Torque Limiter with overload and load separation functions for

Extruders
Shredders
Centrifuges
Steel rolling mills
Heavy industry

High torque capacity clutch
High torque – small element

- *Immediate drive disconnection in case of an overload*
- *For high speed and long run-downtime*
- *High disengagement and repetitive accuracies*
- *Integration into existing design*

K.440.03.GB

power-transmission

EAS®-overload clutch

Manufacturer's declaration

EAS®-clutches are not machines within the scope of the Machinery directive 98/37/EG, but components for installation into machines or equipment. An initial start up is prohibited until it has been noticed that the machinery or the equipment into which this product has been incorporated corresponds to the EG-guide lines.

Safety regulations

Warning!

- If the EAS®-clutches have been modified or reconverted.
- If the relevant standards of the safety or installation conditions are not observed.

Necessary protective measures to be undertaken by the user

- Cover all moving parts to prevent squeezing and seizing.

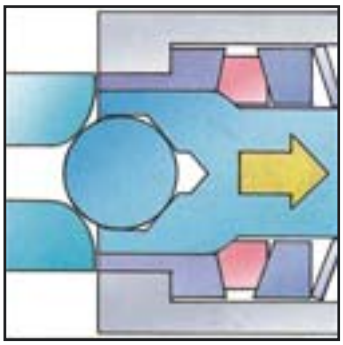
Only qualified and well-trained specialists should work on the units to avoid any personal injury or damage to machinery.

With these safety notes no claim on completeness is raised!

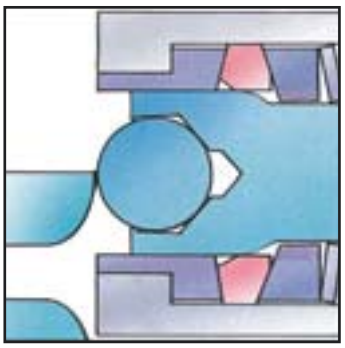
Operating principle of the EAS®-overload clutch elements

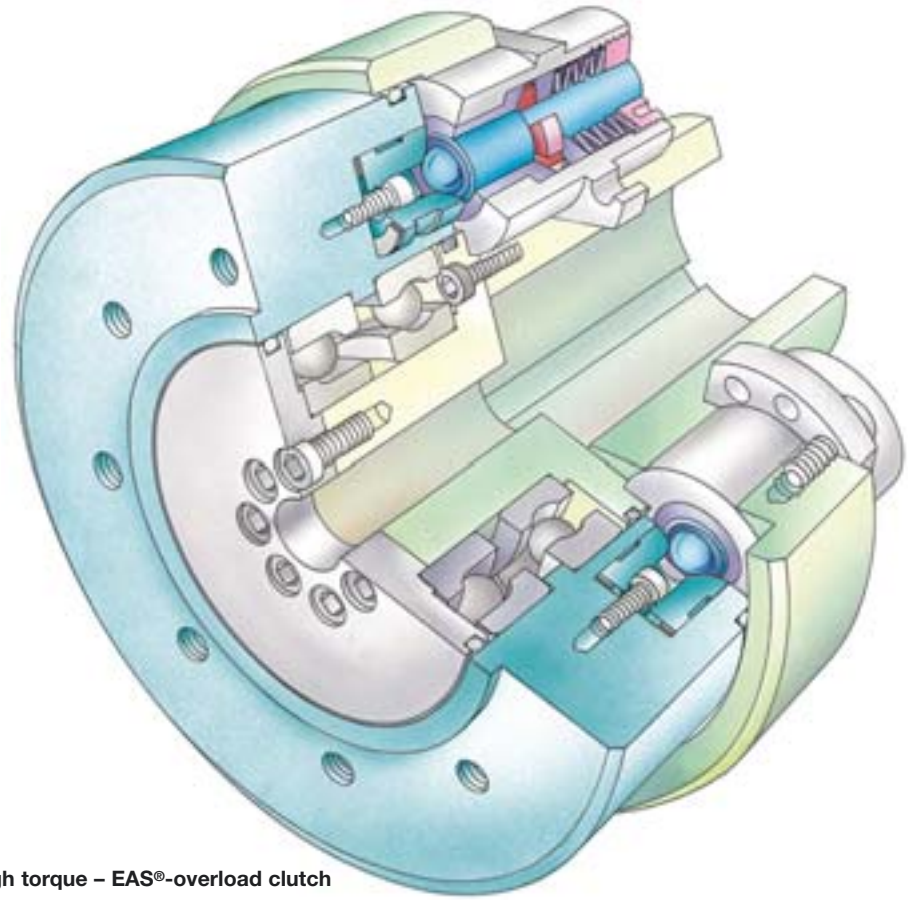
* When the proportional peripheral force per element becomes too large, the resulting axial force to the ball/spherical cup via the pin will disconnect the torque transmission.
* The maximum peripheral force is determined individually by the mayr® cup springs and pressure adjusting ring which in turn limits the transmittable torque.
* Due to the axial stroke of the pin (ball carrier) the switching segments move radially outwards, disengaging the driving and driven components.
* Manual re-engagement of the ball by pressure on the pin in the direction of the spherical cup or by the mayr® automatic re-engagement unit (pneumatic, hydraulic, electromechanical or mechanical actuation).

engaged



disengaged





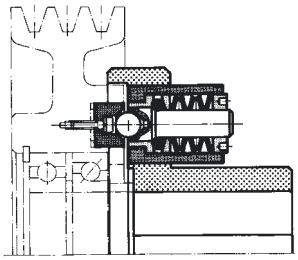
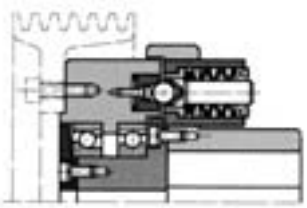
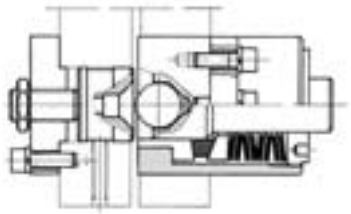
The high torque – EAS®-overload clutch

* Designed for high torques
* As standard up to 190.000 Nm
* Available with torque adjustment
* Application in
  excavators,
  dredgers,
  turbine construction
  sluice drives
  rolling mills
  steel mills
  large lifting devices
* Flexible design to suit customers' requirements
* The ROBA®-tron speed monitor switches off the drive medium in the case of an overload.
* Large and expensive heavy machinery is reliably protected against damage due to overload.

* **Avoids down time**
* **Increases utilisation**
* **Increases productivity**

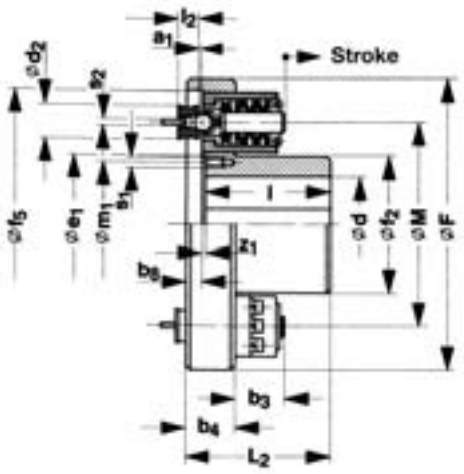
EAS®-overload clutch

Summary of types

EAS®-clutch	Type	Torque [Nm]	Application
EAS® – flanged version (modular overload clutch, sizes 6 - 14)	400._04.0	250 – 190.000	Torque limiting for heavy-duty and high-speed drives in association with large gyrating masses which, in the event of an overload, must slow down freely. Flanged design for fitting chain sprockets, gears, V-belt pulleys, etc. The respective drive elements and bearings are customer supply.
			Page 4
EAS®-short supported hub (modular overload clutch, sizes 6 – 14)	400._04.5	250 – 190.000	Torque limiting with integral bearing at the output end. Drive elements, such as chain sprockets, gears, V-belt pulleys, etc. can be fitted directly without an additional bearing.
			Page 5
EAS®-positive (modular overload clutch, sizes 6 – 14)	435._04.5	250 – 190.000	Torque limiting with positive torsionally flexible coupling for connecting two shafts. The flexible coupling can be assembled axially, equalises shaft misalignments and damps intermittent loads.
			Page 6
Technical explanations			Pages 7 - 10
EAS® – element	44_._04.0		EAS®-elements for flange mounting, or for integration into existing structures. EAS®-elements disconnect the input and output mechanically allowing over-running in the event of an overload.
			Pages 11 - 14
Technical explanations			Pages 15 and 16
Electronic accessories			ROBA®-tron speed monitor Pages 17 and 18

