

**Model Industrial  
RCDL**

**Nutating Disc Meters**

**Installation &  
Operation Manual**



## GENERAL DESCRIPTION

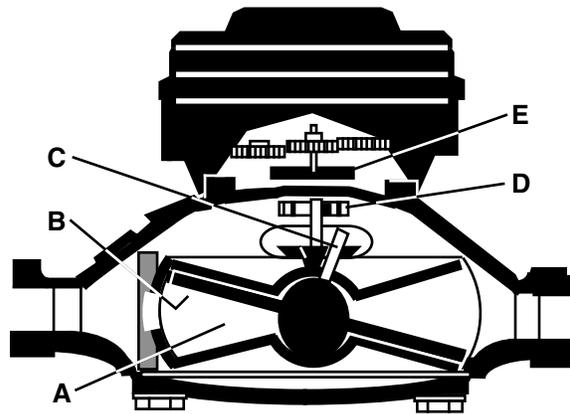
Badger's RCDL positive displacement meters are one of the most cost effective methods in metering industrial fluids. The RCDL meter's simple but efficient design assures high accuracy and repeatability over the entire meter flow range.

Available in five sizes, 1/2" through 2" for flows up to 170 GPM, these meters are extremely rugged and reliable. Maintenance is seldom required, but if necessary, takes only a few minutes. All parts are designed and built of materials to meet your application, providing you with long life and a trouble-free, precision flow meter.

To complement the RCDL meter line, Badger offers a complete line of accessories that includes totalizers, electromechanical and electronic transmitters, rate of flow indicators and batch/process controllers.

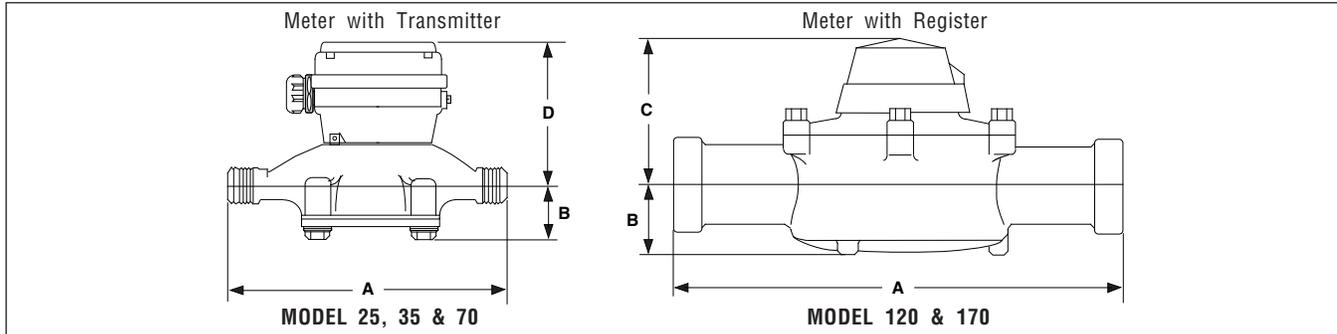
The metering principle, known as positive displacement, is based on the continuous filling and discharging of the measuring chamber. Controlled clearances between the disc and the chamber insure precise measurement of each volume cycle. As the disc nutates, the center spindle rotates a magnet, whose movement is sensed through the meter wall by a follower magnet or by various sensors. Each revolution of the magnet is equivalent to a fixed volume of fluid, which is converted to any engineering unit of measure for totalization, indication or process control.

Figure 1.



Liquid flowing through the meter chamber (A) causes a disc (B) to nutate or wobble. This motion, in turn, results in the rotation of a spindle (C) and drive magnet (D). Rotation is transmitted through the wall of the meter to a second magnet (E) or varied style of sensor pickup.

