wired to the amplifier
- Digitally reproducible settings
- Free scaling of the analogue input
- Programmable via USB / LIN bus
- Monitoring of the input signal (e.g. for joystick)
- Characteristic curve linearization over 21 XY points
- Free parameterization of RAMP, MIN / MAX, output current and DITHER (frequency, amplitude)
- Nominal output current up to 2.6 A
- Simple and application-oriented parameterization with WPC software

2.1 Device Description



3 Application and use

3.1 Installation Specifications

This device has been designed and tested in accordance with the applicable EMC standards and complies with these regulations with regard to emitted interference and interferences.

The device must be installed and wired in accordance with the documentation and EMC aspects. Trouble-free operation can only be guaranteed if the following instructions are observed.

- Only shielded wires should be used.
- The cable shielding should be connected to the operating ground in a low-impedance and low-inductive manner (i.e. "over a large area") to protect against electric fields. (see also EN50178 Chap 4 and VDE 0100 Part 540). The local requirements for shielding must be taken into account in any case.
- Observe the interference voltage discharge through earthing measures on the valves.
- Unused wires in signal lines should be short-circuited and grounded.
- Pay attention to the separate routing of signal and power lines, especially in the case of long parallel line routes. If possible, keep a distance of 300 mm and thus keep the coupling capacities small. Different voltage levels, e.g. power supply 230V/50 Hz and measuring signal 24V DC, should never be combined in one cable.
- In systems with strong sources of interference, such as frequency converters, interference emissions should be reduced by suitable filter networks and EMC-compliant grounding. The instructions of the manufacturers of these devices provide appropriate information on this.
- Make sure you have a low-impedance power supply, such as using regulated power supplies (IEC364). These enable optimum interference voltage dissipation.
- According to the classification of the device in accordance with EN55011 / EN55032 / EN 61000-6-4, this is class A equipment, industrial area. This device may cause radio interference in residential areas. In this case, the operator may be required to take appropriate measures.

3.2 Commissioning

Step	Activity
Installation	Install the device according to the block diagram. Make sure that the wiring is correct.
First power-on	Make sure that there is no unwanted movement of the drive (e.g. switching off the hydraulics). Plug in a power meter and check the current consumption of the device. If, with major deviations, it does not correspond to the specifications of the technical data, there could be wiring errors.
Structure of communication	For parameterization, connect a PC (notebook) via the USB interface or the LIN bus adapter. The LIN-Bus adapter is connected between the M12 wiring connector and the device. The structure of the communication can be found in the documents of the WPC-300 operating program. It should be noted that single-wire communication takes place via LIN. Set the communication protocol to half-duplex.
Pre-parameterization	Now parameterize the following parameters (based on the system design and circuit diagrams): The output current CURRENT and the valve-typical parameters such as DITHER and MIN/MAX. This pre-parameterization is necessary to minimize the risk of uncontrolled movement.
Controlsignal	Check the control signal and the magnetic current. In the state that has not yet been activated, no magnetic current should flow to the solenoid coil. You can display the magnetic current in the WPC-300.
Switch on the hydraulics	After that, the hydraulics can be switched on. The module does not generate a signal yet. Actuators should be stationary or drifting slightly (leaving the position at slow speed) if it is a directional control valve.
Activating setpoint	**ATTENTION!** The output stage is always active with the supply voltage. The magnetic current should change in proportion to the increasing input signal.
Optimize Setting	The settings such as ramp time and overlap compensation can now be made.

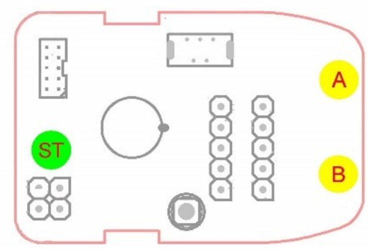
4 Functionality and technical description

4.1 Input- and output signals

Connection	Supply
PIN 1	Power supply (see technical data)
PIN 3	0 V (GND) power supply.
Connection	Analog Signals
PIN 2	Setpoint input AIN+; +/- 10 V or 4... 20 mA, scalable
PIN 4	Setpoint input AIN-; 0 V, signal-GND
Connection	Communication
PIN 5	LIN-Bus Connection The device can be read and parameterized via a communication adapter.
Connection	PWM A output on amplifier housing (according to EN175301-803)
Contact 1	PWM Output for controlling solenoid A
Contact 2	PWM Output for controlling solenoid A
Contact PE	Earth connection
Connection	PWM B output on cable housing (according to EN175301-803)
Contact 1	PWM Output for controlling solenoid B
Contact 2	PWM Output for controlling solenoid B
Contact PE	Earth connection

4.2 LED Indicator

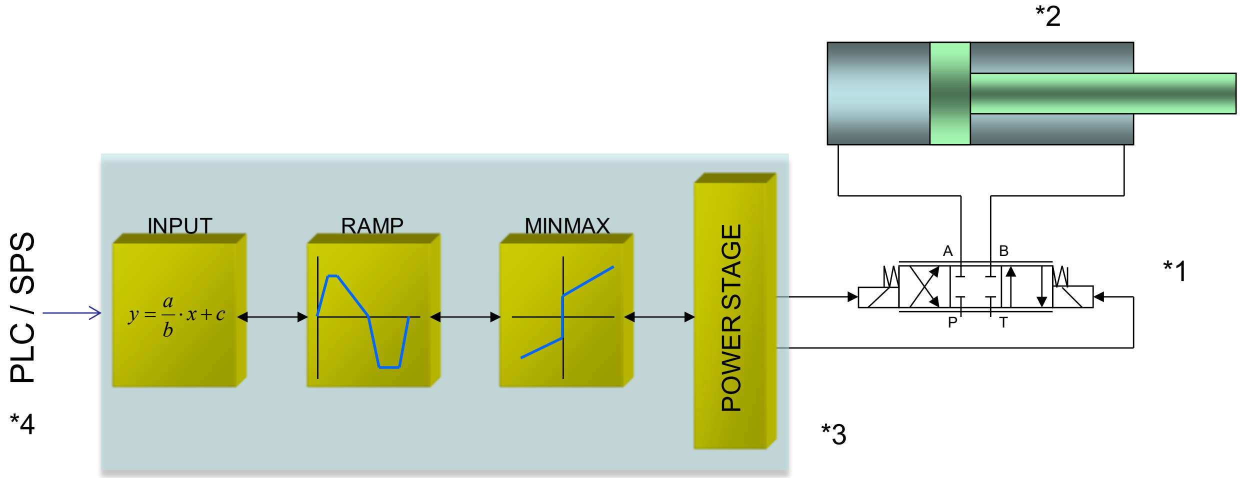
LEDs	Description of LED Function
Green Status	Green LED: READY indicator OFF: No power supply ON: System is operational Flashing: Error condition
Yellow Magnetic current dis-play	A-LED = Current on solenoid A; B-LED = Current on solenoid B;



