hejm automation

Parameter, Instructions for device series DR322 when used as a syncro controller.

Hardware version DR300_02

Software version DR300_06

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1. Introdution

The device series DR312, DR322 can operate in various applications. Parameter P06 is used to adjust the device to the application.

Different parameter lists are shown then.

When the device is used as a syncro controller, this parameter has to be set in a range between 12 to 14.

2. Comissioning

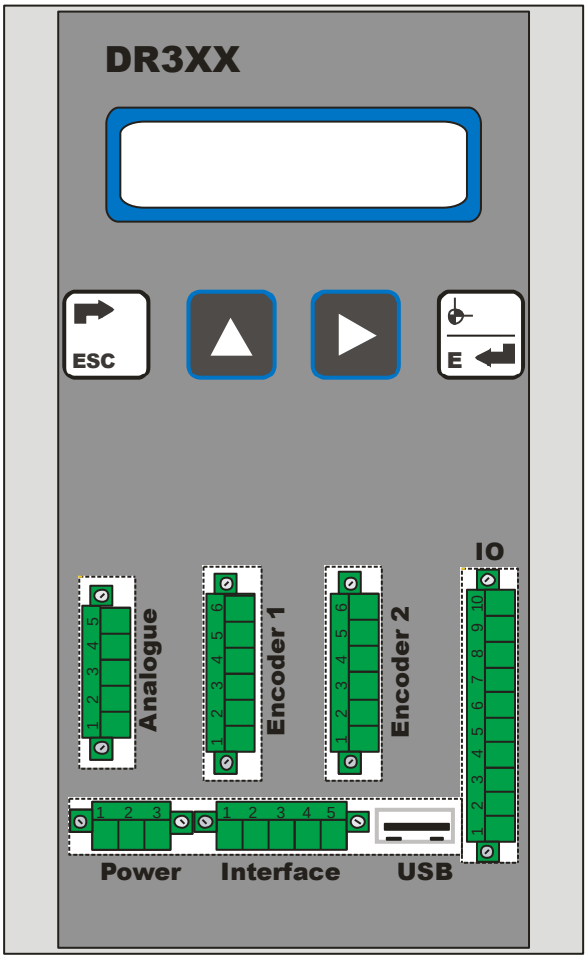


Abb. 1 Connection located on the front panel

CON1	Power supply for electronic 24V DC (Power)
	Terminal strip 3 pin
Pin 1	GND, 0V
Pin 2	+24V DC, +/- 10%
Pin 3	NC, not connected

CON2	Analogue inputs (Analogue)
	Terminal strip 5 pin
Pin 1	GND
Pin 2	0 – 10V, or +/- 10V input for optional application
Pin 3	0 – 10V, or +/- 10V input for optional application
Pin 4	0 – 20mA, or 4 – 20mA input for optional application
Pin 5	0 – 20mA, or 4 – 20mA input for optional application

CON3	Measuring system motor 1 (Encoder 1)
	Terminal strip 6 pin
Pin1	GND for measuring system supply
Pin 2	+24V for measuring system supply max. 120 mA.
Pin 3	Signal A
Pin 4	Signal B
Pin 5	Signal Z
Pin 6	GND, for shield

When brushless DC motors are connected, the rotor position signals can be used as a measuring system too.

In this case Con 3 will not be used.

CON4	Measuring system motor 2 (Encoder 2)
	Terminal strip 6 pin
Pin1	GND for measuring system supply
Pin 2	+24V for measuring system supply max. 120 mA.
Pin 3	Signal A
Pin 4	Signal B
Pin 5	Signal Z
Pin 6	GND, for shield

When brushless DC motors are connected, the rotor position signals can be used as a measuring system too.

In this case Con 4 will not be used.

CON5	Inputs, Outputs
	Terminal strip 10 pin
Pin1	GND
Pin 2	+24V supply for external switches, sensors max. 100 mA.
Pin 3	Start positive direction
Pin 4	Start negative direction
Pin 5	Limit switch minus motor 2
Pin 6	Limit switch plus motor 2
Pin 7	Limit switch minus motor 1
Pin 8	Limit switch plus motor 1
Pin 9	Output 1, reserved for future use
Pin 10	Output 2, reserved for future use

For security reasons both motors are stopped, when a limit switch gets active and the device is used as a synchro controller.

CON6	Interface(Interface)
	Terminal strip 5 pin
Pin 1	Can L
Pin 2	RS232 RxD
Pin 3	RS232 TxD
Pin 4	Can H
Pin 5	GND

CON7	USB update connector (USB)
	USB connector

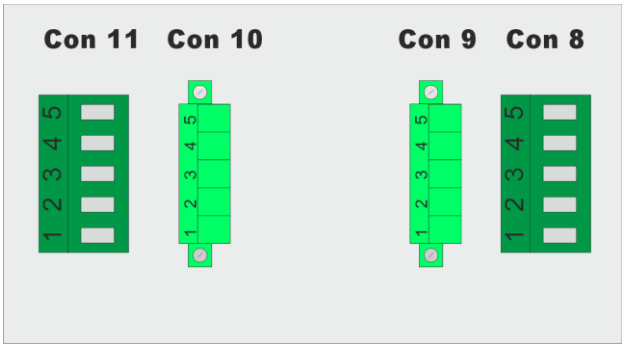


Abb. 2 Wiring diagram bottom plate

CON8	**Motor connector for DC motor 1**
	Terminal strip 5 pin (Master motor in synchron mode)
Pin1	GND, input for motor supply
Pin 2	+24V - + 48V DC input for motor supply
Pin 3	Motor phase T
Pin 4	Motor phase S
Pin 5	Motor phase R, not connected when brushed motors are used

CON9	**Rotor position encoder for DC motor 1**
	Terminal strip 5 pin
Pin1	GND, for rotor position encoder supply
Pin 2	+12V for rotor position encoder supply ,(5V supply possible via internal jumper)
Pin 3	Hall sensor C (Motor phase T) Connect this to GND when brushed motors are used.
Pin 4	Hall sensor B (Motor phase S)
Pin 5	Hall sensor A (Motor phase R)

CON10	Motor connector for DC motor 2
	Terminal strip 5 pin (Master motor in synchron mode)
Pin1	GND, input for motor supply
Pin 2	+24V - + 48V DC input for motor supply
Pin 3	Motor phase T
Pin 4	Motor phase S
Pin 5	Motor phase R, not connected when brushed motors are used
	Terminal strip 5 pin (Slave motor in synchron mode)

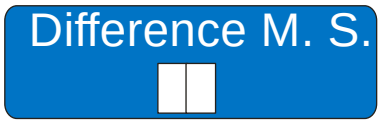
CON11	Rotor position encoder for DC motor 2
	Terminal strip 5 pin
Pin1	GND, for rotor position encoder supply
Pin 2	+12V for rotor position encoder supply ,(5V supply possible via internal jumper)
Pin 3	Hall sensor C (Motor phase T) Connect this to GND when brushed motors are used.
Pin 4	Hall sensor B (Motor phase S)
Pin 5	Hall sensor A (Motor phase R)

3. Display

The first information window shows the position of the master in the upper line and the slave position in the second line.