Flanged version

Type 400._04.0



Sizes 6 – 14 Type 400._04.0

Technical data

size	Limiting torques for overload M_G min – max [kNm] Type 400.404.0	Type 400.504.0	Type 400.604.0	EAS®-element size	EAS®-element number	Max. speed n_{max} rpm	Weight with d_{max} kg	Stroke of the control element in the event of an overload mm	Mass moments of inertia kgm^2
6	0,25 – 0,70	0,55 – 1,1	1,1 – 2,2	0	2	3500	13,4	6	0,09
7	0,45 – 1,3	1,0 – 2,0	2,0 – 4,0	0	3	3000	18,6	6	0,16
8	0,75 – 2,1	1,625 – 3,25	3,25 – 6,5	0	4	2800	28,4	6	0,31
9	2,0 – 4,0	3,0 – 6,0	6,0 – 12	1	3	2500	57,6	8	0,95
10	3,3 – 6,6	5 – 10	10 – 20	1	4	2200	84,3	8	1,96
11	6,3 – 12,6	9,5 – 19	19 – 38	1	6	2000	119	8	4,01
12	4 – 11	10 – 30	30 – 60	2	4	1800	223	12	11,10
13	7,6 – 21	19 – 57,5	57,5 – 115	2	6	1500	355	12	26,5
14	12,5 – 34,5	31,5 – 95	95 – 190	2	8	1200	631	12	60,9

Table of dimensions

size	a_1	b_3	b_4	b_8	d_{max}	d_2	$e_1{}^{H7}$	F	f_2
6	2	43	44	14	70	30	98	230	96
7	2	43	44	14	90	30	123	260	120
8	2	43	44	14	110	30	150	304	150
9	2	56	56	16	135	40	190	380	190
10	2	56	56	16	160	40	240	450	220
11	2	56	56	16	200	40	290	535	260
12	3	110	70	20	250	60	350	660	320
13	3	110	70	20	300	60	430	800	390
14	3	110	75	25	350	60	480	960	500

size	f_5	L_2	l	l_2	M[1)]	m_1	s_1	s_2	z_1
6	212	127	110	22	155	84	8xM8	M6	3
7	240	158	140	22	180	110	8xM10	M6	4
8	282	188	170	22	225	130	8xM12	M6	4
9	362	231	210	30	270	157	8xM16	M6	5
10	420	271	250	30	340	190	8xM16	M6	5
11	506	311	290	30	425	240	12xM16	M6	5
12	609	366	340	40	505	290	12xM20	M8	6
13	743	418	390	40	640	350	16xM24	M8	8
14	903	485	450	40	795	400	16xM24	M8	10

1) tolerance sizes 6 – 8 +/- 0,03, sizes 9 – 14 +/- 0,05

We reserve the right to make dimensional and design alterations.

Order example:

To be included when ordering, please state:	size	Type	bore Ø d^{H7}	with ROBA®-tron
Order example:		400._04.0		see page 17

6 – 14 → size

* low torque range . . . . . 4 → Type

* medium torque range . . . . . 5 → Type

* high torque range . . . . . 6 → Type

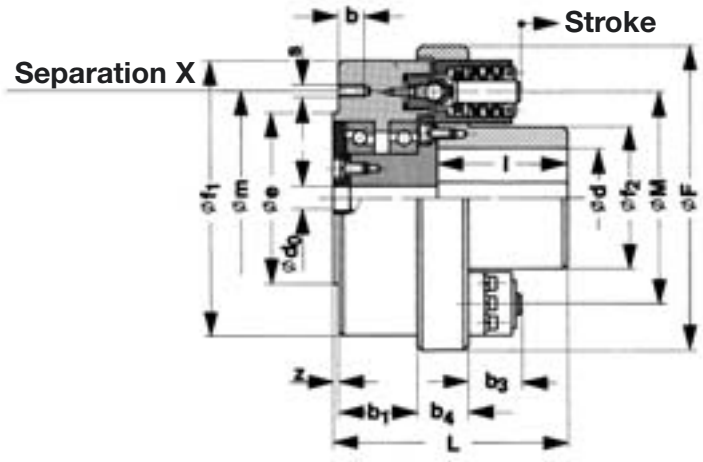
bore Ø d^{H7} ← according to size

* see technical data, limiting torque for overload M_G

Example: Order number 8 / 400.604.0 / 95

EAS®-overload clutch

Short supported hub **Type 400._04.5**



Sizes 6 – 14 Type 400._04.5

Technical data and table of dimensions

size	Limiting torques for overload M_G min – max [kNm] Type 400.404.5	Type 400.504.5	Type 400.604.5	EAS®-element size	EAS®-element number	Max. speed n_{max} rpm	Mass moments of inertia Hub side kgm²	Mass moments of inertia Flange side kgm²	Weight with d_{max} kg
6	0,25 – 0,70	0,55 – 1,1	1,1 – 2,2	0	2	3500	0,09	0,10	31
7	0,45 – 1,3	1,0 – 2,0	2,0 – 4,0	0	3	3000	0,16	0,19	46
8	0,75 – 2,1	1,625 – 3,25	3,25 – 6,5	0	4	2800	0,31	0,41	70
9	2,0 – 4,0	3,0 – 6,0	6,0 – 12	1	3	2500	0,95	1,34	140
10	3,3 – 6,6	5 – 10	10 – 20	1	4	2200	1,96	2,79	212
11	6,3 – 12,6	9,5 – 19	19 – 38	1	6	2000	4,01	6,41	320
12	4 – 11	10 – 30	30 – 60	2	4	1800	11,10	14,97	550
13	7,6 – 21	19 – 57,5	57,5 – 115	2	6	1500	26,5	40,2	900
14	12,5 – 34,5	31,5 – 95	95 – 190	2	8	1200	60,9	103	1650

size	Max. permissible forces [1] at the flange connection Radial forces [kN]	Axial forces [kN]	Stroke mm	b	b_1	b_3	b_4	$d_{0\ max}$	d_{max}
6	30	21	6	20	58	43	44	25	70
7	45	31,5	6	25	68	43	44	30	90
8	60	42	6	30	78	43	44	40	110
9	90	63	8	35	94	56	56	48	135
10	120	84	8	35	110	56	56	58	160
11	180	126	8	40	122	56	56	85	200
12	240	168	12	45	134	110	70	95	250
13	360	252	12	50	170	110	70	110	300
14	480	336	12	50	192	110	75	140	350

size	e_{h7}	F	f_1	f_2	L	l	M	m	s	X	z
6	136	230	210	96	189	110	155	175	M12	8x45°	4
7	147	260	238	120	228	140	180	190	M16	8x45°	4
8	165	304	280	150	270	170	225	220	M20	8x45°	4
9	242	380	360	190	330	210	270	285	M24	8x45°	5
10	276	450	418	220	387	250	340	325	M24	12x30°	6
11	380	535	504	260	441	290	425	430	M27	12x30°	8
12	385	660	606	320	508	340	505	500	M30	12x30°	8
13	430	800	740	390	599	390	640	600	M36	12x30°	10
14	600	960	900	500	686	450	795	750	M36	16x22,5°	10

1) line of influence of the radial force at the screw down area

We reserve the right to make dimensional and design alterations.

Order example:

To be included when ordering, please state:	size	Type	bore Ø d^{H7}	bore Ø d_0	with ROBA®-tron
Order number:		400 . _04 . 5			see page 17

6 – 14 → size
* low torque range . . . . . 4 → Type
* medium torque range . . . . . 5 → Type
* high torque range . . . . . 6 → Type

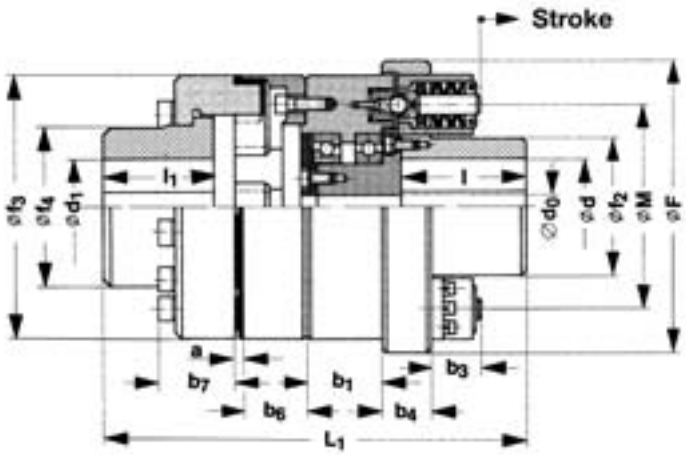
bore Ø d^{H7} ← according to size
bore Ø d_0 ← according to size