4.3 Typical System Structure

This minimal system consists of the following components

(*1) Proportional valve
(*2) Hydraulic cylinder
(*3) Power Amplifiers
(*4) Interface to PLC with analog and digital signals



4.4 Functionality

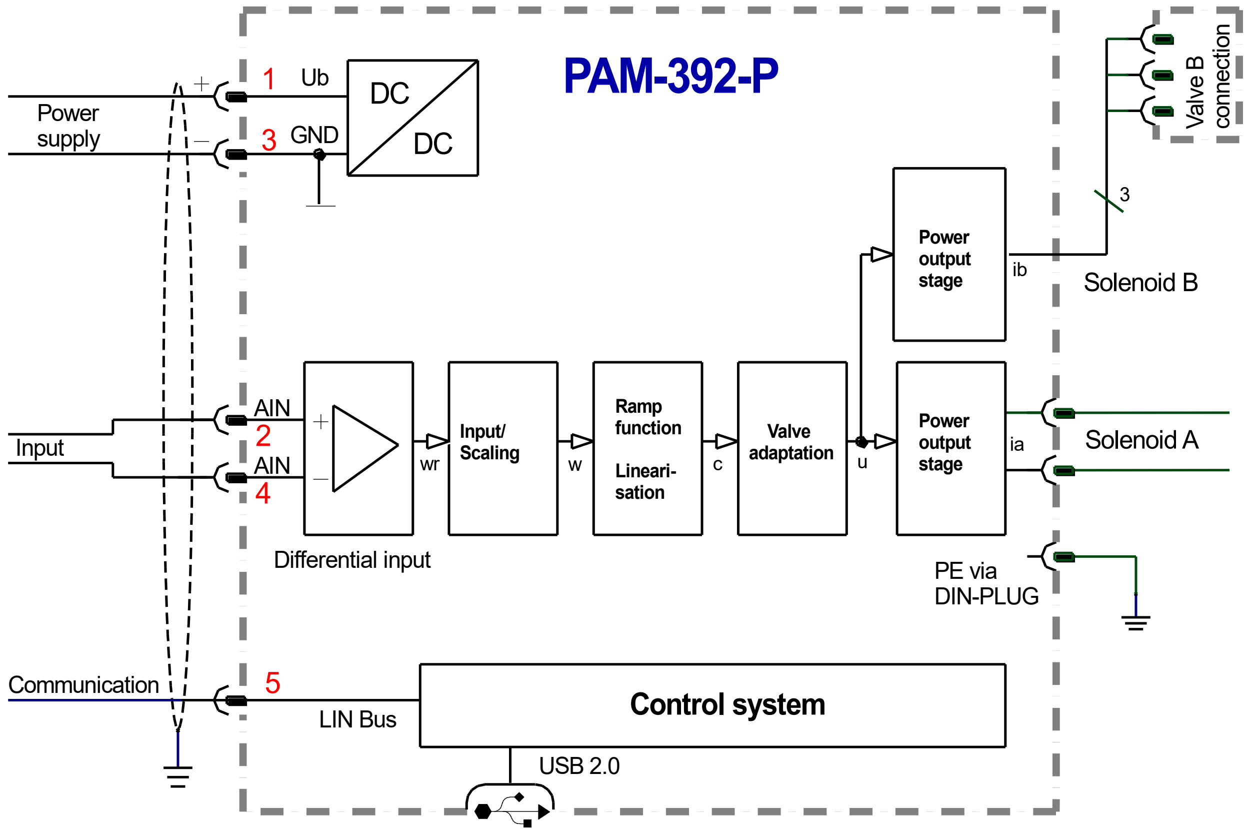
This power amplifier is controlled by an analogue signal (from the PLC, from a joystick or from a potentiometer). Error-free operation is indicated by a status LED.

The integrated standard functions are configured via the various parameters.

In the event of a fault, the power amplifier is deactivated and the fault is indicated by the flashing status LED. The error state is reset in the default setting after the error has been resolved.

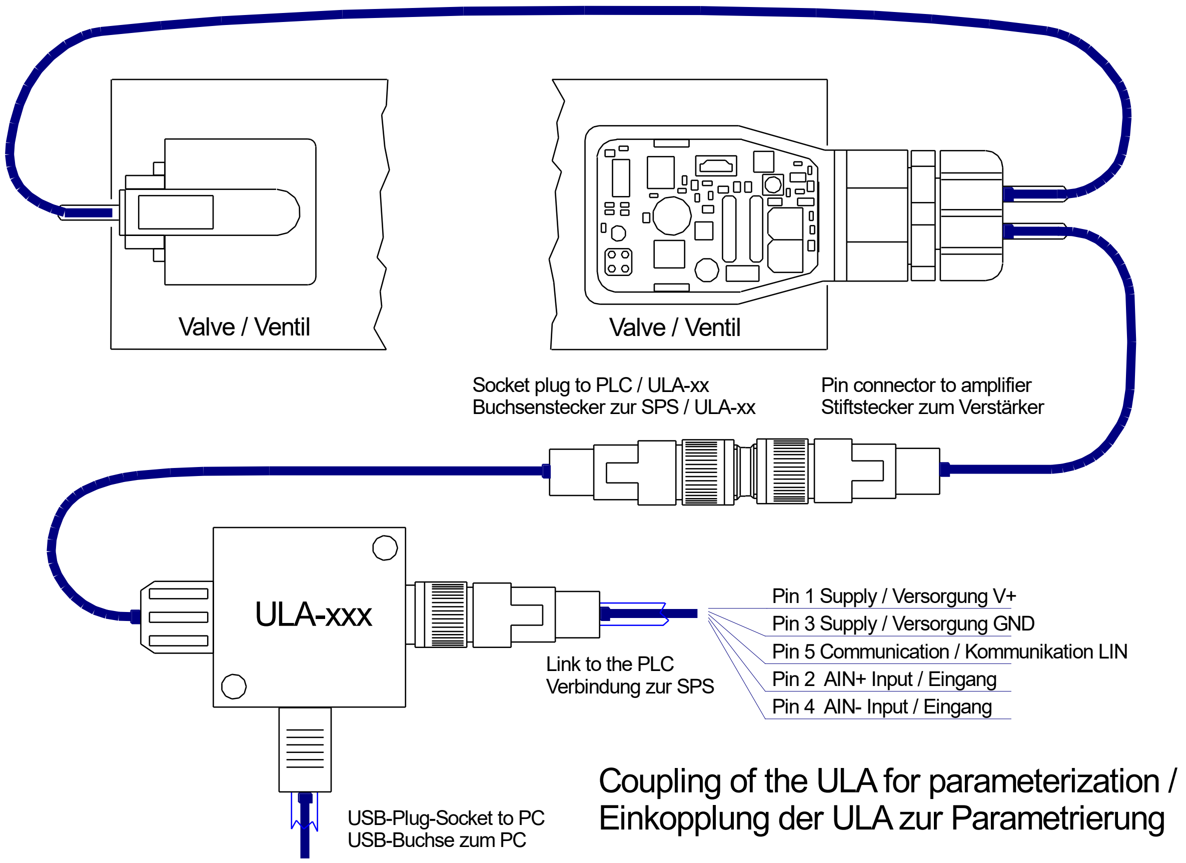
The output current is regulated, which achieves high accuracy and good dynamics. All commercially available proportional valves (up to 2.6 A) can be controlled with this power amplifier.

