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**Keep the operating instructions of the metering pump and the accessories readily accessible.**

**2. Scope of delivery**

Be careful when unpacking the metering pump and order-related accessories in order not to miss small parts. Immediately compare the scope of delivery to the delivery note. If there are any discrepancies, try to find out the reason.

**1. Technical data**

KARDOS N...		16	36	56	72	130	225	320	530	750	1300	2500	4200
max. pressure [bar]	Plastic	10										6.5	3
	St. steel	400		325	250	130	80	52	32	24	13	6.5	3
Flow rate at max. pressure	[l/h]	15	34	53	68	125	215	306	500	715	1225	2400	4100
	[ml/stroke]	2.5	5.6	8.8	11.3	20.7	35	51	83	119	204	392	716
Piston - ø	[mm]	8	12	15	17	23	30	36	46	55	72	100	135
Stroke frequency	[1/min]	100											
Suction lift	[mbar]	120											
Motor power	[kW]	selectable 0.55 - 0.75 - 1.1 - 1.5 - 2.2											
Weight [kg]	Metering head	Plastic	4			8			15		20	30	
		St. steel	7			17			34	38	45	78	
	Simplex gear	manual	95			96			97		98	99	
		ATE	100			101			102		103	104	
	Duplex gear	manual	135			137			139		141	143	
		ATE	145			147			149		151	153	

**3. Installation**

When planning, installing and operating a system, the metering pump must be selected with due regard to the local regulations. This applies to the choice of suitable pump materials, the handling of the chemicals and the electrical installation. The technical data of the pump listed above must also be taken into account and the system dimensioned accordingly (e.g. loss of pressure when dimensioning the line with regard to nominal width and length).

The planning engineer and user are responsible for ensuring that the entire system with integrated metering pump is designed in such a way that leaking chemicals due to a failure of wear parts (e.g. worn packing) or ruptured tubing do not cause any permanent damage to system parts and buildings. If there is a large danger potential of the chemical plant the installation must be designed in such a way as to prevent unnecessarily high consequential damage even if the metering pump fails. We therefore recommend to install leakage monitors and containment tanks.

**Note:** Due to their design piston pumps are not leakage-free. This must be taken into account when planning the process and the system.

Metering pumps are designed according to the highest quality standards and have a long service life. Despite this, some parts are subject to wear

caused by operation (e.g. piston, packing, valve seats, valve balls). Regular visual inspection is therefore necessary to ensure reliable longterm operation. The metering pump must be installed so that it is readily accessible to operating and maintenance personnel. It should be serviced regularly to avoid downtimes.

Supplementary fittings are recommended to increase the metering accuracy and functional reliability. Such fittings include backpressure valves, relief valves, leakage monitors and low-level controls as shown in the following installation example.

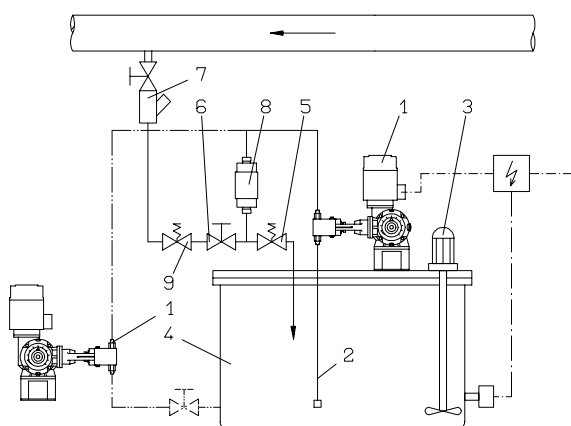
Suitable tools must always be used to work on plastic connecting parts. Undue force must never be applied as otherwise the parts may be damaged or destroyed. Plastic parts (particularly those made of PVC) can be screwed and unscrewed more easily if the thread has been lubricated with Vaseline or silicone grease.