* see technical data, limiting torque for overload M_G

Example: Order number 7 / 400.504.5 / 80

Positive detachable

Type 435._04.5



Sizes 6 – 14 Type 435._04.5

Technical data and table of dimensions

size	Limiting torques for overload M_G min – max [kNm] Type 435.404.5	Type 435.504.5	Type 435.604.5	EAS®-element size	number	Max. speed n_{max} rpm	Mass moments of inertia Hub side kgm²	Flexible side kgm²	Weight with d_{max} kg
6	0,25 – 0,70	0,55 – 1,1	1,1 – 2,2	0	2	3500	0,09	0,24	56
7	0,45 – 1,3	1,0 – 2,0	2,0 – 4,0	0	3	3000	0,16	0,42	78
8	0,75 – 2,1	1,625 – 3,25	3,25 – 6,5	0	4	2800	0,31	0,81	115
9	2,0 – 4,0	3,0 – 6,0	6,0 – 12	1	3	2500	0,95	3,25	251
10	3,3 – 6,6	5 – 10	10 – 20	1	4	2200	1,96	6,12	367
11	6,3 – 12,6	9,5 – 19	19 – 38	1	6	2000	4,01	18,15	655
12	4 – 11	10 – 30	30 – 60	2	4	1800	11,10	23,78	860
13	7,6 – 21	19 – 57,5	57,5 – 115	2	6	1500	26,5	66,6	1440
14	12,5 – 34,5	31,5 – 95	95 – 190	2	8	1200	60,9	169,6	2630

size	Stroke [mm]	a	b_1	b_3	b_4	b_6	b_7	$d_{0\ max}$	d_{max}
6	6	4	58	43	44	62,5	75,6	25	70
7	6	4	68	43	44	66,5	80,6	30	90
8	6	5,5	78	43	44	76	91,7	40	110
9	8	8	94	56	56	94	111,3	48	135
10	8	8	110	56	56	102	119,3	58	160
11	8	8	122	56	56	108	130,5	85	200
12	12	12	134	110	70	60	118	95	250
13	12	13	170	110	70	73	131	110	300
14	12	13	192	110	75	80	147	140	350

size	$d_{1\ max}$	F	f_2	f_3	f_4	L_1	l	l_1	M
6	95	230	96	214	136	380,5	110	107	155
7	100	260	120	240	146	437,5	140	117	180
8	115	304	150	265	164	512	170	137	225
9	160	380	190	370	241	638	210	176	270
10	180	450	220	415	275	724	250	196	340
11	240	535	260	575	368	826	290	240	425
12	180	660	320	606	280	845	340	228	505
13	200	800	390	740	310	980	390	258	640
14	260	960	500	900	400	1161	450	338	795

We reserve the right to make dimensional and design alterations.

Order example:

To be included when ordering, please state:	size	Type	bore Ø d^{H7}	bore Ø d_1^{H7}	bore Ø d_0	with ROBA®-tron
Order number:		435 . _04 . 5				see page 17

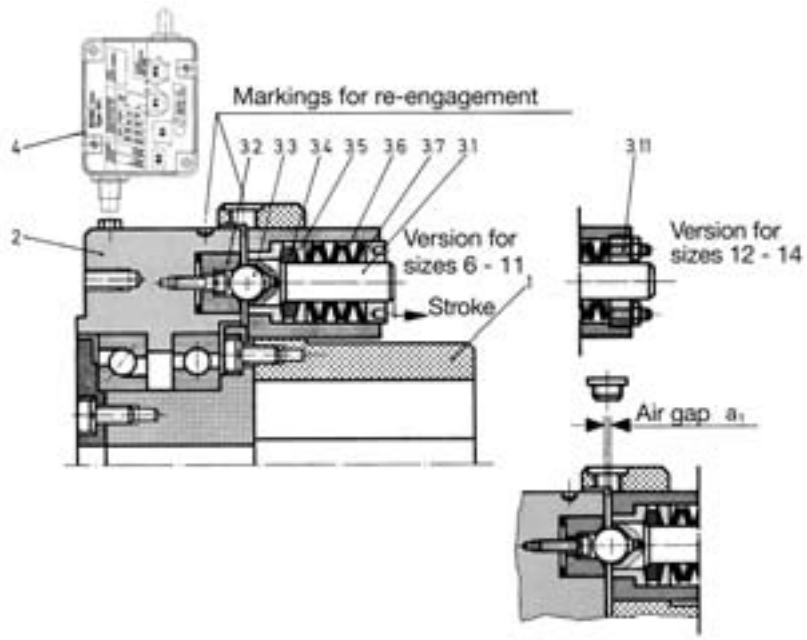
6 – 14
* low torque range 4
* medium torque range 5
* high torque range 6

according to size
according to size
according to size

* see technical data, limiting torque for overload M_G

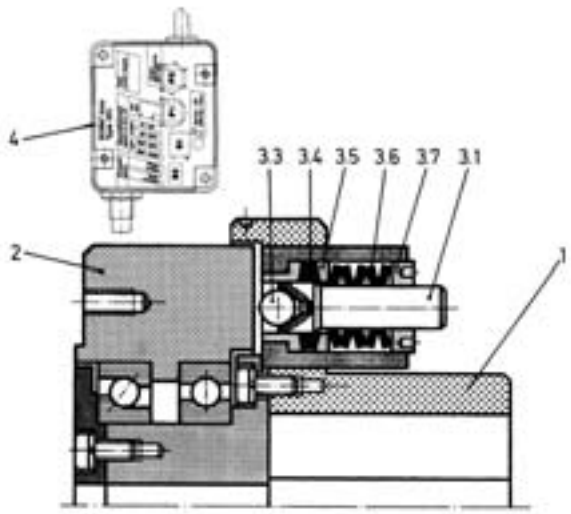
Example: Order number 9 / 435.504.5 / 110 / 130

Technical explanations



Engaged position

Fig. 1



Disengaged position

Fig. 2

Torque path:
hub 1 – bolt 3.1 – balls 3.3 – thrust piece 3.2 – output flange 2

Torque setting:

The limiting torque for an overload on the clutch can be set by changing the pretensioning of the cup springs of each overload element.
For sizes 6 – 11, by turning the adjusting nut 3.7 and, for sizes 12 – 14, by means of setscrews 3.11 (see fig. 1).
It must be ensured that all overload elements of the clutch are uniformly set. EAS®-overload clutches of sizes 6 – 14 can be set at the factory with the desired limiting torque for an overload.
Subsequent setting or adjustment via setting diagrams is also possible.

Operating principle:

In the event of an overload, hub component 1 and output flange 2 are turned against each other and the bolts 3.1 of the overload elements are pressed against the force of the cup springs 3.6 out of the thrust pieces 3.2 via the control segments 3.4. The control segments 3.4 travel radially outwards over the control edges of the bolts 3.1 and hold the bolts 3.1 in their disengaged position (see fig. 2).
The hub component 1 and output flange 2 are now disconnected. The masses which were originally connected can now coast freely. The drive is electrically disconnected via a ROBA®-tron speed monitor 4.

Re-engagement:

Re-engagement is effected simply by means of axial pressure on the bolt end of each overload element. The hub 1 and the output flange 2 are rotated against each other in the correct angular position (re-engagement position recognizable by marking holes on the outside diameter of the clutch, fig. 1).
The bolts 3.1 are returned to their engaged position by tapping the ends of the bolts with a plastic mallet. The clutch is ready for operation again when all overload elements of the clutch are re-engaged. The level of the engaging force depends on the set limiting torque for an overload and can be calculated using the following formula.
Re-engagement can also be carried out automatically by compressed air.
We request your enquiry in this regard.

$\mathbf{F_E = k \cdot M_G\ [kN]}$

F_E = Total engaging force for all overload elements of the clutch [kN]

k = Calculation factor $[\frac{1}{m}]$ as per table 1

M_G = Set limiting torque for an overload attachment [kNm]

Bores and location on shaft:

EAS®-overload clutches, sizes 6 – 14, are supplied as standard with finished bores and keyways to DIN 6885. The clutch can be secured axially to the shaft by means of a push-on cover, or directly with a screw (fig. 4).
Other forms of shaft and hub connections, such as splined profiles, tooth systems, shrink fittings, pressure oil connections, etc., are also possible.