4.5 Block diagram

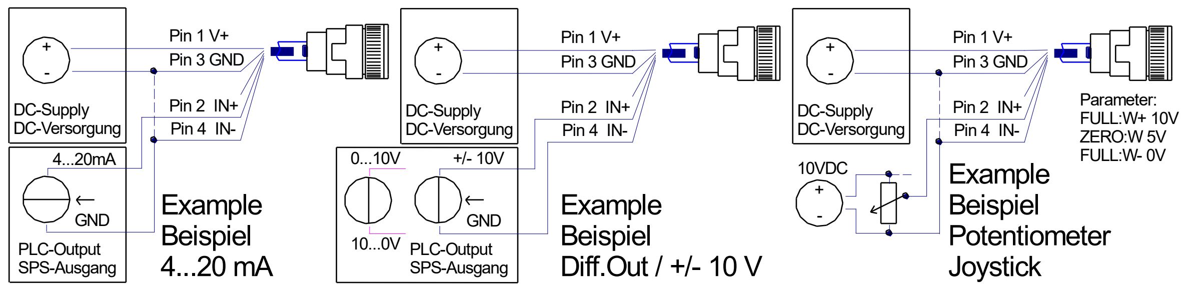


4.6 Typical Wiring

The ULA-xxx[1] communication adapter can be coupled into the existing connection via the alternative parameterisation to the mini-USB socket. The plug amplifier uses a communication line that is read out by the ULA-xxx. The communication protocol must be set to half-duplex in the WPC-300 terminal programme. The ULA-xxx is no longer required for normal operation.



Coupling of the ULA for parameterization / Einkopplung der ULA zur Parametrierung



[1] The xxx in the designation describes the different variants of the communication adapter.

4.7 Specifications

Supply voltage Current requirement External protection	**[VDC]** **[mA]** **[A]**	10… 30 (with. Rippel) < 40 + Solenoid current 3 medium character
Analog inputs: Voltage Input resistance Signal resolution Current Burden Signal resolution	 **[V]** **[kOhm]** **[%]** **[mA]** **[Ohm]** **[%]**	Unipolar/Differential -10… 10 min. 55 0,003 4...20 240 0.006
PWM Power Outputs Maximum Output Current Frequency	 **[A]** **[Hz]**	 2.6 61… 2604 selectable in defined steps
System Sampling Times Magnetic current regulator Signal processing	 **[ms]** **[ms]**	 0.125 1
Serial interface Transmission rate LIN Transmission rate USB	**-** **[kBaud]** **[kBaud]**	 19.2 Halfduplex 9.6… 115.2
Housing and Magnetic connection Tightening torque of the housing screw	**[DIN EN]** **[Nm]**	175 301-803-A 0.5
Protection class Temperature range Storage temperature	 **[°C]** **[°C]**	IP65 (with gasket) according to EN60529 -40… 65 -40 …70
Weight	**[kg]**	0.125
Connector 1 Connector 2, Solenoid A Connector 3, Solenoid B Parameterisation interface		M12, 5-pole (DESINA Standard) to cable with 0,125 m PUR halogen-free black Valve connector type A Valve connector Type A to line 3x0,5 with 0.41 m with 0,15 m PUR halogen-free black USB 2.0 Mini
EMC		EN 61000-6-2: 2019 EN 61000-6-3: 6/2007 + A1:2011

5 Parameter

5.1 Parameter overview

Relevant parameters are entered with the configuration programme from version WPC300-4.0 in floating point format. The physical values of the analogue input in V and mA have a resolution of mV and µA. The relative values have a resolution of 0.01%.

In configuration programmes up to version WPC300-3.6, the values are entered without a floating point in the smallest resolution unit in integer format. In the table and in the parameter descriptions, the resolutions and value ranges are shown in the coloured brackets (xx).

Group	Command	Default	Unit	Description
	MODE	STD	-	Parameter view
General settings				
	LG	EN	-	Changing language help texts
	SENS	AUTO	-	Error control procedure
	CCMODE	OFF	-	Characteristic curve linearization
Analogue input				
	SIGNAL:W	V	-	Type of input signal
	ZERO:W	0	V (mV)	Voltage scaling for signal input at zero point
	FULL:W+	10	V (mV)	Voltage scaling: Signal input at the positive end point
	FULL:W-	-10	V (mV)	Voltage scaling: Signal input at the negative end point
	ZERO:WA	12	mA (µA)	Current scaling for signal input at zero point
	FULL:WA+	20	mA (µA)	Current scaling; signal input at upper end point
	FULL:WA-	4	mA (µA)	Current scaling; signal input at lower end point
	LIM:W	0	V (10mV)	Monitoring ranges for analogue signal voltage
	LIM:WA	0	mA (10µA)	Monitoring ranges for analogue signal current
Set value ramp				
	AA:1	100	ms	1.Quadrant, Solenoid A rising
	AA:2	100	ms	2.Quadrant, Solenoid A falling
	AA:3	100	ms	3.Quadrant, Solenoid B rising
	AA:4	100	ms	4.Quadrant, Solenoid B falling
Output signal adaptation				
	CC	X Y	-	Definable characteristic curve linearization
	SIGNAL:U	+	-	Output polarity
	MIN:A	0	% (0.01%)	Overlap compensation
	MAX:A	100	% (0.01%)	Output scaling
	MIN:B	0	% (0.01%)	Overlap compensation
	MAX:B	100	% (0.01%)	Output scaling
	TRIGGER	2	% (0.01%)	Overlap compensation, Response threshold
Power amplifier				
	CURRENT	1000	mA	Nominal current of solenoid coils
	DFREQ	121	Hz	Dither frequency
	DAMPL	5	% (0.01%)	Dither Amplitude

