WEST

Technical Documentation

MOT-114-P

Power amplifier with motor potentiometer function

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1 General Information

1.1 Order number

MOT-114-P - Power amplifier with up to 2.6 A and motor potentiometer function

1.2 Scope of supply

The scope of supply includes the module plus the terminal blocks which are part of the housing.
The Profibus plug, interface cables and further parts which may be required should 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)

Any standard cable with USB-A and USB-B connector can be used as the programming cable.

1.4 Symbols used

General information

Safety-related information

1.5 Legal notice

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Date: 07.01.2025

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.
- To ensure adequate cooling the ventilation slots must not be covered.
- The device must be disposed of in accordance with national statutory provisions.

2 Characteristics

This module is used for the control of proportional valves with one or two solenoids. Various parameters allow an optimized matching with the concerned valve. The dynamic integrated power amplifier with a control/cycle time of 0,125 ms is inexpensive and a space-saving solution.

The amplifier is controlled via switching inputs. Relating to them there are demand values which will be activated over a relating ramp function and can be parameterized freely. Optional a previously saved command value can be activated directly after switching on and activating the device.

The output current is closed loop controlled and therefore independent from supply voltage and solenoid resistance. The current output is observed with regard to cable breakdown and over current (short circuit).

By the free parameterization of the power stage all typical proportional valves of the different manufactures can be optimal adapted.

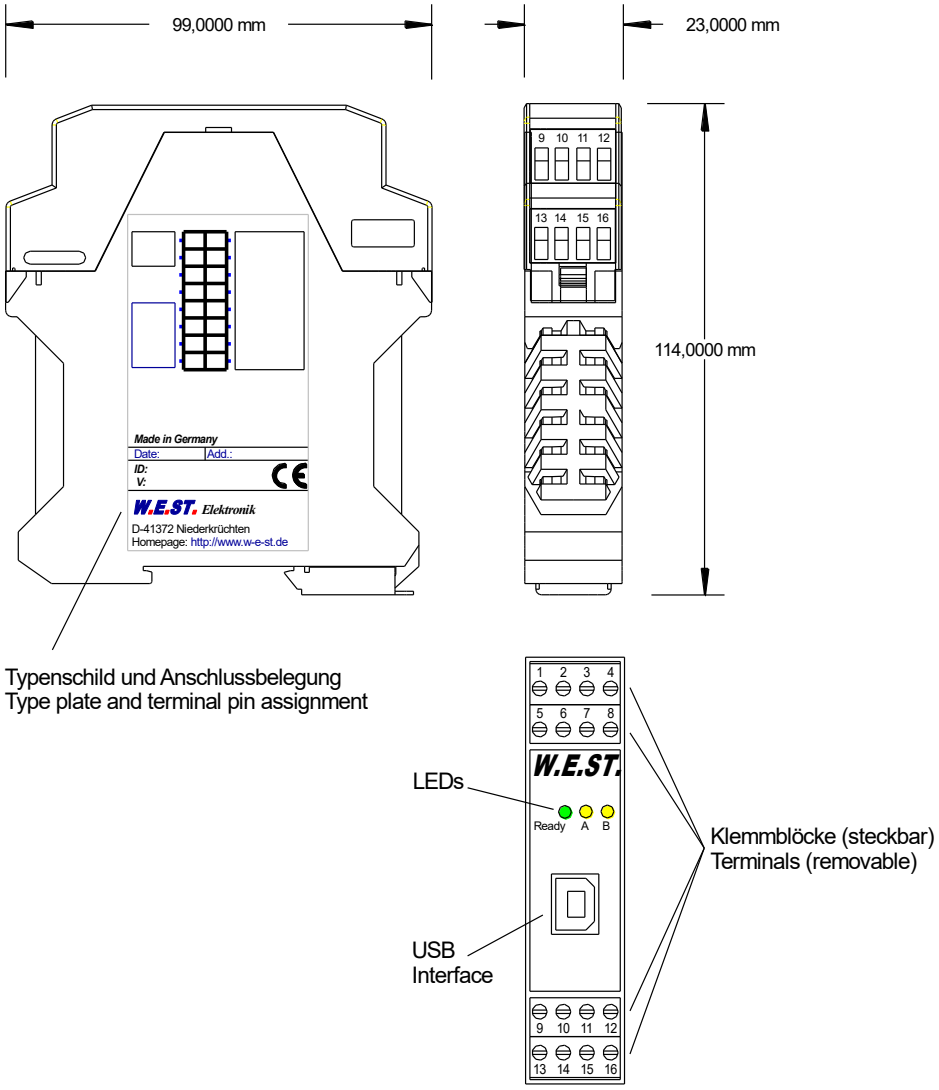
Because of the easy handling a very short training period is guaranteed.

Typical applications: General pressure control with pressure valves (direct or via a servo pump).