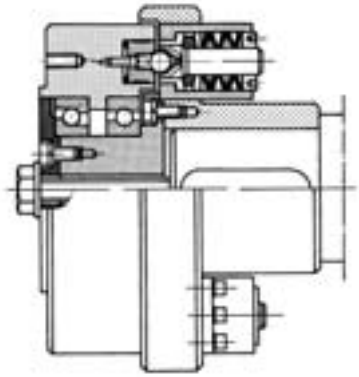


Fig. 4

EAS®-size		6	7	8	9	10	11	12	13	14
Calculation-factor k	$[\frac{1}{m}]$	1,7	1,4	1,3	1,0	0,8	0,6	0,5	0,4	0,3

Table 1

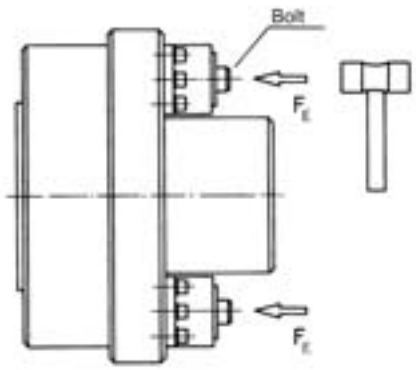


Fig. 3

Maintenance:

EAS®-overload clutches of sizes 6 – 14 require no special maintenance. They are dust and moisture proof and are lubricated for life. The clearance a_1 between the thrust piece 3.2 and the front face of the overload element is set at the factory and does not require re-adjustment. There is one inspection port per overload element on the outer circumference of the clutch (see fig. 1, page 5).
Special maintenance may become necessary only where there is an excessive amount of dirt and dust or under extreme ambient conditions. In this case, we request that you contact the works.

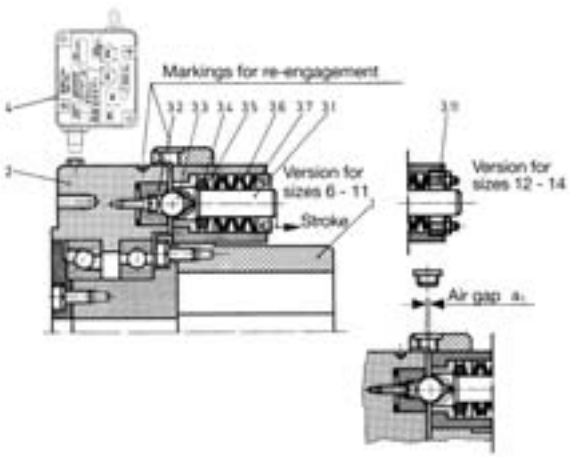


Fig. 5

Technical explanations

Construction:

All parts of the clutch are made from steel which is machined all over and protected against corrosion by zinc phosphating.

The construction of the EAS®-overload elements is as described on page 15. The clutch is also suitable for running in oil.

Flanged version

(Type 400.604.0):

This type can be used for attachment to an existing drive element (gear, belt pulley, etc.). The thrust piece of the clutch can be built into the mounted drive element, and the hub component (with the built-in EAS®-overload elements) can be fixed onto the shaft.

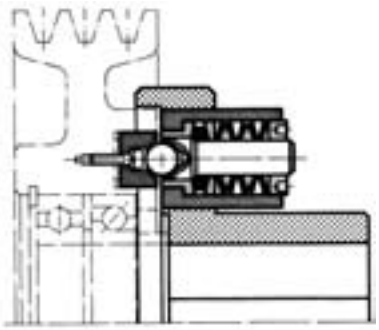


Fig. 6

Short mounted hub

(Type 400.604.5):

With this type, the drive element can be fitted directly onto the mounted flange at the output end of the clutch, (fig. 7).
The bearing can absorb high additional forces in axial and radial directions (see table of dimensions on page 5).

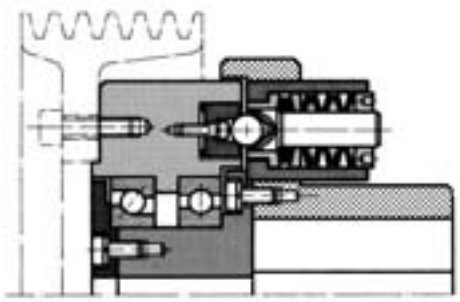


Fig. 7

EAS®-positive

(Type 435.604.5):

EAS®-overload clutch, combined with positive flexible coupling sections for connecting two shafts (fig. 8).

For the sizes 6 – 11 the flexible coupling section is designed as positive claw coupling with exchangeable intermediate ring made of highly damping, oil and temperature resistant material (fig. 10).

For the sizes 12 – 14 a claw coupling with radially plugable flexible resilient pads is used (fig. 11).

For both versions the flexible elements can be exchanged with mounted clutch and the input and output can be dismantled radially.

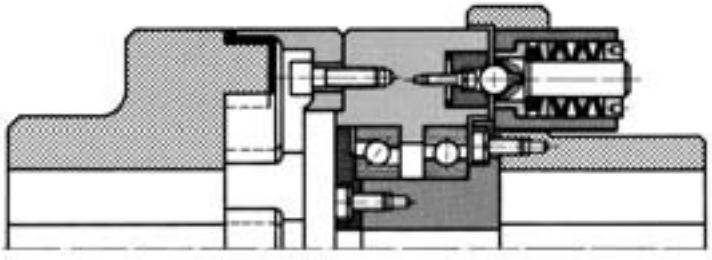


Fig. 8

Shaft misalignments

The possible misalignments of the flexible coupling section, as shown in table 2 below, represent general reference values which may be considered appropriate with a view to obtaining the longest possible service life for the coupling and shaft bearing.

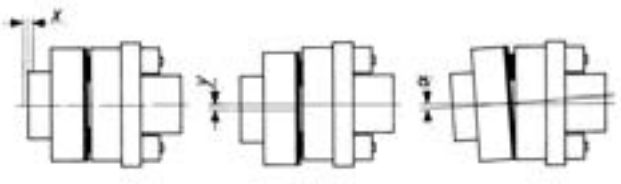


Fig. 9

EAS® size	6	7	8	9	10	11	12	13	14
Axial displacement x [mm]	±2,0	±2,0	±2,5	±2,5	±2,5	±2,5	±0,5	±0,5	±0,5
Radial misalignment y [mm]	0,7	0,7	0,7	0,8	1,0	1,0	1,0	1,0	1,0
Angular misalignment α [°]	0,21	0,19	0,17	0,15	0,14	0,1	0,35	0,3	0,25
T_{KN} [kNm]	1,67	2,67	4,17	10,1	15	30	38	73	146

Table 2

Choice of sizes for EAS®-positive coupling:

$$M_{G\,max} = \frac{1{,}8 \cdot T_{KN}}{k_1 \cdot k_2 \cdot k_3 \cdot k_4}\ [kNm]$$

$M_{G\,max}$ = Maximum limiting torque to be set for an overload [kNm]
T_{KN} = Rated torque of positive flexible coupling [kNm] see table 2
k_1 = Minimum safety factor for mode of operation [-]
k_2 = Minimum safety factor for period of operation [-]
k_3 = Minimum safety safety factor for starting frequency/engaging frequency [-]
k_4 = Minimum safety factor for ambient temperature [-]

Fig. 10

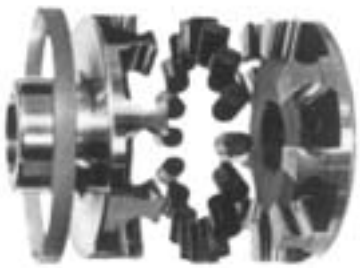


Fig. 11

Driven machines	Factor k_1
a) With constant running and negligible masses to be accelerated.	1
b) With constant running and low masses to be accelerated.	1,2
c) With uneven running and moderate masses to be accelerated.	1,4
d) With uneven running, moderate masses to be accelerated and impacts.	1,7
e) With uneven running, large masses to be accelerated and strong impacts.	2
f) With uneven running, very large masses to be accelerated and particularly strong impacts.	2,4

Minimum-safety factors k_3 for starting frequency/ engagement frequency	Starts per hour	above / up to	1	1 / 20	20 / 40	40 / 80	80 / 160	160
	Mode of operation as per above table for factors k_1		Factor k_3					
		a)	1	1,2	1,3	1,5	1,6	2
		b)	1	1,09	1,18	1,37	1,46	1,8
		c)	1	1,08	1,17	1,25	1,33	1,65
		d)	1	1,07	1,15	1,23	1,23	1,55
		e)	1	1,07	1,12	1,18	1,18	1,32
		f)	1	1,06	1,08	1,1	1,1	1,1

Minimum safety factors k_2 for period of operation	Daily running time over / up to	2 / 2	2 / 8	8 / 16	16 / hours
	Factor k_2	0,9	1	1,12	1,25

Minimum safety factors k_4 for ambient temperature	20 °	40 °	60 °	80 °
	1	1,1	1,2	1,3

