# SIEMENS

## Rotary-Piston Meters

for Industrial Liquids

**DN 25, PN 10: 7MR1110**
**DN 32, PN 10: 7MR1210**
**DN 50, PN 6 und PN 10: 7MR1410**
**DN 80, PN 4 und PN 6: 7MR1610**

**Instructions** Ord. No.: C73000-B5176-C15-5

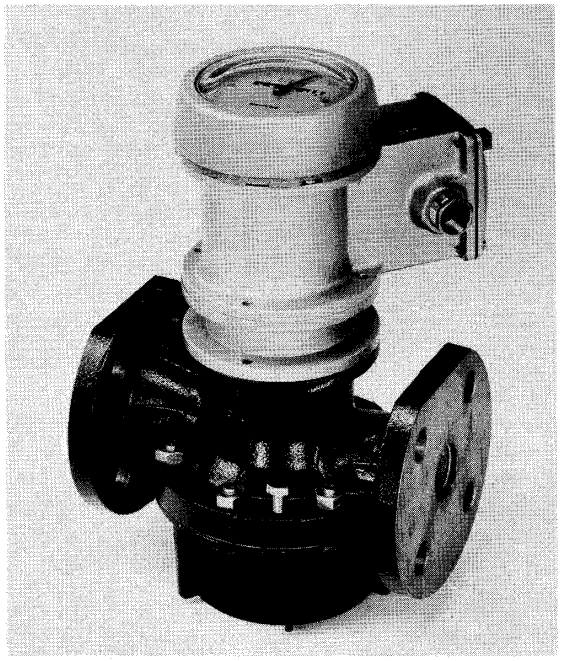


Fig. 1/1 Rotary-piston meter DN 32/PN 10 with electric pulser and register typ 01

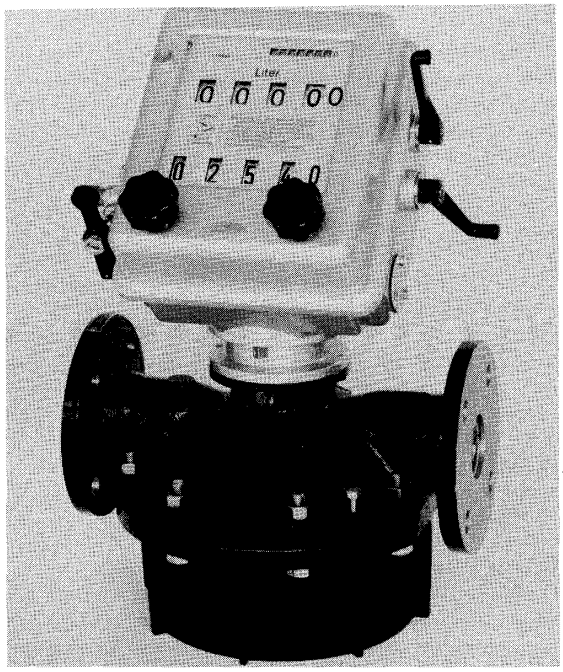


Fig. 1/2 Rotary-piston meter DN 50, PN 10 with quantity preset register type 50

**Contents**



**⚠ WARNING**

Dangerous voltages may be present in this equipment during operation. High pressure and aggressive media may be applied to this equipment. Failure to properly maintain this equipment can result in severe personal injury or substantial property damage.

Only qualified personnel should work on or around this equipment.

The successful and safe operation of this equipment is dependent on proper handling, installation, operation and maintenance.

*QUALIFIED PERSON*

A "qualified person" is one who is familiar with the installation, construction and operation of the equipment and the hazards involved.

In addition, he has the following qualifications:

- Is trained and authorized to operate and maintain equipment in accordance with established safety practices for equipment with electrical circuits, high pressure and aggressive media.
- Is trained in the proper care and use of protective equipment in accordance with established safety practices.
- Is trained in first aid.

# 1 Description

## 1.1 Application

The positive displacement meters with rotary-piston mechanism or rotary-piston meters as referred to in this manual, are employed for volumetric acquisition in consumption and distribution or processing of liquids of the most different types (e.g., acids, bases, solvents and diluents, fuels etc.) especially in the primary industry, the chemical industry, the food industry as well as in power stations and heating stations. Their main features are high accuracy, great reliability and negligible pressure loss.

The meters are approved in Germany and in many other countries for service requiring a licencing by the gauging authorities. The local licencing rules are to be complied with. Meters which are intended for licenced use in the Federal Republic of Germany, have already been tested by the gauging authorities before delivery.

The rotary-piston meter should only be used for the liquid it was ordered for and only in the specified flow range. The materials used in the rotary-piston meters are carefully selected to meet the requirements imposed by the specific application and the measuring tolerance is defined for the specified conditions. Using the meters for other than the specified liquids or at different concentration, viscosity, temperature, as well as exceeding the rated pressure can cause measuring errors or excessive wear or failure of the meter. In case of incomplete or missing operational data upon ordering, we cannot guarantee a correct layout of the devices.

The liquid to be measured should not contain solid impurities, such as suspended substances or sediments. If such foreign matters are present a filter should be inserted in front of the meter. The sieve in the rotary-piston meter is not designed to serve as filter for such impurities. When using the rotary-piston meters in licenced gauging plants, the use of filters is specified.
Sudden shock waves (liquid or water hammer) which occur for example in long lines when a shut-off valve is suddenly closed, should be avoided to prevent damaging the meter.

When a rotary-piston meter is used in a line under vacuum (e.g. suction line of a pump) care must be taken to prevent the entry of air and the evaporation of the liquid measured. Air or gas pockets in the liquid are also measured and lead to false results. To prevent this, a gas separator can be inserted in front of the meter.

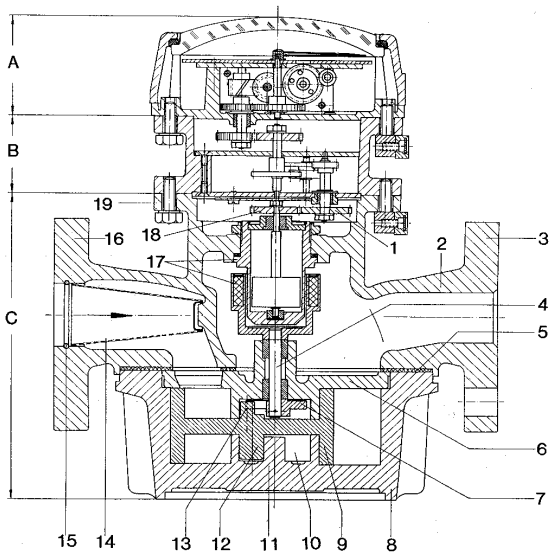
## 1.2 Construction

The rotary piston meter consists of at least three modules: the measuring mechanism, the reduction mechanism and the register (Fig. 1/3). The three modules are combined to a unit. In addition, further modules, e.g. sensors, can be inserted between the flanges.