Group	Command	Default	Unit	Description
	PWM	2604	Hz	PWM Frequency
	ACC	-	ON	Automatic solenoid current controller adjustment
	PPWM **IPWM**	7 40	- -	Setting the magnetic current regulator at ACC=OFF

5.2 *Parameter Description*

5.2.1 MODE (Switching of parameter groups)

Command	Parameter	Unit	Group
MODE x	x= STD|EXP	-	**STD**

This command changes the parameter mode. Various commands (defined via STD/EXP) are blanked out in standard mode. The several commands in expert mode have more significant influence on the system performance. Therefore, they should be changed with care.

5.2.2 LG (Switching the language for the help texts)

Command	Parameter	Unit	Group
LG x	x= DE|EN	-	**STD**

You can choose the English or German language for the help texts in the WPC.

ATTENTION: After changing the language setting, the "ID" button in the menu bar of the WPC-300 must be pressed to reload the parameter list.

5.2.3 SENS (Failure monitoring)

Command	Parameter	Unit	Group
SENS X	x= ON|OFF|AUTO	-	**STD**

This command is used to activate monitoring functions (4... 20 mA sensors, magnetic current monitoring, LIM limitations, and internal module monitoring).

ON: All functions are monitored. The device shuts down after a detected error. The status light flashes and shows the fault status. A reset is only possible after the assembly has been restarted (interruption of the supply voltage). This mode should only be used when automatic rewinding needs to be prevented for safety reasons, as in AUTO mode.

OFF: No monitoring function is active.

AUTO: AUTO RESET Mode, all functions are monitored. After the fault state is no longer present, the module automatically returns to the normal operating state.

The monitoring function should always be active, so that errors can remain visible via the status display. However, it can be deactivated for troubleshooting purposes.

5.2.4 CCMODE (Activation of characteristic curve linearization)

Command	Parameter	Unit	Group
CCMODE x	x= ON|OFF	-	**EXP**

This command is used to activate or disable the linearization function. (CC or CCA). By deactivating it immediately, a simple and quick assessment of the linearization is possible.

5.2.5 SIGNAL:W (Type of input signal)

Command	Parameter	Unit	Group
SIGNAL:W x	x= OFF|V|C	-	**STD**

This command is used to define the type of input signal (current or voltage). In the OFF setting, the analogue input is deactivated. The differential input corresponds to an analogue signal of +/- 10 VDC, the current input of 4...12...20 mA.

5.2.6 ZERO:W / WA (Analogue value scaling)

5.2.7 FULL:W+ / WA+ (Analogue value scaling)

5.2.8 FULL:W- / WA- (Analogue value scaling)

Command	Parameter	Unit	Group
ZERO:W x FULL:W+ x FULL:W- x ZERO:WA x FULL:WA+ x FULL:WA- x	-10…10 (-10000..+10000) -10…10 (-10000..+10000) -10…10 (-10000..+10000) 4…20 (4000..+20000) 4…20 (4000..+20000) 4…20 (4000..+20000)	V; Resolution in mV V; Resolution in mV V; Resolution in mV mA; Resolution in µA mA; Resolution in µA mA; Resolution in µA	**STD**

These parameters are used to adjust the input signal of the analogue value read in.

In addition to entering the signal type using the "SIGNAL:W" parameter, the zero point (ZERO), the positive end point and the negative end point of the analogue value (FULL) can be defined.

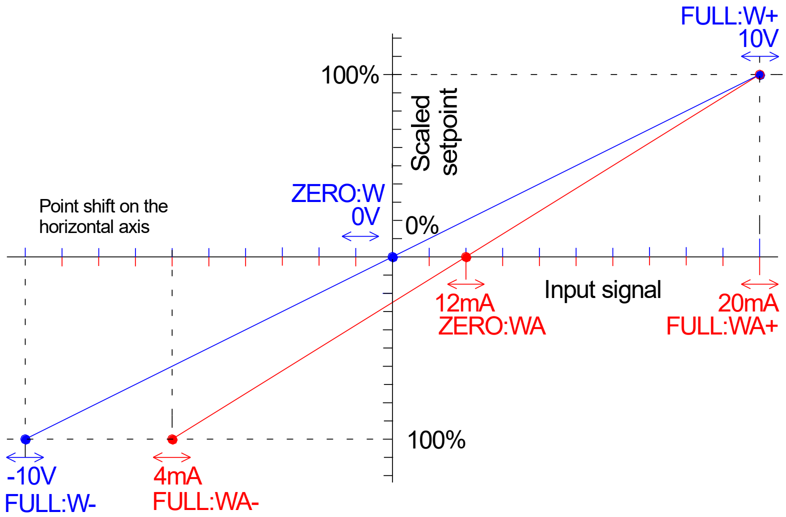
FULL:W+ and FULL:W- determine the end values of an analogue signal.

Please note that FULL:W- is recalculated after FULL:W+ has been entered; however, a deviating specification contrary to the calculated value can then be made.

A deviating input signal of, for example, 9.8 V (and -9.8 V) instead of 0 to +/- 10 V can therefore be normalised to a module-internal signal value of 0 to +/- 100 % by entering FULL:W+ with 9.8 V and FULL:W- with -9.8 V.

A further detailed note has been added in the appendix, the new commands replace the previous scaling.

The following diagram shows the relationship between the analogue signals and the scaled internal set-points, which are always mapped to -100% to 100%. The ZERO parameter shifts the zero point and the FULL + / - parameter shifts the end points on the horizontal axis.