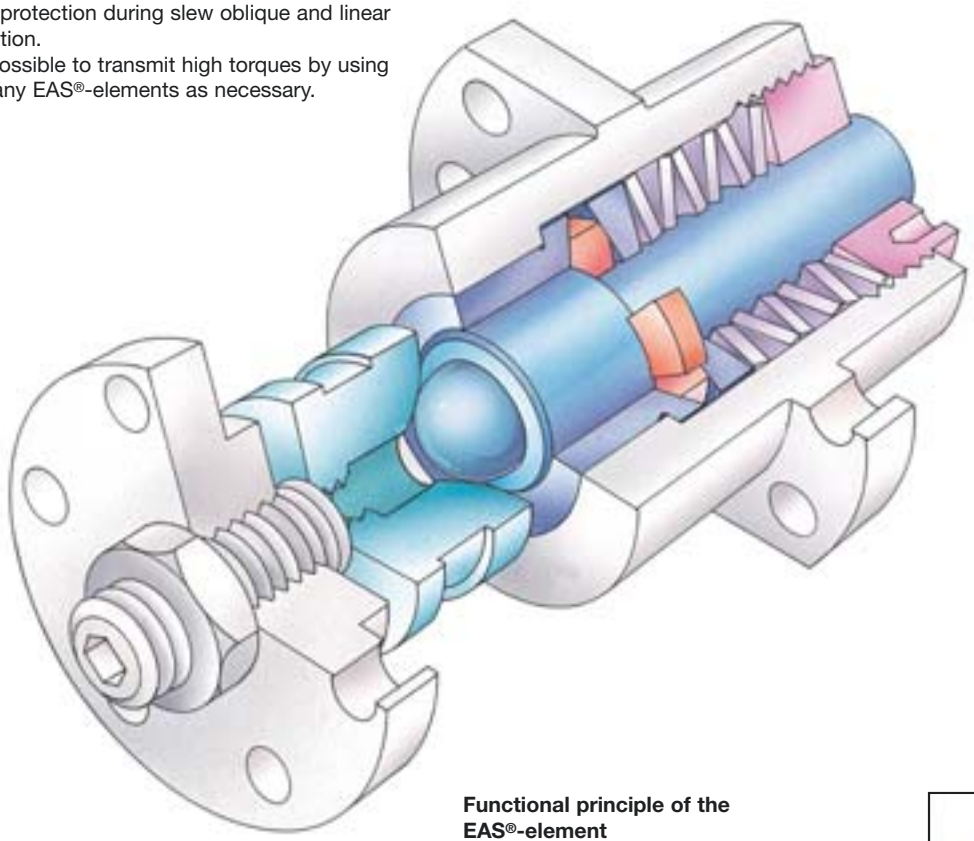
Table 3

EAS®-element

High torque – small element EAS®-element

* The torque of large rigid clutches are controlled.
* They are suitable for retro-fitting into existing constructions.
* With EAS®-elements it is possible to realize constructively the customers special requirements.
* Suitable for the drives of turntables and rings etc..
* Load protection during slew oblique and linear operation.
* It is possible to transmit high torques by using as many EAS®-elements as necessary.

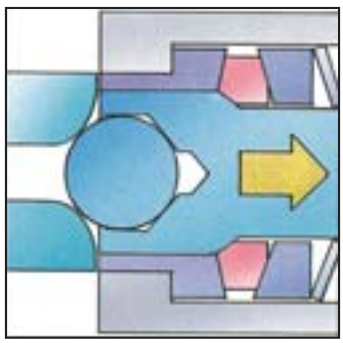
*** In case of an overload the whole installation can be halted via the mayr® limit switch.**
*** With the EAS®-elements a whole range of large clutches are available.**
*** The most viable alternative in the large clutch range.**



Functional principle of the EAS®-element

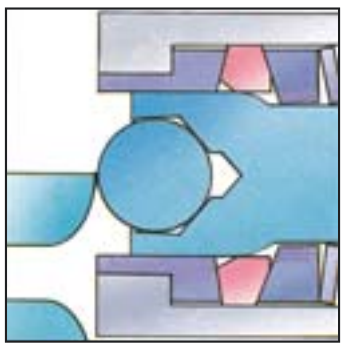
* If the circumferential force per element is too large, the resulting axial force and movement via the ball / pocket disconnect the drive / torque transmission.
* The maximum circumferential force is determined by the individual element cup springs and adjusting rings, thus setting the transmittable torque.

engaged



* Due to the axial movement of the bolt (ball carrier) the switching segments are forced radially outward, disconnecting the components axially.
* Re-engagement of the element by axial pressure on the bolt end, or via the mayr® re-engagement unit (pneumatic, hydraulic, electromechanical or mechanical).

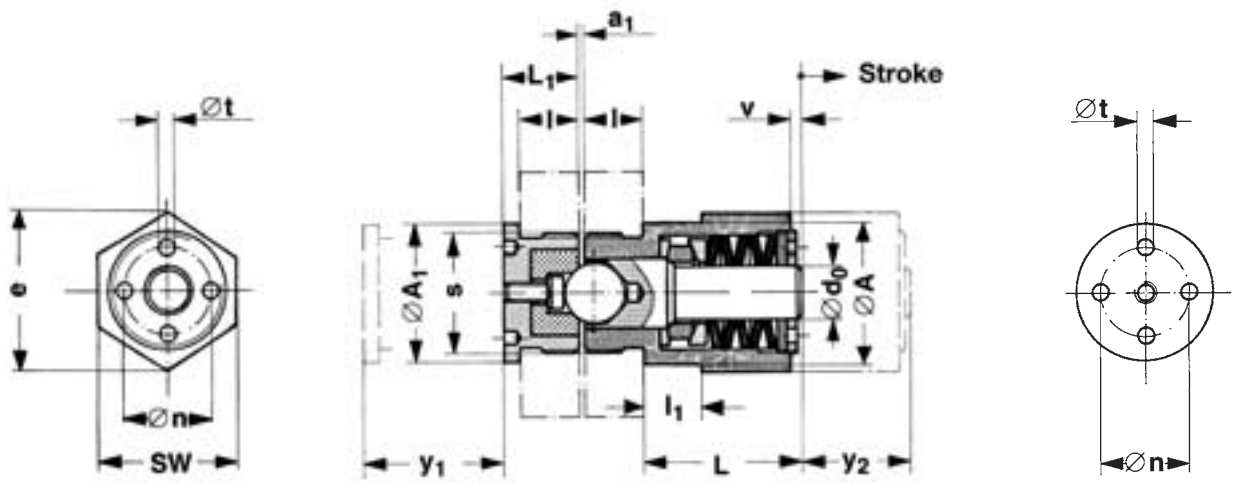
disengaged



Designs of the EAS®-element

Standard sizes 02 – 01

Type 440._04.0



Sizes 02 – 01 Type 440._04.0

Technical data

size	Circumferential force F_u			Axial force F_{ax}			Stroke	Weight
	Type 440.404 kN	Type 440.504 kN	Type 440.604 kN	Type 440.404 kN	Type 440.504 kN	Type 440.604 kN	mm	kg
02	0,22 – 0,54	0,50 – 1,40	1,20 – 2,5	0,20 – 0,48	0,45 – 1,26	1,08 – 2,25	2,5	0,25
01	1 – 2	1,25 – 2,50	2,50 – 5,0	0,90 – 1,80	1,12 – 2,25	2,25 – 4,50	4	0,60

Table of dimensions

size	A_{h7}	A_1	a_1	d_0	e	L	L_1	l	l_1	n	s	SW	t	v	y_1 3)	y_2 3)
02	28	28	1,0	10	31,2	28	15	12	7	17	M24 x 1,0 1)	27	3	2	12	16
01	38	35	1,5	14	41,6	40	21	15	10	22	M30 x 1,5 2)	36	4	3	15	21

1) tightening torque M_A = 40 Nm
2) tightening torque M_A = 60 Nm
3) y_1 and y_2 are withdrawal dimensions

We reserve the right to make dimensional and design alterations.