Features

- **Motor potentiometer function**
- **Compact housing**
- **Digital reproducible adjustments**
- **Characteristic linearization via 10 XY-points per direction**
- **Controlling valves with one or two solenoids**
- **Free parameterization of ramps, MIN and MAX, DITHER (frequency and amplitude) and PWM frequency**
- **Nominal output current up to 2.6 A**
- **Adaptable to all standard proportional valves**
- **Application orientated parameter settings**
- **Fault diagnosis and extended function checking**
- **Simplified parameterization with WPC-300 software**

2.1 Device description



3 Use and application

3.1 Installation instructions

- This module is designed for installation in a shielded EMC housing (control cabinet). All cables which lead outside must be screened; complete screening is required. It is also necessary to avoid strong electro-magnetic interference sources being installed nearby when using our open and closed loop control modules.

- **Typical installation location:** 24 V control signal area (close to PLC)
  The devices must be arranged in the control cabinet so that the power section and the signal section are separate from each other.
  Experience shows that the installation place close to the PLC (24 V area) is most suitable. All digital and analogue inputs and outputs are fitted with filters and surge absorbers in the device.

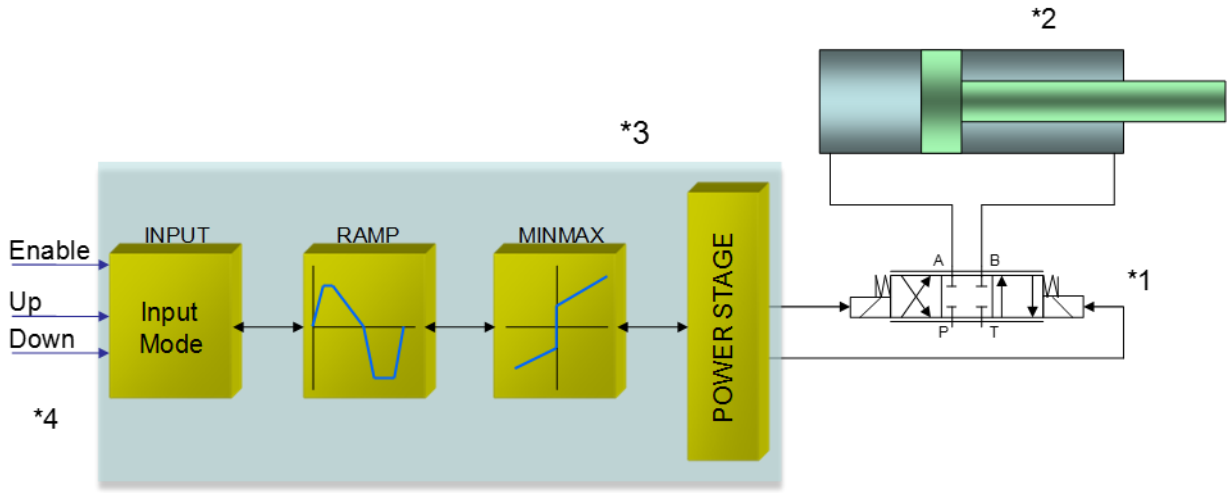
- The module should be installed and wired in accordance with the documentation bearing in mind EMC principles. If other consumers are operated with the same power supply, a star-shaped ground wiring scheme is recommended. The following points must be observed when wiring:
  - The signal cables must be laid separately from power cables.
  - Analogue signal cables **must be screened**.
  - All other cables must be screened if there are powerful interference sources (frequency converters, power contactors) and cable lengths > 3 m. Inexpensive SMD ferrites can be used with high-frequency radiation.
  - The screening should be connected to PE (PE terminal) as close to the module as possible. The local requirements for screening must be taken into account in all cases. The screening should be connected to at both ends. Equipotential bonding must be provided where there are differences between the connected electrical components.
  - If having longer lengths of cable (> 10 m), the diameters and screening measures should be checked by specialists (e. g. for possible interference, noise sources and voltage drop). Special care is required if using cables of over 40 m in length, and if necessary the manufacturer should be consulted if necessary.

- A low-resistance connection between PE and the mounting rail should be provided. Transient interference is transmitted from the module directly to the mounting rail and from there to the local earth.
- Power should be supplied by a regulated power supply unit (typically a PELV system complying with IEC364-4-4, secure low voltage). The low internal resistance of regulated power supplies gives better interference voltage dissipation, which improves the signal quality of high-resolution sensors in particular. Switched inductances (relays and valve coils) which are connected to the same power supply must always be provided with appropriate overvoltage protection directly at the coil.

3.2 Typical system structure

This minimal system consists of the following components:

(*1) Proportional valve
(*2) Hydraulic drive
(*3) Power amplifier MOT-114-P
(*4) Interface to PLC



3.3 Method of operation

This power amplifier is driven with digital switching inputs. By them preset demand values are selected which will be approached via a ramp function while the relating input is high. If the signal gets removed, the actual command value is frozen until one of the inputs gets high again. Optional the last frozen command value can be stored automatically and will be approached again after restarting the application. Alternatively another digital input allows outputting a fix value independent from the motor potentiometer function. Only one of these digital inputs can be active at the same time. New command is possible after disabling all three inputs. The ENABLE signal (typical 24 V) activates the functionality and reports this at a READY output if no error occurs.

