

RINGSPANN	Installations and Operating Instructions for speed controller ESC 230 S, to monitor differences in speed (slip)			E 04.707 e (replaced E 05.644 e)	
	issue: 07.12.2016	version: 02	Author: VANW	checked: STAM	pages: 6 page: 1

IMPORTANT

Please read these instructions carefully before installing and operating the product. Your particular attention is drawn to the notes on safety.

These installation and operating instructions are valid on condition that the product meets the selection criteria for its proper use. Selection and design of the product is not the subject of these installation and operating instructions.

Disregarding or misinterpreting these installation and operating instructions invalidates any product liability or warranty by RINGSPANN; the same applies if the product is taken apart or changed.

These installation and operating instructions should be kept in a safe place and should accompany the product if it is passed on to others – either on its own or as part of a machine – to make it accessible to the user.

This device fulfils the requirements of the EU Standards
 EMC Directive 2014/30/EU,
 Low voltage Directive 2014/35/EU,
 RoHS Directive 2011/65/EU.

SAFETY NOTICE

- Installation and operation of this product should only be carried out by skilled personnel.
- Repairs may only be carried out by the manufacturer or accredited RINGSPANN agents.
- If a malfunction is indicated, the product or the machine into which it is installed, should be stopped immediately and either RINGSPANN or an accredited RINGSPANN agent should be informed.
- Switch off the power supply before commencing work on electrical components.
- Rotating machine elements must be protected by the purchaser to prevent accidental contact.
- Supplies abroad are subject to the safety laws prevailing in those countries.



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1. Functional Description

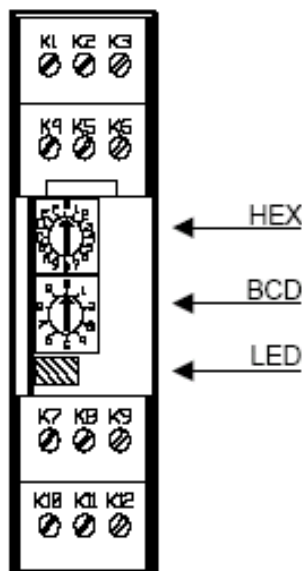
The speed controller ESC 230 unit monitors differences of two speeds (slip). The maximum relative difference between both speeds can be limited from 0.5% to 14.3%. When one of these speeds changes and the difference exceeds the limit (e.g. a belt pulley slips or a coupling has switched off) the built-in relay switches. When both speeds changes uniformly no speed difference appears and the relay and the transistor stays in normal position

For speed detection proximity switches with NPN,PNP or NAMUR output can be used to detect rotating impulse sources like screw heads or holes. These impulses will enter input 1 and input 2 of the ESC 230 as a periodical rectangle signal. A proximity switch can be used to detect multiple impulse sources if they are uniform in distance and dimension over the circumference. The quantity of impulse sources as well as the speeds can be different for both inputs of the ESC 230 until no relative difference will occur. This constant relation between both inputs can be adjusted by a HEX coding switches. This feature allows to detect speeds at any part of a shaft and to use existent mounting screws.

The ESC 230 can work with and without auto-reset. Without auto-reset the relay stays off when an speed difference occurs. With auto-reset the relay switches on again, when both speeds comes back to the correct relation .

When the plant is standing still no speed signals and no speed difference will occur so that the ESC will stay in normal operation mode. When the plant stopped after operation this mode will start 15 seconds later. When the plant starts again the ESC monitors immediately both inputs again. Without power supply and 0.5 seconds after switching on the supply the relay is off (fail safe).

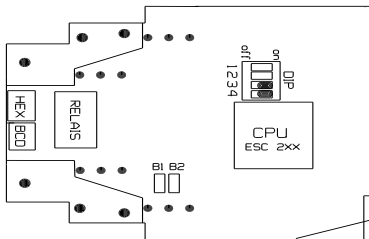
2. Terminals



Terminal	Function
1	power supply + 24 V DC
2	not in use (ESC 200 for analogue speed output)
3	power supply 0 V DC
4	Relay contact, nc, closed when both speeds are correct
5	Relay contact, nc, closed when both speeds are correct
6	Transistor output PNP, nc, 24V when both speeds are correct
7	Coding the limit value 0,5%...14%
8	Coding the limit value 0,5%...14%
9	Coding the limit value 0,5%...14%
10	Input 2 for proximity switch
11	Input 1 for proximity switch
12	ground connection for the proximity 0 V DC (=K3)
HEX	Code switch for speed relation P
BCD	Code switch for speed relation P
LED	glows if both speeds are correct

3. Operation settings

To change the operation settings please release both sides of the housing of the ESC 230 S until the four nuts are free and pull out the board with the terminals. The table below shows the settings. Default positions are bold printed.