**Note:** The compatibility of the Vaseline or grease with the metered chemical must always be checked first.

The ambient temperature of the pump must not exceed 40 °C. Radiated heat from devices and heat exchangers must be shielded so that the metering pump can still dissipate its own heat. Direct sunlight must be avoided. A canopy roof must be provided to protect the pump against the weather when installed outdoors.

The metering pump must be installed with suction and discharge valves in an upright position. It must be bolted onto suitable ground to ensure stability. The system piping must not apply any forces to the connections and valves of the metering pump. The pump must be interlocked electrically and hydraulically to prevent accidental metering after the process has ended.

### Installation example



### Legend

1	KARDOS N	MB 1 09 02
2	Suction line	MB 1 22 01
3	Electric agitator	MB 1 36 03
4	Tank	MB 1 20 01
5	Relief valve	MB 1 25 01
6	Diaphragm shutoff valve	MB 1 24 01
7	Injection nozzle	MB 1 23 01
8	Pulsation dampener	MB 1 27 01
9	Backpressure valve	MB 1 25 01

### 4. Electrical connection of the pump

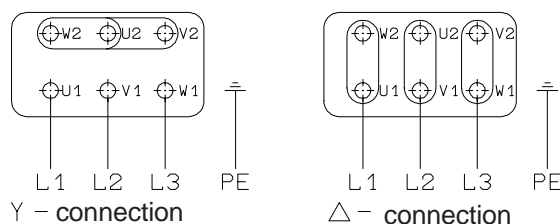
- The electrical connection of the metering pump must be in accordance with the local regulations and may only be carried out by qualified personnel.
- The cable type and cross-section of the power supply cables must be selected according to the motor data.
- The cable bushing to the motor terminal box must be made correctly. We recommend the use of compression glands with strain relief.
- The required protection class must be ensured by correct installation of the electrical connections.

### Electrical connection data

Pump size	Voltage [Volt]	Power [kW]	Current [A]
...N 4200	400/230 50 Hz	0.55	1.50/2.60
...N 4200	400/230 50 Hz	0.75	2.00/3.50
...N 4200	400/230 50 Hz	1.10	2.70/4.70
...N 4200	400/230 50 Hz	1.50	3.50/6.10
...N 4200	400/230 50 Hz	2.20	4.80/8.30
...N 4200	400/230 50 Hz	3.00	6.60/11.4

### Wiring diagram of the drive motor

- Three-phase supply



- Special version

Other electrical versions can be found in the separate circuit diagrams.

- Electric servomotor ATE

The technical data and connection diagrams can be found on page BW 1 09 02 / 7+8.

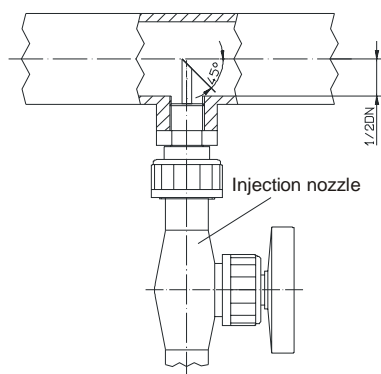
### 5. Safety instructions

- ⇒ The safety rules applicable on site must be observed when working on metering plants (e.g. use of personal protective equipment).
- ⇒ Before starting any work on the metering pump and system, all mains lines must be disconnected and secured against reconnection. The metering lines must be connected before reconnecting the power supply in order to prevent any chemical still in the metering head from being expelled.
- ⇒ Important: The piston area must remain open for checking, which may be dangerous if accessed directly. Maintenance work in the piston area may only be carried out if the pump is switched off.

