MONTECH

USER MANUAL

HANDLING COMPONENTS

Rotary Units DAP-1 / DAPI-1

BA-100010

english, Edition 01/2007

Table of contents

1. Important information

1.1. Operational discharge

This user manual describes the mechanical construction, the load limit, the assembly, the support and the spare parts of the rotary units DAP-1 / DAPI-1.
It is an integrated component of the operating instructions of amplifier and the operator software.

1.2. Declaration of EU conformance (to Directive on Machines, Appendix II A)

Regulations and standards taken into account:
– Directive on Machines 89/392/EEC, 91/368/EEC

Manufacturer:
Montech AG, Gewerbestrasse 12 CH–4552 Derendingen
Tel. +41 32 681 55 00, Fax +41 32 682 19 77

1.3. Product description and application

Rotary drives DAP-1/DAPI-1 are used where ever regularly rotating movements forwards and backwards have to be performed. Under all circumstances the performance limits quoted in the technical data have to be taken into account. With freely rotating masses particular attention must be paid to the mass moment of inertia.

1.4. Dangers

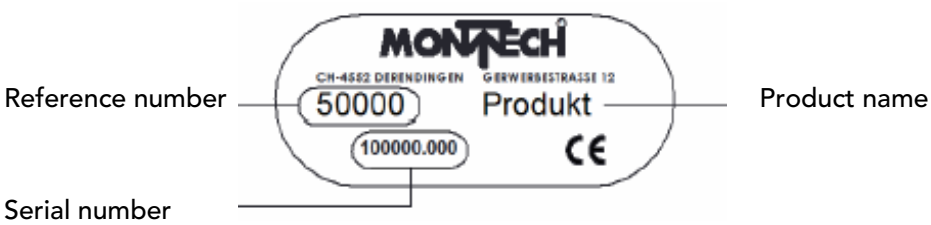
The actuation of freely rotating masses with rotary drives DAP-1/DAPI-1 is only permissible when it is safeguarded by Moving, Isolating Protective Devices in accordance with EN 292-2, para 4.2.2.3.
The present operating instructions are intended to ensure that the DAP-1/ DAPI-1 rotary drives are installed expertly and safely. It is a must, to comply with maximum load.

– During work on the device, it must be ensured that the compressed air cannot be switched on by unauthorized persons!

1.5. Additional information

The aim of the present User Manual is to enable users to employ rotary drive DAP-1 / DAPI-1. correctly and safely. Should further information be required in relation to your particular application, please contact the manufacturer.
When reordering User Manuals, it is essential to quote the reference number, the product name and serial number.
This document can be obtained from our homepage www.montech.com.

Fig. 1-1: Nameplatte



Montech AG
Management

U. D. Wagner

i.V.

C. Wullschleger

1.6. Validity of the User Manual

Our products are continually updated to reflect the latest state of the art and practical experience. In line with product developments, our User Manuals are continually updated.
Every User Manual has an order number (e.g. BA-100010) and an edition number (e.g. 01/2007). The order number and the addition number are shown on the title page.

2. Technical data

			DAP-1	DAPI-1
Range of adjustment of angle of rotation		[°]	0-180	0-180
Piston diameter		[mm]	20	20
Permissible moment of inertia		[kgcm²]	40	40
Permissible shaft loading	1)	[Nm]	5	5
Permissible axial load tension/compression		[N]	90/120	90/120
Weight		[kg]	0.54	0.64
Operating pressure		[bar]	2-6	
Operating medium			oiled or unoiled air, filtered to 5 µm drew point <6°C	
Damping in endpositions			Hydraulic shock absorbers	
Repeatability	2)	[°]	≤0.01	
Check of end positions	3)		Induct. proximity switch	
Pneumatic connection			Hose-ø 4 mm	
Speed regulation			adjustable exhaust throttles with M5 thread and push-on union ∅4mm dia.	
Ambient temperature		[°C]	10-50	
Rel. humidity			< 95% (non condensing)	
Air purity			normal workshop atmosphere	
Warranty			2 years from the date of delivery	
Maintenance			oil the greasing felt	
Installation position			arbitrary	
Material			aluminium, steel, bronze, plastic	

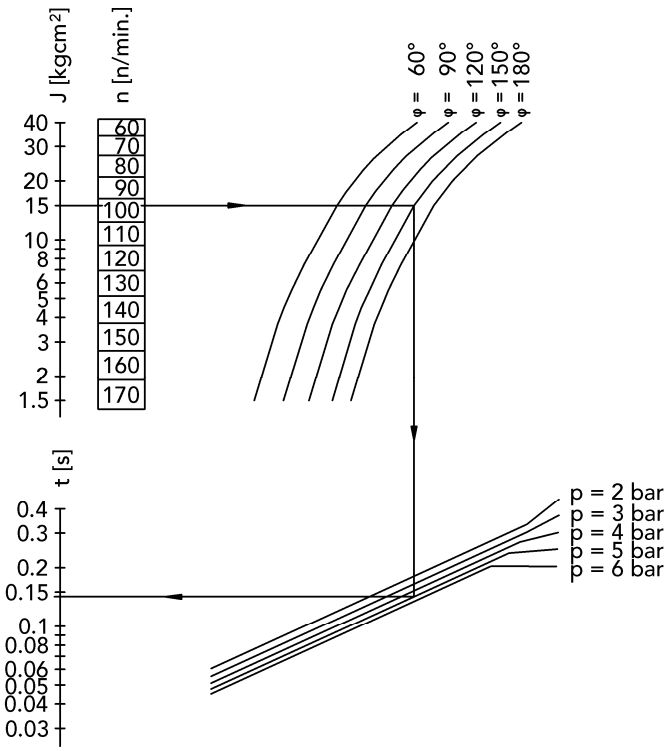
1) Variation of end positions during 100 successive strokes
2) Load acting about the longitudinal axis of the rotating shaft
3) See special accessories

2.1. Special accessories

- Inductive proximity switch PNP, 6.5mm dia. with LED, proof against short circuit and wrong polarity, with a switching clearance of 2mm and a cable 2m long, Ref.No. 508842; plug-in Ref.No. 508843.
- Angle adapter WA to the cultivation of grip arms with internal air feed, right-angled to the axis of rotation (inclusive gasket kit) Article No. 43711. (See Fig. 3-4: Gripper axis perpendicular to the axis of rotation)
- Linear adapter LA for feed eccentrically arranged consumer Article No 44390. (See Fig. 3-5: Gripper axis outside the axis of rotation)
- The push-button actuator converts a pneumatic signal into an electronic. Employment for frequent change in pressure trick and/or lagging Article No 41886.
- Adjustable exhaust throttle with push-on union for hose 2.7/4 mm dia.: Article No. 505023 (for throttling loads connected to rotary unit DAPI-1

2.2. Performance diagram *

Fig. 2-1: Performance diagram



Example:
J = 15 kgcm^2
φ = 150°
p = 5 bar

Results:
$n_{max.}$ = 100 Double strokes per minute
t = 0.14 s

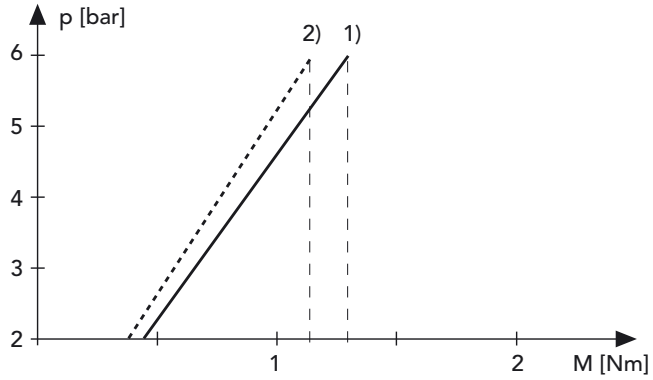
J = Mass moment of inertia
n = max number double strokes
p = Pneumatic op. pressure
t = travel time per stroke
φ = Angle of rotation

*Scope:

- Centre of gravity of the rotating mass located in the axis of rotation, which may be in any position.
- Centre of gravity of the rotating mass outside the axis of rotation, with the axis vertical.

2.3. Pressure-torque diagram

Fig. 2-2: Pressure-torque diagram

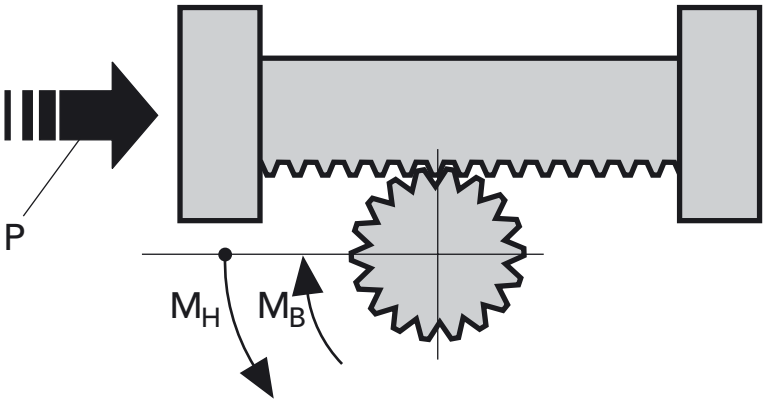


p = Pneumatic operating pressure.