5.2.9 LIM (Signal Monitoring)

Command	Parameter	Unit	Group
`LIM:W x` `LIM:WA X`	`x= 0… 2 (0…200)` `x= 0… 4 (0…400)`	`V (0.01V)` `mA (0.01mA)`	**EXP**

This parameter can be used to set up analogue value monitoring of the control unit.

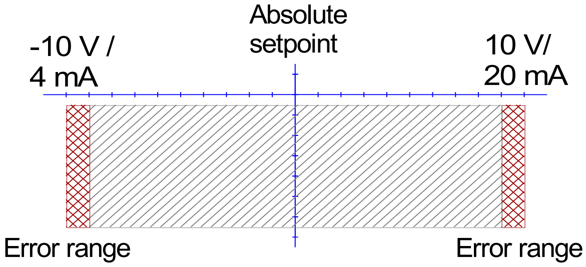
The monitoring generates an error if the analogue signal of the control is outside a defined permitted range. The error ranges are set at the lower and upper end of the range limits of the set signal type (V/mA). The status message indicates that the analogue input is within these ranges and the power stage is deactivated.

This function can be used, for example, to monitor a joystick/potentiometer for cable breaks and short circuits. A value of 0 [V/mA] deactivates this function.

If the input is set to a current loop signal, the Lim monitoring allows a monitoring range within 4 to 20 mA.

Example: LIM 1 V defines an error range from 0 to 1 V and from 9 to 10 V (1 V on the lower and upper signal limit).

If the signal is greater than 9V or less than 1V, the signal is outside the permitted range and an error is recognised. The error monitoring (SENS) handles this error accordingly.

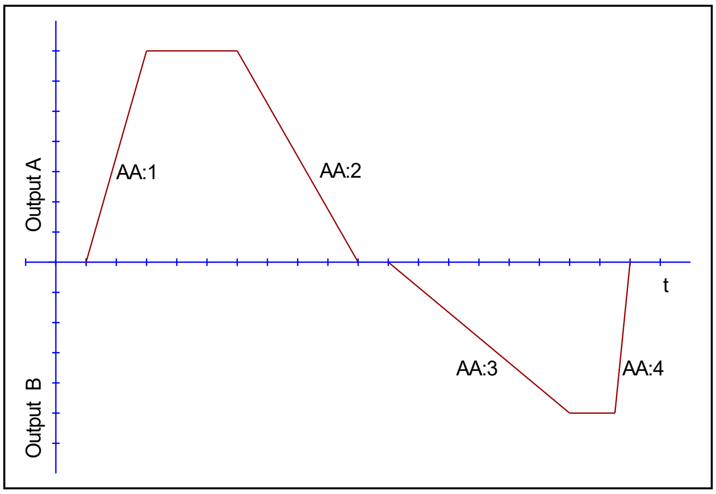


5.2.10 AA (Ramp function)

Command	Parameter	Unit	Group
`aA:i x`	`i= 1… 4` `x= 1… 120000`	`-` `ms`	**STD**

Four quadrant ramp function.

The first quadrant represents the ascending ramp (magnet A), the second quadrant represents the descending ramp (magnet A). The third quadrant represents the ascending ramp (magnet B) and the fourth quadrant represents the descending ramp (magnet B).



5.2.11 CC (Characteristic curve linearization)

Command	Parameter	Unit	Group

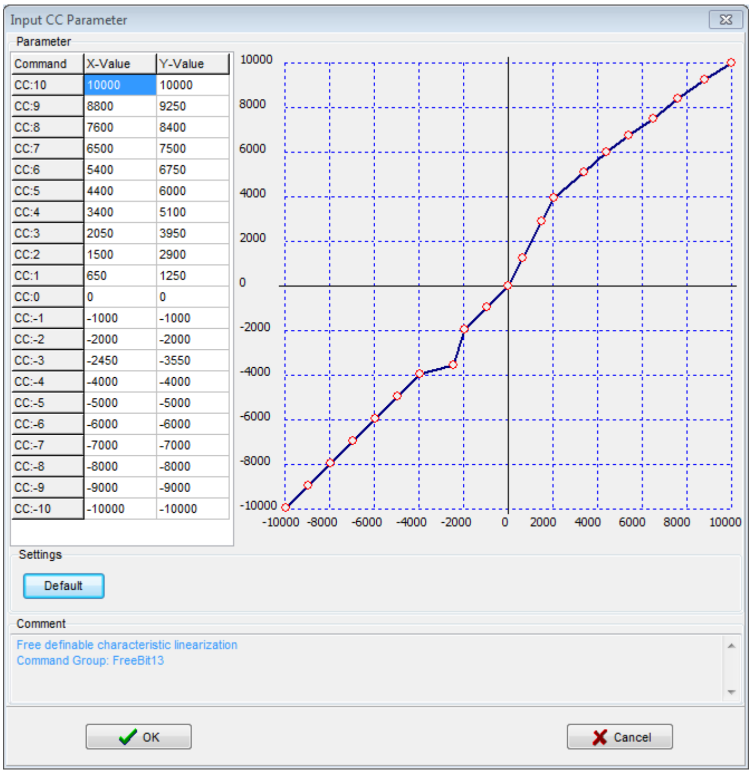
`CC:i x y`	`i= -10… 10`
	`x= -10000… 10000`
	`y= -10000… 10000`
		`-`
		`0.01 %`
		`0.01 %`
			CCMODE=ON

A user defined signal characteristic can be set by this function. For activating the parameter CCMODE has to be switched to ON.

The positive indexes stand for the solenoid A, the negative ones represent the solenoid B. The curve is calculated according to the equation of the linear interpolation: **y=(x-x1)*(y1-y0)/(x1-x0)+y1**.

The influence of the linearization can be estimated via the process data on the monitor or on the oscilloscope.

For the input of the characteristics linearization, the WPC-300 program provides a table and a graphic data input. The input signal is mapped on to the X-axis and the output signal is mapped on to the Y-axis.



5.2.12 SIGNAL:U (Polarity of the output signal)

Command	Parameter	Unit	Group
SIGNAL:W x	x= +/-	-	**STD**

This command defines the polarity of the control signal. As a result, the drive of magnet A is directed to magnet B and vice versa.