In case of malfunction the power stage gets deactivated and the error is reported by a deactivated READY output and a flashing READY LED.

The output is current controlled whereby a high accuracy and a good dynamic is obtained.

Example:

Typical application is for example a manual pressure control. The pressure value can be increased or decreased by using the switching inputs. After restart of the system the pressure value can be reactivated over the ramp function. Variations of the pressure value, caused for example by temperature, are easy to compensate by the switching inputs.

3.4 Commissioning

Step	Task
Installation	Install the device in accordance with the circuit diagram. Ensure it is wired correctly and that the signals are well shielded. The device must be installed in a protective housing (control cabinet or similar).
Switching on for the first time	Ensure that no unwanted movement is possible in the drive (e. g. switch off the hydraulics). Connect an ammeter and check the current consumed by the device. If it is higher than specified, there is an error in the wiring. Switch the device off immediately and check the wiring.
Setting up communication	Once the power input is correct the PC (notebook) should be connected to the serial interface. Please see the WPC-300 program documentation for how to set up communication. Further commissioning and diagnosis are supported by the operating software.
Pre-parameterization	Parameterize now (with the help of the system redundancy and the connection diagram) the following parameters: The COMMAND VALUES for the digital inputs. The output CURRENT and the typical valve parameter DITHER and MIN/MAX. Pre-parameterization is necessary to minimize the risk of an unintentional movement / pressure.
Control signal	Check the control signal (output signal). The control signal (solenoid current) lies in the range of 0... 2,6 A. In the current state it should show around 0 A.
Switching on the hydraulics	The hydraulics can now be switched on. The module is not yet generating a signal. Drives should be at a standstill or drift slightly (leave its position at a slow speed).
Activating ENABLE	**CAUTION!** The power stage gets activated. The controller can now be driven by the digital inputs.
Controller optimization	Now optimize the settings depending on the application.