M_H = Holding torque; corresponds to that which can be externally applied to the stationary pinion shaft, without it moving.

M_B = Moving torque; corresponds to that made available by the pneumatic drive at the rotating pinion shaft.

Fig. 2-3: DAP left-hand / right-Hand end position

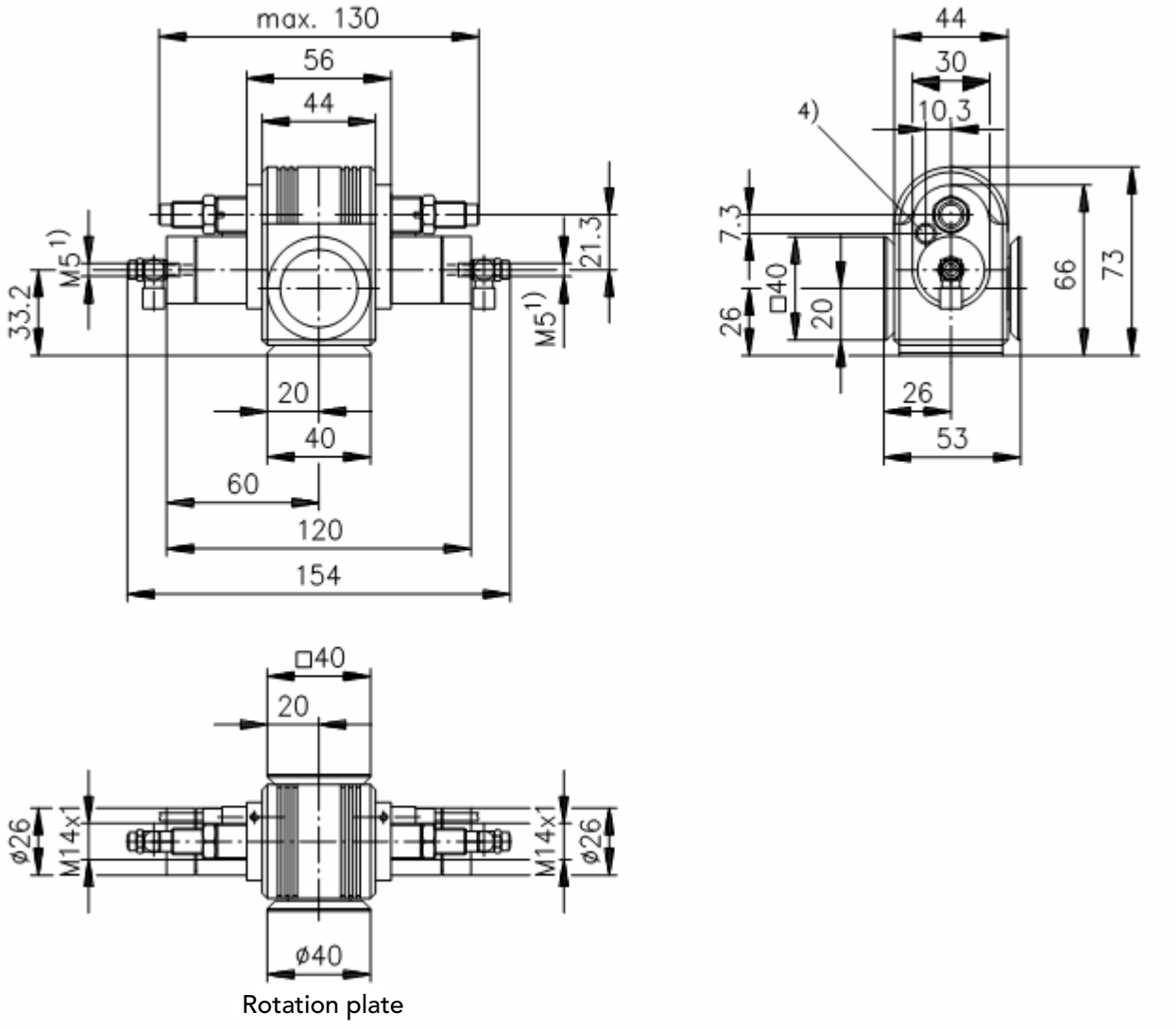


$M_H = p \cdot 0.21$ 1) see Fig. 2.2

$M_B = p \cdot 0.18$ 2) see Fig. 2.2

2.4. Dimensioned diagrams DAP-1

Fig. 2-4: Dimensioned diagram DAP-1



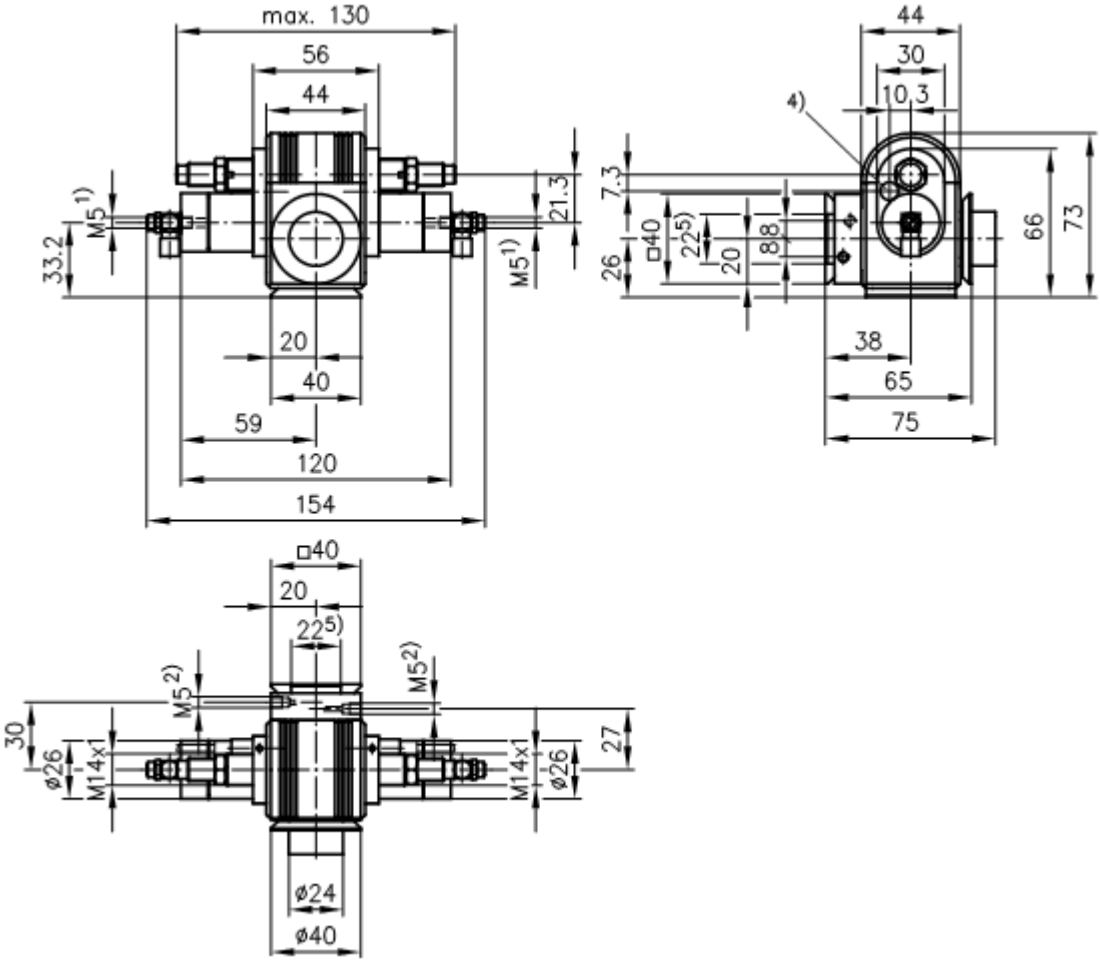
Rotation plate

1) Compressed air feed of the rotary drive
4) Admission for inductive proximity switches

Designation	Article No.
DAP-1	44821

2.5. Dimensioned diagrams DAPI-1

Fig. 2-5: Dimensioned diagram DAPI-1



Rotation plate

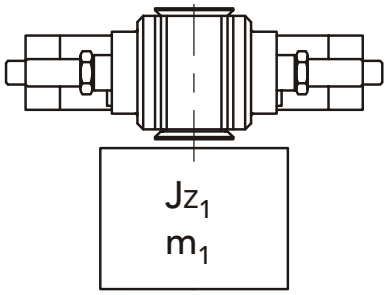
1) Compressed air feed of the rotary drive
2) Compressed air feed for consumers at turning wave
4) Admission for inductive proximity switches
5) dovetail width