5.2.13 MIN (Compensation of the overlap)

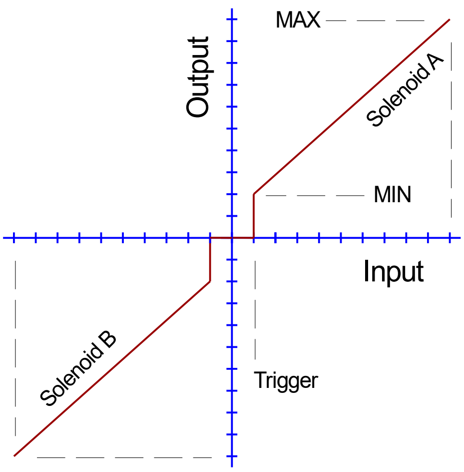
5.2.14 MAX (Output Scaling)

5.2.15 TRIGGER (Threshold value of MIN function)

Command	Parameter	Unit	Group
 min:i x max:i x Trigger x	i= A|B x= 0… 60 (0…6000) x= 40… 100 (40…10000) x= 0… 30 (0…3000)	- % (0.01%) % (0.01%) % (0.01%)	**STD**

The output signal is adapted to the valve by these commands. With the MAX value the output signal (the maximum valve current) will be defined. With the MIN value the overlap (dead band of the valve) will be compensated. Via the TRIGGER the activation point of the MIN function is set and so a non-sensitive range around the zero-point[2] can be specified.

CAL  :he MIN value is set too high, it influences the minimal velocity, which cannot be adjusted any long



[2] This dead band is necessary, in order to avoid unrequested activations caused by small variations of the input signal. If this module is used in a position controls, the TRIGGER value should be reduced (typical: 1…10).

5.2.16 CURRENT (Nominal Output Current)

Command	Parameter	Unit	Group
CURRENT x	x= 500… 2600	mA	**STD**

This parameter is used to set the nominal current of the magnet. The dither signal and also MIN/MAX always refer to the selected current range.

5.2.17 DAMPL (Ditheramplitude)

5.2.18 DFREQ (Dither frequency)

Command	Parameter	Unit	Group
DAMPL x DFREQ X	x= 0… 30 (3000) x= 60… 400	% (0.01%) Hz	**STD**

The dither[3] can be defined freely with this command. Different amplitudes or frequencies may be required depending on the respective valve. The dither amplitude is defined in % of the nominal current (see: CURRENT command).

CAUTION: The PPWM and IPWM parameters influence the effect of the dither setting. These parameters should not be changed again after the dither has been optimized.

CAUTION: If the PWM frequency is less than 500 Hz, the dither amplitude should be set to zero.

5.2.19 PWM (PWM Frequenz)

Command	Parameter	Unit	Group
PWM x	x= 61… 2604	Hz	**STD**

The frequency can be changed in the defined steps (61 Hz, 72 Hz, 85 Hz, 100 Hz, 120 Hz, 150 Hz, 200 Hz, 269 Hz, 372 Hz, 488 Hz, 624 Hz, 781 Hz, 976 Hz, 1201 Hz, 1420 Hz, 1562 Hz, 1736 Hz, 1953 Hz, 2232 Hz and 2604 Hz). The optimum frequency depends on the valve.

Attention: The PPWM and IPWM parameters should be adapted when using low PWM frequencies because of the longer dead times which forces a reduced stability of the closed loop control (see 5.2.21 and 5.2.22).

[3] The DITHER is a superimposed signal to reduce the hysteresis. This function is defined by the amplitude and frequency. The DITHER frequency should not be confused with the PWM frequency. In some proportional valve documentations a mistake is done by the definition of the DITHER / PWM frequency. It is recognizable by missing information about the DITHER amplitude.

5.2.20 ACC (Automatic adjustment of the magnetic current regulator)

Command	Parameter	Unit	Group
ACC x	x= ON|OFF	-	**EXP**

Operation mode of the closed loop current control.
ON: In automatic mode PPWM and IPWM are calculated depending on the preset PWM-frequency.
OFF: Manual adjustment

5.2.21 PPWM (Solenoid current controller P gain)

5.2.22 IPWM (Solenoid current controller I gain)

Command	Parameter	Unit	Group
PPWM x IPWM X	x= 0… 300 x= 1… 100	- -	**EXP**

The PI current controller for the solenoids is parameterized with these commands.

CAUTION: These parameters should not be changed without adequate measurement facilities and experiences.

Attention, if the parameter ACC is set to ON, these adjustments are done automatically.

If the PWM frequency is < 250 Hz, the dynamic of the current controller has to be decreased.
Typical values are: PPWM = 1… 3 and IPWM = 40… 80.

If the PWM frequency is > 1000 Hz, the default values of PPWM = 7 and IPWM = 40 should be chosen.

5.3 PROCESS DATA (Monitoring)

Command	Parameter	Unit
WR W C U	Analogue real input Setpoint after input scaling Setpoint after linearization Solenoid current setpoint	V / mA % % %
IA ib	Solenoid current A Solenoid current B	mA mA

The process data are the variable variables that can be continuously observed in the monitor or oscilloscope.

6 Appendix

6.1 Failure monitoring

Following possible error sources are monitored continuously when SENS = ON / AUTO:

Source	Fault	Behaviour
Setpoint, Input Current Monitoring	Not in the valid area	The power amplifier is disabled.
Setpoint outside the range specified by the LIM function	Not in the valid area	The power amplifier is disabled.
Solenoid A Solenoid B	Wire break	The power amplifier is disabled.
EEPROM (when switching on)	Data error	The power amplifier is disabled.

6.2 Troubleshooting

It assumes an operational state and existing communication between the module and the WPC-300. Furthermore, the parameterization for valve control is set on the basis of the valve data sheets.

For fault analysis, the RC mode can be used in the monitor.

ATTENTION: When working with RC (Remote Control) mode, all safety aspects must be thoroughly checked. In this mode, the module is controlled directly and the machine control cannot influence the module.

FAULT	CAUSE / SOLUTION
Operating voltage is active, the module shows no response, the status LED is off.	Power supply is interrupted. If there is no power supply, there is no communication via our operating program. If the connection is established with WPC-300, a power supply is also available. In this case, it is also possible to check in the monitor whether the READY signal is present.
The status LED flashes.	The flashing status LED or the non-luminous READY message as a terminal message indicates that an error has been detected by the module. Errors can be: • Cable breakage, 4... 20 mA input signal . Input signal is below 3 mA. • LIM monitoring. Input signals are out of the permitted range. • Broken cables or incorrect wiring to the solenoids. • Internal data error: Run command/button SAVE to delete the data error. System has loaded the DEFAULT data again. With the WPC-300 operating programs, the fault can be localized directly via the monitor.