### Measuring mechanism

It comprises the housing (upper and lower part with the flanges), the measuring system and the transmission equipment. The measuring system consists of the measuring chamber, with cover, rotary piston and partition wall. In the measuring chamber are arranged the slotted rotary piston and, radially, the partition wall.

The piston movement in the transmission equipment is transmitted to the register by a driver, the mechanism shaft, a magnet coupling and the two adjusting gear wheels. One of the adjusting gear wheels belongs to the measuring mechanism, while the other is part of the reduction mechanism.




A Register
B Reduction mechanism
C Metering mechanism

1 Gear wheels
2 Upper part of the housing
3 Flange of outlet side
4 Shaft of metering mechanism
5 Housing gasket
6 Cover of measuring chamber
7 Drive
8 Measuring chamber
9 Rotary piston
10 Guide ring
11 Measuring chamber pin
12 Longer piston pin
13 Shorter piston pin
14 Sieve
15 Circlip to secure the sieve
16 Flange, input side
17 Magnetic coupling
18 Interchangeable gear on mechanism
19 Mounting flange for add-on units

Fig. 1/3 Rotary-piston meter DN 25, PN 10 with reduction mechanism and register type 01

### Reduction mechanism

The reduction mechanism is flanged between measuring system and register. It matches the measuring chamber content which depends on the meter size, to the rotation values by means of its gear wheel mechanism.

## Registers

All registers, like pointer or figure roller registers, are provided with a standard flange for mounting on the reduction mechanism. Depending on design and position of the scale with respect to the mounting flange, the registers are provided with a code number (Figs. 1/4 to 1/7).

The non-reset pointer-roller register type 01 is a single pointer register with a 5-digit figure-roller counter. One revolution of the pointer corresponds to the progression by one digit on the fastest roller of the figure roller counter. Individual quantities are calculated from the difference of two readings. The scale is always horizontal (with reference to a vertical shaft of the metering mechanism) (Fig. 1/4).

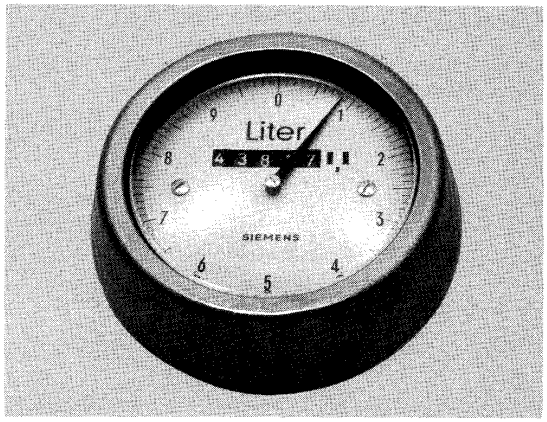



Fig. 1/4 Type 01 non-reset pointer-roller register

The reset pointer-roller registers types 11, 12 and 13 are double pointer registers with two reset pointers and a 5-digit figure roller totalizer. The smaller pointer indicates the full revolution values of the larger pointer. One revolution of the larger pointer corresponds to one revolution of the last roller of the figure roller totalizer. The types of the double-pointer registers only differ in the arrangement of the scale.

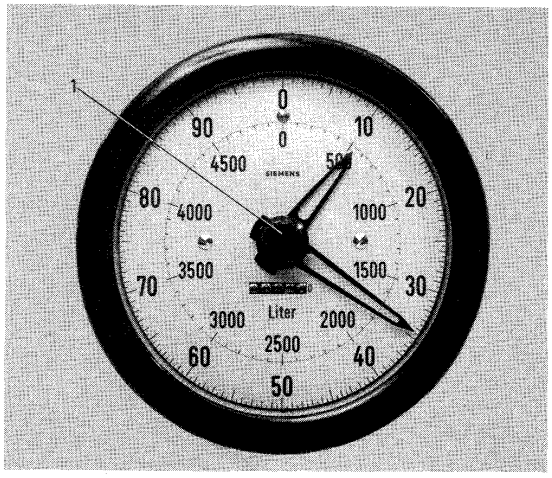



Fig. 1/5 Types 11, 12 and 13 reset pointer-roller registers

| Double-pointer roller register | Scale |
|---|---|
| Typ 11 | horizontal |
| Typ 12 | vertical |
| Typ 13 | inclined by 45 ° |

The roller totalizer counts all measured values continuously and cannot be reset. The pointers can be reset by counter-clockwise rotation of knob 1 (Fig. 1/5).

The reset figure-roller register type 21 has a figure-roller counter with five, large, reset-type figure rollers and an 8-digit non-reset roller totalizer. The scale is inclined at 45 °. The roller totalizer counts all measured values continuously. The large figure rollers are reset by turning the crank 1 (Fig. 1/6) counterclockwise.


Fig. 1/6 Type 21 reset figure-roller register

Type 22 reset figure-roller register with printer mechanism consists of the above described type 21 register with an additional 6-digit printer mechanism arranged in a common casing. Its application is recommended in the cases where a printed receipt is required for the quantities received or output. A digital release of the analog indication of the last roller takes place with the additional sixth digit of the printer (with respect to the figure roller counter). Additional print rollers make possible a two-digit identification of the measuring point on the printed ticket. With this unit also the scale is inclined at 45 °.

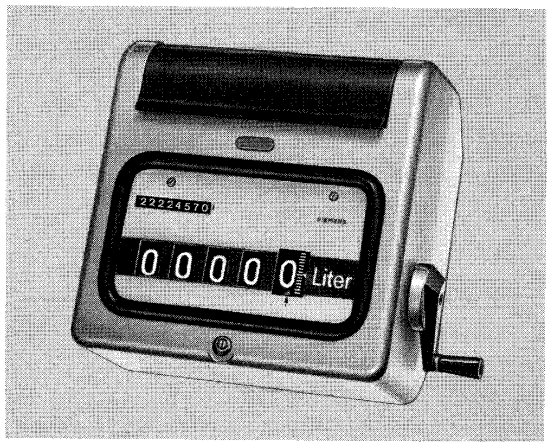
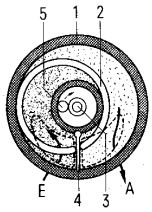



Fig. 1/7 Type 22 reset figure-roller register with ticket printer

### 1.3 Mode of operation

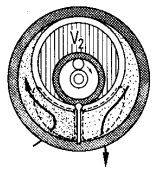
The measuring method is based on the continuous filling and emptying of the measuring spaces formed by the walls of the measuring chamber and the rotary piston as well as the separation plate which is radially inserted between the inlet and outlet openings.