4 Technical description

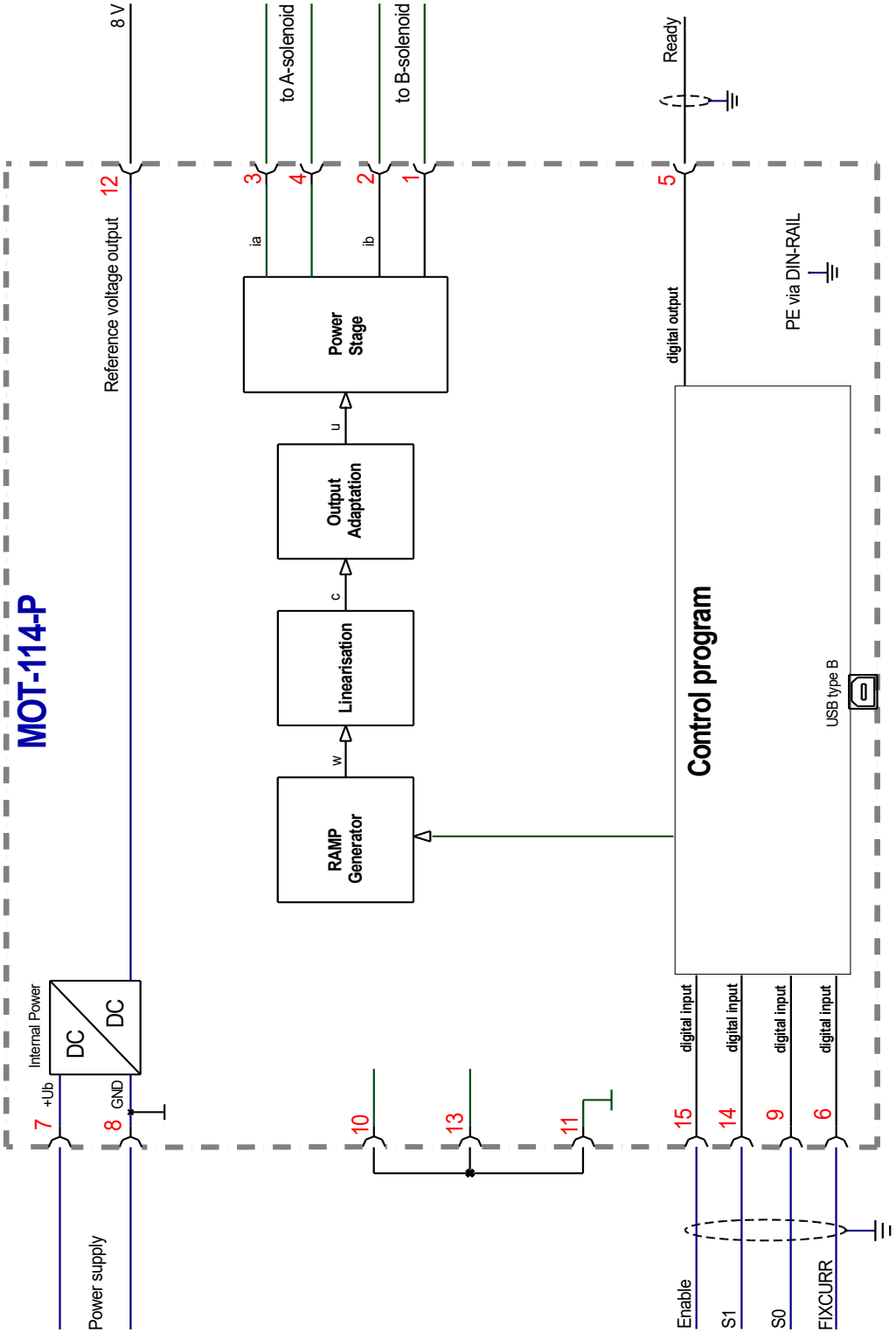
4.1 Input and output signals

Connection	Supply
PIN 7	Power supply (see technical data)
PIN 8	0 V (GND) connection.
Connection	**Analogue signals**
PIN 10 / 13	Reference potential for the digital inputs, have to be connected to PIN 11.
PIN 11	0 V (GND) potential for input signals
PIN 12	8V reference voltage output
Connection	**Solenoids**
PIN 2 / 1	PWM output solenoid B
PIN 3 / 4	PWM output solenoid A
Connection	**Digital inputs and outputs**
PIN 15	**ENABLE input:** Generally enabling of the application. Erases error messages, activates the power stage and the READY signal.
PIN 14	**S1 input:** Preset value for S:1 will be activated as demand value (wa).
PIN 9	**S0 input:** Preset value for S:0 will be activated as demand value (wa).
PIN 6	**FIXCURR input:** Preset value for FIXCURR will be activated as demand value (wa).
PIN 5	**READY output (special function possible with PIN:5):** **ON:** The module is enabled; there are no discernable errors. **OFF:** ENABLE is not available or an error has been detected.

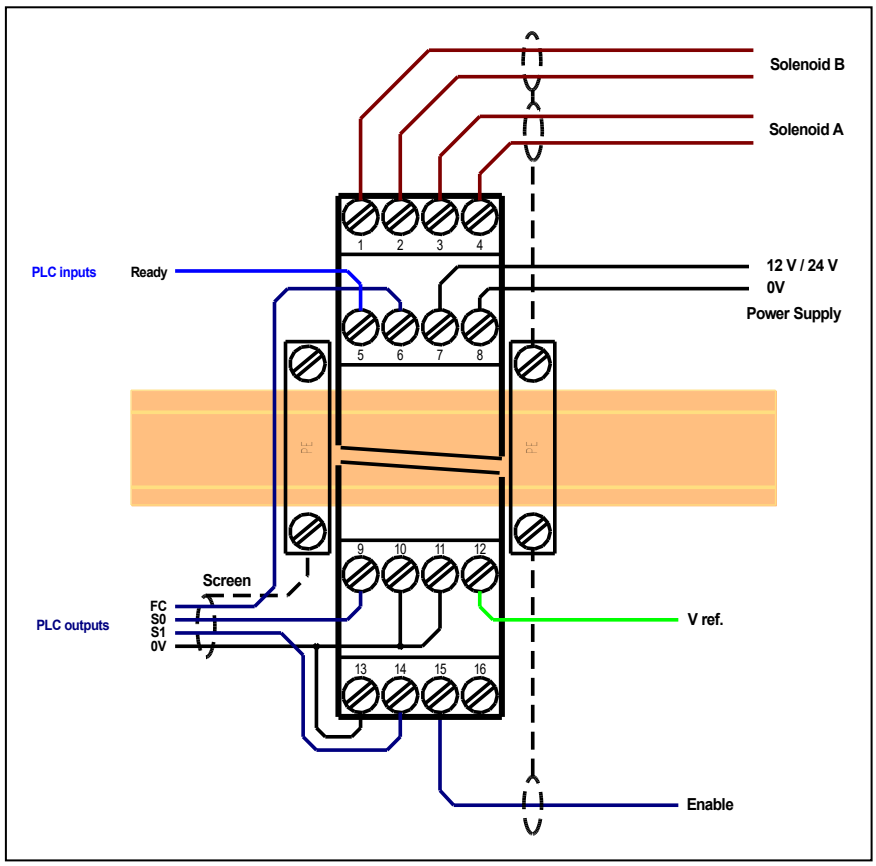
4.2 LED definitions

LEDs	Description of the LED function
GREEN	Identical to the READY output. **OFF:** No power supply or ENABLE is not activated **ON:** System is ready for operation ***Flashing:*** Error discovered
YELLOW A OR B	Intensity proportional to the solenoid current
GREEN + YELLOW A	1. **Chasing light (over all LEDs):** The bootloader is active. No normal functions are possible. 2. **All LEDs flash shortly every 6 s:** An internal data error was detected and corrected automatically! The module still works regularly. To acknowledge the error the module has to be cycle powered.
YELLOW A + YELLOW B	**Both yellow LEDs flash oppositely every 1 s:** The non-volatile stored parameters are inconsistent! To acknowledge the error, data has to be saved with the SAVE command or the corresponding button in the WPC.