Press  will switch the information windows.

Here the difference between master and slave is shown.



The third information window shows the difference between master and slave by a moving square. When two squares are shown, the difference between master and slave is 0.

Press  to switch to the 4. Information window.

The motor current of master and slave are shown here.

4. Parameter

The device provides 8 levels .

1. Datuming Master
2. Datuming Slave
3. Parameter level All
4. Parameter level Master
5. Parameter level Slave
6. Factory level
7. Adjust level
8. Test level

To datum an axis manually follow the steps below.

When 

is pressed the device switches to the parameter selection screen.

On the screen appears

Open the datuming function by pressing 

On the screen appears

The second line shows the setting of parameter P02 in axis 1 level.

When this is the value, the axis should be datumed to 

must be pressed twice.

When 

is pressed, the datuming function is finished without any changes.

When the value appearing on the screen should be changed press

once. A blinking cursor is shown on the last decade.

Use  to move the cursor to the right position,

And afterwards use  to change the digit. When the blinking cursor is set to the highest digit, the sign can be changed too.

When  is pressed, the actual value of the axis is set to the displayed value..

After 

is pressed the device switches back to operational mode.

When changing a parameter follow the steps below .

When 

is pressed the device switches to the parameter selection screen.

It appears

Select other parameter levels using the  key.

Open a parameter level by pressing 

.

The upper line shows the active parameter level and the second line the parameter number and value.

Change to the next parameter by pressing  ,

select the last parameter with the  key.

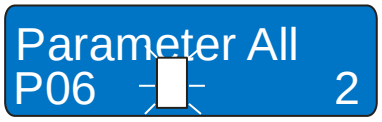
After  was pressed a few times P06 will appear on the screen for example

To change the value 

must be pressed. A blinking cursor is shown on the last decade.

Press  to increment the decade.

Change the position of the blinking cursor by pressing  ,



And change the value of the decade using  . When the blinking cursor is set to the highest digit, the sign can be changed too.

Store the parameter to RAM by pressing  and the next parameter is shown automatically .

When the changed value is out of its limits the minimal or maximal value is shown.

5. Parameter list

The parameters shown in the following are all performed according to the sample

- Parameter number Name [unit, minimum/maximum value) Parameter description.

Parameters with index ro can only be read

Parameters in which P05 is entered as the unit refer to the unit specified in parameter P05 (master or slave level).

Parameters which are filled with index ro can only be read.

Parameter level All

P02 *Software version [ro/------,-------]*

Actual software version of the device.

P03 *Language [Language/0,1]*

Setting	Language
0	German
1	English

Parameter level All

P06 *Device functionality [Function/1,15]*

Setting	Function
1	The device is used as a one axis speed controller. Analogue input 1 will set the variable speed.
2	The device is used as a two axis speed controller. Analogue input 1 and 2 will set the variable speed.
3	The device is used as a one axis speed governer. Analogue input 1 will set the variable speed.
4	The device is used as a two axis speed governer. Analogue input 1 and 2 will set the variable speed.
5 - 8	Reserved for further expansions.
9	The device is used as a one axis positioning module. The demand value and commands are sent by one of the available interfaces.
10	The device is used as a two axis positioning module. The demand values and commands are sent by one of the available interfaces.
11	Reserved for further expansions.
12	The device is used as a synchronization module. The motors are started by activating the forward or backward input. The motor will run to the positive or negative software limit, while the input is active. Axis 2 will follow axis 1 synchron or in the adjusted ratio.
13	The device is used as a synchronization module. The demand value, start and stop commands are sent via the available interfaces. Axis 2 will follow axis 1 synchron or in the adjusted ratio.

14	The device is used as a synchronization module. The variable speed is selected by the analogue input one and the axis is started by the controller release input one. Axis 2 will follow axis 1 synchron or in the adjusted ratio. Axis 2 can also be synchronized to an external motor. For this the analogue input must be disconnected and the measuring input of the master must be connected to the encoder input axis one. Axis two will follow the digital signal of encoder 1.

P08 *Customer number for special devices [ro/------,-------]*

P10 *Reserved for further use [ro/------,-------]*

P21 *Security code for parameter level [6 decade number/ 0, 999999]*

The parameters may be protected against unintended changes by using a security code.

Data can only be entered in the parameter level All, Axis 1 and Axis2 after entering this code.

P22 *Security code for datuming level [6 decade number/ 0, 999999]*

Datuming may be protected against unitended changes by using a security code.

Datuming can only be done after entering this code.

Parameter level All:

P70 Switching input logic 1 [binary code/ 0,255]

In engineering both normally open and normally closed devices are used as electrical switches.

In order to adapt the device quickly to suit any hardware, the

switching behavior of the inputs can be determined using this parameter.

The input is connected with a NO contact by pressing 0, and it is

connected with a NC contact by pressing 1.

6 inputs are available using the device as a position controller

Up to 64 various combinations are possible with these 6 inputs.

The following table gives a more detailed description of the procedure.

Parameter level All:

The following table gives a more detailed description of the procedure.

Input	0	1	2	3	4	5	6	7
NC/NO	NO	NO	NC	NC/NO	NC/NO	NO	NC/NO	NC/NO
Binary value	0	0	1	1/0	1/0	0	1/0	1/0
Decimal value	1	2	4	8	16	32	64	128

S = NO(Binary value 0)

Ö = NC(Binary value 1)

The following inputs are used in this software:

Input 0 = Reference cam motor 1 – BCD Code 1

Input 1 = Referece cam motor 2 – BCD Code 2

Input 2 = Limit switch motor 2 negative – BCD Code 4

Input 3 = Limit switch motor 2 positive – BCD Code 8

Input 4 = Limit switch motor 1 negative – BCD Code 16

Input 5 = Limit switch motor 1 positive – BCD Code 32

Parameter level All:

To calculate parameter value to be entered, determine if input 1 to 8 is needed as NO or NC. Then multiply the binary value with the decimal value for each input and add up the results of each input.