The measured medium flowing through the mechanism moves the rotary piston. In the process, the piston is moved in such a way by the piston pin which runs in the guide slot around the chamber pin that it slides to and fro on the separation plate with its slot. The rotational movement of the piston pin is transferred to the indicator mechanism by the transmission system. One revolution of the piston pin corresponds to the flow of a liquid quantity equal to the chamber volume.




Position 1

The liquid enters through the inlet opening (E) into the shaded part of the measuring chamber. Due to the overpressure, the liquid fills the inner space of the rotary piston and moves it in the direction of the arrow.

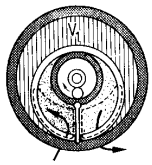



Position 2

The inner space of the rotary piston (volume $V_2$) is now filled and shut off. The liquid continues to flow into the chamber and moves the piston in the same direction.

Position 3

The inner space of the rotary piston is partly over the outlet opening (A). The contents ($V_2$) can flow out or are forced through the outlet opening by the movement of the piston.




Position 4

The outer measuring space (volume $V_1$) is filled and shut off. The rotary piston is partly over the inlet opening and continues to move back to position 1. In this process the contents ($V_1$) flow through the outlet.

The sum of the two volumes ($V_1 + V_2$) represents the displacement of the measuring chamber.

A Outlet opening for measuring liquid
E Inlet opening for measuring liquid

1 Measuring chamber
2 Rotary piston
3 Chamber pin
4 Separation plate
5 Piston pin

Fig. 1/8 Schematic representation of the measuring principle

### 1.4 Technical data

Error limits

Between ± 0.2 % and ± 0.5 % of setpoint (depending on the measured medium, on the range and on the actual calibration regulations), with exception of meters of plastics and enamel/plastics design where ± 1 % of setpoint is valid.

Permissible operation temperature

The permissible temperature of the measured medium with rotary-piston meters depends on the piston material, the number of heat insulating elements between meter and attachment modules, and, in the case of meters of plastics or enamel/plastics design, on the type of plastics used. The ordering data are ruling.

Pressure loss

The pressure loss in the rotary-piston meter depends on the flow rate and on the viscosity of the medium. Fig. 1/9, e.g. shows the pressure loss for DN 25, 32, 50 and 80 rotary piston meters in dependence of the flow rate at 1 mPa ·s.

Strainers

Mesh width depending on measured medium e.g.
approx. 0.2 mm for carburettor fuels, solvents etc.
approx. 0.4 mm for diesel fuels, heating oils, fruit juice etc.
approx. 0.8 mm for heavy fuels, lubricating oils etc.

Meter sizes (DN), pressure rating (PN) and permissible flow rates ($\rho$)

| Design | DN | PN | Rated flow rate (l/min) | Permissible flow rate (l/min) At viscosity (mPa · s) | Min.[4] | Max. interruption [5] [3] | Max. duration |
|---|---|---|---|---|---|---|---|
| Industrial design | 25, 32 | 10 | 100 | 0,3 | 12 | 100 | 50 |
| | | | | 0,6 | 6 | 100 | 50 |
| | | | | 1 | 5 | 100 | 50 |
| | | | | 5 | 3 | 100 | 50 |
| | | | | 800 | 1 | 100 | 50 |
| | | | | 2000 | 1 | 50 | 50 |
| | | | | 5000 | 1 | 20 | 20 |
| Up to PN 10 | | | | 10000[2] | 1 | 10 | 10 |
|  | 50 | 6 (10)[1] | 500 | 0,3 | 40 | 400 | 165 |
| | | | | 0,6 | 20 | 500 | 165 |
| | | | | 1 | 18 | 500 | 165 |
| | | | | 5 | 10 | 500 | 165 |
| | | | | 800 | 2 | 400 | 165 |
| | | | | 2000 | 2 | 200 | 165 |
| | | | | 5000 | 2 | 80 | 80 |
| | | | | 10000[2] | 2 | 40 | 40 |
| | 80 | 4 (6)[1] | 1000 | 0,3 | 60 | 800 | 350 |
| | | | | 0,6 | 35 | 1000 | 350 |
| | | | | 1 | 25 | 1000 | 350 |
| | | | | 5 | 10 | 1000 | 350 |
| | | | | 800 | 5 | 800 | 350 |
| | | | | 2000 | 5 | 350 | 350 |
| | | | | 5000 | 5 | 150 | 150 |
| | | | | 10000[2] | 5 | 75 | 75 |

1) Values in brackets apply to housing made of CrNiMo steel.
2) Flow rates for higher viscosities on inquiry; experience already gained up to 200 000 mPa · s.
3) Max. 1000 h/year.
4) Increase by factor of 2 for rotary pistons made of metal and by a factor of 3 for rotary pistons made of PCTFE and PTFE graphite.
5) With metal rotary pistons: reduce by a factor ≈ 0.8 to increase service life.

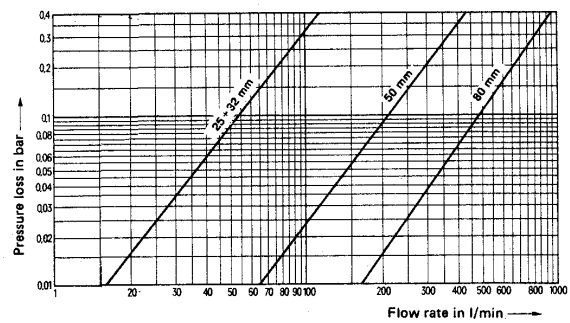
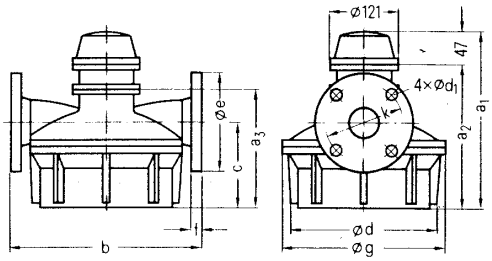
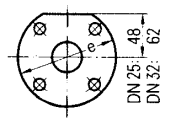



Fig. 1/9 Pressure loss versus flow rate at 1 mPa · s viscosity of the meas. medium for DN 25, 32, 50 and 80 meters

Dimensions of the rotary-piston meters, industrial design, with pointer and figure-roller register