Element		Funktion
DIP 1		no function
DIP 2		no function
DIP 3	off on	NPN or NAMUR proximity switch at K10 PNP proximity switch at K10
DIP 4	off on	NPN or NAMUR proximity switch at K11 PNP proximity switch at K11
B1	off on	Auto-Reset, automatical reset secured position, no automatical reset.
B2	off on	Normal monitoring of slip Test program

4. Starting up operation

- Use screw heads, edges of castings, bores or drilled holes as impulse sources which are suitable to the proximity switch. A good detection is secured when the width of the impulse sources is as large in diameter as the proximity switch and the depth or height is greater than the nominal switching distance s_n . In case multiple impulse sources are employed on the circumference, it is important that they are mounted symmetrically on a pitch circle and are of the same dimensions. Example: A proximity switch with M8x1 thread has 1,5 mm nominal switching distance and will reliably detect impulse sources of 8mm width and 1,5 mm height (depth).
- Apply the proximity switch in a distance of $s_n - 50\%$ in front of the impulse sources. If the impulse source to be used is smaller in diameter than the diameter of the proximity switch then decrease the mounting distance. If the impulse sources are flat and protrude less than s_n increase the mounting distance. Turn the plant slowly and check that the proximity switch detects all the impulse sources.
- Connect your power supply to K1 and K2 without switching on the power. If the material of the casing is aluminium (type C) a connection between protective earth and terminal PE is necessary.
- Open the housing and set the operation setting as described in 2.
- Connect the Relay contacts K4, K5 and the PNP-transistor output with your control equipment.
- Connect the black wires of the proximities (output) with K11 and K10 of the ESC 230. PNP or NPN-proximities additionally needs external power supply, brown wire = +24 V DC, blue wire = 0 V DC. NAMUR -proximities need connection to 0 V DC with the blue wire.
- Select the maximum speed difference with K7,K8,K9, see limit setting chapter 5.
- Set the actual relation of both impulse inputs with HEX and BCD, see chapter 7.

Now switch on the power supply.

Attention: Changes at HEX, BCD, K7..K9 will be valid only after powering up the unit again.

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5. Limit setting

The ESC 230 monitors the relation between speed n_1 at input 1 and n_2 at input 2.

The input 1 is the reference.

The terminals K7,K8,K9 of the ESC encodes the limit of the maximum allowable speed difference in percent of n_1 (slip), by releasing or connecting the terminal with 0V (K12). The relay switches off when the speed relation exceeds this limit. The low tolerances 0,5% up, to 1,5% should be used only when both proximity switches are triggered by one impulse per rotation and $P = 1,0$.

K7	K8	K9	Difference in % of n_1	Reaction delay in periods
off	off	off	14,3	7
0 V	off	off	10,0	7
off	0 V	off	6,25	5
0 V	0 V	off	4,0	5
off	off	0 V	2,5	3
0 V	off	0 V	1,5	3
off	0 V	0 V	1,0	2
0 V	0 V	0 V	0,5	2

Example: For 10% speed difference, terminal K7 is to connect with K12, K8 and K9 are unconnected

At 1000 min^{-1} actual speed at input 1 the ESC 230 switches off when input 2 shows 1101 min^{-1} or 899 min^{-1} ($1000 \text{ min}^{-1} \pm 10\%$).

The reaction delay depends from the limit. One period is the time between each speed signal (trigger) at the slowest input.

6. Speed limits, Signal requirements, Hysteresis

The ESC 230 S allows input signals of 4 min^{-1} to 60000 min^{-1} . For speeds below 4 min^{-1} on both inputs or stand-still the ESC will stay in normal operation mode and the relay is closed. If only one speed is below 4 min^{-1} and the other speed is higher the ESC will react as for a speed difference, the ESC switches off and switches back to normal operation after 15 seconds (auto-reset).

Miscalculations and incorrect switch offs can occur for input speeds above 60000 min^{-1} . Input signals above 120000 min^{-1} (2 kHz) should be avoided.

Both input signals should be free from spikes, so mechanical contacts as relays must not be used. The right table shows the trigger values (voltages and currents) for the inputs. Each status must be active for at least 0,04 ms ($f_{\max} = 25\text{kHz}$).

Type	Trigger values for ESC inputs, at K10,K11 and K12,	
	U_T	I_T
PNP	7,5 V	+ 2,2 mA
NPN	5,5 V	- 1,6 mA
NAMUR	5,5 V	- 1,6 mA

Auto-Reset (B1=off) is possible only if the speed difference is below 75% of the limit (25% Hysteresis),

Example: 7,5% for 10%-limit or 3% for 4% limit.