Example: Input 0, 1, 3, 4 = NO.

Input	NC / NO	Binary	Decimal	Binary x Decimal	
0	NO	0	128	0	+
1	NO	0	64	0	+
2	NC	1	32	32	+
3	NO	0	16	0	+
4	NO	0	8	0	+
5	NC	1	4	4	=
			Total	36	

Enter “356” in parameter All/P70 to get required input configuration

Parameter level All:

P74 *Switching output logic [binary code/ 0,3]*

The device hast wo optional switching outputs. The switching logic can be set in this parameter.

Setting	Function
0	Both outputs switch to high level when activated.
1	Input 1 is switched to tristate and Input 2 is switched to high when activated.
2	Input 1 is switched to high and Input 2 is switched to tristate when activated.
3	Both outputs are switched to tristate when activated

P81 *Baud rate for serial communication [Baud/ 4800/256000]*

When the device has a serial interface the baud rate for serial communication must be set here.

Setting	Baud rate
0	4800
1	9600
2	19200
3	38400
4	56000
5	115200
6	256000

Parameter level All:

P82 *Device address for serial communication [Address/11,99]*

The following addresses are not allowed in this protocol.
All addresses smaller than 11 and addresses with whole tenner decades as 20,30,40….
These are used as group addresses.

P84 *Baudrate for Can communication [Baud/ 125kB/1MB]*

Setting	Baud rate
1	125 kBit
2	250 kBit
3	500 kBit
4	800 kBit
5	1 Mbit

P89 *Can device address [address/ 1/127]*

The can address of the device is set here.

P90-P93 *Analogue adjust values of 4 – 20 mA inputs [DAC value 0/2047]*

These parameters are reserved for customized software versions.

P94 *Analogue offset 0-10V input motor 1 [DAC value/ 0/2047]*

This parameter is a reserved for customized software versions.

P95 *Analogue offset 0-10V input motor 2 [DAC value/ 0/2047]*

This parameter is a reserved for customized software versions.

Parameter level All:

P96 *Temperature Offset [°C/ -20/+20]*

This parameter is used to compensate a temperature offset of the temperature sensor in the drive.

P97 *Shut down temperature of the drive [°C/ 0/95]*

The motor drive will be switched of, when it reaches the temperature set here to prevent it from overheating.

Parameter level Master

P02 *Datum value [P05/ -9999999,9999999]*

When an axis is datumed automatically, the actual value is set to this parameter value.
When the axis should be datumed manually this value is suggested in the display.

P03 *Software limit switch min. [P05/ -9999999, 9999999]*

The minimum input value, the device should accept as a demand value.

P04 *Software limit switch max. [P05/ -9999999, 9999999]*

The maximum input value, the device should accept as a demand value.

P05 *Distance for multiplication [any desired length unit/ 1, 10000]*

Contains any desired distance.
These two parameters are needed so that the internal counter can be set to various mechanical conditions, such as drives, spindle stroke, etc.

1. Any desired distance in the desired unit and resolution

(P05).

2. The number of increments sent by the encoder to the

unit when travelling the distance in P05. (P06).

Only if these specifications are entered in P05 and P06 with no rounding

error, will the counter operate correctly over the entire range.

Therefore the distance selected should always be one where a whole

number of pulses is sent by the encoder .

Parameter level Master

P06 *Pulse/ distance [Encoder resolution/ 1, 100000]*

Number of pulses per travel distance entered in P05 (the factor is automatically calculated from P05 and P06).

Example 1: The encoder in use sends 100 pulses to the counter over a distance of 1.00 mm. The actual value and the demand values etc. should be sent in 1/100 mm. Therefore each pulse arriving from the encoder must be accounted for. Therefore, set P05 and P06 to the same value (e.g. 1, 1 or 10,10 or 100, 100).

Example 2: The encoder in use again has a resolution of 1/100 mm. But here the actual values and demand values need to resolve to one place after the decimal point, i.e. 1/10 mm. This means that over a distance of 1 (0.1 mm) 10 pulses are sent by the encoder to the counter. Therefore set P05 to smaller than P06 by a factor of 10 (e.g. 1, 10 or 10.100 or 100, 1000).

Example 3: A machine with a spindle drive has the following key data:

Spindle rise 5.0 mm/rotary encoder with a resolution of 20 pulses

per revolution. The actual value and demand values need to resolve

down to one decimal place, i.e. 1/10 mm. This means that over a distance of 50 (5.0 mm) 20 pulses are sent by the encoder to the counter.

Therefore, set P05 to 50 and P06 to 20.

For inch settings, enter P05 in inches.

Parameter level Master

P07 *Maximum permanent motor current [x.xx Ampere/ 0.01, 20.00]*

When the motor current exceeds the current set here for more than one second the motor will be stopped and an error message appears on the display.

The measured current may differ in a range of ± 10% of the real current.

P08 *Number of automatic restarts [piece / 0, 10]*

If the actual value lies outside the demand value +/- tolerance window

when positioning has been completed, then positioning to the same

demand value will be restarted. This process is repeated until the actual

value lies within the tolerance window, but not more often than the value entered here.

P09 *Tolerance window [P05/ 0, 250]*

If the actual value is inside the demand value ± tolerance window range after positioning, then the demand value is displayed instead of the real actual value.

P10 *Drive deactivation delay time when position reached or stop*

[x.xx sec/ 0.00, 10.00]

To avoid the motor overheating unnecessarily when positioning has been completed, the drive free signal is switched off after the time period entered here.