Designation	Article No.
DAPI-1	44905

2.6. Load calculation

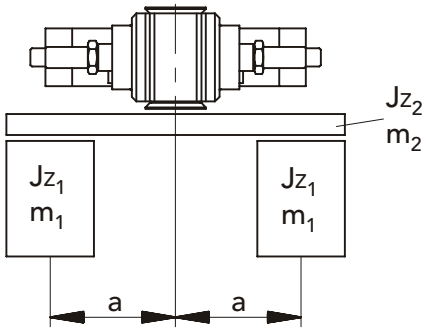
Examination of the individual case

Fig. 2-6: Situation of the attachment parts



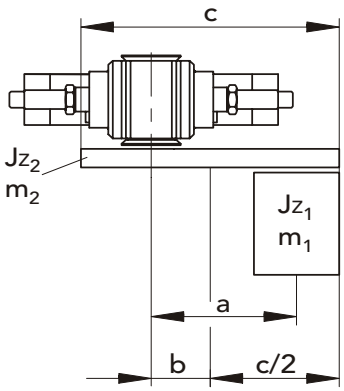
Situation of the axis of rotation		
vertical	horizontal	bevelled
$J_{Ges} = J_{z1}$		
$M_1 < m_{zul}$	M_1 to check	M_1 to check $F_{1\,zul}$ to check $F_{2\,zul}$ to check

Fig. 2-7: Situation of the attachment parts



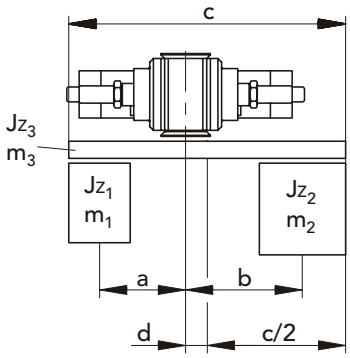
Situation of the axis of rotation		
vertical	horizontal	bevelled
$J_{Ges} = 2 \cdot (J_{z1} + m_1 \cdot a^2) + J_{z2}$		
$\sum m_1 ... m_2 < m_{zul}$	M_1 to check	M_1 to check $F_{1\,zul}$ to check $F_{2\,zul}$ to check

Fig. 2-8: Situation of the attachment parts



Situation of the axis of rotation		
vertical	horizontal	bevelled
$J_{Ges} = J_{z1} + m_1 \cdot a^2 + J_{z2} + m_2 \cdot b^2$	trial	trial
$m_1 + m_2 < m_{zul}$	M_1 to check M_H to check M_B to check	M_1 to check $F_{1\,zul}$ to check $F_{2\,zul}$ to check M_H to check M_B to check

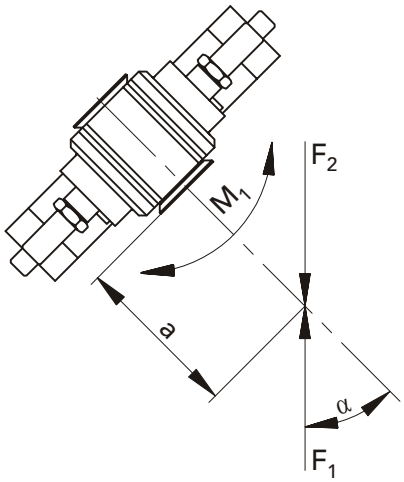
Fig. 2-9: Situation of the attachment parts



Situation of the axis of rotation		
vertical	horizontal	bevelled
$J_{Ges} = J_{z1} + m_1 \cdot a^2 + J_{z2} + m_2 \cdot b^2 + J_{z3} + m_3 \cdot d^2$	trial	trial
$\sum m_1 ... m_2 < mzul$	M_1 to check M_H to check M_B to check	M_1 to check $F_{1\,zul}$ to check $F_{2\,zul}$ to check M_H to check M_B to check

2.7. Sample calculation

Fig. 2-10: Sample calculation examination of the individual case



Examine the forces F_1 and F_2, as well as the Moment M_1

$$F_{1zul} = \frac{F_{zul}}{\cos\alpha}$$

$$M_1 = F_{1vorh} \cdot \sin\alpha \cdot a < M_{1zul}$$

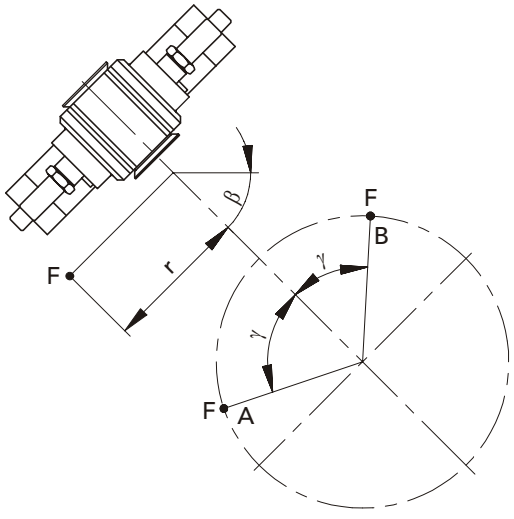
$$F_{2zul} = \frac{F_{zul}}{\cos\alpha}$$

$$M_1 = F_{2vorh} \cdot \sin\alpha \cdot a < M_{1zul}$$

Examine the movement and retaining moment M_B and M_H in the end positions A and/or. B.

$$M_{vorh} = F \cdot r \cdot \cos\beta \cdot \sin\gamma$$

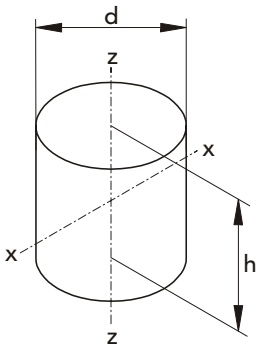
In the formula the larger of the two occurring angles γ is to be used.



		DAP-1
m_{zul}	[kg]	9
F_{zul}	[N]	90
$M_{1\,zul}$	[Nm]	5

2.8. Formulas for calculating moments of inertia

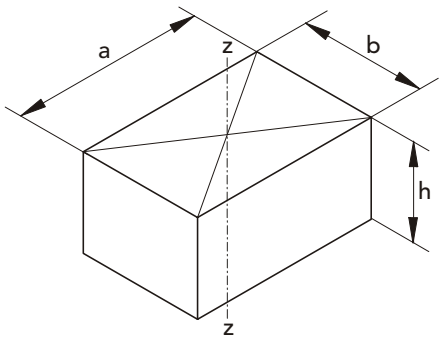
Fig. 2-11: Formulas for calculating moments of inertia



$$m = \frac{1}{4} \cdot \rho \cdot \pi \cdot d^2 \cdot h$$

$$J_z = \frac{1}{8} \cdot m \cdot d^2$$

$$J_x = \frac{1}{16} \cdot m \cdot \left(d^2 + \frac{4}{3} h^2 \right)$$



$$m = \rho \cdot a \cdot b \cdot h$$

$$J_z = \frac{1}{12} \cdot m \cdot \left(a^2 + b^2 \right)$$

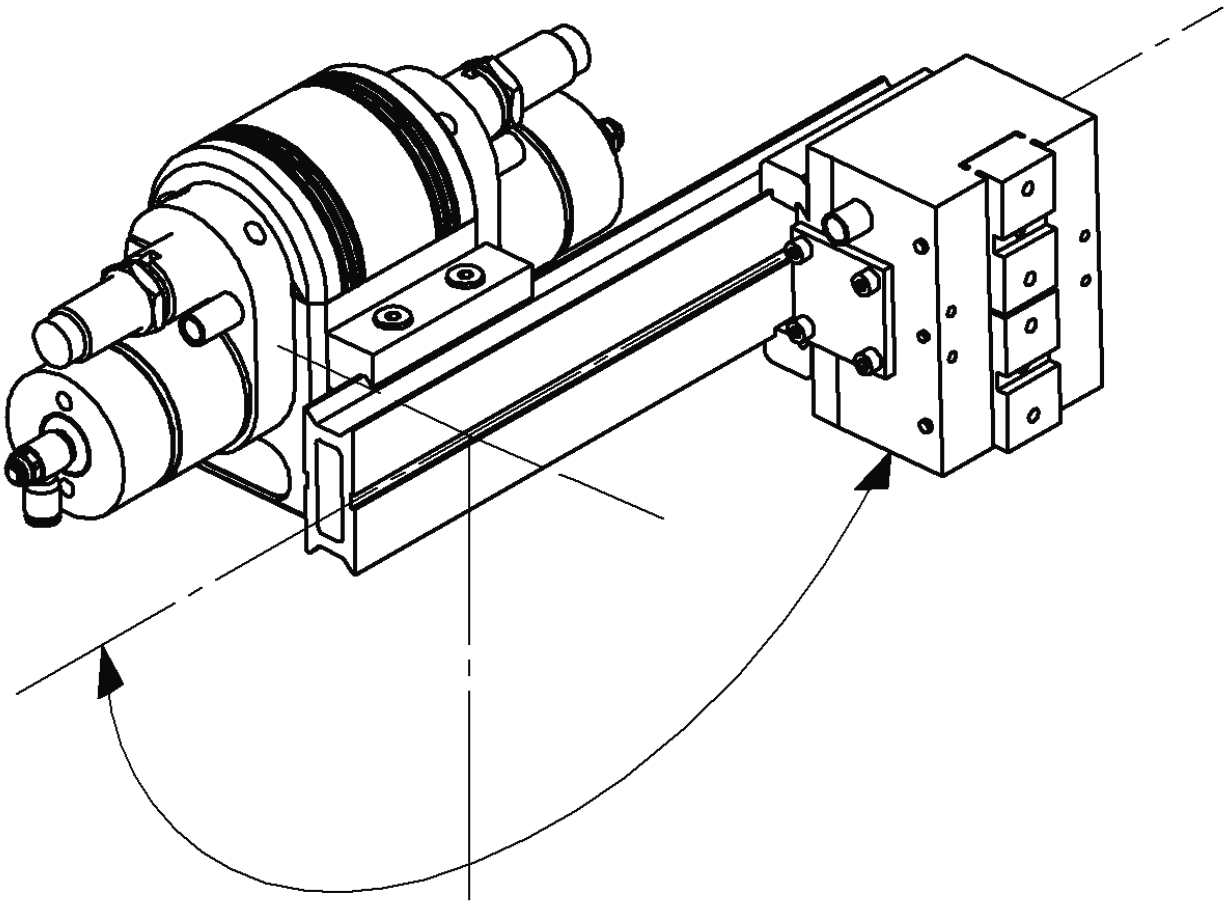
J_z	Moment of inertia with axis of rotation z - z	[kgcm^2]
J_x	Moment of inertia with axis of rotation x - x	[kgcm^2]
m	Mass	[kg]
ρ	Density	[kg/cm^3]
a	Length	[cm]
b	Width	[cm]
d	Diameter	[cm]
h	Height	[cm]