## METER OPTIONS/SPECIFICATIONS



Meter Model	Meter Size Inches	Flow Range GPM	Housing Material	End Connections	DIMENSIONS (INCHES)				Approximate Weight Pounds
					Laying Length A	Center Line to Base B	Register Height C	Transmitter Height D	
M 25	5/8	1/2 - 25	BZ or PL Corrosion Resistant Internal	NPT - Male	7.5	1.7	3.3	4.4	5
M 25	3/4	1/2 - 30	BZ or PL Corrosion Resistant Internal	NPT - Male	7.5	1.7	3.3	4.4	5
M 35	3/4	3/4 - 35	BZ	NPT - Male	9.0	1.7	3.6	5.0	6
M 40	1	3/4 - 50	PL	NPT - Male	10.75	1.9	3.8	5.5	5
M 70	1	1 - 70	BZ Corrosion Resistant Internal	NPT - Male	10.75	2.3	4.2	5.6	12
M 120	1 1/2	2 - 120	BZ Corrosion Resistant Internal	NPT - Female	12.62	2.4	4.6	6.0	20
M 170	2	2 - 170	BZ	NPT - Female	15.25	2.9	5.1	6.5	30

BZ = Bronze; PL = Plastic

Model 25, Model 70 and Model 120 are available with optional corrosion resistant internals; temperature limit with this option is increased on the bronze housing model to 250° F.

Table 1 - Configuration and Specification Data for Model RCDL Disc Meters

## UNPACKING AND INSPECTION

Upon receipt of meter, perform the following:

**NOTE: If damage to the shipping container is evident, request the carrier to be present when meter is unpacked.**

A. Carefully open the shipping container. Remove all the cushioning material surrounding the meter and carefully lift the meter from the container.

Retain all of the packing material for possible use in reshipment or storage of the meter.

B. Visually inspect the meter and the accessory device for any physical damage such as scratches, loose or broken parts, or any other damage that may have occurred during shipment of the product.

**NOTE: If damage is found upon receipt of the equipment, request inspection by the carrier's agent within 48 hours of the delivery. Then file a claim with the carrier. A claim for the equipment damaged in transit is the responsibility of the customer.**

## INSTALLATION

Any special instructions required for the installation and/or electrical connection of any meter-mounted or free-standing accessory devices such as registers, pulse transmitters, and remote batch controllers, will be provided as a supplement to this manual.

A. Please read the following instructions to become familiar with the requirements and the recommended procedures involved.

**CAUTION: The meter must be operated in an application within the specified temperature range to obtain optimum accuracy and prevent damage to any internal components.**

1. Verify the fluid operating temperature range is compatible with the materials of construction of the meter received.

**CAUTION: The life of the meter will be impaired if it is operated at flow rates in excess of those indicated in the product specifications.**

2. If any solid material is present in the liquid, installation of a strainer is recommended upstream of the meter.
3. Locate the meter installation with consideration for sufficient space for cleaning and maintenance of the meter.

B. Review the overall dimensions (including laying length requirements) of the meter as listed in Table 1 of this manual on page 2. If necessary, consideration may also need to be given for height dimensions including the meter mounted accessory. Then proceed as follows:

1. Measure the overall length of the meter with the connection pieces attached to the inlet and outlet spuds of the meter.

2. Be sure to provide this proper gap length in the facility piping.

**CAUTION: Excess gap length may cause excessive strain on connection assemblies.**

3. Remove the connections and install one connection piece in each end of the facility pipe gap provided in step #2. Allow for the gaskets at the inlet and the outlet spuds of the meter.
4. Install the meter making sure that the flow arrow marking on the meter housing is in the correct relationship to the direction of the fluid flow in the system.
5. Tighten the meter connections.

**Note instructions on packaging from connection assembly when tightening.**

6. To relieve any possible strain on the facility piping that might be caused by the weight of any of the large size meters, it is recommended that consideration be given to incorporating a meter support to be placed under the housing of the meter.

To ensure that the meter has been properly installed and operational:

A. Slowly open the upstream valve to apply fluid pressure to the meter. Check the connections for any possible leakage. Retighten the connections as required.

B. Perform a functional test of the meter utilizing the adjustment and calibration procedures that are included later in this manual.

## GENERAL OPERATING INSTRUCTIONS

In general, the operation of a Model RCDL disc meter is either manually controlled or accessory controlled. Manual operation applies to the applications employing hand-operated valves or other manually activated, flow-regulating devices that are not functionally controlled by a meter accessory. Accessory controlled operation applies to applications when a meter accessory provides a signal output to activate and/or deactivate a valve or other flow control device.