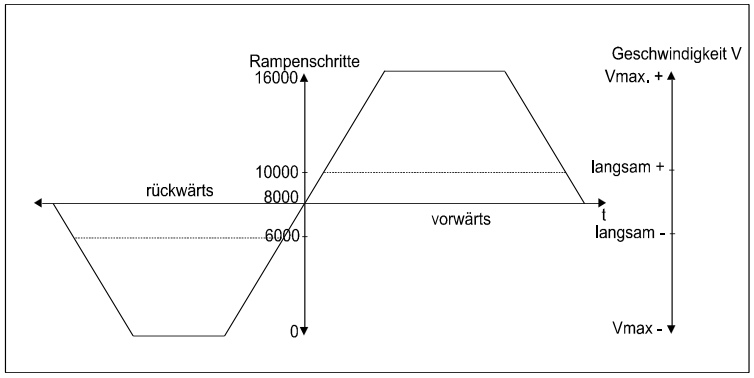
If the time selected is too short, the motor may not dwell at the target point but continue beyond it due to inertia.

Parameter level Master

P11 *Maximum ramp distance for acceleration ramp [encoder pulses / 1, 250000]*

This parameter determines the number of ramp steps the controller passes over in its complete range.

The negative and positive positioning process is presented in the following graph.



In the reverse range, the controller accelerates from standstill (ramp value 8000) to its maximum possible speed in a backwards/reverse direction (ramp value 0) remains at this speed for a certain period of time before deceleration and reaching standstill (ramp value 8000)

In the forward range, the controller accelerates from standstill (ramp value 8000) to its maximum possible speed in a forwards direction (ramp value 16000) remains at this speed for a certain period of time before deceleration and reaching standstill (ramp value 8000)

The ramp length determines how rapidly the controller should reach its maximum speed.

High values lead to long and low values lead to short ramp distances.

Parameter level Master

P12 *Maximum ramp distance for deceleration ramp*

[encoder pulses / 1, 250000] ***Custom***

See P11 for more detailed information.

This parameter is used for the deceleration ramp.

If the ramp length is too short, it can cause the target to be overshot, whereas if the ramp length is too long, it can lead to a long positioning time.

P13 *Fast speed forwards and backwards [Percent 1, 100]*

1% ... 100%: percent of the maximum speed of automatic positioning.

P14 *Manual slow speed [Percent / 1, 100]*

1% ... 100%:percent of the maximum speed of automatic positioning.

P15 *Deceleration ramp after stop command [x.xx sec/ 1, 1000]*

The time interval the motor requires to reach standstill after a stop command.

P17 *Backlash compensation time [x.xx sec/ 0, 10.00]*

The time during which the motor pauses at the loop reversal point before moving towards the target .

If P17 is set to 0 , the backlash compensation function is deactivated.

P18 *Backlash compensation distance [P05/-10000,10000]*

Exceed demand values on this distance during backlash compensation.

The backlash compensation is driven to lower demand values when in the negative range, to higher demand values when in the positive range.

Parameter level Master

P19 *Integral term1 [controller intervention all / 1, 250]*

The integral term of the regulating algorithms determines, how often the I term should intervene in the closed loop control.

1 is equivalent with the time entered in P 22, 2 is equivalent with 2 x P22 etc.

1 = Max. gain (the controller intervenes in the positioning of all in the

P22 set time field) The consequence is rapid start and sharp braking

depending on the time set.

...

250 = Min. reinforcement (the controller intervenes in the positioning of all 250 in the P22 set time field.) The consequence is slow start and gentle braking depending on the time set.

P20 *Integral term 2 [controller intervention all / 1, 250]*

See parameter P19, however only for restarting if specified in P08

P21 *Differential term for brake ramp [%/ 0, 100]*

The differential term only intervenes before the target during the declining ramp if the motor decelerates too much or comes to a standstill.

Setting = 0 deactivates the D term.

Setting = 100 sets the D term to its maximum

P22 *Feedback monitoring interval [sec/ 0.0001, 5.0000]*

Measurement period during which the internal demand values and actual values of the controller must agree before it intervenes.

Parameter level Master

P23 *Feedback acceleration ramp pulse no.[pulse/ 0, 200]*

The controller has a with superimposed closed loop control to monitor stopping.

During the period P22 the encoder must send the pulse value written in

P23 to the controller.

If this does not occur, the controller identifies this as a stop and

the superimposed control is activated.

A higher value leads to an early closed loop intervention

P24 *Feedback deceleration ramp pulse no. [pulse/ 0, 200]*

The controller has a with superimposed closed loop control to monitor stopping

During the period P22 the encoder must send the pulse value written in

P24 to the controller.

If this does not occur, the controller identities this as a stop and

the superimposed control is activated.

A higher value leads to an early closed loop intervention

P25 *Edge counting mode [Edge evaluation/ 4, 4]*

Here always 4.

P26 *Counting direction [direction/ 0, 1]*

Altering this value from 0 to 1, or vice versa, reverses the counting direction of the unit.

0 = forwards
1 = backwards

Parameter level Master

P27 *Measuring system selection[measuring system/ 0, 1]*

Setting	Measuring system
0	Incremental meauring system selected. (for example encoder) Advantage: Very high frequencies > 1 MHz possible, when high speed components are assembled. Disadvantage: When a rotor position encoder is connected, only 2 channel are recorded. This may result in an extended inaccuracy. A combination for setting 0 and 1 for the different axis is not possible.
1	The rotor position encoder signals of the connected motor is used. Advantage: All three channels of the encoder are recorded. Disadvantage: The maximum counting frequency is only 5kHz. The drive will be set automatically to drive a brushless DC motor when this parameter is set to 1. A combination for setting 0 and 1 for the different axis is not possible.

P31 *Timer encoder monitoring [sec/0, 5.000]*

During the time set in this parameter, the controller must get two pulses from the connected measuring system.

Otherwise the controller stops the motor and shows an error message.

When this parameter is set to 0, the encoder monitoring is switched off.

Parameter level Master

P32 *Operating threshold for encoder monitoring (% / 0, 100)*

In some applications the connected motor must move very slowly to its target position.

Then the encoder frequency could fall below the frequency set in P31 and would cause an error message.

Setting the operating threshold in % of the maximum ramp value will prevent the system from faulty error messages.

Only when this threshold is exceeded, the encoder monitoring is active.

P36 *Closed loop controller [Mode/0,1]*

The controller has an integrated position control to ensure the motor stays at the defined point.

Setting	Function
0	Position control deactivated.
1	Position control activated.

Position control may only be used in machines which constitute no direct hazard to people or machines due to the continually active closed loop feature. This works constantly against mechanical influences such as pressure and tension.

Please note: the motor may overheat due to constant closed loop activity.