3. Commissioning

3.1. Installation position

In principle, the rotary units may be mounted in any position. But it should be borne in mind that when the axis of rotation is not vertical and the centre of gravity of the mass is eccentric with respect to the axis of rotation, additional variable torques are likely to occur. They may be either in the direction of rotation or in the opposite direction. The result is that the permissible mass moment of inertia has to be reduced from 40kgcm^2 and that the time (t) shown in the performance diagram (Fig.2-1) becomes longer owing to the speed being reduced.

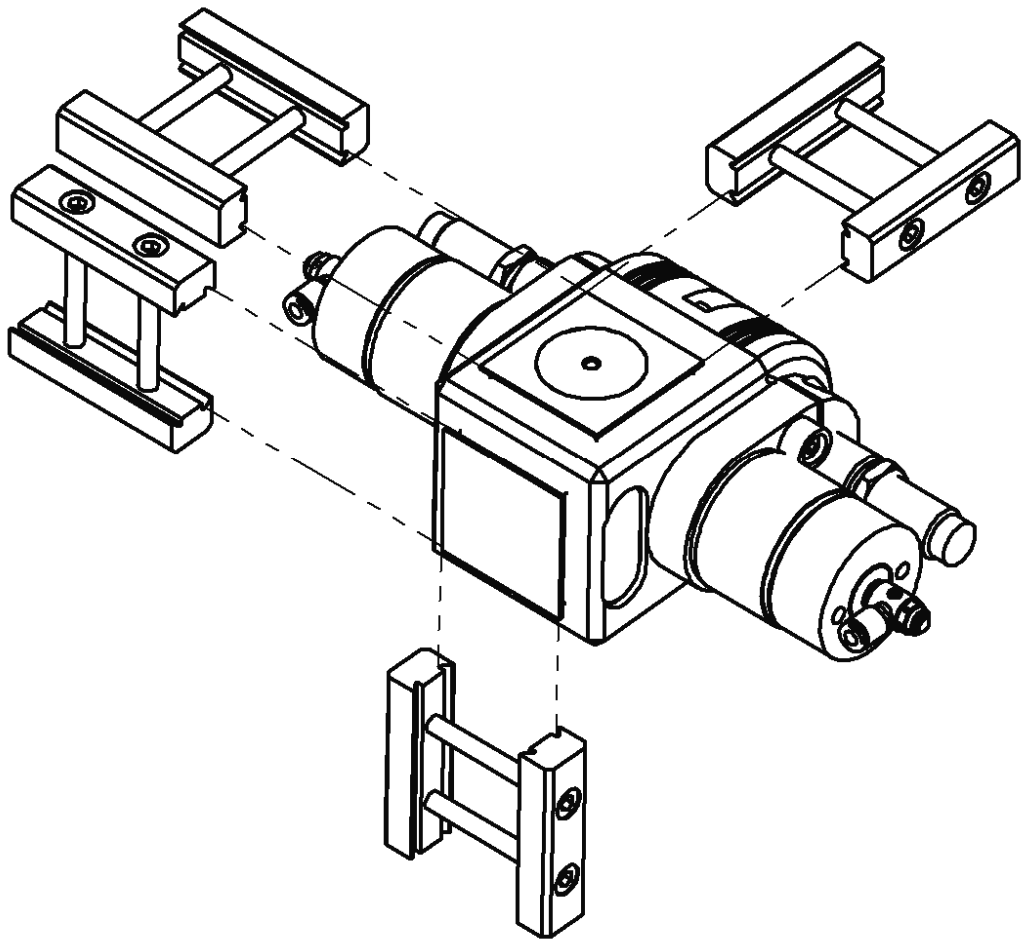
Fig. 3-1: installation position



3.2. Mounting

The rotary units DAP-1 and DAPI-1 may be mounted in any position on any QUICK-SET dovetail. With the MONTECH Quick-Set components mounting structures can be constructed quickly and easily. Any correction to the position of the rotary unit (displacement of the axis) determines which of the 3 methods of mounting is most suitable.

Fig. 3-2: mounting position



3.3. Mounting moving bodies on the rotating axis

With internal supply of compressed air (Fig.3-1 … Fig.3-3)