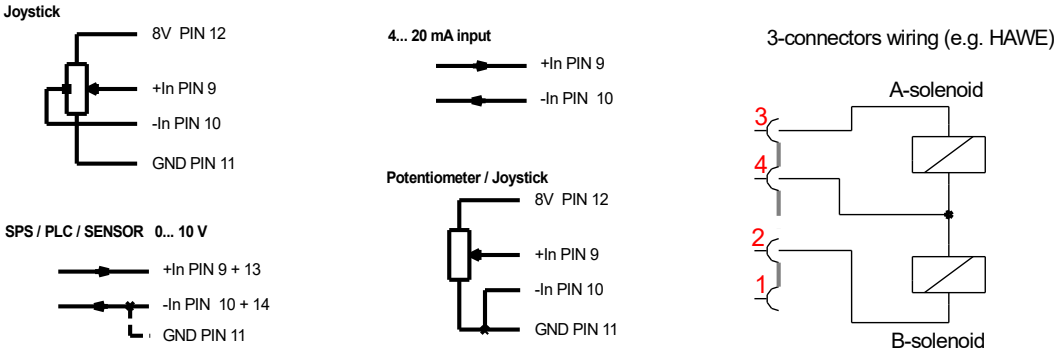
4.3 Circuit diagram



4.4 Typical wiring



4.5 Connection examples



4.6 Technical data

Power supply (U_b) Power consumption max. External fuse	**[VDC]** **[mA]** **[A]**	12… 30 (incl. ripple) 30 + solenoid current 3 medium time lag
Reference output Voltage Maximum load	 **[V]** **[mA]**	 8 25
Digital inputs OFF ON Input resistance	 **[V]** **[V]** **[kOhm]**	 < 2 > 10 25
Digital outputs OFF ON Maximum output current	 **[V]** **[V]** **[mA]**	 < 2 max. U_b 50
PWM power outputs Maximum output current Frequency	 **[A]** **[Hz]**	broken wire and short circuit monitored 2.6 61… 2604 selectable in steps
Sample times Current controller Digital inputs	 **[µs]** **[ms]**	 125 10
Serial interface	**-** **[kBaud]**	USB - virtual COM Port 9,6… 115,2
Housing Material Flammability	 **-** **[class]**	Snap-on module to EN 50022 PA 6.6 polyamide V0 (UL94)
Weight	**[kg]**	0,13
Protection class Temperature range Storage temperature Humidity Vibrations	 **[°C]** **[°C]** **[%]** **-**	IP20 -20… 60 -20… 70 < 95 (non-condensing) IEC 60068-2-6 (Category C)
Connections Communication Plugs PE	**-**	 USB type B 4-pole terminal blocks PE: via the DIN mounting rail
EMC		EN 61000-6-2: 8/2005 EN 61000-6-4: 6/2007 ; A1:2011

5 Parameters

5.1 Parameter overview

Group	Command	Default	Unit	Description
Basic parameters				
	LG	EN	-	Changing language help texts
	MODE	STD	-	Parameter view
	ASTOREW	OFF	-	Automatic storing of the command value for restart
	RA:OFF	100	ms	Switching off ramp time
	PIN:5	RDY	-	Function of PIN:5
	SENS	ON	-	Malfunction monitor
Pretending command value				
Motor potentiometer function				
	S:0	0	0.01 %	Demand value for input S0
	S:1	10000	0.01 %	Demand value for input S1
	RA:S	5000	ms	Command signal ramp time
Direct control				
	FIXCURR	0	0.01 %	Demand value for input FIXCURR for directly controlling
	RA:FIX	100	ms	Command signal ramp time
Output signal adaptation				
	SIGNAL:U	1S+	-	Type and polarity of the output signal
Characteristics linearization				
	CCMODE	OFF	0.01 %	Activation and deactivation of the characteristic linearization
	CC:-10…+10	X Y	-	Linearization function
Valve adaption classic				
	MIN:A **MIN:B**	0 0	0.01 % 0.01 %	Deadband compensation
	MAX:A **MAX:B**	10000 10000	0.01 % 0.01 %	Output scaling
	TRIGGER	200	0.01 %	Deadband compensation trigger point
Parameters of the power stage				
	CURRENT	1000	mA	Rated solenoid current
	DFREQ	121	Hz	Dither frequency
	DAMPL	500	0.01 %	Dither amplitude
	PWM	2604	Hz	PWM frequency
	ACC	ON	-	Current loop auto adjustment
	PPWM **IPWM**	7 40	- -	P-Gain of the current loop I-Gain of the current loop

5.2 Basic parameters

5.2.1 LG (Changing the language)

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

Either German or English can be selected for the help texts.