In certain circumstances, this may lead to faster deterioration or even motor failure.

Parameter level Master

P37 *Closed loop gain factor (Gain factor / 0, 10.0000)*

The closed loop controller time is now constant.

This parameter set the force of the integral term of the controller.

A setting of 1.0000 means, that an increment difference of the

measuring system is sent 1:1 to the analogue output of the unit.

P38 *Closed loop window (increments / 0, 1000)*

After positioning, if the actual value does not correspond to the demand value ± position window in encoder increments, then the closed loop controller is activated automatically.

Within this position window the closed loop control is deactivated.

Parameter level Master

P39 *Closed loop mode (mode / 0, 3)*

The closed loop controller can function in four different modes.

Setting	Mode
0	The closed loop controller is only activated when positioning is complete. (Closed loop to demand values only).
1	The closed loop controller sets to actual value after switch-on or stop, but when positioning is complete, to the demand value.
2	The closed loop function is active until the time in P10 (Axis1) is reached and the axis is inside the closed loop window.
3	Same as mode 0, but the drive free output is only deactivated after stop.

P40 *Closed loop P- term (amplification/ 0, 50000)*

The closed loop controller proportional term can be set in this parameter.

The value entered here is multiplied by the difference between the demand value and actual value (in encoder increments) and used as ramp increments.

This means that when there are long ramp lengths in P 11 master or slave, a higher value can be set. For shorter ramp lengths a lower value must be set to prevent oscillation.

This value should not be greater than1% of the ramp length entered in P12 master when running the first trials.

If no oscillation occurs, the value can be increased.

Parameter level Master

P42 *Motor rotation direction (forwards, backwards / 0, 1)*

This parameter inverts the actual direction of engine rotation.

If the motor is rotating in the wrong direction, this parameter must be altered or the cables connecting the motor must be exchanged.

P52 *Invert move direction [Direction/0,1]*

This parameter gets only active, when P06 in parameter level All is set to 12. Changing this parameter will switch the exteranl inputs „Start positive direction" and " Start negative direction" .

P53 *Analogue input [Range/ 0/1]*

Setting	Input range
0	The analogue input will work in a range of +/- 10V for speed and direction control.
1	The analogue input will work in a range of 0 - 10V for speed control. Master and slave will only move in ne direction.

P56 *Tolerance range for stand still voltage[Volt/ 0.00/2.00]*

In case of potential difference between the analogue source and the device it is possible to adjust an analogue range, within an analogue value is interpreted as 0 volt.

This will prevent the motor to drift out of its position.

Parameter level Master

P70 *Ramp detection [off,on/ 0,1]*

When the time-controlled controller is activated, ramp detection must be activated once.

After pressing the start button, the control system performs a complete ascending and descending ramp movement with the time specified in P71.

It is important to ensure a sufficiently long distance is available for the ramp movement, as end positions are ignored in this mode.

This parameter is automatically reset after successful detection.

P71 *Ramp time [seconds/ 0.020,2.000]*

This parameter sets the ramp time for the time-controlled controller. When setting, consider whether the motor can follow the specified time.

P72 *Controller selection [Controller type/ 0, 1]*

When this parameter is set to 1, the time-controlled controller is active. Setting it to 0 uses the controller previously used in the system.

To leverage the advantages of the time-controlled controller, the ratio between P05 and P06 should be at least 4. So, P06 should be at least 4 times greater than P05. However, this also depends on the dynamics of the motor.

P73 *P - term [PWM steps/ 0.00,100.00]*

During the ramp movement, the control constantly determines the motor's position. If a difference between the setpoint and actual position is detected, the difference is multiplied by the value set here. The result is then added to the PWM output value to compensate the difference.

Parameter level Master

P74 *I - term [PWM steps/ 0.0000,5.0000]*

During the ramp movement, the control constantly determines the motor's position. If a difference between the setpoint and actual position is detected, the integral value is increased or decreased by the value set here. The result is then added to the PWM output value to compensate the difference.

P75 *0-Offset compensation [off,on/ 0, 1]*

DC motors require a certain voltage level in the controller to initiate motion. This parameter activates compensation for this voltage level.

If ramp detection is active and this parameter is set to 1, the value stored in P66 is automatically determined.

In most cases, this parameter can be set to 0.

P76 *0-Offset PWM steps [PWM steps/ 0, 1000]*

This parameter allows modification of the determined value for 0-Offset Compensation.

The maximum modulation of the PWM value is +/- 2047 steps. Therefore, the 0-offset range can be up to approximately 50% of the maximum modulation.

P77 *Readjust time for dynamic ramp [seconds steps/ 0.00, 10.00]*

In case the motor does not hit the target after the ramp is finished, the motor is still active during the time set here, as long as the motor hits the target or the time is reached. This parameter should be set to 0 when the closed loop function is active.

P79 *Reserved [---/---,---]*

Parameter level Master

P90 *Decimal place [Decimal place 0, 5]*

This parameter is used to set the decimal place within the display.

0 = turn off decimal point

1 = one decimal place etc.

Setting the decimal place has no effect on the display resolution.

This is only done using parameters P05 and P06 in the master and slave level.

Parameter level Slave

P02 *Datum value [P05/ -9999999,9999999]*

When an axis is datumed automatically, the actual value is set to this parameter value.
When the axis should be datumed manually this value is suggested in the display.

P03 *Software limit switch min. [P05/ -9999999, 9999999]*

The minimum input value, the device should accept as a demand value.

P04 *Software limit switch max. [P05/ -9999999, 9999999]*

The maximum input value, the device should accept as a demand value.

Parameter level Slave

P05 *Distance for multiplication [any desired length unit/ 1, 10000]*

Contains any desired distance.
These two parameters are needed so that the internal counter can be set to various mechanical conditions, such as drives, spindle stroke, etc.

1. Any desired distance in the desired unit and resolution

(P05).

2. The number of increments sent by the encoder to the

unit when travelling the distance in P05. (P06).

Only if these specifications are entered in P05 and P06 with no rounding

error, will the counter operate correctly over the entire range.

Therefore the distance selected should always be one where a whole

number of pulses is sent by the encoder .

Parameter level Slave

P06 *Pulse/ distance [Encoder resolution/ 1, 100000]*

Number of pulses per travel distance entered in P05 (the factor is automatically calculated from P05 and P06).