Fig. 3-3: Gripper axis = axis of rotation

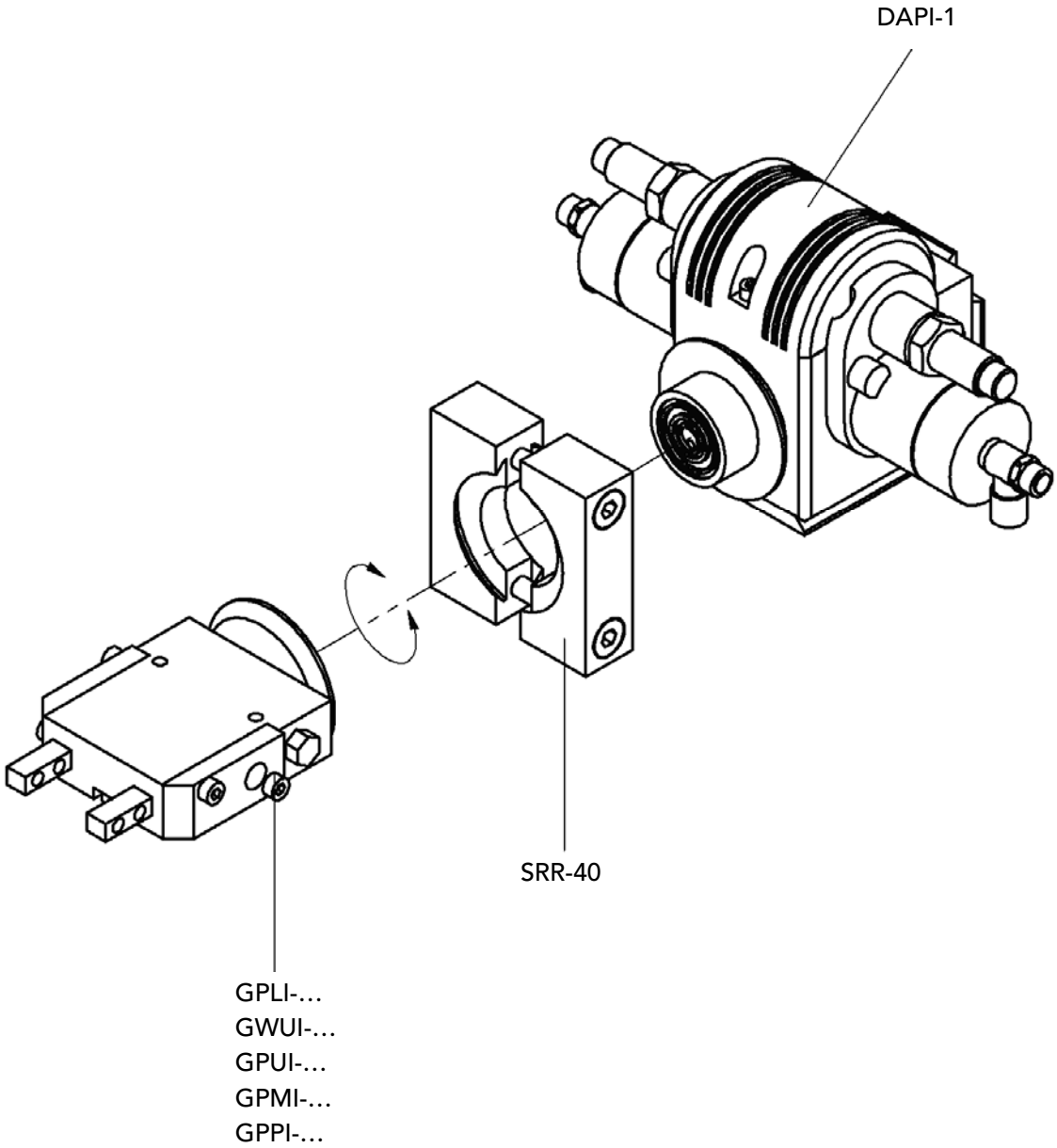


Fig. 3-4: Gripper axis perpendicular to the axis of rotation

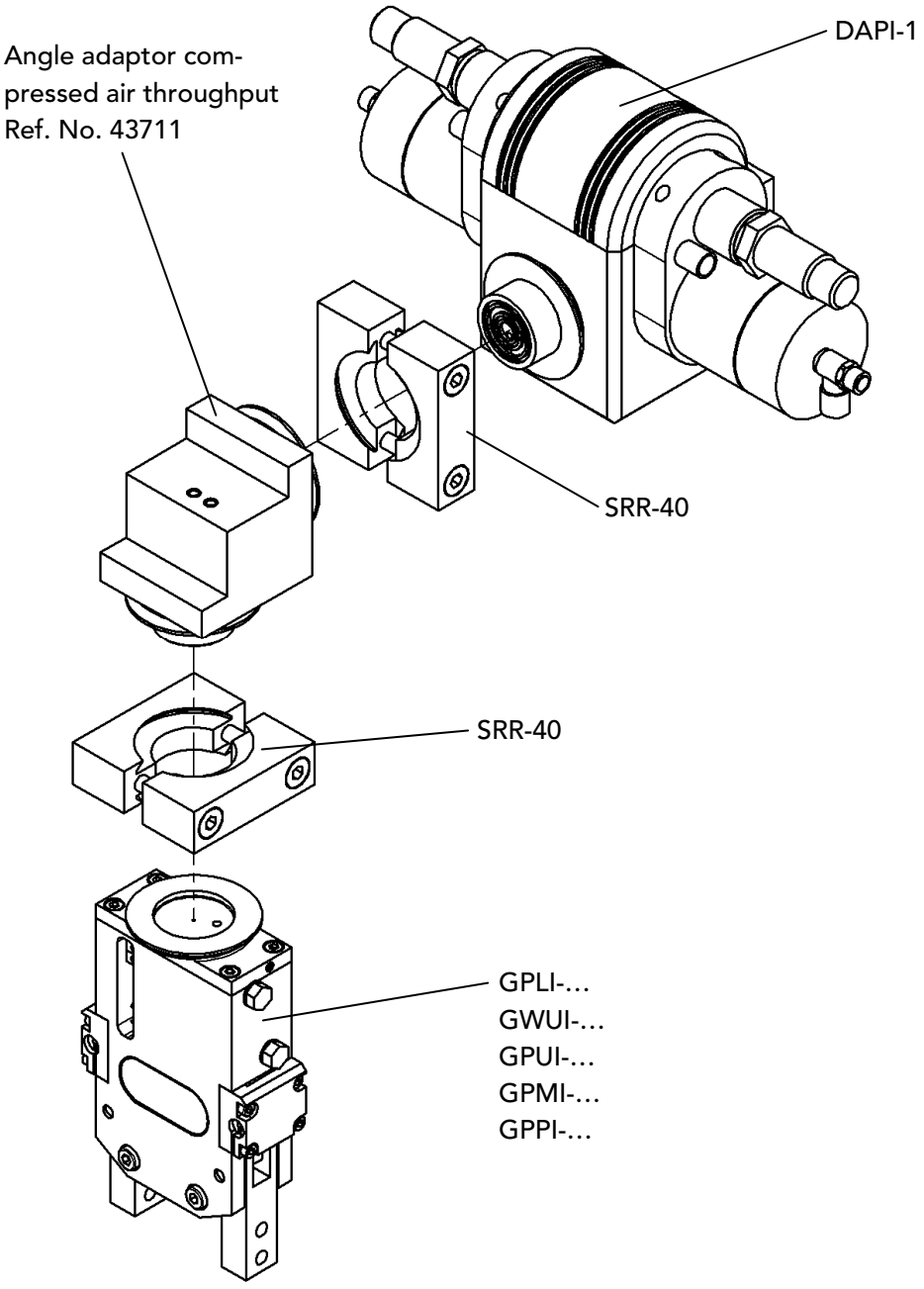
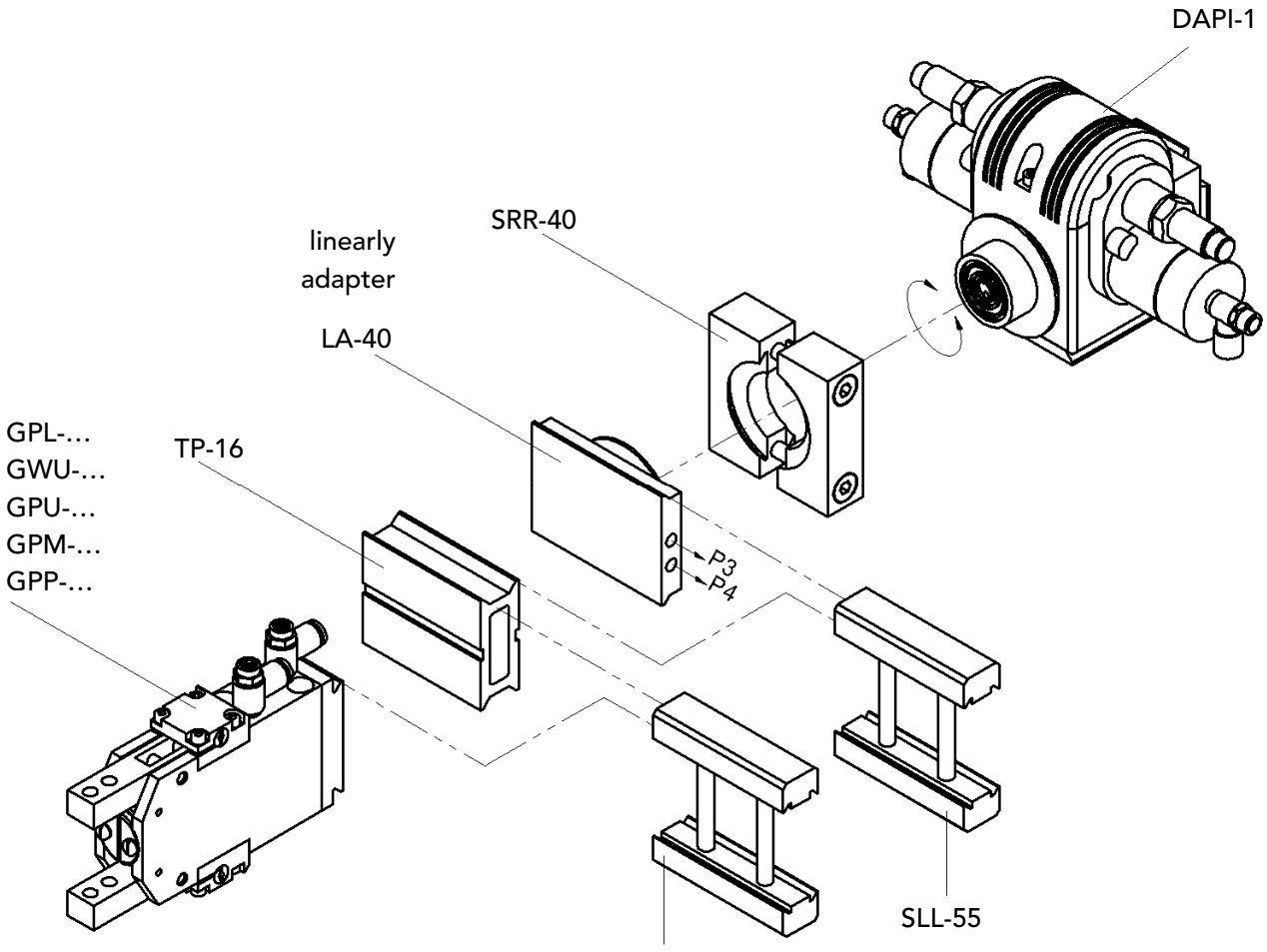