CAUTION: After changing the language settings, the ID button in the menu bar (WPC-300) must be pressed (module identification).

5.2.2 MODE (Parameter view)

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

This command changes the operating mode. Various commands (defined via STD/EXP) are blanked out in Standard Mode. The commands in Expert Mode have a more significant influence on system behavior and should accordingly be changed with care.

5.2.3 ASTOREW (Automatic command value storing)

Command	Parameters	Unit	Group
ASTOREW x	x= ON|OFF	-	**STD**

If this parameter is ON, the actual command value will be stored in the EEPROM when the active digital input is switched off. After restarting the system the stored value will be activated over the ramp function when the enable signal gets activated.

Attention: if a long ramp time was preset it is possible that the related input is deactivated before the output has reached the chosen demand value. In this case the actual reached control value is stored, not the preset value for the switching input.

5.2.4 RA:OFF (Switching off ramp time)

Command	Parameter	Unit	Group
RA:OFF X	x= 1… 600000	ms	**EXP**

Ramp time for decreasing the solenoid current when Enable was deactivated. The preset time always relates to 100% signal range.

5.2.5 PIN:5 (Function of the digital output)

Command	Parameter	Unit	Group
PIN:5 X	x= RDY|ACT	-	**EXP**

This command defines the function of the digital output at PIN5. Alternatively to our standard READY signal the output may stays controlled while the switching off ramp function is active.

5.2.6 SENS (Malfunction monitor)

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

This command is used to activate/deactivate the monitoring functions (output current and internal failures) of the module.

ON: All monitoring functions are active. Detected failures are reset by deactivating the ENABLE input.

OFF: No monitoring function is active.

AUTO: Auto reset mode. All monitoring functions are active. If the failure doesn't exist anymore, the module automatically resumes to work.

Normally the monitoring functions are always active because otherwise no errors are detectable via the READY output. Deactivating is possible mainly for troubleshooting.

5.3 Pretending command value

5.3.1 S (Demand value)

Command	Parameters	Unit	Group
S:I X	i= 0|1 x= -10000… 10000	- 0.01 %	**STD**

With these two parameters the demand values for the switching inputs S0 and S1 are preset.

5.3.2 RA:S (Command signal ramp time)

Command	Parameter	Unit	Group
RA:S X	x= 1… 600000	ms	**STD**

Ramp function for taking over the pre-set demand values when getting activated. This time always relates to a signal change of 100%.

5.3.3 FIXCURR (Fix output current)

Command	Parameter	Unit	Group
FIXCURR X	x= -10000… 10000	0.01 %	**EXP**

This command defines a fix output current which can be activated by the relating digital input. The value refers to the parameterized nominal CURRENT.

This direct control is independent from the motorpotentiometer function and will be taken over as command value via it's own ramp function and given to the power stage when the digital input gets activated.

5.3.4 RA:FIX (Command signal ramp time)

Command	Parameter	Unit	Group
RA:FIX X	x= 1… 600000	ms	**EXP**

Ramp function for taking over the pre-set FIXCURR value when getting activated. This value always relates to a signal change of 100%.

5.4 Output signal adaptation

5.4.1 SIGNAL:U (Output polarity)

Command	Parameter	Unit	Group
SIGNAL:U X	x= 1S+|1S-|2S+|2S-	-	**STD**

This command is used to define the type of output signal and its polarity.

Selectable are one solenoid or two solenoid control. Furthermore the direction of the output signal can be switched. Using applications with one solenoid it means an inverted characteristic curve. If two solenoids are used it effects the switching of the solenoids.

- 1S+: One solenoid standard
  - C = 0… 100% -> U = 0… 100%
- 1S-: One solenoid inverted
  - C = 0… 100% -> U = 100… 0%
- 2S+: Two solenoids standard
  - C > 0 -> Controlling IA
  - C < 0 -> Controlling IB
- 2S-: Two solenoids switched
  - C > 0 -> Controlling IB
  - C < 0 -> Controlling IA

5.4.2 CCMODE (Characteristics linearization)

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

This command activates the characteristic linearization function. Deactivating immediately allows an easy and fast evaluation of the linearization.