**CAUTION: Valves controlling the fluid flow through the meter should be opened and closed slowly to prevent shock loads that may damage the meter measuring element.**

A. MANUAL OPERATION. The following procedures are for use in simple metering applications where the flow of fluid is controlled by hand-operated valves located upstream and downstream of the meter.

1. Slowly open the upstream valve to apply fluid to the meter.
2. Slowly open the downstream valve to initiate the metering operation.
3. Adjust downstream valve so the flow rate of the fluid does not exceed the maximum continuous flow rate specification of the meter. (Refer to Table 1 of this manual.)

**NOTE: On meters with an accessory device providing a totalizing indicator, the flow rate of the fluid can be checked by timing the number of gallons registered in one minute.**

4. To stop metering, slowly close downstream valve; then close upstream valve.

B. ACCESSORY CONTROLLED OPERATION. Operating procedures for accessory controlled applications are dependent on the specific function of that accessory employed and its electrical interconnection with a flow control device or devices. Refer to the bulletin or bulletins covering the applicable accessories for specific operating instructions (included as a supplement to this manual when required.)

## SHUTDOWN INSTRUCTIONS

If the meter is to be shut down for an extended period of time, it is recommended that the measuring chamber of the meter be thoroughly flushed out to prevent the settling out of undissolved solids or the accumulation of corrosive deposits.

## MAINTENANCE

### PREVENTIVE MAINTENANCE

Preventive maintenance consists of periodic inspection and cleaning procedures. The procedures should be performed at regular intervals and any defects discovered should be corrected before further operation of the meter.

#### PERIODIC INSPECTION

A. Visually inspect meter and accessory for missing hardware, loose connections, broken register glass, damaged wiring, or other signs of wear or deterioration. Repair or replace components as required.

B. Verify proper flow rate and pressure for meter. A loss in pressure, with the resulting flow rate decrease, may indicate the meter screen is clogged and requires cleaning.

#### CLEANING

Clean all dust, dirt, grease, moisture, or other foreign material from exterior of meter and applicable accessory.

### CALIBRATION CHECK AND ADJUSTMENT

The following instructions are provided to assist in performing on-site calibration check and/or adjustment.

#### ACCURACY TEST

- A. Place a test tank of known volume at output of meter.
- B. Fill test tank to calibrated level. Make test run at same flow rate to be used in actual operation.
- C. Record quantity indicated on applicable accessory.
- D. Repeat test three times and average recorded results.
- E. Perform the following calculations to determine percent of accuracy of meter-accessory combination.

$$\frac{\text{Qty. Indicated on Accessory}}{\text{Actual Quantity in Test Tank}} \times 100 = \text{Meter Accuracy}$$

#### Example 1.

$$\frac{95 \text{ Gallons}}{100 \text{ Gallons}} \times 100 = 95\% \text{ Accuracy}$$

The meter-mounted accessory is slow and reading low so it must be speeded up by a calibration adjustment.

#### Example 2.

$$\frac{104 \text{ Gallons}}{100 \text{ Gallons}} \times 100 = 104\% \text{ Accuracy}$$

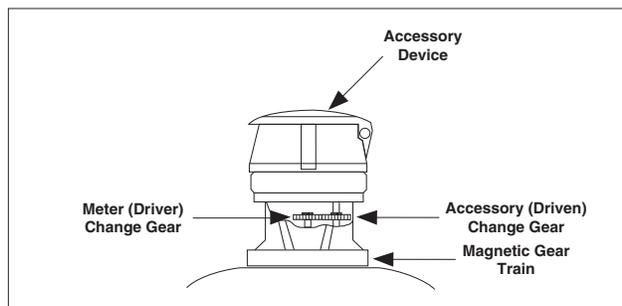
In this example, the meter accessory is fast and running high so it must be slowed down by calibration adjustment.