6.3 Additions to setpoint scaling

The physical input signal is converted into the bipolar setpoint W via a scaling function. This ranges in the interval -100% ... 100%. Negative values normally cause the output for solenoid B to be activated if the output signal is not inverted using the SIGNAL:U parameter.

The scaled setpoint is subsequently processed by other functions (e.g. ramp, overlap compensation, output scaling). The setpoint scaling therefore only has the task of mapping the input signal to the range of +/-100% in a meaningful way. This also applies, for example, if you want to limit the actuation on one side. Output scaling is provided for this purpose.

The specification of the setpoint scaling is made via parameters that are entered in the appropriate physical unit V or mA:

- ZERO:W is the input signal that produces a setpoint W of 0 %
- FULL:W+ is the input signal that produces a setpoint W of +100 %
- FULL:W- is the input signal that produces a setpoint W of - 100 %

The parameters for scaling a current signal (SIGNAL:W = C) are called ZERO:WA, FULL:WA+ and FULL:WA-.

The scaling is usually symmetrical, i.e. the same signal span is used in both signal directions.

Example: Standard scaling +/- 10 V = +/- 100%

ZERO:W = 0 V, FULL:W+ = 10 V, FULL: W- = -10 V

To make input easier, the software initially sets the FULL:W- parameter automatically when changing ZERO:W or FULL:W+ so that the scaling is symmetrical. This takes place within the possible limits as long as the resulting value is within the signal range +/- 10 V or 4-20 mA.

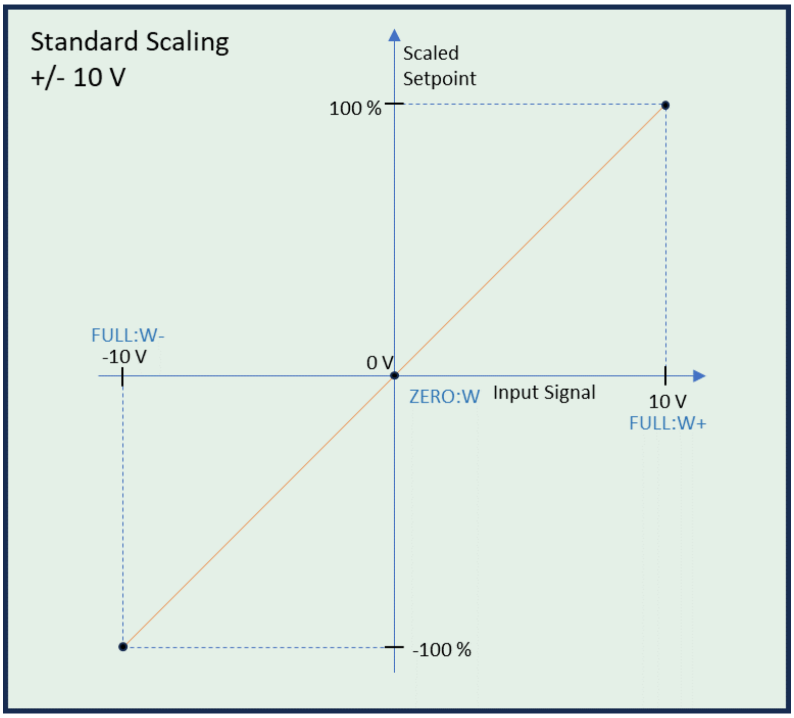
However, it is possible to change FULL:W- manually afterwards and thus realise asymmetrical scaling with different signal spans.

ATTENTION: An inconsistent assignment occurs if FULL:W- is placed on the same side of ZERO:W as FULL:W+, e.g. with ZERO:W = 0 V, FULL:W+ = 10 V and FULL:W- = 5V. In this case, the negative signal direction will be blocked.

CAUTION: Any reduction in the input signal range reduces the resolution and increases the sensitivity to signal interference.

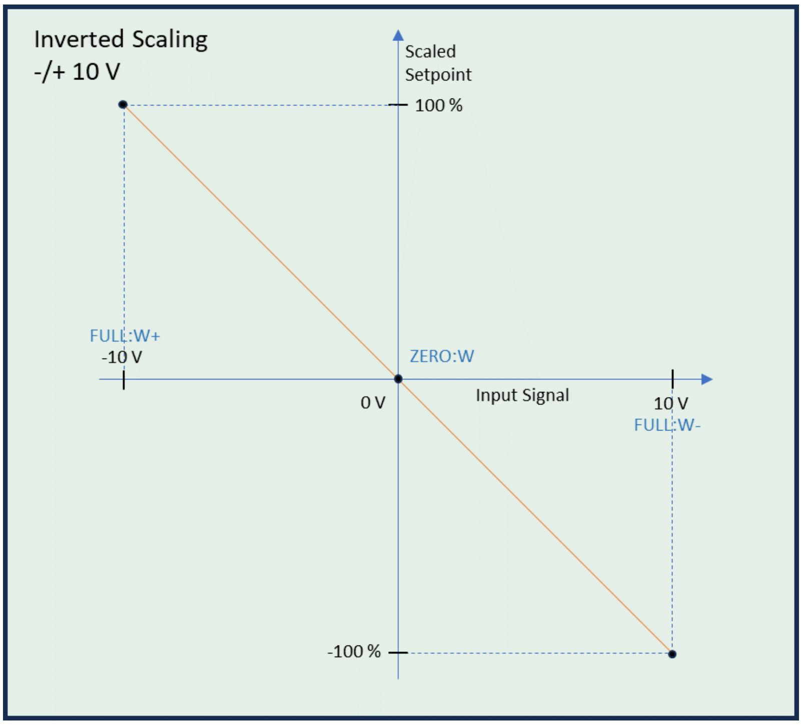
The following examples show the function using typical cases:

Standard case when the input signal range of +/- 10 V is fully utilised. These parameters correspond to the factory setting.