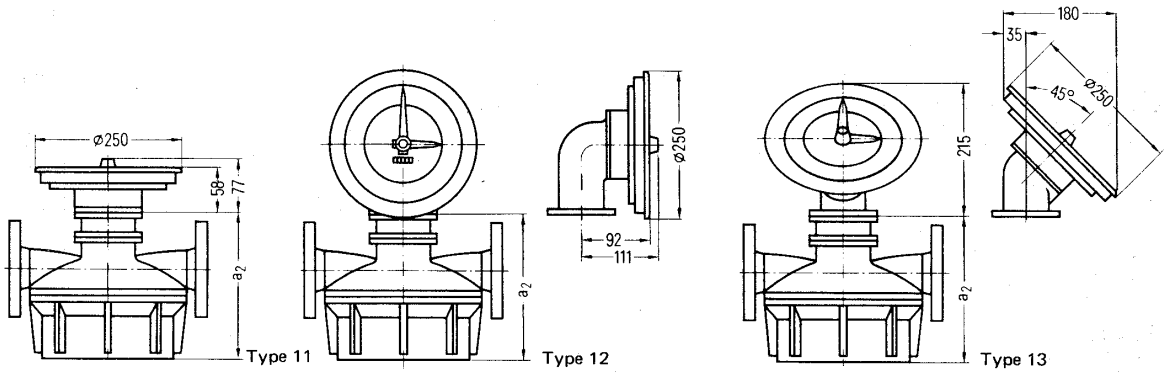



with type 01 register

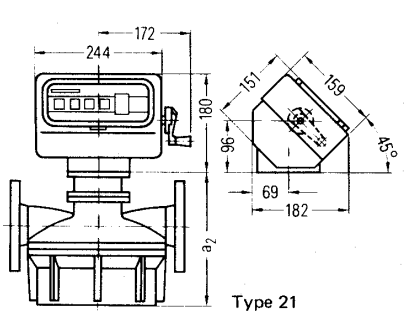


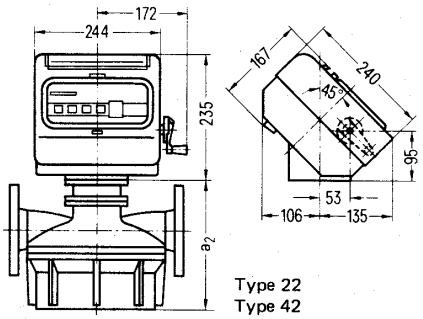

Flanges smoothened down at top with DN 25 and DN 32 rotary-piston meters

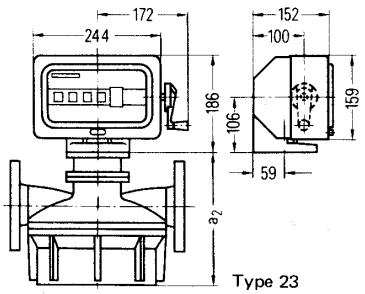
| Dimension | DN 25 PN 10 | DN 32 PN 10 | DN 50 PN 6 PN 10 | DN 80 PN 4 PN 6 |
|---|---|---|---|---|
| $a_1$ | 237 | 237 | 289 | 328 |
| $a_2$ | 190 | 190 | 242 | 281 |
| $a_3$ | 153 | 153 | 205 | 244 |
| b | 210 | 210 | 325 | 410 |
| c | 90 | 90 | 147 | 185 |
| d | 140 | 140 | 250 | 340 |
| $d_1$ | 14 | 18 | 18 | 18 |
| e | 115 | 140 | 165 | 190 |
| f | 16 | 16 | 17 | 18 |
| g | 155 | 155 | 275 | 365 |
| k | 85 | 100 | 125 | 150 |

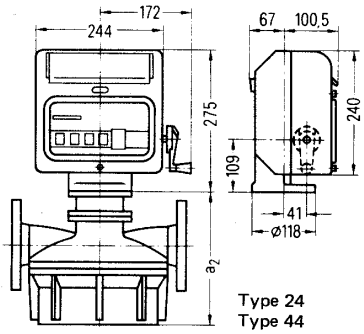



Rotary-piston meter with double-pointer dial



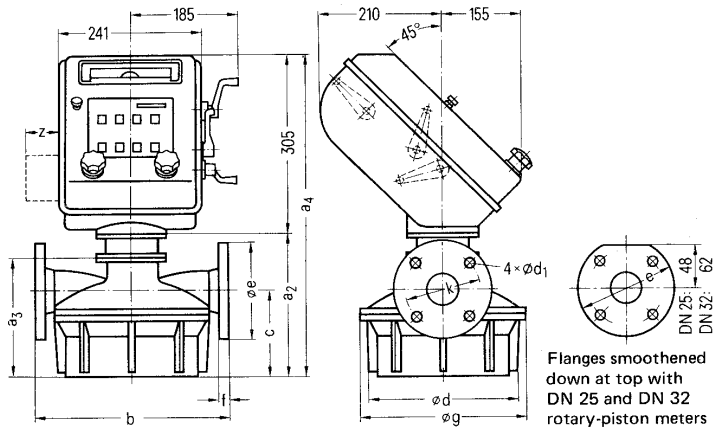




Rotary-piston meter with figure-roller register

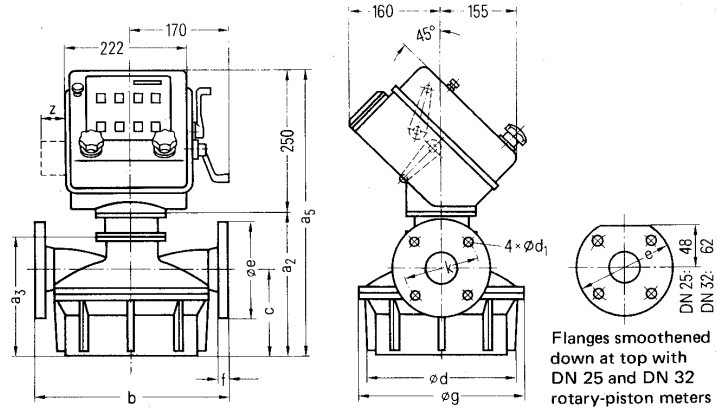
Dimensions of the rotary-piston meters, industrial design, with additional units and quantity preset register