## CHANGE GEAR CALIBRATION

If the accuracy test of a meter-accessory combination indicates that adjustment is required and change gears are the medium; proceed as follows:

A. Remove applicable Driver (Accessory) change gear and Driven (Meter) change gear.

**NOTE: The number of teeth and outside diameter is stamped on each gear.**



**Figure 3 - Change Gear Locations on Model RCDL Meters**

B. Calculate ratio of existing change gears as follows:

$$\text{Ratio} = \frac{\text{No. of Teeth on Accessory Change Gear}}{\text{No. of Teeth on Meter Change Gear}}$$

C. Calculate new change gear ratio required by multiplying the ratio of existing change gears by the percent-of-meter accuracy determined in the accuracy test.

Example

$$\text{Existing Change Gear Ratio} = \frac{42 \text{ Teeth}}{43 \text{ Teeth}} = .976$$

Meter Accuracy = 95%

$$\text{Corrected Change Gear Ratio} = .976 \times \frac{95}{100} = .927$$

D. If change gear charts are available, select a new change gear combination that matches corrected change gear ratio. If new gears are not available, submit order for corrective change gears to nearest Badger Meter Representative or contact the Industrial Division of Badger Meter, Inc.

**NOTE: When ordering, specify serial number of meter, meter model and size, accessory device employed, number of teeth and diameter of existing change gears, and corrected change gear ratio required.**

E. Observe the position of old change gears on spindles before removing. Install new change gears on meter and accessory spindles and assemble accessory to meter. Care should be taken to obtain full mesh when assembling accessory to meter gear train adapter. Note position information from old gears.

## ELECTRONIC CALIBRATION

If electronic scaling is the accessory medium for calibration, see accessory technical brief for instructions.

## SERVICING

The following instructions are for removal, inspection and installation of meter parts/assemblies. Refer to applicable illustrated parts list for part numbers of components and ordering information. Accessory service and repair procedures are provided in literature specific to that device.

### METER ASSEMBLY

These procedures are for disassembly of the meter:

A. Shut off fluid flow to meter. Place container under meter and relieve fluid pressure in the meter by uniformly loosening bolts (bronze meter) or retaining ring (plastic meter). Fluid will run out into container.

B. Remove bolts or retaining ring while holding housing bottom in place. Remove housing bottom. Chamber assembly may drop from housing as bottom is removed.

C. If chamber assembly is out, set aside. If not, first remove chamber strap and then chamber assembly.

D. Remove meter screen. Inspect screen for dirt and corrosion. Clean or replace as necessary.

E. Inspect the chamber assembly:

1. Check the disc in the chamber assembly for warpage, cracks or wear. A severely worn disc can cause over delivery of the fluid being metered.
2. Check the thrust roller and thrust roller insert for excessive wear.

After inspection, clean or replace the chamber assembly as necessary. If chamber is worn or corroded, it is always recommended that the entire chamber and disc assembly be replaced.

F. Re-install housing chamber assembly, screen, chamber strap and bottom as follows:

1. Assemble screen in proper location.
2. Locate chamber assembly in proper orientation. Add chamber strap.
3. Position housing bottom with the correct seal. (Replacement of seal is always recommended.)
4. Assemble bolts or retaining ring and tighten.