Order example:

To be included when ordering, please state:	size	Type	with ROBA®-tron
Order number:		4 4 0 . _ 04 . 0	see page 17

02 – 01
* low torque range 4
* medium torque range 5
* high torque range 6

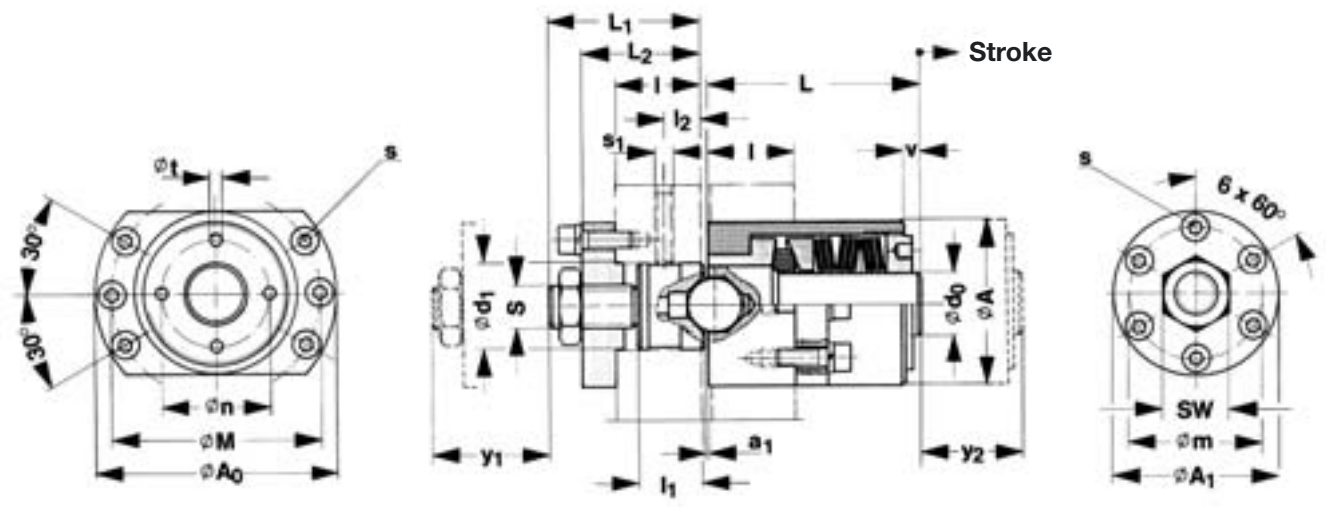
* see technical data

Example: Order number 01 / 440.504.0

EAS®-element

Standard sizes 0 – 2

Type 440._04.0



Sizes 0 – 2 Type 440._04.0

Technical data

size	Circumferential force F_u			Axial force F_{ax}			Stroke	Weight
	Type 440.404 kN	Type 440.504 kN	Type 440.604 kN	Type 440.404 kN	Type 440.504 kN	Type 440.604 kN	mm	kg
0	1,8 – 5,0	3,75 – 7,5	7,5 – 15	1,62 – 4,5	3,37 – 6,75	6,75 – 13,5	6	1,75
1	5 – 10,0	7,5 – 15	15 – 30	4,5 – 9	6,75 – 13,5	13,5 – 27	8	4,1
2	4 – 11,0	10 – 30	30 – 60	3,6 – 9,9	9 – 27	27 – 54	12	11,3

Table of dimensions

size	A_{h7}^{H8}	A_0	A_1	a_1	b	d_0	$d_{1\,h7}^{H8}$	L	L_1	L_2	l	l_1	l_2	M
0	55	85	55	2	12	20	30	73	52	42	30	22	12	72
1	75	110	75	2	15	30	40	96	65	51	40	30	17	95
2	100	150	100	3	20	40,6	60	160	80	70	50	40	22	128

size	m	n	S	s	s_1	SW	t	v	y_1 4)	y_2 4)
0	44	31	M12	M6 1)	M5	19	5	3	8	38
1	60	48	M20	M8 2)	M6	30	6	4	10	50
2	80	69	M24	M12 3)	M8	36	8	19	10	65

1) fastening screw DIN 912 10.9 M_A = 9 Nm
2) fastening screw DIN 912 10.9 M_A = 19 Nm
3) fastening screw DIN 912 10.9 M_A = 76 Nm
4) y_1 and y_2 are withdrawal dimensions

We reserve the right to make dimensional and design alterations.

Order example:

To be included when ordering, please state:	size	Type	with ROBA®-tron
Order number:		4 4 0 . _ 04 . 0	see page 17

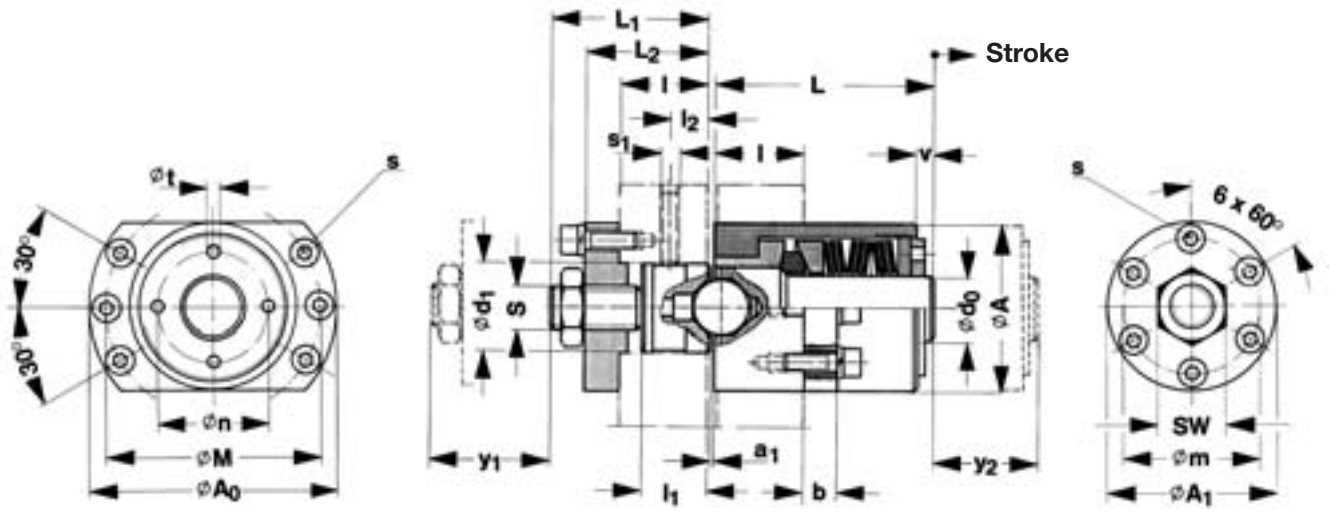
0 – 2
* low torque range 4
* medium torque range 5
* high torque range 6

* see technical data

Example: Order number 0 / 440.504.0

Strengthened sizes 0 – 2

Type 441.604.0



Sizes 0 – 2 Type 441.604.0

Technical data

size	Circumferential force F_u kN	Axial force F_{ax} kN	Stroke mm	Weight kg
0	19 – 38	10 – 20	6	1,75
1	38 – 75	20 – 40	8	4,1
2	75 – 150	40 – 80	12	11,3

Table of dimensions

size	A_{h7}^{H8}	A_0	A_1	a_1	b	d_0	$d_{1\,h7}^{H8}$	L	L_1	L_2	l	l_1	l_2	M
0	55	85	55	2	12	20	30	73	52	42	30	22	12	72
1	75	110	75	2	15	30	40	96	65	51	40	30	17	95
2	100	150	100	3	20	40,6	60	160	80	70	50	40	22	128

size	m	n	S	s	s_1	SW	t	v	y_1 4)	y_2 4)
0	44	31	M12	M6 1)	M5	19	5	3	8	38
1	60	48	M20	M8 2)	M6	30	6	4	10	50
2	80	69	M24	M12 3)	M8	36	8	19	10	65

1) fastening screw DIN 912 10.9 M_A = 9 Nm
2) fastening screw DIN 912 10.9 M_A = 19 Nm
3) fastening screw DIN 912 10.9 M_A = 76 Nm
4) y_1 and y_2 are withdrawal dimensions

We reserve the right to make dimensional and design alterations.

Order example:

To be included when ordering, please state:	size	Type	with ROBA®-tron
Order number:		4 4 1 . 6 04 . 0	see page 17

0 – 2

Example: Order number 1 / 441.604.0

EAS®-element

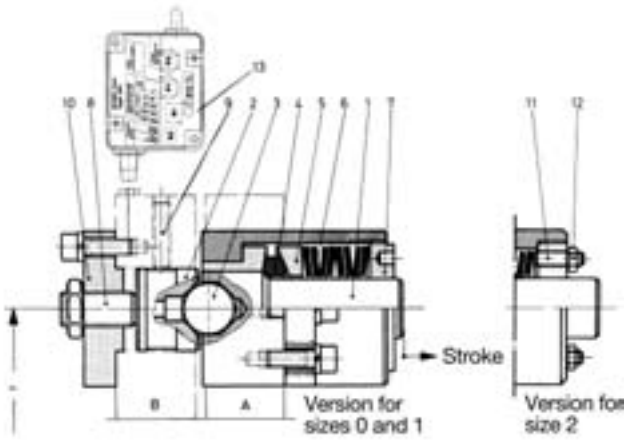


Fig. 1 engaged position

Function description:

EAS®-elements for flange mounting, or for integration into existing structures. EAS®-elements are available in five sizes (02 - 2).