Example 1: The encoder in use sends 100 pulses to the counter over a distance of 1.00 mm. The actual value and the demand values etc. should be sent in 1/100 mm. Therefore each pulse arriving from the encoder must be accounted for. Therefore, set P05 and P06 to the same value (e.g. 1, 1 or 10,10 or 100, 100).

Example 2: The encoder in use again has a resolution of 1/100 mm. But here the actual values and demand values need to resolve to one place after the decimal point, i.e. 1/10 mm. This means that over a distance of 1 (0.1 mm) 10 pulses are sent by the encoder to the counter. Therefore set P05 to smaller than P06 by a factor of 10 (e.g. 1, 10 or 10.100 or 100, 1000).

Example 3: A machine with a spindle drive has the following key data:

Spindle rise 5.0 mm/rotary encoder with a resolution of 20 pulses

per revolution. The actual value and demand values need to resolve

down to one decimal place, i.e. 1/10 mm. This means that over a distance of 50 (5.0 mm) 20 pulses are sent by the encoder to the counter.

Therefore, set P05 to 50 and P06 to 20.

For inch settings, enter P05 in inches.

Parameter level Slave

P07 *Maximum permanent motor current [x.xx Ampere/ 0.01, 20.00]*

When the motor current exceeds the current set here for more than one second the motor will be stopped and an error message appears on the display.

The measured current may differ in a range of ± 10% of the real current.

P25 *Edge counting mode [Edge evaluation/ 4, 4]*

Here always 4.

P26 *Counting direction [direction/ 0, 1]*

Altering this value from 0 to 1, or vice versa, reverses the counting direction of the unit.

0 = forwards
1 = backwards

Parameter level Slave

P27 *Measuring system selection[measuring system/ 0, 1]*

Setting	Measuring system
0	Incremental meauring system selected. (for example encoder) Advantage: Very high frequencies > 1 MHz possible, when high speed components are assembled. Disadvantage: When a rotor position encoder is connected, only 2 channel are recorded. This may result in an extended inaccuracy. A combination for setting 0 and 1 for the different axis is not possible.
1	The rotor position encoder signals of the connected motor is used. Advantage: All three channels of the encoder are recorded. Disadvantage: The maximum counting frequency is only 5kHz. The drive will be set automatically to drive a brushless DC motor when this parameter is set to 1. A combination for setting 0 and 1 for the different axis is not possible.

Parameter level Slave

P31 *Timer encoder monitoring [sec/0, 5.000]*

During the time set in this parameter, the controller must get two pulses from the connected measuring system.

Otherwise the controller stops the motor and shows an error message.

When this parameter is set to 0, the encoder monitoring is switched off.

P32 *Operating threshold for encoder monitoring (% / 0, 100)*

In some applications the connected motor must move very slowly to its target position.

Then the encoder frequency could fall below the frequency set in P31 and would cause an error message.

Setting the operating threshold in % of the maximum ramp value will prevent the system from faulty error messages.

Only when this threshold is exceeded, the encoder monitoring is active.

P42 *Motor rotation direction (forwards, backwards / 0, 1)*

This parameter inverts the actual direction of engine rotation.

If the motor is rotating in the wrong direction, this parameter must be altered or the cables connecting the motor must be exchanged.

Parameter level Slave

P60 *Relation of correction value (Relation / 0, 1)*

Setting	Relation
0	The correction value is calculated from the difference of the pulses of the measuring systems. This increases the accuracy, but may increase the risk of motor vibrations.
1	The correction value is calculated from the difference of the demand and actual value shown on the display. This may increase the risk of a higher inaccuracy, But may result in a smoother motor control.

P61 *P -Gain [Factor/ 0.000/30.000]*

This parameter is the multiplying factor of the system deviation.

After multiplying the system deviation with this factor, the value is used to control the drive.

A large value will cause a strong coupling, but can cause motor vibrations too.

P62 *I -Gain [Factor/ 0.0000/6.0000]*

This parameter is used to compensate system deviations, that could not be balanced out by the P-Gain.

A large value will cause a fast compensation, but can cause motor vibrations too.

Parameter level Slave

P63 *Maximum value for I -Gain [PWM increments/ 0/2000]*

The integral factor cause by a system deviation needs a certain time to stay stable. To reduce the risk of motor vibrations the maximum value controlled by the drive can be set here.

When this parameter is set to 2000, the maximum value control is switched of.

P90 *Dezimalpunkt [Dezimalstelle/ 0, 5]*

Mit diesem Parameter wird der Dezimalpunkt innerhalb der Anzeige gesetzt.

0 = Dezimalpunkt ausgeschaltet

1 = eine Dezimalstelle usw.

Die Einstellung des Dezimalpunktes hat keinen Einfluss auf die Auflösung der Anzeige.

Diese wird nur mit den Parametern P05 und P06 vorgenommen.

5.1.1 Parameterliste

Für Servicezwecke ist es ratsam, die bei der Auslieferung der Maschine in der Steuerung hinterlegten Parameter zu dokumentieren. Dazu kann nachfolgende Tabelle verwendet werden.

5.1.1 Parameter list

For service purpose it could be helpful to document the parameter setting of the device before the machine is shipped.

Therefor the following table can be used.

Parameter	Parameter setting	Default
Parameter All		
P02 Software version	---	Actual version
P03 Language		0
P06 Device functionality		12,13,14
P08 Customer number for special devices		0
P10 Reserved	---	3.0
P21 Security code for parameter level		0
P22 Security code for datuming level		0
P66 Activating start when axis reached target		0
P70 Switching input logic 1		0
P74 Switching output logic		0
P81 Baud rate for serial communication		1
P82 Device address for serial communication		11
P84 Baud rate for can communication		0
P89 Can device address		3

P90, P91 for special devices		0
P92, P93 for special devices		1.000
P94 Analogue offset motor 1		0
P95 Analogue offset motor 2		0
P96 Temperature offset		7
P97 Shut down temperature of drive		85

Parameter Master	Parameter setting	Default
P02 Datum value		1000.0
P03 Software limit switch min.		0.0
P04 Software limit switch max.		1000.0
P05 Distance for multiplication		1.0
P06 Pulse/distance		40
P07 Maximum permanent motor current		6.00
P08 Number of automatic restart.		0
P09 Tolerance window		0.0
P10 Drive deactivation delay time		0.20
P11 Maximum ramp distance for acceleration ramp		1000
P12 Maximum ramp distance for deceleration ramp		1000
P13 Fast speed forward and backward		100