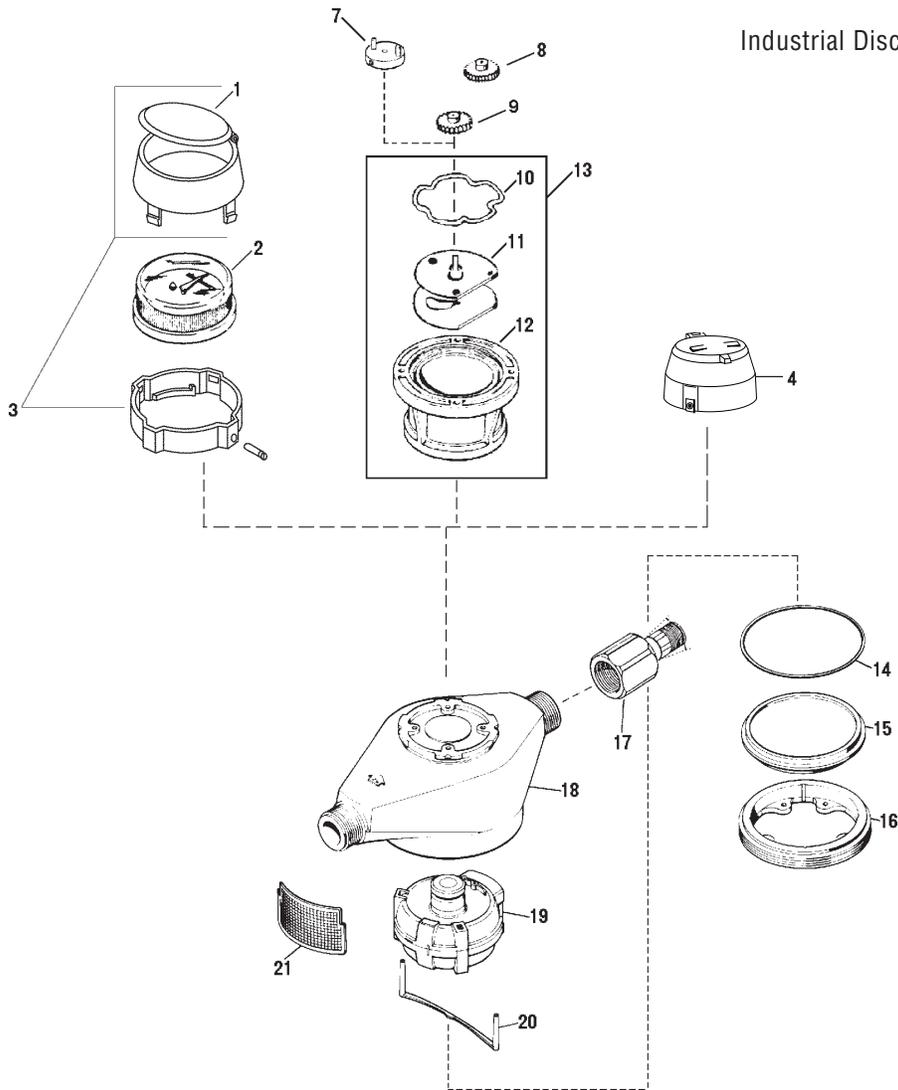
### ALTERNATIVE DISASSEMBLY METHOD FOR SERVICE

Loosen connection pieces slightly. Turn meter upside down, putting gravity on your side. This will help eliminate the possibility of the chamber assembly and/or screen component dropping during disassembly and causing damage.

### RECALIBRATION

After repair or replacement of a meter component or assembly, perform the calibration check and adjustment procedure to ensure that the meter is properly calibrated and will operate in accordance with published specifications.

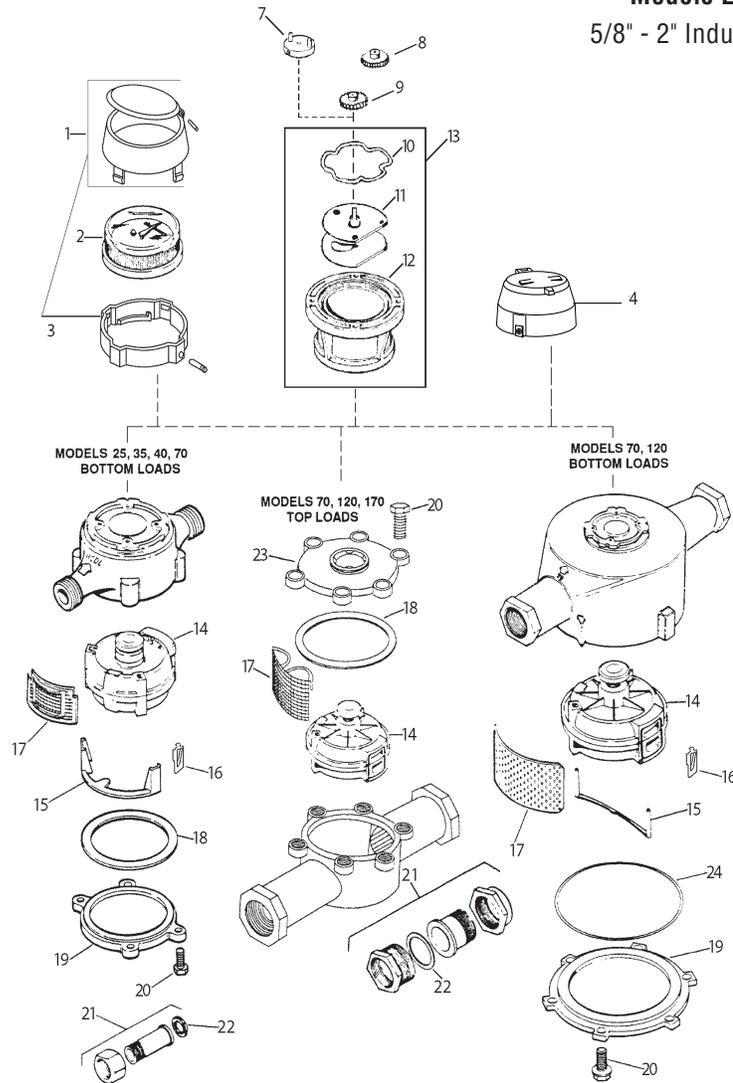
**Models 25 and 40**  
Industrial Disc Meters — Thermoplastic