EAS®-elements disconnect the input and output mechanically allowing over-running in the event of an overload.
Re-engagement of the individual elements by hand (automatic re-engagement on request).

Torque path:

flange A (supplied by customer) – bolt 1 – ball 3 – thrust piece 2 – flange B (supplied by customer).

Operating principle:

In the event of an overload, the two flanges A and B rotate against each other and the bolt 1 is pressed against the force of the cup springs 6 out of the thrust pieces 2 via the control segments 4 and the thrust washer 5. The control segments 4 travel radially outwards over the control edge of the bolt 1 and hold the bolt 1 in its disengaged position (see fig. 2). The positive connection of the two flanges A and B is broken. The masses which were originally connected can now coast freely. The drive is electrically disconnected via a ROBA®-tron speed monitor (see page 17).

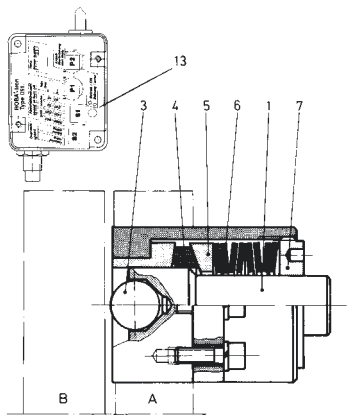


Fig. 2 disengaged position

Construction:

The EAS®-elements are totally enclosed and lubricated for life with a grease filling. All parts of the overload element are in high-quality heat-treatable steels and are protected against corrosion by zinc phosphating.

Bolt 1, thrust piece 2, ball 3, control segments 4 and thrust washers 5 are hardened. The ball 3 rotates in the bolt 1 and is secured to prevent it from falling out.
The elements are also suitable for running in oil.

Element selection:

The limiting torque for an overload M_G at the clutch composed of elements is calculated on the basis of:

$$\mathbf{M_G = z \cdot F_u \cdot r\ [kNm]}$$

(1 kNm = 1000 Nm)

M_G = Limiting torque for overload in [kNm].

F_u = Circumferential force per element in [kN] (see table of dimensions).

r = Pitch circle radius (on which elements are located) in [m] (see fig. 1).

z = Number of elements [-]

Fitting the EAS®-elements sizes 02 – 2:

- The locating bores and tapped holes for the EAS®-elements are to be produced in accordance with the table of dimensions.
- Before fitting, check whether the elements are in the engaged position. Measure dimension p in accordance with table 1 below. The elements are supplied ex works in the engaged position.
- Fit EAS®-element into flange A. Observe tightening torque M_A in accordance with the details given in the table of dimension.
- Lubricate thrust piece 2 well (use Klüber Lubrication Staburags N12 or Optimol Longtime PD) and push it into flange B. Setscrew 9 must be removed.
- Screw on over 10. The setscrew 8 must be removed. Observe tightening torque M_A in accordance with the details given in the table of dimensions.
- Set the clearance a_1 in accordance with table 1 below by tightening setscrew 8 or bushing 11. After setting the clearance, lock setscrew 8.
- Secure thrust piece 2 with setscrew 9.
- Record set clearance dimension a_1 for subsequent checking.

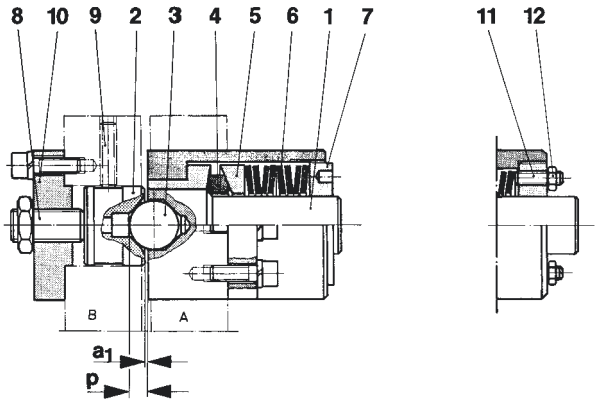


Fig. 3 Sizes 0 – 2

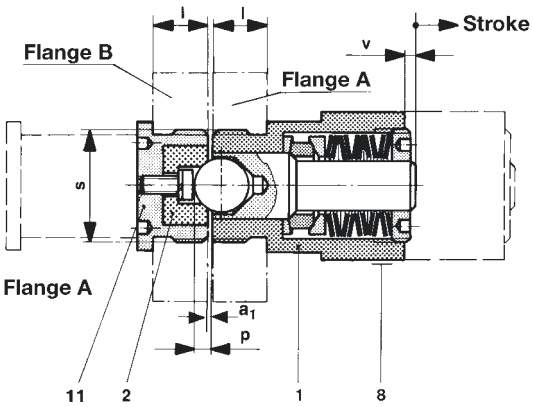


Fig. 4 Sizes 02 and 01

EAS®-element size	02	01	0	1	2
Checking dimension p [mm]	3,5	5,5	8,0	10,5	15,5
Clearance dimension a_1 [mm]	$1,0_{-0,2}$	$1,5_{-0,2}$	$2,0_{-0,5}$	$2,0_{-0,6}$	$3,0_{-0,6}$

Table 1

Torque setting:

The limiting torque for an overload is set at the clutch by changing the cup spring prestressing of each element. For sizes 02 – 1, setting is carried out with the adjusting nut 7 and, for size 2, by means of 4 setscrews M10 11 to DIN 913. All 4 setscrews must be uniformly adjusted and locked. When setting the torque, it is essential to ensure that all elements on the clutch are uniformly adjusted.
The EAS®-elements can be set at the factory for the desired circumferential force F.
Subsequent setting or adjustment via setting diagrams is also possible.

Re-engagement:

Re-engagement occurs by axial pressure on the bolt end.
The level of engaging force F_E depends on the circumferential force F_u set and can be calculated roughly with the aid of the following formula.

For element Type 440._04.0: $F_E = 0,12 \cdot F_u$ [kN]

For element Type 441.604.0 $F_E = 0,08 \cdot F_u$ [kN]

F_E = engaging force per element [kN]

F_U = set circumferential force [kN]

Engagement can also be automated or remotely controlled with mechanical, pneumatic or hydraulic accessories.

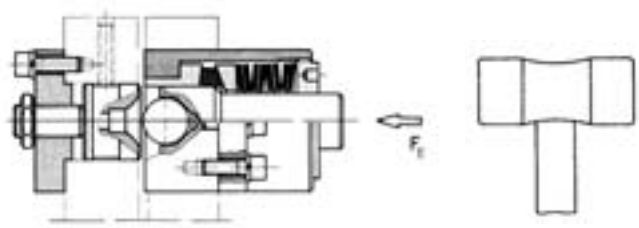


Fig. 5

Maintenance:

The EAS®-elements are completely enclosed and lubricated for life with a grease filling and therefore they do not require any maintenance.
Following maintenance work is necessary at the clutch:

- After the first 20 disengagements check and, if necessary, adjust the circumferential play of the clutch and the clearance dimension a_1 originally set. Regrease thrust piece (2).
- After this, these checks and the regreasing of the thrust pieces (2) are necessary during routine inspections.

Inspection frequency:

- For element Type 440._04.0:
  approx. 1 year of after 1.000 disengagements.
  For element Type 441.604.0:
  approx. 1 year or after 100 disengagements.
  Where there is an excessively great amount of dust and dirt or under extreme ambient conditions these intervals between maintenance operations can be reduced considerably.
- If the clearance dimension a_1 increases by an unusually large amount:
  for size 02 by 0,3 mm
  for size 01 by 0,1 mm
  for size 0 by 0,3 mm
  for sizes 1 and 2 by 0,4 mm
  The axial bearing of the two clutch flanges must be checked without fail.

Manufacturing declaration

The ROBA®-tron is a component for installation into a machine according to the machine guide line 98/37/EC. An operation is prohibited until it has been noticed that the machine in which this unit is fitted, corresponds to the EC-regulations.
The ROBA®-tron corresponds to the low voltage regulation 73/23/EC as well as to directives for resistance against malfunctions acc. to 89/336/EC. There are no malfunction signals according to the EMC-regulation from the ROBA®-tron.

Safety regulations!

Hazardous voltage when connecting the mains-supply voltage. Only qualified and well-trained specialists should work at the units to avoid any personal and material damages.