Invert the scaling, inverted characteristic curve:

FULL:W+ is set to -10 V, FULL:W- automatically becomes 10 V.:

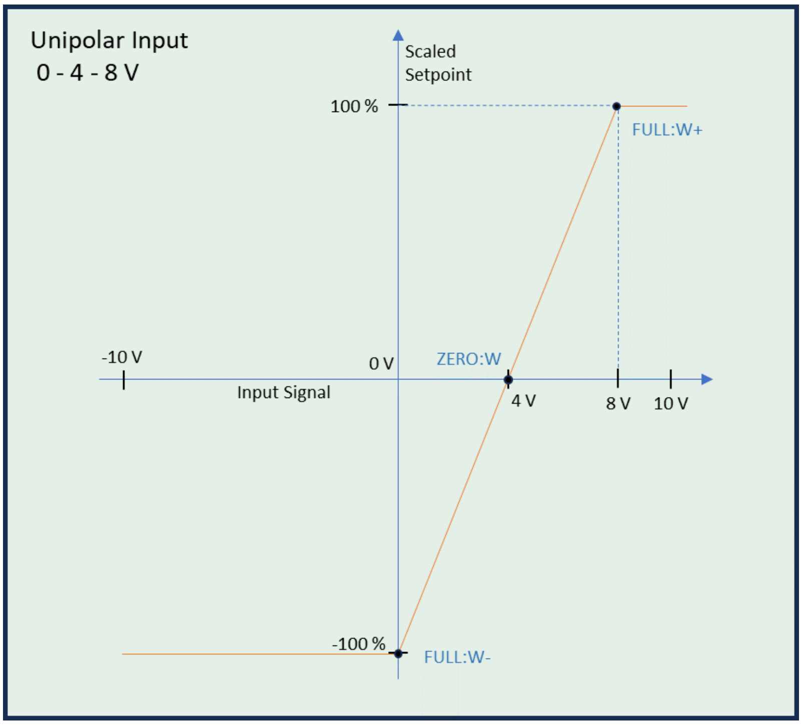


In this case, the input signal only moves within the limits of 0 to 8 V, at 4 V the valve should be in neutral position*:*

ZERO:W is set to 4 V,

FULL:W+ is set to 8 V,

FULL:W- is automatically set to 0 V.



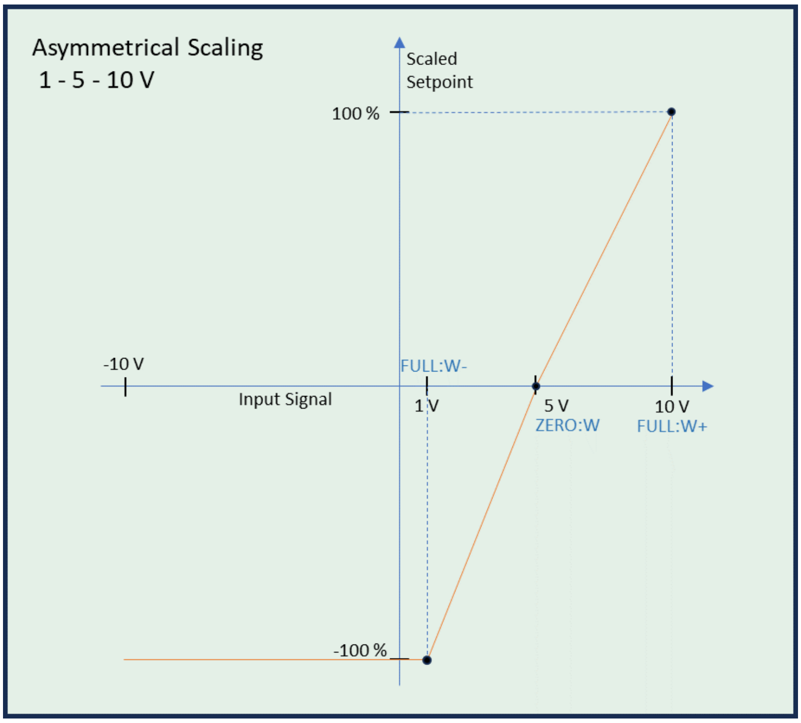
In this case, the input signal only moves within the limits of

1 to 10 V, at 5 V the valve should be in neutral position:

ZERO:W is set to 5 V,

FULL:W+ is set to 10 V,

FULL:W- is initially set to 0 V automatically, but should then be changed to 1 V manually.



The input is scaled as a current signal in the same way with the parameters ZERO:WA, FULL:WA+ and FULL:WA-

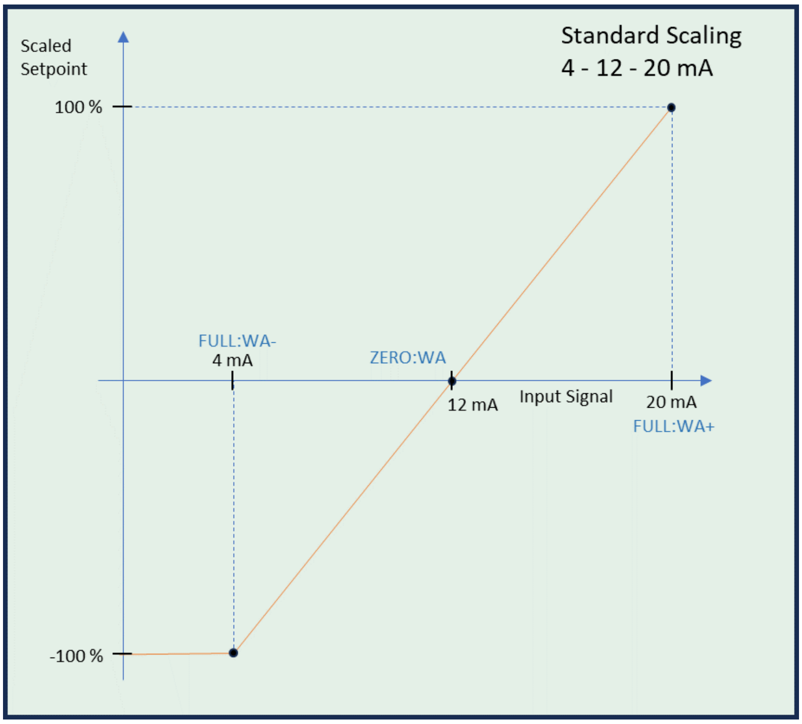
As with voltage signal scaling, all options for characteristic curve inversion, restricted signal ranges and asymmetrical scaling are available by making the appropriate settings.

Standard case when the input signal range of 4-12-20 mA is fully utilised. These parameters correspond to the factory setting:

ZERO:WA = 12 mA

FULL:WA+ = 20 mA

FULL:WA- = 4 mA



6.4 Notes