Item No.	Part Description
1	Shroud Assembly, Plastic (Cover, top and roll pin, no btm.)
2	Register Assembly, U.S. Gallons Register Assembly, Liters/M3
3	Shroud Assembly, Plastic (Cover, top, btm., roll pin)
4	Pulse Transmitter Register RTR
7	Coupling (Series 76 Register)
8	Change Gear, Driver
9	Change Gear, Driven
10	Retaining Ring
11	Gear Train (234:1)
11	Gear Train (30:1)
12	Housing, Mach.
13	Gear Train Assy. (234:1)
13	Gear Train Assy. (30:1)

Item No.	Part Description
14	Housing Bottom "O" Ring Seal
15	Housing Bottom
16	Retaining Ring
17	Connection Assembly, 1/2" Plastic Connection Assembly, 3/4" Plastic Connection Assembly, 1" Plastic Connection Assembly, 1/2" Bronze Connection Assembly, 3/4" Bronze Connection Assembly, 1" Bronze
18	Housing 5/8" x 1/2", 7 1/2" LL Housing 5/8" x 3/4", 7 1/2" LL Housing 1" x 1", 10 3/4" LL
19	Chamber and Disc Assembly, Plastic Chamber and Disc Assembly, LCP
20	Chamber Retainer Strap
21	Screen

**Models 25, 35, 40, 70, 120 and 170**  
**5/8" - 2" Industrial Disc Meters — Bronze**



Item No.	Part Description
1	Shroud Assembly, Plastic (Cover, top & roll pin) (No btm.)
2	Register Assembly, Gallons Register Assembly, Liters/M3
3	Shroud Assembly, Plastic (Cover, top, btm. & roll pin)
4	Pulse Transmitter Register RTR
7	Coupling (Series 76 Reg.)
8	Change Gear, Driver
9	Change Gear Driven
10	Retaining Ring
11	Gear Train (234:1)
11	Gear Train (30:1)
12	Housing, Mach.
13	Gear Train Assy. (234:1)
13	Gear Train Assy. (30:1)
14	Chamber & Disc Assy., Std. Chamber & Disc Assy., LCP

Item No.	Part Description
15	Chamber Retainer Strap
16	Spring Clip (High Temp. Only) (Model 25, 70 and 120 Only)
17	Screen
18	Housing Gasket , Buna N Housing Gasket, Viton
19	Housing Bottom
19A	Washers (6 needed)
20	Housing Bolt
21	Conn. Assembly (2) 1/2" Conn. Assembly (2) 3/4" Conn. Assembly (2) 1" Conn. Assembly (2) 1 1/2" Conn. Assembly (2) 2"
22	Conn. Washer (1) 1/2" Conn. Washer (1) 3/4" Conn. Washer (1)
23	Housing Top
24	Bottom Seal "O" Ring



Please see our website at  
[www.badgermeter.com](http://www.badgermeter.com)  
for specific contacts.

Due to continuous research, product improvements and enhancements, Badger Meter reserves the right to change product or system specifications without notice, except to the extent an outstanding bid obligation exists.



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