Electronic units are principally not fail-safe! The installation and operating instruction has to be read carefully and the relevant safety regulations have to be observed before installation and initial operation

Application

- To monitor decreasing and increasing speeds and cycles. For example, turbines, mill works, conveyor systems, agitating machines, centrifuges, hoisting units.
- Special application in connection with the ROBA®-slip hub to avoid long slipping times in case of an overload.
- Trouble indicator in connection with linear overload protection EAS®-axial.

Special Characteristics

- Self-monitoring: In case of breakage of cable, incorrect installation of the NAMUR transmitter or voltage failure.
- Application possibilities in small overall dimensions, especially with the external NAMUR-transmitter.
- Sealed components, unaffected by outside influences

Function

Note: The common designation **cycles** or **cycle speeds** is used for speeds or cycles due to simplification.

The ROBA®-tron monitors „increasing" or „decreasing" speeds. A signal is transmitted to determine the current cycle speed **(actual value)** which is compared with the pre-set switch-off cycle speed **(set value)** when the control flag passes through the initiator zone.

In case the **actual value** achieves the set switch-off cycle speed the ROBA®-tron transmits a signal to switch-off the equipment or for another control function.

The **monitoring ranges** can be selected and determined with a DIP-switch. The ROBA®-tron switches to ***„malfunction"***, if:

a) with **increasing** speeds the actual value is increased up to the set switch-off cycle speed or
b) with **decreasing** speeds the actual value has fallen to the set speed.

The signal relay switches from:

„active operation" LED signals green – signal relay is energised
to ***„malfunction"*** LED does not signal – signal relay is de-energised

The **switch-off cycle speed** is pre-set:

„roughly" with a 4-step DIP-switch and
„sensitively" with potentiometer

The **switch-off cycle speed** of 0-5 secs. allows the slow raising of the drive up to the operating cycle speed.

Connection

Cable arrangement:
Place NAMUR-transmitter-cable
(Type 051.000.6 with external NAMUR-transmitter)
not together with other energised cables

Examples for connection

Start by switching-on the supply voltage,
e.g. by pressing the motor-start-button.

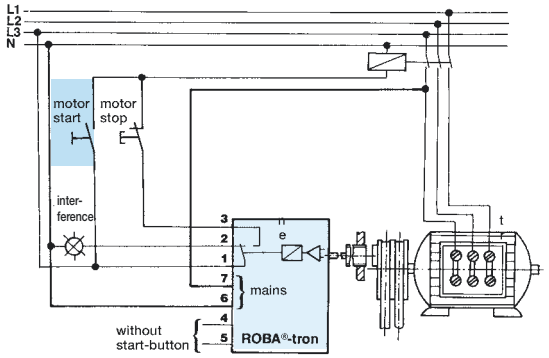


Fig. 2

Start by closing the start-button
(Lock in voltage is already switched-on)

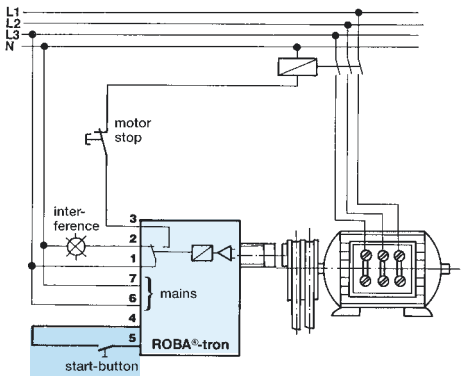


Fig. 3

Funktional operation

Adjustment to monitor decreasing cycle speeds

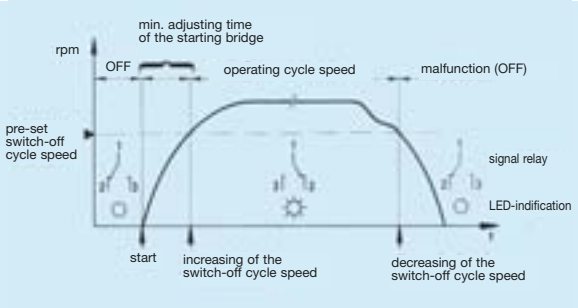


Fig. 1

Start:

- ❑ By switching-ON the supply voltage or closing the start-button.
- ❑ **Signal relay** is energised. Contacts 1 and 2 open, 1 and 3 close.
- ❑ **LED-illuminates** „ON".

The **signal relay** remains *energised,* when
a) the starting bridge is set (max. 5 s)
b) the operating cycle speed is achieved, i.e. over the switch-off cycle speed.

Malfunction:

- ❑ **Malfunction** is signalled, when

a) the operating cycle speed is not achieved
b) the operating cycle speed reducing slowly has achieved the switched-off cycle speed.

- ❑ **Signal relay** is de-energised. Contacts 1 and 2 close, 1 and 3 open. Signal relay remains de-energised and can only be energised by a new start.
- ❑ **LED-distinguished** -„OFF".

Technical data

Available supply voltages:

- ❑ 230 VAC ± 10% 50–60 Hz
- ❑ 115 VAC ± 10% 50–60 Hz
- ❑ 24 VDC ± 5% pole connection safe

Signal relay:	potential-free changeover contact 1–2–3
Contact load:	230 VAC/3 Amp.
Bouncing time:	max. 1 ms
Power consumption:	2 VA
Protection:	amplifier IP 65, compound filled NAMUR proximity switch IP 67
Ambient temperature:	amplifier: -10 °C up to +60 °C NAMUR proximity switch: -25 °C up to +60 °C
Storage temerature:	-25 °C up to +70 °C
Starting bridge:	0 to 5 s

NAMUR-proximity switch:

acc. to EN 50227
switching distance: S_n 4 mm
metal cylinder M12 x 1
max. switching frequency 1 kHz
flush installation is not possible

NAMUR-proximity switch:

acc. to EN 50227
switching distance: S_n 2 mm
metal cylinder M12 x 1
max. switching frequency: 2 kHz
flush installation possible

Speed ranges

Cycle time	Speed
10 – 60 min^{-1}	6 – 1 s
50 – 240 min^{-1}	1,2 – 0,25 s
200 – 1100 min^{-1}	0,3 – 0,055 s
960 – 5000 min^{-1}	0,06 – 0,012 s

Sensor lug: Iron metal □12 x 1 oder Ø 12 x 1
Weight: 400 g

Adjustment to monitor increasing cycle speeds

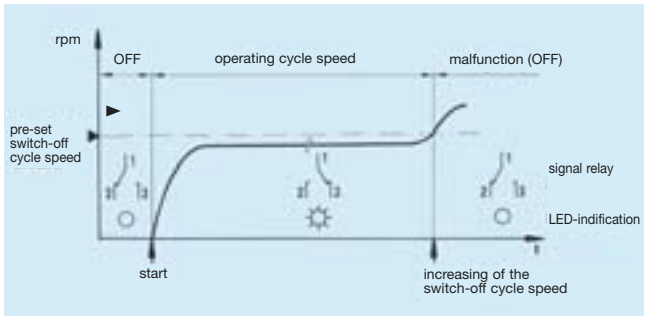


Fig. 2

Start:

- ❑ By switching on the supply voltage or closing the start button.
- ❑ **Signal relay** is energised. Contacts 1 and 2 open, 1 and 3 close.
- ❑ **LED-illuminates** „ON".

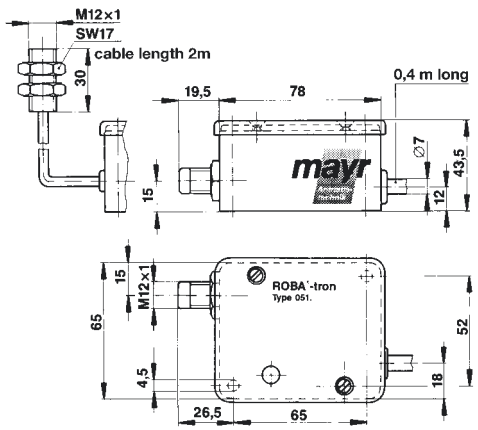
The **signal relay** remains *energised,* when
a) a speed „zero" or
b) the speed is below the switch-off cycle speed.

Malfunction:

- ❑ **Malfunction** is signalled, when the operating cycle speed has reached the set cycle speed.
- ❑ **Signal relay** is de-energised. Contacts 1 and 2 close, 1 and 3 open.

Note: If the operating cycle speed exceeds the switch-off cycle speed in the starting phase for a short time, the signal for malfunction can be suppressed with the starting bridge.

Dimensions



Order example:

To be included when ordering, please state:	Type	supply voltage
Order number:	0 5 1 . 0 0 _ . 6	_ _ _

transmitter internal 2
transmitter external 1

230 VAC
115 VAC
24 VDC

Example: Order number 051.002.6 / 230 VAC