If auto-reset is deactivated the ESC unit has to be switched on (power up) to get the normal operation mode.

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7. Adapting the Input relation

For different speeds n_1, n_2 or different trigger sources in normal operation both inputs can have frequency relations greater than 1. To allow operation under this conditions, a factor P can be set at the HEX- and BCD.

$$P = \frac{\text{speed } n_1 \times \text{trigger per rotation 1}}{\text{speed } n_2 \times \text{trigger per rotation 2}}$$

When both inputs uses the same number of trigger pulses and the speed should be the same at normal operation HEX and BCD should be set to „0“ (P=1,00).

Example: *Speed measuring is in front of and behind a gearbox with 10,3:1 ($n_1:n_2$). The trigger impulse for*

The input 1 is the keyway of the gearbox input shaft; the trigger impulse of the input 2 are six screws of a torque limit device behind the gearbox. Then we have

$P = (10,3 \times 1) / (1 \times 6) = 1,7167$. Set P to the nearest value (1,72) with Sie HEX =9 and BCD = 3 .

HEX	Coding of HEX and BCD for the input relation P									
	BCD									
	0	1	2	3	4	5	6	7	8	9
0	1,00	160	80,0	53,3	40,0	32,0	26,7	22,9	20,0	17,8
1	16,0	14,5	13,3	12,3	11,4	10,7	10,0	9,41	8,89	8,42
2	8,00	7,62	7,27	6,96	6,67	6,40	6,15	5,93	5,71	5,52
3	5,33	5,16	5,00	4,85	4,71	4,57	4,44	4,32	4,21	4,10
4	4,00	3,90	3,81	3,72	3,64	3,56	3,48	3,40	3,33	3,27
5	3,20	3,14	3,08	3,02	2,96	2,91	2,86	2,81	2,76	2,71
6	2,67	2,62	2,58	2,54	2,50	2,46	2,42	2,39	2,35	2,32
7	2,29	2,25	2,22	2,19	2,16	2,13	2,11	2,08	2,05	2,03
8	2,00	1,98	1,95	1,93	1,91	1,88	1,86	1,84	1,82	1,80
9	1,78	1,76	1,74	1,72	1,70	1,68	1,67	1,65	1,63	1,62
A	1,60	1,58	1,57	1,55	1,54	1,52	1,51	1,50	1,48	1,47
B	1,45	1,44	1,43	1,42	1,40	1,39	1,38	1,37	1,36	1,35
C	1,33	1,32	1,31	1,30	1,29	1,28	1,27	1,26	1,25	1,24
D	1,23	1,22	1,21	1,20	1,194	1,185	1,18	1,17	1,16	1,15
E	1,143	1,135	1,13	1,12	1,11	1,103	1,10	1,09	1,08	1,074
F	1,067	1,06	1,053	1,046	1,04	1,032	1,026	1,02	1,013	1,006

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8. Technical data

Common data

Speed range	:	4...60000 pulses per minute
Power supply.....	:	24 V DC +/- 20%
current supply.	:	max. 80 mA
Operation temperature.....	:	-10...+ 60° Celsius
storage temperature.....	:	-40...+ 80° Celsius
EMC-Directives.....	:	DIN EN 61000-6-1 and 61000-6-2 DIN EN 61000-6-3 and 61000-6-4

Adherence of all required EMC limits have been proofed in certified laboratories.

Relay (K4,K5)

relay output.....	:	250 V AC, 5 Amp. 30 V DC, 5 Amp.
Function	:	nc, opens at limit exceed

Transistor output (K6)

Function	:	PNP, nc, opens at limit exceed
Power supply.....	:	via Terminal 1 internally
Maximum output current	:	150 mA

Proximity switch PNP, (DIP 3,4 = on)

Trigger voltages K10 - K11.....	:	+7,5 V DC +/- 10%
Input current at 24 V, K10, K11	:	12 mA, Ri = 1900 Ohm

Proximity switch NPN, NAMUR (DIP 3,4 = off)

Trigger voltage.NAMUR.....	:	-1,5 mA +/- 10%
Trigger voltage NPN.....	:	+5,5 V +/- 10%
Input current NPN	:	-5,2 mA +/- 20%

Dimensions, Weight

Weight.....	:	250 gram
Dimensions	:	75 x 22,5 x 100 mm
Terminals	:	12 pieces, tinned, wire cross section 2.5 mm max.
Protection grade.....	:	IP40, Terminals IP20
Mounting.....	:	35mm DIN rail ; DIN 46277 and DIN 50 022