P14 Manual slow speed		20
P15 Deceleration ramp after stop command		0.10
P17 Backlash compensation time		0.00
P18 Backlash compensation distance		0.0
P19 Integral term 1		1
P20 Integral term 2		1
P21 Differential term for break ramp		0
P22 Feedback monitoring interval		0.0500
P23 Feedback acceleration ramp pulse no.		1
P24 Feedback deceleration ramp pulse no.		1
P25 Edge counting mode	4	4
P26 Counting direction		0
P27 Measuring system selection		0
P31 Timer encoder monitoring		0.00
P32 Operating threshold for encoder monitoring		50
P36 Closed loop controller		0
P37 Closed loop gain factor		0.0100
P38 Closed loop window		0
P39 Closed loop mode		0
P40 Closed loop P-term		10
P42 Motor rotation direction		0
P52 Invert move direction		0
P53 Analogue input		0
P56 Tolerance range for stand still voltage		0.00

P70 Ramp detection		0
P71 Ramp time		1.000
P72 Controller selection		0
P73 P- term		0.000
P74 I- term		0.0000
P75 0- Offset compensation		0
P76 0- Offset PWM steps		0
P77 Readjust time for dynamic ramp		0.00
P79 Reserved		0
P90 Dezimal place		1
Parameter Slave	Parameter setting	Default
P02 Datum value		1000.0
P03 Software limit switch min.		0.0
P04 Software limit switch max.		1000.0
P05 Distance for multiplication		1.0
P06 Pulse/distance		40
P07 Maximum permanent motor current		6.00
P25 Edge counting mode	4	4
P26 Counting direction		0
P27 Measuring system selection		0
P31 Timer encoder monitoring		0.00
P32 Operating threshold for encoder monitoring		50
P42 Motor direction		0
P60 Relation of correction value		0
P61 P-Gain		0.100
P62 I-Gain		0.0040
P63 Maximum value for		2000

I -Gain		
P90 Dezimal place		1

6. Adjustment of control parameters

When used as a synchro controller care must be taken to the following things.
The device always synchronise master and slave due to the pulses received from the measuring systems.
Therefore the speed is always related to the frequency of the measuring system. Not to the rotation speed of the motor.
To enable the slave motor to synchronise to the master even when the master is running at maximum speed, the maximum speed of the slave should be at least 10% higher.
When both motors should run in a relation of 1:1 and the same motors and measuring systems are used for master and slave, parameter P13 in the master level should not be set higher than 90%. The slave motor should be able to balance a system deviation in both directions then.
When master and slave should run with different motor speeds, parameter P60 in parameter level slave must be set to 1.
The speed relation must be set with parameter P05 and P06 than for both axis.
When the master motor should run double the speed of the slave, the relation of P06 : P05 of the master should be set double the relation of these parameters of the slave.
In this case, the maximum speed of the master, set in P13 should be set less than 50% to enable the slave following the master in all operating conditions.
When the slave should run double the speed of the master set the relation on the slave side double the relation of the master.
For commissioning, the control parameters P61 and P62 should be set to 0 and the slave motor should be disconnected.
Run the master motor with slow speed then and check the rotation direction.
When the motor moves in the wrong direction change P42 of the master.
When the display counts in the wrong direction afterwards, P26 must be changed too.
The actual values of master and slave must be set to 0 then.
Should the slave count in the wrong direction, P26 of the slave must be changed.
When this parameter had to be changed, both axis should be set to the same actual value afterwards.

To reach a good motor coupling P61 of the master must be increased. The setting of this parameter depends on the dynamic of the used motors and the occurring loads. This parameter should be set as high as possible, without getting the risk of system vibrations.
When the setting of P61 is found, P62 should be increased in the same manner as P61 before.
The counting difference in the display should go back to 0 then.

7. Setting up the time-controlled controller

The parameters mentioned below exclusively pertain to Axis 1.

Begin by selecting the desired ramp time in parameter P72 and setting parameters P70 and P71 to 1.

After exiting the menu, initiate ramp detection by pressing the start button.

The setpoint must be different from the actual value. The ramp is executed towards the setpoint.

Note that due to mechanical constraints (end positions, etc.), the ramp movement can still take place. For the initial attempt, set P75 to 0.

Ramp detection automatically stores the determined ramp values in P11 and P12, which should not be altered thereafter.

To determine ideal settings for the proportional (P73) and integral (P74) values, deactivate the position controller and set P09, P10, and P74 to 0.

For the initial attempt, set P73 to 0.00. Then input setpoints where the motor can reach its maximum speed and initiate positioning.

The motor may not reach the target position. Adjust P73 in 1.00 steps until the difference between setpoint and actual value decreases, and the motor runs smoothly without significant corrections.

If adjusting this parameter doesn't improve results, the ramp time may be too short.

Then set P74 to, for example, 0.0040, and P10 to 1.00. Additionally, set P22 to a value greater than or equal to 0.5000. The motor should now reach the target position. Input short positioning distances.

If the motor still doesn't reach the target position, fine-tune P74. If this doesn't yield a better result, adjust P73.

If the target position is not achieved even with very small distances (1 or 2 display increments), set P75 to 1 and increase P76 until the display value changes. Then P74 may need to be slightly reduced.

If faster cycle times are needed, reduce P10 and P22 until the target position is reliably reached.

8. Serial interface

8.1 Connecting to the PC

An RS232 connection consists of at least 3 lines.

RxD Receive Data

TxD Transmit Data

GND Ground

A 9-pin Sub-D female on the PC is used.

RxD and TxD must be cross-connected, since the sender of the one device is connected to the receiver of the other device.

8.2 Einleitung

Das Protokoll ist basierend auf DIN 66019, ISO 1765, ANSI X3.28.

Diese Normen beschreiben ein Steuerungsverfahren im Übermittlungsabschnitt eines Übertragungssystems.

Nur die übergeordnete Einheit besitzt die Funktion des Bus-Masters und die an ihn angeschlossenen Einheiten sind Slaves mit individuellen Adressen. Slaves dürfen nicht allein senden, sondern nur nach Aufforderung durch den Master.

Die Kommunikation zwischen Master und Slave geschieht mittels drei Aufrufarten.