Fig. 3-5: Gripper axis outside the axis of rotation

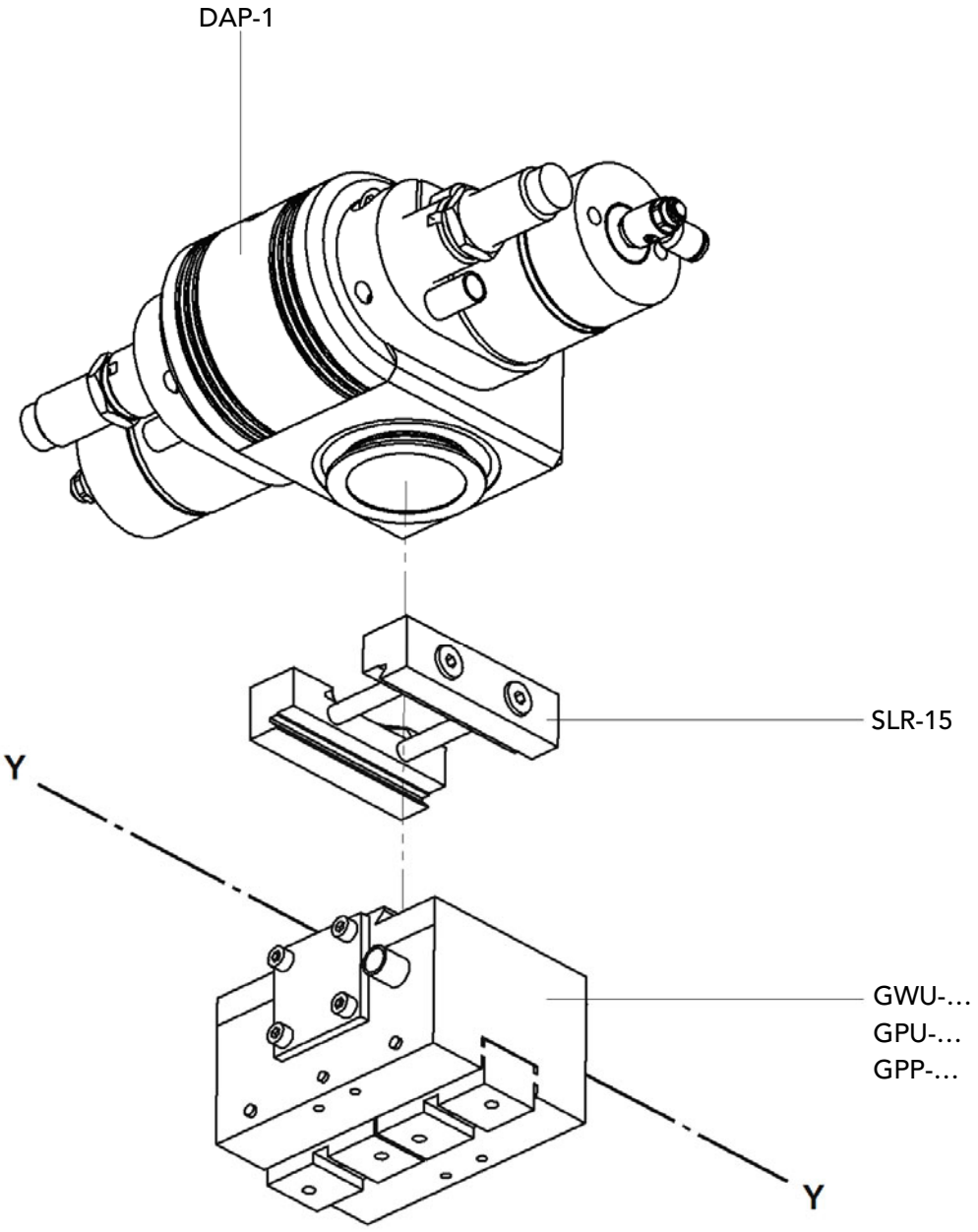


SLL-12, SLL-20, SLL-55 (according to type of gripper)

The loads (e.g. grippers) are fed through the holes P3 and P4.

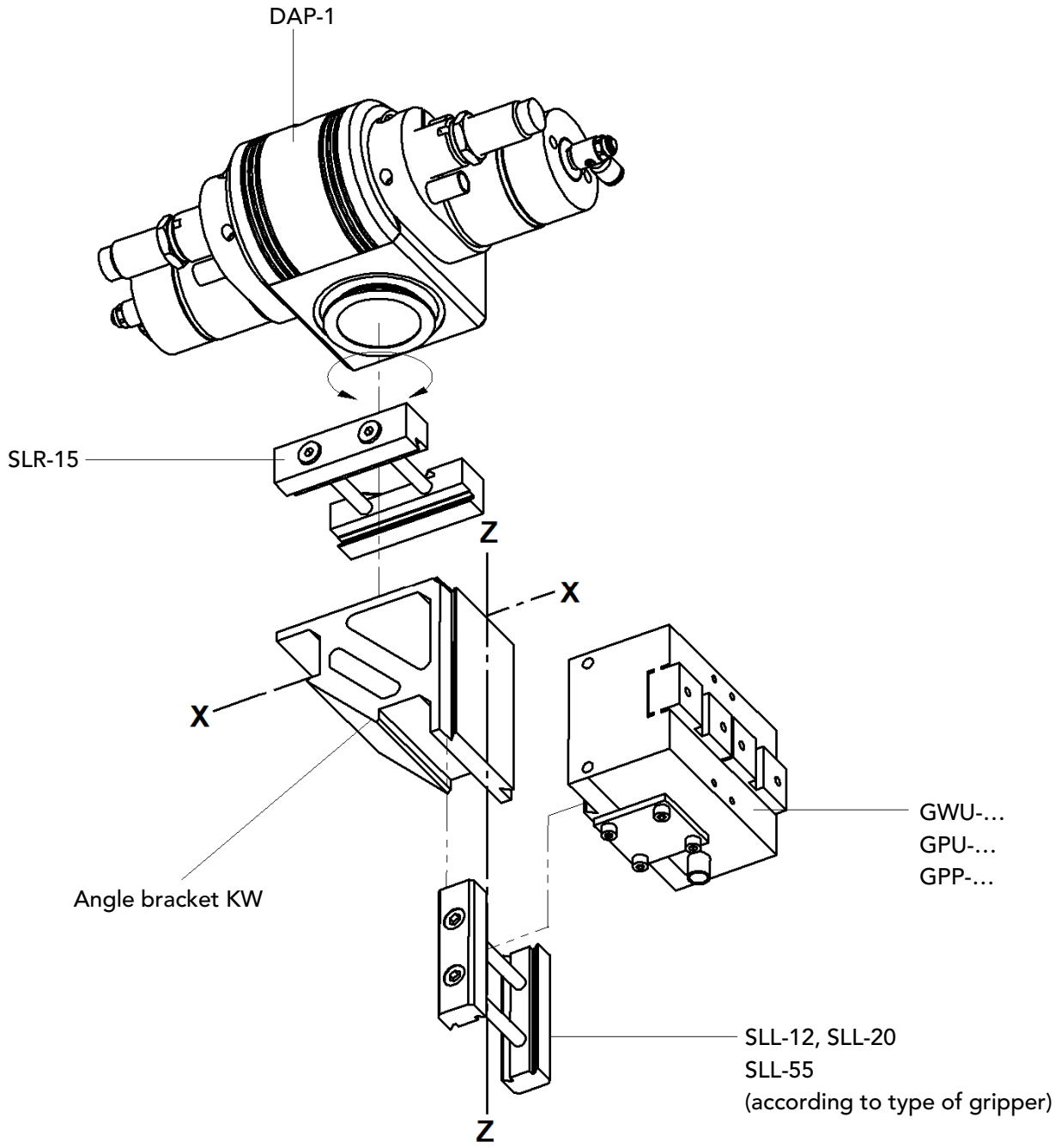
With external compressed air supply (Fig.3-6, Fig.3-7)

Fig. 3-6: Gripper axis located close to the axis of rotation.



The gripper axis can be displaced in the y-y axis by about ± 5mm from the axis of rotation.

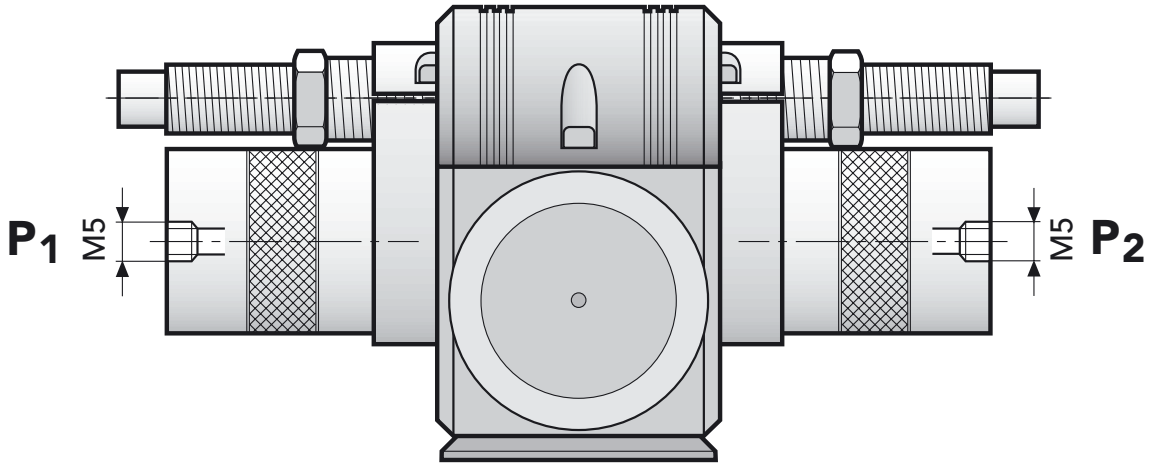
Fig. 3-7: The gripper axis is perpendicular to the axis of rotation.



