

BAUMÜLLER

**TECHNOLOGY FUNCTION
SYNCHRONISATION
CONTROL**

Technical description and
operation manual

Edition February 1996

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This operation manual is intended as a complement to the technical description and the operation manual of the apparatus.

**READ AND COMPLY WITH THE OPERATION MANUAL AND
THE SAFETY NOTES BEFORE COMMISSIONING**

This manual contains the necessary information for normal operation of the products described therein. The drives may only be used, maintained and repaired by personnel familiar with the operation manual and the applicable regulations on working safety and accident prevention. The devices are manufactured to a high technical specification and are operationally safe. Provided that all safety instructions have been adhered to, there will be no personal danger during the installation and commissioning stages.

The commissioning is prohibited until it has been positively determined that the machine, into which these components are to be incorporated, complies with EC machine regulations.

This technical description replaces and nullifies all previous description. In order to provide the best possible service, we reserve the right to alter information without notice.

Manufacturer and Baumüller Nürnberg GmbH

Supplier's address: Ostendstr. 80
90482 Nürnberg
Germany

Tel. (++49-911) 5432 - 0

Fax (++49-911) 5432 - 130

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Country of origin: Made in Germany

Date of manufacture: Determined from the serial number on the machine/motor.

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ABBREVIATIONS

AI	Function module analog inputs
OS	Function module operating system
SC	Function module synchronisation control
RFG	Function module ramp function generator
i	Transmission ratio
ID no..	Identification number
Inc	Zähleinheit der Position
L	Function module position controller
M	Function module drive manager
N	Function module speed controller

1 GENERAL

The programm option synchronisation via a electronic gearbox, can be considered as a connection between incremental encoder and position controller

The positional changes of a machine component (e.g. rotating shaft) are converted, by means of an incremental encoder, into electrical signals, and translated via the incremental encoder evaluation into digital values.

This position actual values are converted with the gearbox transmission ratio and as position set values passed on to the following position controller. The motor, which is controlled by the position controller follows this set values.

The transmission ratio can be altered online within the range $[1/30000 \dots 30000/1]$. The electronic gearbox calculates mathematically exact without an deviation.

If the drive controller , in the synchronous mode, is switched onto electronic gearbox then the actual value position (indicated by the incremental encoder value and the position controller) at this point in time, are used as a basis for calculation. For the electronic gearbox, this means that, from this point in time, the rotating shaft (leading axis) and the motor (following axis) do not have a set and accurately defined angular relationship.

For an accurate angular relationship the leading and following axes must previously have been set up to on another.

2 COMMISSIONING

In general 3 different synchronous modes may be set up.:

2.1 Synchronous modes

- **Angular synchronisation**

The position controller tries to minimise the positional deviations between leading and following axes. In doing so it is reinforced by the N-interpolation, which calculated a main specific value for the speed controller from the continually changing positional set values. Corrected set value via the N-interpolation and datum set value via the speed controller result in a summation of speed set value.

- **Speed synchronisation**

As for the Angular synchronisation however, the position controller is switched (K_v -factor = 0). Greater positional deviations between leading und following axes may appear. The speed pre-regulation must generate 100 % of the required speed set value.

- **Angular synchronisation with analog main specific value**

As for the Angular synchronisation, but with following additions::

To the speed set value (via the position controller) an analog speed set value is added, in the ramp function generator. To a certain extent, a transmission ratio for the analog set value can be set by means of calibrating the analog input. The main set value (of N-interpolation) may be replaced completely or mixed via the analog main set value.

2.2 Synchronous operational modes

The following settings, according to the selected operating mode, are capable of being input, consequently via the controller.

Module	ID no.	Name	Angular synchronisation	Speed synchronisation	Angular synchronisation with analog main set value
Ramp function generator	17	RFG polarity	0	0	0
	13	RFG input selection	1	1	4
	5	RFG ramp-up time 2 [s]	0.001	0.001	0.001
	11	RFG ramp-down time 2 [s]	0.001	0.001	0.001
	16	RFG rounding [ms]	0	0	0
Position controller *	202	P Kv-factor [1/s]	> 0, as required	= 0	> 0, as required
	207	P N-interpolation [%]	as required	= 100	comply with calibration analog input
	201	P Mode, bit no. 3 encoder selection: resolver	bit no. 2 = 0	bit no. 2 = 0	bit no. 2 = 0
Synchronisation control	257	SC edit mode	0	0	0
	255	SC rpm following axis	as required	as required	as required
	256	SC rpm leading axis	as required	as required	as required
Analog input	279	AI1 scaling	-	-	comply with N-interpolation and transmission ratio
	280	AI1 target ID no.	-	-	2
Drive manager	120	M control word	0	0	0
	122	M desired operation mode	-5	-5	-5
	120	M control word	6	6	6
	120	M control word	15	15	15