Flanges smoothened down at top with DN 25 and DN 32 rotary-piston meters

| Dimension | DN 25 PN 10 | DN 32 PN 10 | DN 50 PN 6 PN 10 | DN 80 PN 4 PN 6 |
|---|---|---|---|---|
| $a_2$ | 190 | 190 | 242 | 282 |
| $a_3$ | 153 | 153 | 205 | 244 |
| $a_4$ | 493 | 493 | 547 | 586 |
| $a_5$ | 440 | 440 | 492 | 531 |
| b | 210 | 210 | 325 | 410 |
| c | 90 | 90 | 147 | 185 |
| d | 140 | 140 | 250 | 340 |
| $d_1$ | 14 | 18 | 18 | 18 |
| e | 115 | 140 | 165 | 190 |
| f | 16 | 16 | 17 | 18 |
| g | 155 | 155 | 275 | 365 |
| k | 85 | 100 | 125 | 150 |
| z | See page 3/7 for switch dimensions | | | |

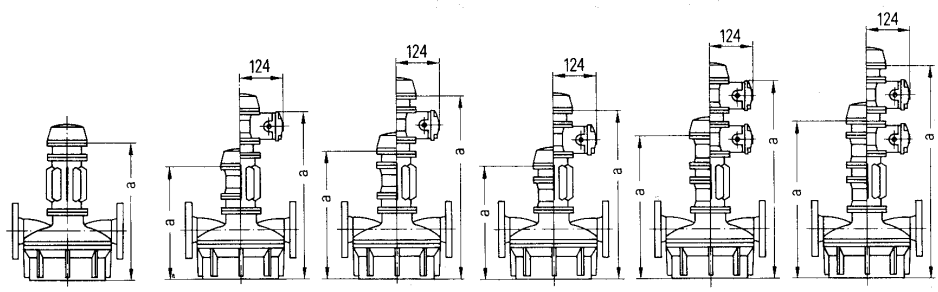
Types 34 and 35




Flanges smoothened down at top with DN 25 and DN 32 rotary-piston meters

Types 50 to 54

Rotary-piston meters DN 25, DN 32, DN 50 and DN 80, PN 4, PN 6 and PN 10, with quantity preset register




| Additional unit, design | 01 | 02 | 03 | 12 | 13 | 04 | 05 | 06 | 07 | 16 | 17 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Rotary-piston meter | Dimension a (values in brackets: rotary-piston meter with 2 insulation attachments) | | | | | | | | | | |
| DN 25 and DN 32, PN 10 | 349 (508) | 272 | 430 (590) | 309 | 467 (627) | 272 | 430 (590) | 354 | 513 (672) | 391 | 550 (709) |
| DN 50, PN 6 and PN 10 | 401 (560) | 324 | 483 (642) | 361 | 520 (679) | 324 | 483 (642) | 406 | 565 (724) | 443 | 602 (761) |
| DN 80, PN 4 and PN 6 | 440 (599) | 363 | 522 (781) | 400 | 559 (818) | 363 | 522 (781) | 445 | 604 (763) | 482 | 641 (800) |

Rotary-piston meters DN 25, DN 32, DN 50 and DN 80, PN 4, PN 6 and PN 10, with additional units

## 2 Installation and operation

### 2.1 Unpacking

All packing material must be removed from the meter. In order to prevent foreign matter from entering the internal parts of the meter, the cover plates over the flanges should be left until the meter is mounted in the plant.

### 2.2 Drilling the flanges

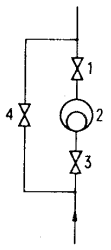
Rotary-piston meters with undrilled flanges can be delivered on request. In such a case, we recommend to drill the flanges in accordance with the applicable Standard Specifications (in Germany to DIN 2501).

When drilling the flanges, care must be taken to ensure that no foreign matter or borings enter the meter. These materials may block the meter when it is in operation or may cause damage to sensitive rotary pistons (e.g. carbon pistons). The two connection openings of the meter must be carefully covered during drilling and the material used for covering again completely removed afterwards, taking care not to allow borings to enter the measuring system. In the process (to prevent borings from falling in the inside of the meter), hold the meter in such a way that the stuffing material can be removed only downward. Till the meters are finally mounted in the plant, the flanges must again be closed.

### 2.3 Mounting

Where the rotary-piston meter is mounted outdoors, a sufficient protection against climatic influences must be provided. Freezing of the liquid may cause damage to the meter. The rotary-piston meter should, if possible, be mounted in the pressure line and, especially when measuring corrosive liquids, it must be mounted in such a position that it remains filled with measuring liquid also during plant shutdown times. The meter can be mounted in any position which only depends on the readability of the register. During installation of the pipe work a fitting piece (a tube complying with the connection width of the meter, refer to Section 1.4) must be mounted. In this way the rotary-piston meter is protected against mechanical shocks and stresses in the pipe line, during pipe work and also after it is mounted. In the case of heavy meters it might be advisable (depending on the stability and anchoring of the pipe system) to provide additional securing means.

Should it be required that the process may not be interrupted for cleaning the rotary-piston meter or the sieve, a bypass line can be used in accordance with Fig. 2/1.




| Shut-off valve | Flow through Meter | Bypass |
|---|---|---|
| 1 | open | closed |
| 3 | open | closed |
| 4 | closed | open |

1, 3 and 4 Shut-off valves
2 Rotary-piston meter

Fig. 2/1 Example of a bypass line

Before mounting the rotary-piston meter in the plant, all foreign matter must be completely removed from the pipe lines. This is done most effectively with the fitting piece mounted and at the highest possible flow rate. After the cleaning, the fitting piece can be replaced by the rotary-piston meter. The direction of flow through the meter (marked with an arrow on the meter housing) is of importance. The sealing surfaces of the flanges must be clean and the flange bolts must be tightened uniformly in a cross-wise sequence. The gasket material must be selected to suit the measuring medium and the rated pressure (further details, if required, available from the factory).

### 2.4 Commissioning

The rotary-piston meters are tested before leaving the factory and operate trouble-free if they are correctly mounted.

When taking a rotary-piston meter into operation for the first time, it is advisable to start with a low flow and to check whether the register operates. In this way disturbances (e.g. solid foreign materials in the measuring system) can be detected at an early stage and extensive damage can be prevented by stopping the flow immediately. Any possible faults can be detected and corrected as per Section 3.7. When no fault can be seen at a low flow rate, the flow should be increased, if possible, to the maximum permissible value (Table on p. 5). By the fast flow of liquid, any remaining air in the measuring chamber is removed. Air pockets which remain in the meter may lead to errors in the measurements. When removing the air from the meter the maximum permissible flow rate may not be exceeded to prevent overloading. Exceeding the rated pressure (it is advisable to mount a pressure gauge in the meter supply line) and the maximum permissible measuring liquid temperature must also be avoided.

Meters in plants requiring licencing, must be calibrated by the appropriate gauging authorities.

Before taking the rotary-piston meters into operation, the register of reset meters must be set to zero and in the case of non-reset metees, the already indicated value must be noted.