- ⇒ The metering head of the pump and the system connections and lines may be under pressure. Working on the metering pump requires special safety precautions and may only be carried out by instructed, qualified personnel.
- ⇒ Before startup, all screwed connections must be checked for correct tightness and, if necessary, must be tightened up using appropriate tools.
- ⇒ If connections at the metering head are unscrewed during operation for venting or other reasons, leaking chemical must be removed correctly and completely. This is the only way to avoid the danger of physical injury and corrosion at the metering pump. Leaking chemical may also affect the pump housing.
- ⇒ When changing the chemical, check whether the materials used for the metering pump and the other plant parts are chemically resistant. If there is the danger of a chemical reaction between different media, thorough cleaning first is mandatory.
- ⇒ To operate the pump mount the fan shell in order to ensure sufficient cooling of the motor.

## 6. Injection nozzle assembly

Injection nozzles are fitted with either spring-loaded ball valve or tube valve to prevent any return flow. Injection from bottom to top is recommended to allow air bubbles to escape and to be carried away so that precipitations are avoided. The experience with the chemical to be metered and its properties must be taken into account.



## 7. Startup

1. All the work described in the section "Installation" must be carried out before starting the metering pump. The safety instructions must also be observed.
2. The metering pump is switched on via a control system to be installed externally.
3. The manual or electrical capacity adjustment must be set to maximum stroke to improve priming. During first priming no backpressure should be applied. For this purpose we recommend to install a relief valve on the discharge side of the metering pump.
4. A previously installed priming aid must be filled with chemical first. If the pump is not priming, remove the discharge valve and fill water or chemical (if not dangerous!) into the metering head. Remount valve and start priming.
5. If a venting facility is available as separate unit, open it and wait until liquid flows out. Then close it again. In the case of effervescent liquids allow the liquid to flow out permanently (approx. 1 drop for 1...3 strokes).
6. When correct operation is achieved, set to required flow rate by means of the adjusting knob or remote adjustment. For first approximation refer to the values shown in the "Technical data" table. Depending on the installation and the chemicals used, these values may differ and must be checked under operating conditions.
7. The manufacturer of the metering equipment is not responsible for damages due to excessive or low flow rates resulting from faulty pump settings or incorrect and insufficient installation of peripheral fittings.

## 8. Maintenance

### Lubrication

The piston metering pump KARDOS N is designed for easy maintenance. The gear of the pump is lubricated with gear oil of viscosity class SAE 85W-90 according to DIN 51512.

The initial filling provided should be replaced after approx. 500 hours of operation. The oil should then be changed every 5,000 hours of operation. The capacity equals 4.5 litres for the single gear and approx. 5.5 litres for the duplex gear. The amount of gear oil actually required can be read off from the oil gauge: the oil is filled up to the middle of the view glass.

### Replacing the piston

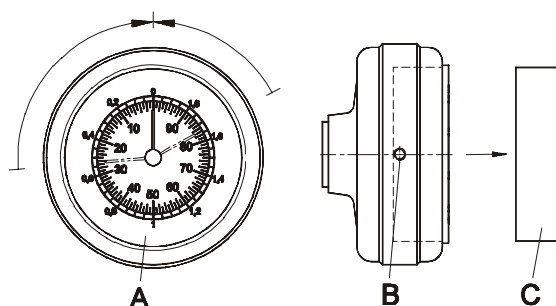
A defective piston or worn packing can be replaced as follows:

1. The chemical contained in the metering line must be drained to depressurize the metering line. Please observe the aforementioned safety instructions for this purpose.
2. The head is removed using an appropriate tool: Unscrew the attachment screws of the metering head, loosen the gland stud. The metering head is then removed in axial direction from the support. Slight rotations of the head make dismantling easier.
3. The piston can now be unscrewed from the piston rod and replaced by a new one, if necessary.
4. To change the packing, the gland stud must be unscrewed. The defective packing is removed using a packing worm. Alternatively, a hook can be used to remove the old packing.
5. After cleaning the packing area, the new packing rings are fitted with offset joints and the gland studs fastened sturdily.  
Caution: The packing material must be compatible with the application and with the chemical.
6. The metering head is now pushed in alignment with the piston and the supporting flange and fixed with the attachment screws after it has reached its final position. Make sure that the valves are positioned vertically.