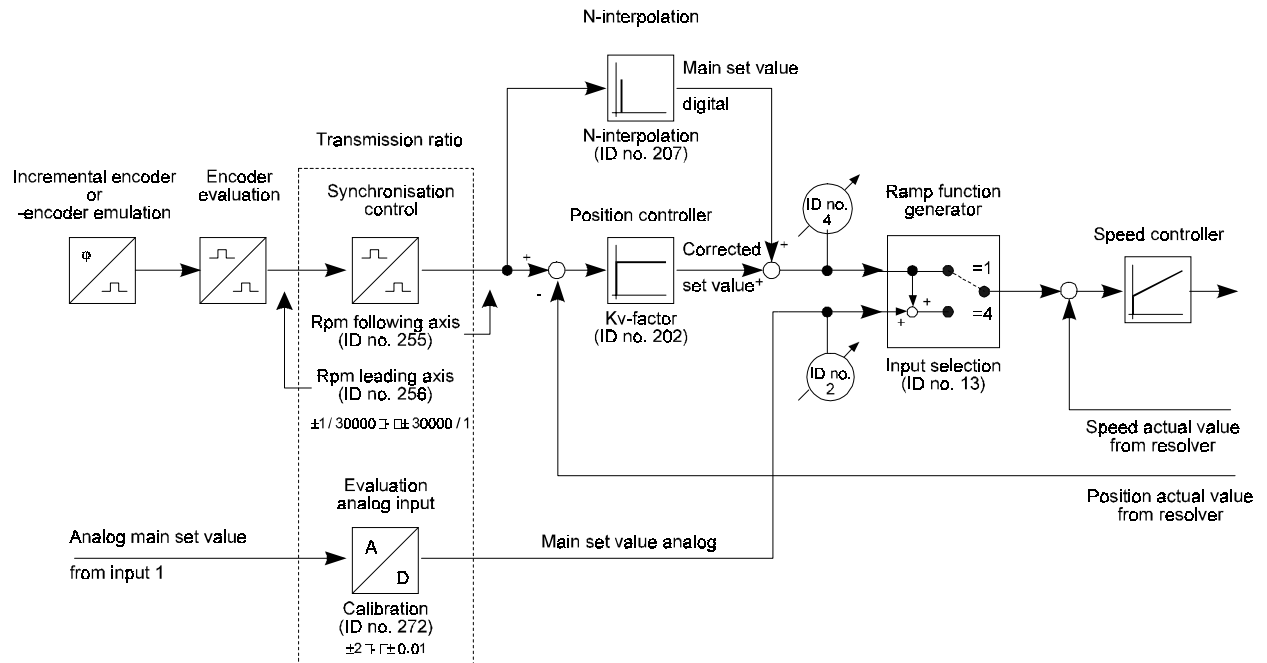
* For the settings of deviation monitoring, actual value monitoring and actual value measurement see operation manual.

3 PARAMETERS

Function

From leading axis

To following axis



Parameter overview

ID no.	Name	Range min. ... max.	Unit	Standard value	Only display
250	SC status	0000 ... FFFF			5
255	SC following axis rpm	-30000 ... +30000		1000	
256	SC leading axis rpm	1 ... 30000		1000	
257	SC edit mode	0 ... 1		0	
258	SC leading axis position	00000000 ... FFFFFFFF	Inc		5
259	SC following axis position	00000000 ... FFFFFFFF	Inc		5

Parameters

Parameter description

250 SC state

This parameter gives the status of the electronic gearing.

Wert	Bedeutung
0	Stop
1	Run

255 SC following axis rpm

Numerator of the quotient which determines the transmission ratio in the electronic gearing.

256 SC leading axis rpm

Denominator of the quotient which determines the transmission ratio in the electronic gearing.

The transmission ratio of the electronic gearing is calculated according to the following equation:

$$i = \frac{\text{Following axis rpm}}{\text{Leading axis rpm}} = \frac{\text{ID no. 255}}{\text{ID no. 256}}$$

Nenner und Zähler des Übersetzungsverhältnisses bestehen aus ganzen Zahlen ohne Nachkommastellen. Der Zähler darf auch negativ werden, damit ist die Funktion eines Umkehrgetriebes realisierbar.

Several transmission ratios and their respective parameter values are displayed in the following table.

i	Leading axis rpm	Following axis rpm
0.2	10	2
-0.78	-100	78
1.15	100	115
9.452	1000	9452
0.3333	10	3

257 SC edit mode

Input acknowledgement for new transmission ratio.

Wert	Bedeutung
0	Transparent mode: all alterations take immediate effect
1	The leading/following axis rpm parameters may be edited. The transmission ratio remains unaltered
1 → 0	The altered leading/following axis rpm parameters are taken over simultaneously.

Example:

Changing transmission ratio from 0.8 to 1.15

- Edit mode = 0 (Transparent mode)

Leading axis rpm	Following axis rpm	Edit mode	Transmission ratio
10	8	0	0.8
10 ⇒ 100	8	0	0.8 ⇒ 0.08
100	8 ⇒ 115	0	0.08 ⇒ 1.15

or

Leading axis rpm	Following axis rpm	Edit mode	Transmission ratio
10	8	0	0.8
10	8 ⇒ 115	0	0.8 ⇒ 11.5
10 ⇒ 100	115	0	11.5 ⇒ 1.15

NOTE

The transparent mode can lead to undesired transmission ratios!

- With edit mode = 1

Leading axis rpm	Following axis rpm	Edit mode	Transmission ratio
10	8	0	0.8
10	8	0 ⇒ 1	0.8
10 ⇒ 100	8	1	0.8
100	8 ⇒ 115	1	0.8
100	115	1 ⇒ 0	1.15

Undesired transmission ratios do not appear with edit mode = 1!

Parameters

2 5 8 SC leading axis position

This parameter displays the position actual value of the incremental encoder evaluation. See IE position actual value ID no. 245.

2 5 9 SC following axis position

This parameter displays the position set value of the position controller
See PC set value ID no. 208.

NOTE

The absolute position values of leading and following axes are inapplicable to the synchronising function. Only the positional changes of the leading axis, due to signal time, are allowed for in calculation of the transmission ratio; these being added to the set positional value of the following axis.