## 3 Maintenance

### 3.1 Checking and servicing

Since the rotary-piston meters are provided with a magnetic coupling for transmitting the piston rotation of the measuring system to the register, a regular service (e.g. lubrication, etc.) is not required. It is only important to comply with the prescribed operating conditions (e.g., operating time, measuring medium characteristics, measuring medium temperature, operating pressure, etc.) as described in Sections 1.1 and 1.4. The rotary-piston meters must be protected against splash water and flooding (which might occur when cleaning the plant with water hoses) by suitable means (e.g. cover with plastics hood).

### 3.2 Recalibration

In systems subject to licencing, rotary-piston meters must be recalibrated every 2 years by the appropriate gauging authorities.

The authorities must be informed before maintenance work requiring removal of the sealing points is carried out (e.g. replacement of piston, cleaning the meter etc.).

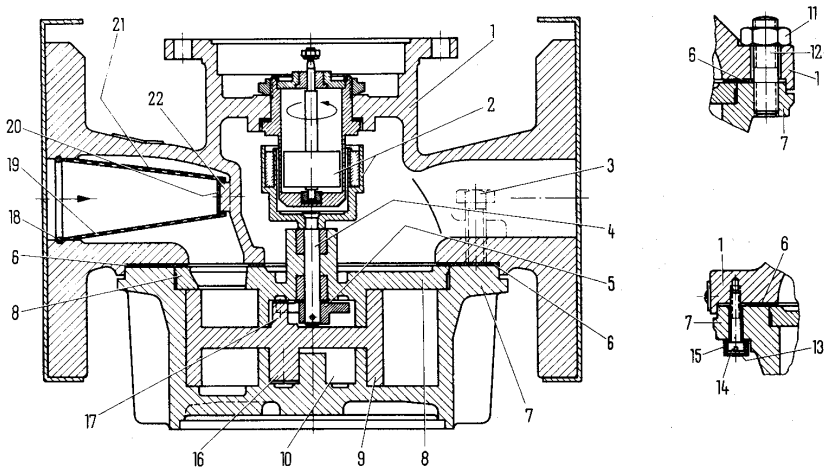
In certain areas this work can be carried out commissioned companies which then request the recalibration by the gauging authorities.

### 3.3 Removing the rotary-piston meter, replacing the rotary piston and cleaning the sieve

The meter must be removed from the system in order to clean it, to replace the rotary piston and to clean the sieve. The liquid flow must be interrupted. If a bypass line has been fitted as in Fig. 2/1, the meter can be shut down without interrupting operation. The meter can be removed from the system after loosening and removing the flange screws at the liquid inlet and outlet.

The sieve (19, Fig. 3/1) can be removed from the inlet line for cleaning by releasing the circlip (18). The meter is ready for operation again after replacing both parts.

The mechanism must be opened to replace the rotary piston. Proceed as when cleaning the meter, Section 3.4.




1 Upper part of housing
2 Magnetic coupling
3 Lifting screw
4 Measuring system shaft
5 Driver
6 Housing gasket
7 Lower part of housing (measuring chamber)
8 Chamber lid
9 Rotary piston
10 Guide ring
11 Nut for housing screw
12 Housing screw (hexagonal screw or stud bolt)
13 Sealing disk
14 Sealing screw
15 Sealing box
16 Longer piston pin
17 Shorter piston pin
18 Circlip
19 Conical sieve
20 Sieve bottom
21 Strap
22 Sieve support

Fig. 3/1 Measuring system of rotary-piston meter DN 32, PN 10

### 3.4 Cleaning the rotary-piston meter (Fig. 3/1)

#### 3.4.1 Dismounting the rotary-piston meter

Pierce the sealing disk (13) with a sharp tool (marking tool, screwdriver) and lift out. Remove all sealing screws (14) and sealing boxes (15).

Carefully lift the register and reduction mechanism including any intermediate units after removing all screws on the unit connection flange of the mechanism. Do not damage the transmission gears for the measured value.

Remove the circlip (18) and sieve (19) from the inlet.

Loosen and remove the nuts (11) from the housing screws (12). Remove the screws (12) if they are not locking screws.

By screwing in the lifting screws (3) loosen the upper part of the housing (1) from the measuring chamber (7) and screw the lifting screws back again. Lift the upper part of the housing from the lower part without tilting, since otherwise the mechanism shaft may become bent. Do not damage the coupling parts of the magnetic coupling (2) and keep away from magnetic material (e.g. iron shavings).

Remove the gasket (6) from the measuring insert and carefully lift the chamber lid (8) with the shaft (4) and the coupling unit.

Lift the rotary piston (9) out of the measuring chamber (7). Caution! Pistons made of carbon or hard rubber are very fragile. A castor is plugged onto the piston pin (17) in some meters. Ensure that this is not lost.

Clean all parts. The upper part of the housing with the casing of the magnetic coupling must not be immersed into the cleaning solution or solvent. Following cleaning, the mechanism shaft must turn easily without friction. All parts of the mechanism must be clean and free from even the smallest amounts of cleaning material.

#### 3.4.2 Fitting together the rotary-piston meter

Fit the rotary-piston meter together in the opposite sequence to that described above. The parts which were dismounted last must be fitted together again first. All parts must be undamaged and free from any foreign parts. Damaged or worn parts must be replaced by original parts made of the same material.

Observe the following additional points when fitting together:

- The housing gasket (6) must be replaced by a new one. It must not be damaged. It is advantageous to apply a little acid-free vaseline to the circular ring on the gasket, but not to the recess and the internal frame. Compressibility losses as a result of a dry bearing can thus be compensated.
- Insert the rotary piston (9) such that the longer piston pin (16) enters the guide ring (10) at the base of the measuring chamber. It must be possible to move the piston in the measuring chamber (7) without restrictions (as shown in Fig. 1/8). If a castor was present on the piston pin (17), replace again.
- When replacing the chamber lid (8) ensure that the driver (5) is located with its cut-out above the shorter piston pin (17) and that it encircles it at the top end. Only then place the chamber lid onto the measuring chamber (7) and press tightly. The rotary piston must rotate smoothly in the measuring chamber when the coupling unit is rotary piston can be observed through the outlet in the chamber lid.
- Before replacing the upper part of the housing (1), check that the lifting screws (3) are screwed back sufficiently that they do not project any more out of the thread. The magnetic coupling (2) and especially its interior space must be free from any foreign material. Now carefully place the upper part of the housing onto the lower part.
- Insert the housing screws (12) if they are not locking screws and tighten the nuts (11) equally and tightly in a diagonally opposite sequence. Screw in the sealing screw (14) with the sealing box (15). The following torques are recommended for the housing screws:

  Rated size DN 25 and DN 32: 30 Nm to 33 Nm

  | | |
  |---|---|
  | DN 50 | : 50 Nm . . . 55 Nm |
  | DN 80 | : 40 Nm . . . 45 Nm |

- Meters with a slightly worn or replaced rotary piston must be readjusted (Section 3.8).