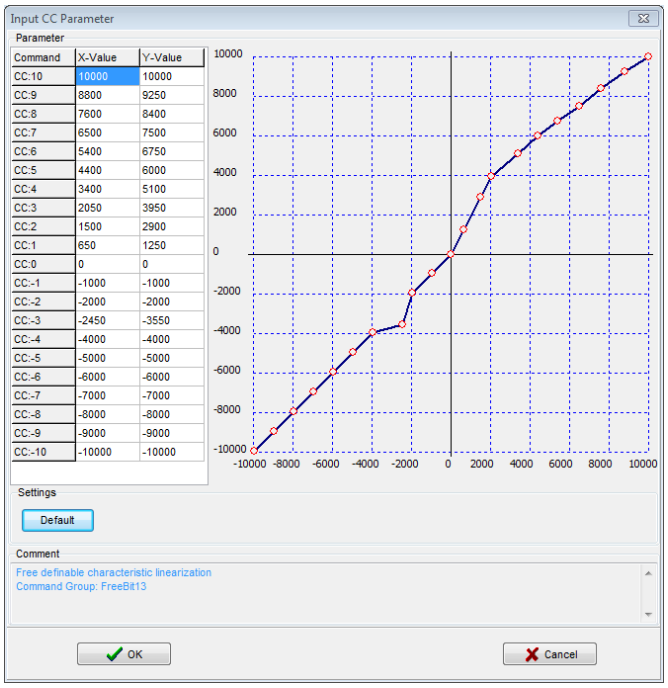
5.4.3 CC (Linearization function)

Command	Parameter	Unit	Group
CC:I X Y x	i= -10… 10 x= -10000… 10000 y= -10000… 10000	- 0,01 % 0,01 %	**CCMODE**

A user significant signal characteristic can be defined 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 illustration 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 characteristic 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.

CAUTION: The MIN/MAX settings are still active. For getting reproducible results these settings should be done not twice (set MIN/MAX to default if CC is used).

5.4.4 MIN (Deadband compensation)

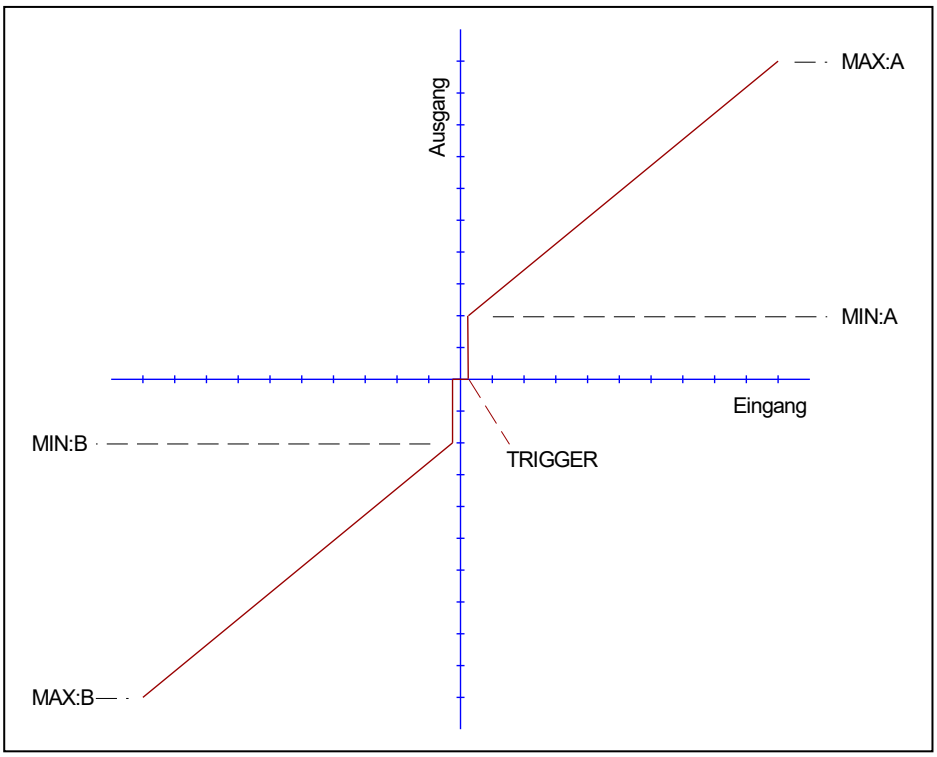
5.4.5 MAX (Output scaling)

5.4.6 TRIGGER (Response threshold for the MIN parameter)

Command		Parameters	Unit	Group
		i= A|B		**STD**
MIN:I	X	x= 0… 6000	0.01 %	
MAX:I	X	x= 3000… 10000	0.01 %	
TRIGGER	X	x= 0… 3000	0.01 %	

With this command, the output signal is adjusted to the valve characteristics. 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[1] can be specified.

CAUTION: If the MIN value is set too high, it influences the minimal pressure, which cannot be adjusted any longer. In extreme case this causes to an oscillating at small input values.



[1] 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).

5.5 Power stage

5.5.1 CURRENT (Rated solenoid current)

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

The nominal current (for 100% opening) of the solenoid is set here. Dither and also MIN/MAX always refer to this current value.