7. The gland stud is tightened carefully to start the bedding-in process of the new packing. For this purpose the pump is run dry first without connection to the medium. After some strokes the gland is retightened.
8. After connecting the metering lines the pumps is started as described in the 'Startup' section. Continue to prestress the gland stud until a minimum leakage occurs. If prestressing is too strong, the return movement of the piston might be restrained. In this case slightly loosen the gland stud again.

### Correction of the stroke length indicator

1. Handwheel A is turned to the left until stop.
2. Then the handwheel is turned back to the right by one rotation. The pump now works at maximum flow rate.
3. Tightening bolt B at the periphery of the handwheel is unscrewed.
4. The indicator housing C can now be turned into the 100% position, the red and black indicator pointing both to 100%.
5. The indicator housing C is now fixed with the tightening bolt.
6. As a check test turn the stroke adjustment into the opposite direction thus verifying the zero stroke position. If there is any deviation, the indicator element C can also be adjusted to this position or fixed to an average position.



## 9. Troubleshooting

TYPE OF FAULT	POSSIBLE CAUSE	RECOMMENDED ACTION
Pump not delivering.	Valves leaking.	Clean and remove air from valves. (See also startup of pump.) Tighten screw connections.
	Valves incorrectly installed.	Reassemble valves. Ensure that the valve balls of suction and discharge valve are located above the valve seats.
	Suction filter, foot valve or suction pipe leaking or blocked.	Clean and seal suction line.
	No stroke movement.	Return spring broken. Replace spring. Consider density of the chemical! Suction lift too high.
Pump delivering too little or irregularly.	Valves blocked or leaking.	Clean and re-seal valves.
Pump delivering too much.	Pressure on suction side too high (pump siphoning).	Install backpressure valve in discharge line.
Strong leakage at piston.	Packing not tightened strong enough.	Tighten gland stud carefully.
	Piston has longitudinal grooves due to normal wear.	Replace piston and packing. See also section 8, maintenance.
	Excessive wear due to abrasive medium.	Replace PTFE packing by Aramid packing.
Pump very noisy.	Roller bearing defective.	Replace roller bearing.
	No or little oil in gearbox.	Refill oil, as described in section "maintenance".
Motor hums and doesn't start.	Wrong connection.	Check electrical wiring.
	Pressure too high.	Check process.

If the problem cannot be corrected on the basis of the above data, return the pump to the factory or contact our Technical Sales Service for further measures. Repairs will be carried out immediately.

**The operating instructions for the metering pump and accessories must be kept within easy reach.**

**Contents**

1. General
2. Technical data
3. Installation
4. Safety instructions
5. Wiring diagrams
6. Start-up
7. Maintenance

**1. General**

The metering pump is installed in accordance with the applicable operating instructions. The following description refers exclusively to the ATE servomotor, types WAN-G2-AA.

**3. Installation**

The ATE servomotor is connected to the pump and calibrated in the factory.

When installing the servomotor, sufficient clearance of at least 150 mm must be provided for later maintenance works.

The electrical connection of the ATE drive must correspond to the local regulations and may only be carried out by technical personnel.

The two basic connection versions possible are shown in the following wiring diagrams.

Cable type and cable cross-section must be selected according to the motor data.

The cable passage to the motor terminal box must be made professionally. The use of gland screw connections with strain relief is recommended.

The required protection class must be ensured by correct installation of the electrical connections.

Please take into account that the ATE drive can only be actuated with the main motor running, i.e.: the ATE drive must be locked electrically, otherwise the adjusting eccentric wears out frequently or is destroyed.