Meters in systems requiring licencing must be recalibrated (see Section 3.2). If the rotary-piston meter is not immediately fitted into the system again following reassembly, the connection flanges must be sealed to prevent entry of foreign matter. A sealed plastic bag is sufficient for short storage periods. If the meter is stored for a longer period, it is recommendable to protect the mechanism parts from corrossion by greasing.

Refer to the notes in Section 2 for installation of the rotary-piston meter into the system and for start-up.

### 3.5 Trouble shooting

The rotary-piston meters are of simple construction and, if correctly used, they can render years of reliable service. Besides normal wear, faults seldom occur. Should trouble however be encountered during commissioning or after extended time in operation, the cause can be located by means of the following table.

| Trouble | Cause | Fault in plant or meter | Remedy |
|---|---|---|---|
| 1. Meter reading too high | Measuring medium contains air or gas | a) Meter is under vacuum and draws air in<br>b) Measuring medium contains air or gives off gas<br>c) Measuring medium evaporates due to too high vacuum | Change plant or install gas separator |
| | | d) Air is carried over from an overhead tank | Install a stabilizer or gas separator |
| 2. Meter reading too low | Flow rate below permissible minimum value | a) Pump delivery too small<br>b) Outlet into closed container, air vent not provided | Change plant |
| | | c) Sieve in meter dirty, filter or pipeline blocked | Clean sieve (refer to Section 3.3), filter or pipeline |
| | Tolerance between rotary piston and measuring chamber too large; piston worn | d) Piston slightly worn | Determine measuring error, replace gear wheels (refer to Sections 3.6 and 3.7) |
| | | e) Piston severely worn | Replace piston (refer to Section 3.3) |
| 3. Register reading remains stationary; flow through meter is stopped | Piston does not rotate | a) Measuring chamber dirty<br>b) Foreign matter in measuring chamber | Clean meter (refer to Section 3.4) |
| | | c) Piston and measuring chamber corroded | Replace meter |
| 4. Register reading remains stationary; flow through meter continues | Piston broken | | Replace piston (refer to Section 3.3) |
| | Magnetic coupling or register damaged | | Send meter in for repair (remove meter as per Section 3.3) |

### 3.6 Determining the indicating error

To determine the indicating error, proceed as follows:

1. In the case of single-pointer registers, take the reading. In the case of setback registers, set to zero.
2. Collect the liquid flowing through the rotary piston meter for testing purposes in a calibrated container (calibration standard).
3. The difference between the quantity N collected in the container and the meter reading A, is the error F ($F = A - N$). For a positive error the meter reading is too high and for a negative error, too low.
4. For official calibration purposes, only certified standards may be employed. The quantity used for test purposes Should normally cause at least 3 pointer or roller rotations of the fastest moving pointer or roller. The lowest flow quantity specified on the scale is also tested during official calibration.

When sending a rotary-piston meter back to the factory because of objected accuracy, please supply the following information:

1. Test quantity in test container (liters or ccm).
2. Value indicated by the register for the test quantity.
3. Type and temperature of medium during the test.
4. Flow through the meter (liters/min) during the test.

Before dispatching, the meter must be carefully emptied. This is of special importance if the meter was used for measuring corrosive or inflammable liquids.

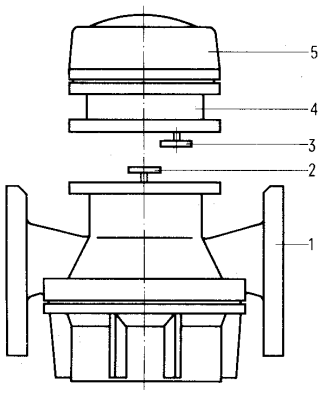
After an extended period of operation the measuring accuracy can be affected by the normal wear on the measuring system parts. The meter then indicates a value smaller than the actual quantity flown through. It is therefore advisable to check the measuring accuracy at regular intervals, depending on the demands imposed upon the meter. If the accuracy does not meet the requirements, the indicating error can be compensated for by readjustment (matching the measuring system with the register). If the meter is readily accessible, it is not necessary to remove the meter from the plant. It is important to ensure that the meter cannot be taken into operation while carrying out the adjustment. If the rotary-piston meter is taken out of the plant, Section 3.3 must be followed.

After determining the quantity error the percentage error must be calculated. For this purpose,the error of the meter must be taken in relation to the actual reading. If the reading is taken as "A" (actual value) and the quantity collected in the calibration container as "N" (nominal value), the percentage error "F" is determined as:

$$F \text{ in } \% = \frac{A-N}{N} \cdot 100$$

If the error calculated according to this equation provides a value, for example, of $F = -0.44$ %, this means that the meter indicates a 0.44-% smaller quantity than the actual quantity flown through.

### 3.7 Adjustment




1 Measuring mechanism
2 Adjusting wheel of measuring mechanism
3 Adjusting wheel of reduction mechanism
4 Reduction mechanism
5 Register

Fig. 3/2 Adjusting wheels of measuring mechanism and reduction mechanism

The adjustment of the rotary-piston meter is carried out by replacing the gear wheels (2 and 3) arranged between the measuring mechanism (1, Fig. 3/2) and the reduction gear (4). Only in the case where insulation spacers are used, the gear wheels are not directly above the measuring mechanism. Replacement of the gear wheels takes place as follows:

1. After taking the meter from the plant or if it remains in the plant, after closing the measured medium supply, remove the seal on the mounting flange of the meter (use a pointed tool to pierce and lift out the seal disc) and screw out the sealing screw.
   Unscrew all flange bolts.
2. Cautiously lift off the register (5) with reduction mechanism (4) from the measuring mechanism flange. In this way the gear wheel (2) is accessible from the measuring mechanism side and the gear wheel (3) from the reduction mechanism.
3. Unscrew the nut from the gear wheel (2) (right-hand thread). Lift off the spring washer and the gear wheel and read and note the designation (stamped figures or figures and letters).
4. Unscrew the nut from gear wheel (3) (left-hand thread). Lift off spring washer and gear wheel; read and note the designation.
5. Determine the required new gear wheels as shown in the following example.

A rotary-piston meter has an indicating error of −0.44 %, determined by testing. The designation on the gear wheel of the measuring system is "1−54" and on the indicating system "1−104". The pair of gear wheels are looked up in column 3 of the Table on page 12. The designation for the pair of gear wheels must appear on one line within a column. In the example chosen the pair of gear wheels is found in column 3 (in bold-face-type).