The angle bracket KW can be displaced in the x-x axis by about ± 8mm. Depending on the type of gripper, the gripper can be displaced in the z-z axis by about ± 8mm (GPP-2) to ± 29mm (GPS-1).

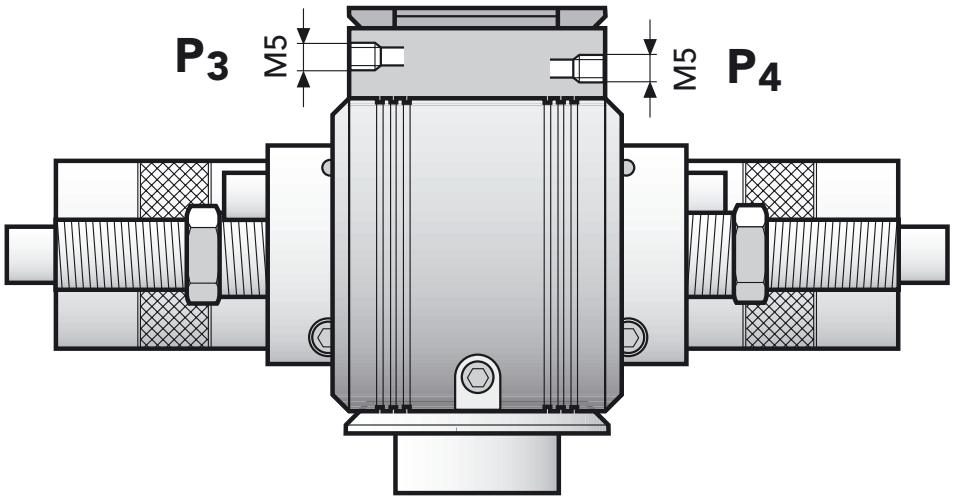
3.4. Compressed air input

Fig. 3-8: compressed air input DAP-1 / DAPI-1



P1 … Rotation clockwise
P2 … Rotation counterclockwise

Fig. 3-9: compressed air input DAPI-1 for loads on the rotating shaft



P3 / P4 Compressed air input for loads on the rotating shaft (Fig. 3-4 … 3-6)

3.5. Setting the angle of rotation φ (see Fig.4-1)

The angle of rotation has to be set using a very low speed of rotation. The nonreturn throttle valves (440) therefore should be opened by only 3 - 4 turns.

- Release the two chhd screws (270a).
- On turning one or both stop sleeves (120) the angle of rotation varies (1 turn = appr. 8°). The stop sleeves (120) may only be adjusted when unloaded.
- Tighten the chhd screws (270a) by 2Nm.
- When the stop sleeves (120) are turned back fully, a maximum angle of Rotation of 180 is obtained.

3.6. Setting the shock-absorbers (see Fig.4-1)

The speed of travel, the mass moment of inertia, the operating pressure and, in certain cases, the position of the axis of rotation, influence the amount of energy to be absorbed by the shock-absorbers. The optimum setting of the shockabsorbers, i.e. that which results in the shortest travel time for given variables, is obtained as follows:

- Mount the rotary unit in the desired position.
- From the fully closed position open the non-return throttle valves (440) about 3 - 4 turns.
- Release the lock-nut of the shock-absorber.
- Screw the shock-absorber (220) into the stop bush (120) until the set angle of rotation ø begins to decrease.
- Increase the speed of travel by opening the non-return throttle valve (440) until the rotating mass moves into the appropriate end position apparently with constant speed, without causing any impact. If this point is not attained, even with the throttle fully open, i.e. if a reduction in speed is apparent just before the end position is reached, the shock-absorber must be slowly turned back until the end position is approached without any apparent speed reduction. In rooms with fluctuating ambient temperature this setting must be carried out at the highest temperature that occurs.
- Tighten the lock-nut of the shock-absorber.

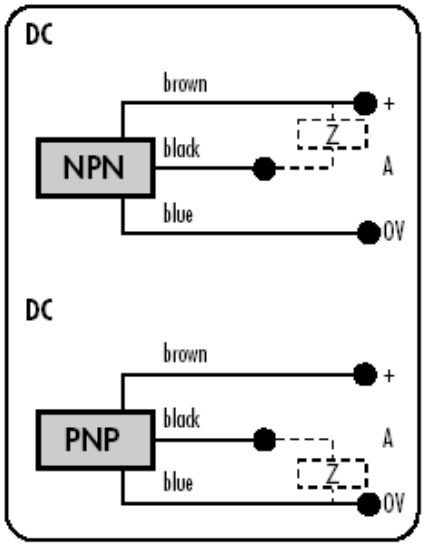
3.7. Setting and connecting the inductive proximity switches

The inductive proximity switches may not be set until the angle of rotation has been determined and no longer changes.

The proximity switches used must possess a switching distance (Sn) of
1 - 2mm, be designed for flush mounting and have a casing 6.5mm in diameter.

Setting procedure (see Fig.4-1)
- Move the rotating shaft into the set end position.
- Insert the proximity switch in the clamping socket (150) and place it in the hole in the casing (10) so that the end face of the sleeve (150) is about 0.3mm from the cube (70). When the proximity switch has been connected electrically, the LED will light up.
- Secure the sleeve (150) and proximity switch by lightly tightening the setscrew (300).

Fig. 3-10: Setting and connecting the inductive proximity switches



3.8. Maintenance

Inspecting the shock-absorbers
All standard equipment from MONTECH contain shock-absorbers of first-class quality. Nevertheless the failure of a shock-absorber cannot be entirely ruled out.

We therefore recommend that during operation attention should be paid to the rotating masses; to ensure that they do not move into their end position with a sharp impact.
Where this does happen, the affected shock-absorber must be immediately readjusted in accordance with "Setting the shock absorbers".
If a satisfactory result is not obtained, the shock-absorber will have to be replaced.

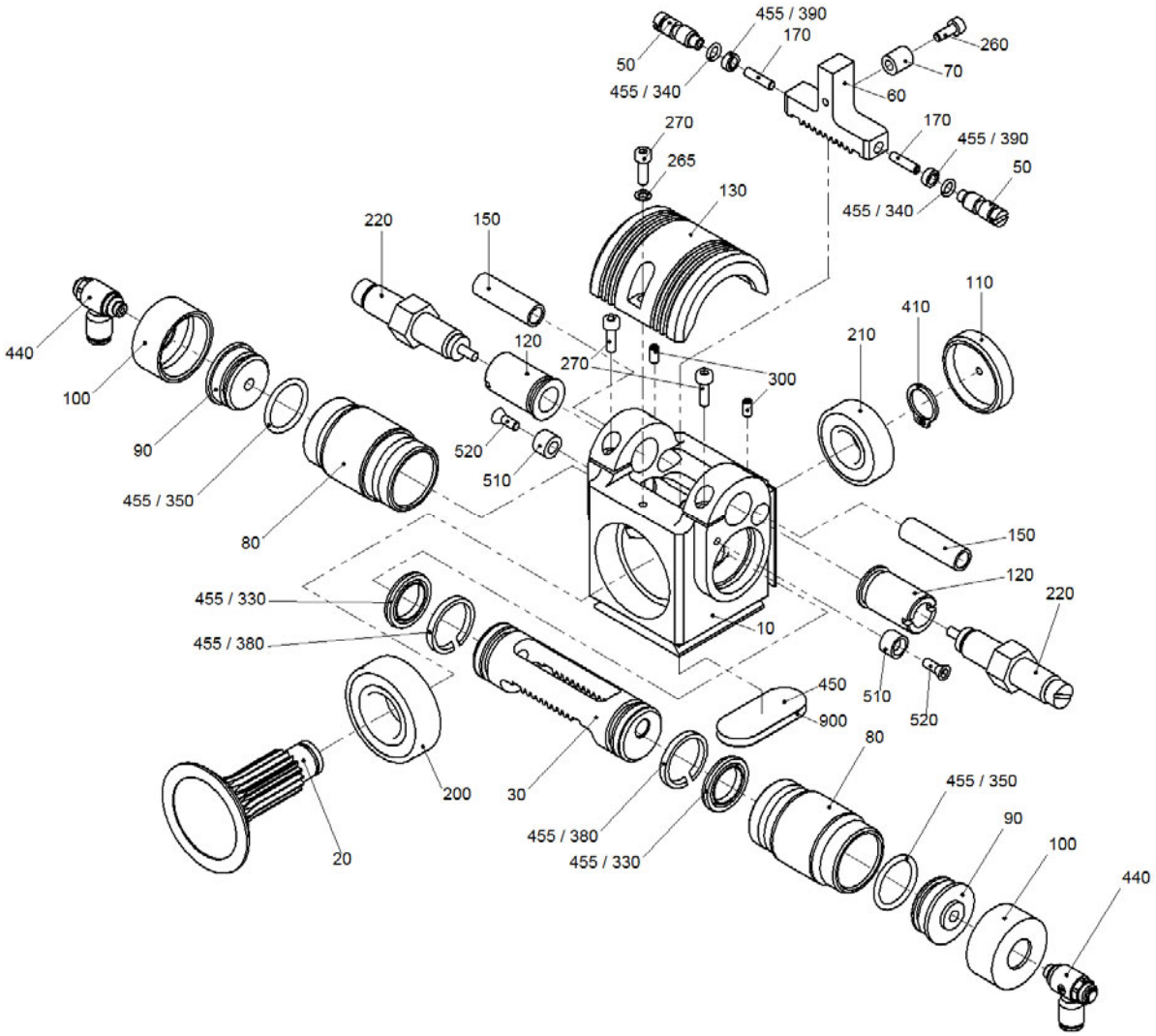
Note: Defective shock-absorbers appreciably shorten the useful life of the rotary units. Accuracy and repeatability of the end positions are then no longer assured.