**2. Technical data**

Type	WAN-G2-AA	WAN-G2-AA/PMR1
Design	Reversible AC motor with self-locking step-down gear.	
Use	For controllers with switching output (3-point control)	For controllers with continuous output 0(4)...20mA
Auxiliary voltage	230V~ ± 10% 50...60 Hz Other voltages upon request.	230V~ ± 10% 50...60Hz
Control		0(4)...20mA
Power consumption	approx. 11.5 W	
Actuating time / bevel	2minutes = 50 rotations = 0...100%	
Position feedback for remote display	Potentiometer 0.5 W 0...1000 Ω = 0...100%	0(4)...20mA (only as an option)
Limit switches	Internal limit switches for limitation of the angle of rotation. Limit position signalled via terminals 4 and 5	
Protection class	IP 54 according to DIN 40050	
Ambient temperature	max. 60°C	
<b>Option</b>		
2nd potentiometer	0...1000 Ω 0.5 W	
Limit switches (2 off)	approx. 250V 1A	

#### 4. Safety instructions

The following safety instructions refer to the ATE servomotor. Furthermore, the notes contained in the enclosed operating instructions of the metering pump also apply to this extended version.

- ⇒ When working on the metering equipment, observe the local safety rules.
- ⇒ Before working on the metering pump and the ATE servomotor, disconnect the main power supply and protect it against reconnection.
- ⇒ Adjustment works in the interior of the ATE drive must be carried out carefully. Connections and internal limit switches might be "alive".
- ⇒ Additional limit switches might be "alive" even with the auxiliary voltage switched off.
- ⇒ After installation works at the ATE servomotor or before startup remount the cover.

#### 6. Start-up

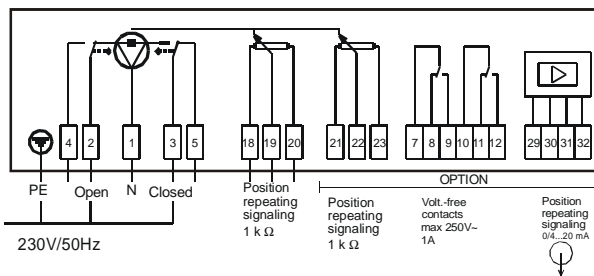
Switch on the main drive motor of the metering pump. The installed electrical interlocking system prevents adjustment of the ATE drive until the main drive motor is running.

Apply brief control pulses to the ATE servomotor to check the sense of rotation.

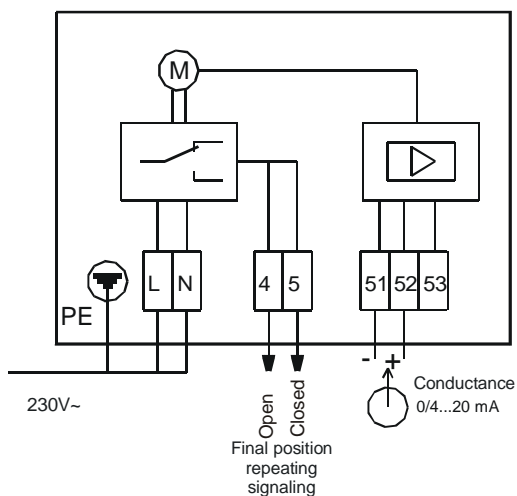
If the sense of rotation is wrong, the supply lines (terminals 2 and 3 in the case of direct controls) are reversed.

The ATE servomotor must be moved to the respective final positions in order to check the limit stop mechanism of the integrated limit switches. The angle of rotation provided by the manufacturer equals 270°. If necessary, the angle of rotation and thus the maximum flow rate can be restricted by adjusting the upper switching cam to the required amount.

#### 5. Wiring diagrams



WAN-G2-AA in the case of control via 230V/50... 60 Hz supply voltage



WAN-G2-AA in the case of control via 0(4)...20mA standard signal

#### 7. Maintenance

The ATE servomotor has been lubricated for life before leaving the factory. Nevertheless, regular inspections are recommended if the drive is operated under extreme service conditions, such as high ambient temperatures or in continuous operation. Molybdenum disulphite is used to relubricate the ATE gear. Suitable grades include "Molykote BR2plus" and "OKS400".