In column 1 in the same line, it can be seen that this gear wheel pair already cimpensates for an indicating error of −0.17 %. The total deviation of the meter is therefore

$$(-0.17) + (-0.44) = -0.61\ \%$$

Where:

−0.17 indicating error already compensated for
−0.44 the indicating error determined
−0.61 sum of both values and therefore the total deviation of the reading from the true value.

The total error determined (−0.61 %) is now looked for in column 1. In the same line, but in column 3, the designation of the new pair of gear wheels to be fitted can be found. In this example, the value −0.61 % is not included in column 1. The closest value (−0.62 %) must then be taken. In this line, column 3, the designation "1−57" is, for this example, then found for the gear wheel of the measuring system and "1−107" for the gear wheel of the reduction mechanism. The existing gear wheel pair must be replaced by the pair found in this manner. The gear wheels of one pair cannot be interchanged when inserting them, since they are provided with different diameter holes.

The meter is assembled in the reversed sequence as described for removing the gear wheels. The following remarks are of importance:

After fitting the new gear wheels they must be well secured by means of the spring discs and nuts. When placing the indicating mechanism onto the measuring housing, care must be taken to ensure that the teeth of the gear wheels engage correctly. The gear wheels may be damaged or the gear wheel shafts bent if special care is not taken before securing the register. When it is correctly seated, the register can be secured with bolts and nuts and the sealing screw. The rotary-piston meter is then again ready for operation. If the meter was removed from the plant for the adjustment, it must be installed in accordance with Section 2. Meters in plants requiring licencing by gauging authorities must be tested and recalibrated (Section 3.2).

To check whether the meter operates correctly, a test run at low flow rate is carried out. If the meter operates correctly, it is advisable to check the measuring accuracy again, as carried out before. The required accuracy must now be obtained. Any deviation still present can only be caused by an error in determination or selection of the gear wheels.

## 4 Spare parts

Should a rotary-piston meter not be sent to the factory for repair or readjustment, but these corrections be carried out on site, the technical data of the meter must be exactly specified when ordering spare parts. These details can be obtained from the dispatch note of the original delivery. It is therefore advisable to keep the original dispatch note with the instruction manual. Without correct details of the factory number and the technical data, it is not possible to supply the correct spare parts.

**Adjusting wheels**

| | Reading error of meter | Number of teeth of the wheels: on meas. system | on interm. module | Designation of the gear wheels on meas. system | on interm. module |
|---|---|---|---|---|---|
| Plus | 2,02 % | 31 | 33 | 1–61 | 1–112 |
| | 1,82 % | 32 | 34 | 1–62 | 1–113 |
| | 1,64 % | 33 | 35 | 1–63 | 1–114 |
| | 1,47 % | 34 | 36 | 1–64 | 1–116 |
| | 1,31 % | 35 | 37 | 1–65 | 1–117 |
| | 1,16 % | 36 | 38 | 1–66 | 1–118 |
| | 1,01 % | 37 | 39 | 1–67 | 1–120 |
| | 0,88 % | 38 | 40 | 1–68 | 1–121 |
| | 0,75 % | 39 | 41 | 1–70 | 1–122 |
| | 0,63 % | 40 | 42 | 1–71 | 1–123 |
| | 0,51 % | 41 | 43 | 1–72 | 1–124 |
| | 0,40 % | 21 | 22 | 1–51 | 1–101 |
| | 0,29 % | 43 | 45 | 1–74 | 1–125 |
| | 0,19 % | 22 | 23 | 1–52 | 1–102 |
| | 0,09 % | 45 | 47 | 1–76 | 1–126 |
| | 0,00 % | 23 | 24 | 1–53 | 1–103 |

| | Reading error of meter | Number of teeth of the wheels: on meas. system | on interm. module | Designation of the gear wheels on meas. system | on interm. module |
|---|---|---|---|---|---|
| Minus | 0,00 % | 23 | 24 | 1–53 | 1–103 |
| | 0,09 % | 47 | 49 | 1–78 | 1–127 |
| | **0,17 %** | 24 | 25 | **1–54** | **1–104** |
| | (0,25 %) | 49 | 51 | 1–80 | 1–128 |
| | 0,33 % | 25 | 26 | 1–55 | 1–105 |
| | (0,41 %) | 51 | 53 | 1–82 | 1–129 |
| | 0,48 % | 26 | 27 | 1–56 | 1–106 |
| | (0,55 %) | 53 | 55 | 1–83 | 1–131 |
| | **0,62 %** | 27 | 28 | **1–57** | **1–107** |
| | 0,75 % | 28 | 29 | 1–58 | 1–108 |
| | 0,87 % | 29 | 30 | 1–59 | 1–109 |
| | 0,98 % | 30 | 31 | 1–60 | 1–110 |
| | 1,09 % | 31 | 32 | 1–61 | 1–111 |
| | 1,19 % | 32 | 33 | 1–62 | 1–112 |
| | 1,28 % | 33 | 34 | 1–63 | 1–113 |
| | 1,37 % | 34 | 35 | 1–64 | 1–115 |
| | 1,45 | 35 | 36 | 1–65 | 1–116 |
| | 1,53 % | 36 | 37 | 1–66 | 1–117 |
| | 1,60 % | 37 | 38 | 1–67 | 1–119 |
| | 1,68 % | 38 | 39 | 1–68 | 1–120 |
| | 1,74 % | 39 | 40 | 1–69 | 1–121 |
| | 1,80 % | 40 | 41 | 1–71 | 1–122 |
| | 1,86 % | 41 | 42 | 1–72 | 1–123 |
| | 1,92 % | 42 | 43 | 1–73 | 1–124 |
| | 2,03 % | 44 | 45 | 1–75 | 1–125 |
| | 2,13 % | 46 | 47 | 1–77 | 1–126 |
| | 2,22 % | 48 | 49 | 1–79 | 1–127 |
| | (2,30 %) | 50 | 51 | 1–81 | 1–128 |
| | (2,41 %) | 53 | 54 | 1–83 | 1–130 |

*NOTE*

The instructions do not purport to cover all details or variations in equipment, nor to provide for every possible contigency to be met in connection with installation, operation or maintenance.

Should further information be desired or should particular problems arise which are not covered sufficiently for the Purchaser's purposes, the matter should be referred to the local Siemens Sales Office.

The contents of the instructions shall not become part or modify any prior or existing agreement, commitment or relationship. The Sales Contract contains the entire obligations of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements of the instructions do not create new warranties or modify the existing warranty.

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