- Send
- Receive
- Broadcast

8.3 Introduction

The protocol is based on DIN 66019, ISO 1765, ANSI X3.28.

These standards describe a control procedure in the data link of a transmission system.

Only the host unit has the function of the bus master, and the units connected to it are slaves with individual addresses. Slaves are not permitted to send by themselves, but rather only when requested by the master.

There are three call types for communication between master and slave.

- Send
- Receive
- Broadcast

8.4 Technical Data

8 Bit ASCII

9600 Baud

1 Stopbit

1 Startbit

Parity (none)

Only in some special cases use

7Bit ASCII

9600 Baud

1 Stopbit

1 Startbit

1 Parity bit

8.5 Functions

Common to the control procedures below is that the transmission control characters specified in the code table per DIN 66 003 are used for data transfer.

The transmission characters are used for determining format, for forward control, backward control, and synchronization.

EOT:	Control character (Hex04)	**E**nd **o**f **T**ransmit
AD1:	Unit address, high byte	
AD2:	Unit address, low byte	
STX:	Control character (Hex02)	**S**tart of **Tex**t
C1:	Parameter code, high byte	
C2:	Parameter code,	
C3:	Parameter code,	
C4:	Parameter code, low byte	
XXX:	Data	
ETX:	Control character (Hex03)	**E**nd of **Tex**t
BCC:	Block check character	
ENQ:	Control character (Hex05)	**Enq**uiry
NAK:	Control character (Hex15)	**N**ot **ack**nowledge
ACK:	Control character (Hex06)	**Ack**nowledge

8.6 Format determination

The transmission character sequence is the format for data transfer. The following transmission control characters are used for indicating the format:

STX: Control character Ctrl B (Hex02) Start of Text

ETX: Control character Ctrl C (Hex03) End of Text

These characters appear only once in the format.

All data are sent in ASCII code.

8.6.1 Forward control

The following transmission control characters are used by the control station or by the send station for specifying the transmission phases:

EOT: Control character (Hex04) End of Transmit
(end of transmission)

ENQ: Control character (Hex05) Enquiry
(station enquiry)

8.6.2 Backward control

Each transmission character sequence, each receive poll and each control command issued to one or more receive stations which does not end the receive state must be confirmed with a reply. The following transmission control characters are used for this:

NAK: Control character (Hex15) Not acknowledge
(negative reply)

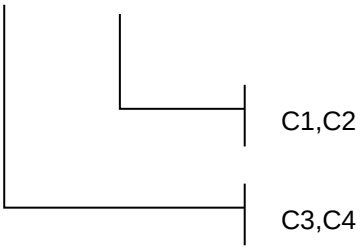
ACK: Control character (Hex06) Acknowledge
(positive reply)

8.6.3 Data control

In the data command the information for activating the parameters, set points and actual values are coded with the axes.

Parameters are implemented as a dual array. All data are handled like parameters. This results in very easy handling of all the data to be managed.

Parameter[Number][Axis]



Each device is modular, and has the character of a slot. There is always a General Level and at least one Axis Level.

The various levels are distributed as follows.

Data command 20XX General Level (calibration value)

Data command 21XX Axis 1

Data command 22XX Axis 2

Data command 23XX Axis 3

8.7 Send

Send transfers data from the master to the slave.

EOT AD1 AD2 STX C1 C2 C3 C4 XXXXXXXX ETX BCC

The data string „XXXXXXXX“ may consist of any number of numerical characters and can contain leading zeros as well as a sign. The Block-Check-Character „**BCC**“ is the exclusive-OR of all characters from "**C1** to "**ETX**“ (all-inclusive)

To prevent the BCC from ending up in the value range of the transmission control characters, Hex20 is added as soon as it is less than Hex20.

If reception was correct, the module answers with "**ACK**“, and in all other cases with "**NAK**“.

All parameters sent to the module are first stored in a data buffer. These parameters do not become active until the "activate data" command is sent.

Example:

Send the parameter value P01 (demand value) 100 to a device with Address 11.

EOT 11 STX 2101 100 ETX BCC

The device responds for a display value with "Ack“

8.8 Receive

The receive is used for requesting values from the modules.

EOT AD1 AD2 STX C1 C2 C3 C4 ENQ

When addressing is correct and the parameter code is correct, the station replies:

STX C1 C2 C3 C4 XXXXXXX ETX BCC

The data string „XXXXXXXX“ may consist of any number of numerical characters and can contain leading zeros as well as a sign. The Block-Check-Character „**BCC**“ is the exclusive-OR of all characters from "**C1** to "**ETX**“ (all-inclusive)

To prevent the BCC from ending up in the value range of the transmission control characters, Hex20 is added as soon as it is less than Hex20.

If the request string contains an invalid or unknown parameter code, the station replies:

STX C1 C2 C3 C4 EOT

In all other cases with "**NAK**“

Example:

Request the display value from a device with Address 11.

EOT 11 STX 2100 ENQ

The device replies for a display value of 100.

STX 2100 100 ETX BCC

8.9 Serial commands

3 commands can be sent over the serial interface.

1. Start axis, data string number 128
2. Stop axis, data string number 129
3. Start go to datum, data string number 136
4. Save data in EEPROM, data string number 138
5. Calibrate, data string number 139

Data command 2152 is used to transmit a command.

Example:

Send the Save data command to a device with Address 11.

EOT 11 STX 2052 138 ETX BCC

Should a command relate to a specific axis only, the axis number must appear in the command address. 2**X**52.

Example:

Start axis 1

EOT 11 STX 2152 128 ETX BCC

Start axis 2

EOT 11 STX 2252 128 ETX BCC

Start both axis

EOT 11 STX 2052 128 ETX BCC

8.10 Status of an axis

The status of the axis can be read out using parameter 80.

To read out the status of axis 2, with unit address 11 the string would be.

EOT 11 STX 2280 ENQ

The unit will answer with a combination of the actual status bits:

The following status bit are implemented.

Value Hex	Decimal	Meaning
0x00	0	Axis not enabled
0x01	1	Axis enabled
0x02	2	Axis running
0x04	4	Axis in position
0x08	8	Go to datum active
0x10	16	Overcurrent occurred
0x20	32	Short circuit detected
0x40	64	Measuring system error
0x80	128	Limit switch active (not used here)

Several combinations of these status bits are possible.

For example the meaning of “3” is, that the axis is enabled and running.

9. Illustration