5.5.2 DFREQ (Dither frequency)

5.5.3 DAMPL (Dither amplitude)

Command	Parameters	Unit	Group
DFREQ X	x= 60… 400	Hz	**STD**
DAMPL X	x= 0… 3000	0.01 %	

The dither[2] can be defined with this commands. Different amplitudes or frequencies may be required depending on the valve. The dither amplitude is defined in % (peak to peak value) of the nominal output current (see: CURRENT command). The dither frequency is defined in Hz. Depending on the internal calculations, the frequency is adjustable in steps only.

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

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

5.5.4 PWM (PWM Frequency)

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

The frequency can be changed in 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.*

[2] The dither is a ripple signal which is superimposed on the current set point and is defined by the amplitude and frequency: the dither frequency and the PWM frequency. The dither frequency should not be confused with the PWM frequency. In some documentations the PWM frequency is described as a dither. This can be recognized by the lack of the dither amplitude.

5.5.5 ACC (Current loop auto adjustment)

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.

5.5.6 PPWM (P gain of the current loop)

5.5.7 IPWM (I gain of the current loop)

Command	Parameters	Unit	Group
PPWM X	x= 0… 30	-	**EXP**
IPWM X	x= 1… 100	-	

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

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

5.6 PROCESS DATA (Monitoring)

Command	Description	Unit
WA	Chosen demand value	%
W	Actual command value after ramp function	%
C	Control signal after CC command	%
U	Output signal to the valve	%
IA	Solenoid current A	mA
IB	Solenoid current B	mA

The process data are the variables which can be observed continuously on the monitor or on the oscilloscope.

6 Appendix

6.1 Failure monitoring

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

Source	Fault	Characteristic
Solenoid A on PIN 3-4	Wrong cabling, broken wire	The power stage and the READY output will be deactivated.
Solenoid A on PIN 3-4	Wrong cabling, broken wire	The power stage and the READY output will be deactivated.
EEPROM (when switching on)	Data error	The power stage and the READY output will be deactivated. Module can be activated by saving the parameters.

6.2 Troubleshooting

It is assumed that the device is in an operable state and there is communication between the module and the WPC-300. Furthermore, the valve control parameterization has been set with the assistance of the valve data sheets.
The RC in monitor mode can be used to analyze faults.

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

FAULT	CAUSE / SOLUTION
ENABLE is active, the module does not respond, and the READY LED is off.	There is presumably no power supply or the ENABLE signal is not present. Other errors are displayed via the READY LED. If there is no power supply, there is also no communication via our operating program. If a connection has been made, then a power supply is also available. In this case in monitor window the ENABLE input can be checked.
ENABLE is active, the READY LED is flashing.	The flashing READY LED signals that a fault has been detected by the module. The fault could be: • A broken cable or no signal at the input (PIN 13 or PIN 14), if 4… 20 mA signals are parameterized. • A broken cable or incorrect cabling to the solenoids. • Internal data error: press the command/SAVE button to delete the data error. The system reloads the DEFAULT data. With the operating program the fault can be localized directly via the monitor.

FAULT	CAUSE / SOLUTION
ENABLE is active; the READY LED is active; no current to the solenoid.	• No command value is available or the parameterization is incorrect. With the WPC-tool you can check if a command value is available. If not, you should check the wiring and/or the command set-point (in the PLC for example). • If the command input is correct, you have to check the valve control parameter. If the current is set too low, the output current and the expected pressure are too low. • The pressure valve is controlled correctly (the output is going up to the nominal current). In this case you may have a hydraulic problem or you are using free-wheeling-diodes in the solenoid plug. Please remove the free-wheeling-diodes to allow a correct current measurement.
ENABLE is active, the READY LED is active and the pressure is instable.	In many cases you may have a hydraulic problem. Electrical problems may be: • Electrical noise at the wire of the power supply. • Very long solenoid wiring (> 40 m), disturbance in the current control loop[3]. • Instable current control loop. The adjustments of the PWM-frequency and the dither (frequency and amplitude) have to be checked carefully. Good experiences are made with: a. PWM-frequency = 2600 Hz (higher frequency), the dither has to be aligned to the valve (amplitude and frequency). b. PWM-frequency = 100… 400 Hz (lower frequency), the dither amplitude is set to 0 % (disabled)[4].

6.3 Description of the command structure

The command structure:

[nnnn:i x] or
[nnnn x]

Meaning:

nnnn - used for an arbitrary command name
nnnn: - used for an arbitrary command name, expandable by an index.
Indexed commands are indicated by the sign ":"
i oder **I** - is a dummy for the index. E. g. an index can be „A" or „B", depending on the direction.
x - parameter value, in case of special commands more than one parameter are possible.

Examples:

MIN:A 2000 nnnn = "MIN", i = "A" and x = "2000"

OFFSET 50 nnnn = „OFFSET" and x = „50"

C:IC 2000 nnnn = "C", i = "IC" and x = "2000"

[3] Maybe you have to adjust / optimize the solenoid control loop (P and I).

[4] In most applications (particularly pressure-actuated pumps) with pressure valves a lower PWM-frequency is the better solution.

7 Notes