DAP-1 / DAPI-1 is generally maintenance-free up to 10 Mio. We recommend the following preventative maintenance to ensure optimum performance of the unit:

- Periodic cleaning of the unit, particularly the mechanical guide.
- Inspection of the seals, possible replacement
- Lubricate with Paraliq P460 (Montech article no. 504721), particularly the mechanical guide

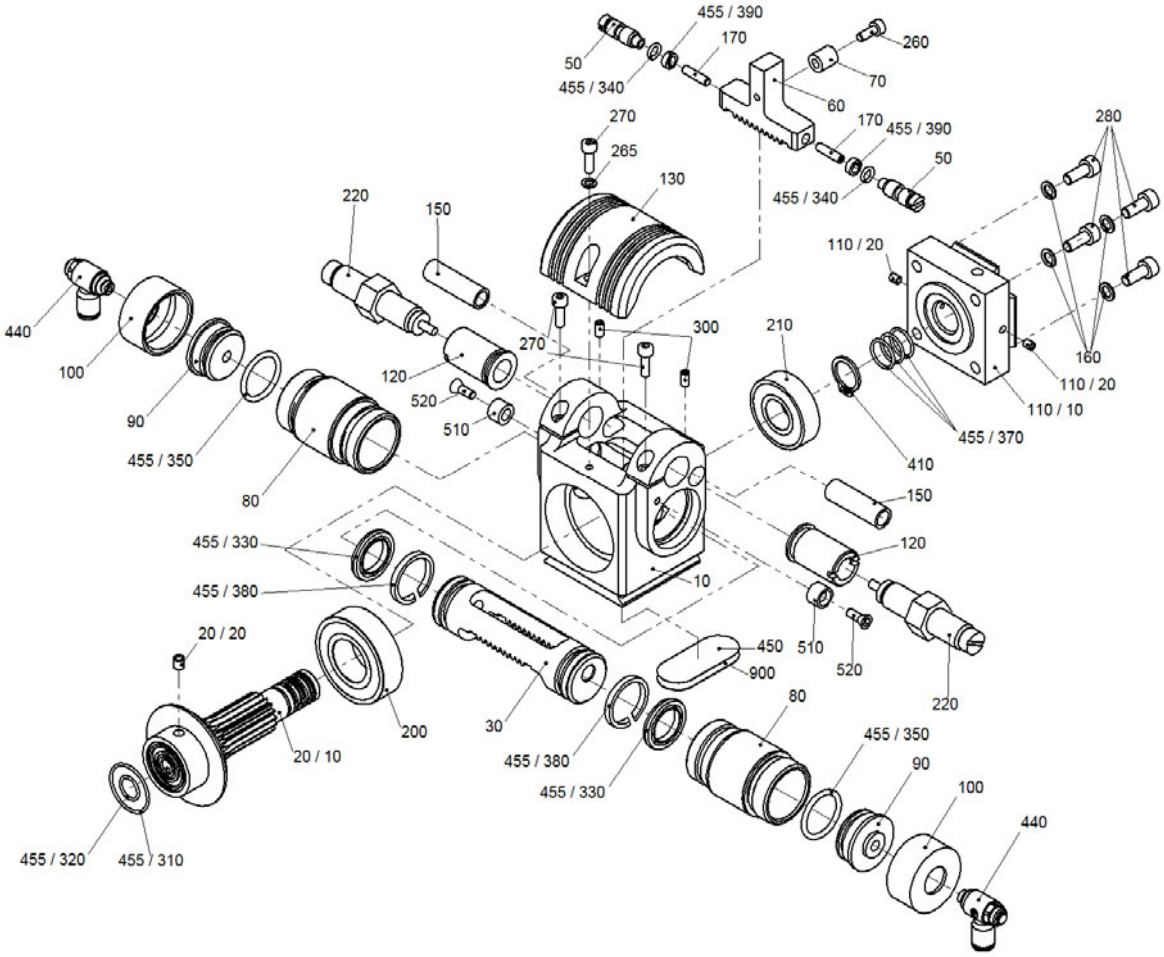
4. Spare parts list DAP-1

Fig. 4-1: Drawing DAP-1



4.1. Spare parts list DAPI-1

Fig. 4-2: Drawing DAPI-1



4.2. Spare parts list DAP-1 / DAPI-1

Item	Designation	Art. No.		Material
		DAP-1	DAPI-1	
10	Housing	45797	45798	Aluminium
20*	Pinion shaft	44828	55214	Steel
30*	Toothed piston	56110	56110	Steel
50	Guide pin	56114	56114	Steel
60*	Rack bar	44825	44825	Steel
70	Damper	45179	45179	Steel
80	Cylindrical tube	48707	48707	Steel
90	Cover	44829	44829	Aluminium
100	Skirted nut	44830	44830	Aluminium
110	Cover	44832	-	POM
110	Cover	-	48377	Aluminium
120	Stop sleev	44831	44831	Steel
130	Hood	45811	45811	ABS
150*	Clamping sleeve	42009	42009	POM
160	Ripped washer	-	502364	Steel
170	Set screw	501890	501890	Steel
200	Grooved ball bearing	501379	501379	Steel
210	Grooved ball bearing	503582	503582	Steel
220*	Shock-absorber	501566	501566	Steel
260	Machine screw	501603	501603	Steel
265	Ripped washer	502363	502363	Steel
270	Machine screw	501604	501604	Steel
280	Machine screw	-	501619	Steel
300	Set screw	501886	501886	Steel
410	Circlip	502449	502449	Steel
440	Non-return throttle valve	505023	505023	Brass
450	Type plate	41620	41620	Various
* Are spare parts and on stock.				

Item	Designation	Art. No.		Material
		DAP-1	DAPI-1	
455*	Seal kit	510008	510009	Various
455/310	O-ring	-	503577	NBR
455/320	O-ring	-	500040	NBR
455/330	Piston gasket	504972	504972	NBR
455/340	O-ring	505190	505190	NBR
455/350	O-ring	505274	505274	NBR
455/370	O-ring	-	503576	NBR
455/380	Guide-ring	46489	46489	POM
455/390	Guide-ring	56113	56113	POM
510	Support	48709	48709	POM
520	Screw	48718	48718	Steel
900	Type plate plaque	48508	48508	PU
* Are spare parts and on stock.				

5. Environmental Compatibility

Materials used
- Aluminium
- Steel
- Acrylnitrite-Butadiene rubber (NBR)
- POM Polyoxymethylene (Polyacetal)
- Paraffinic mineral oil, synthetic hydrocarbon oil
- Polyurehtane (PU)
- Acrylnitril-Butadien-Styrol (ABS)

Surface finish
- Anodized aluminium
- Blackened steel

Shaping processes
- Machining of Al, steel, POM, PTFE
- Moulding NBR gaskets
- Application of polyurethane foam
- Injection moulding of acrylnitril-butadiene-styrene (ABS)

Emissions while in operation
- None

When the equipment is operated with oiled air we recommend returning the exhaust to atmosphere through an oil filter or separator.

Disposal
Rotary units which are no longer fit for service should not be disposed of as complete units, but stripped down to their compoments, which can then be recycled according to the material they contain. The materials used for the components is shown in the list of spare parts. Materials which cannot be recycled shmould be disposed of appropriately.

6. List of figures

MONTECH AG
Gewerbestrasse 12, CH-4552 Derendingen
Fon +41 32 681 55 00, Fax +41 32 682 19 77
info@montech.com, www.montech.com