



GRACO

*First choice when
quality counts.™*

Rev. C

Supersedes Rev. B
and PCN C



This manual contains important
warnings and information.
READ AND KEEP FOR REFERENCE.

INSTRUCTIONS

PRO™ Pulse Electronic Volumetric Flow Meter

For use with Plural Component Precision Mixing Systems

This meter is designed to be used in a Class I, Group D hazardous environment

2800 psi (19.6 MPa, 196 bar) Maximum Working Fluid Pressure

50 psi (350 kPa, 3.5 bar) Maximum Working Air Pressure

Part No. 235-402, Series A

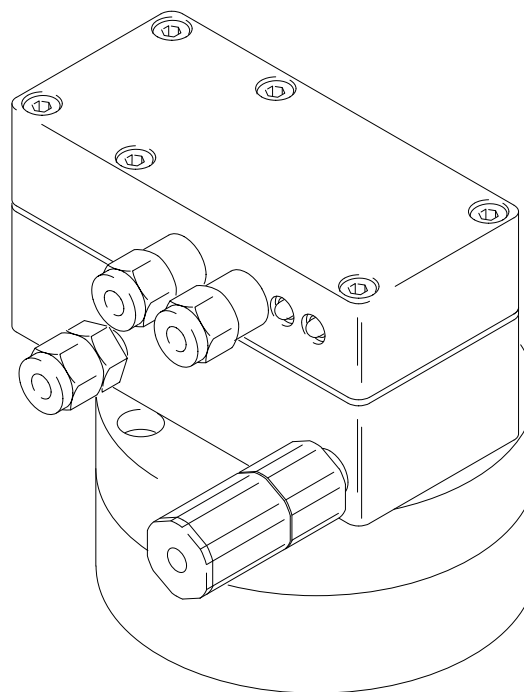
Flow Meter with 0.1 cc per tooth fluid volume flow

Model 235-403, Series A

Flow Meter with 0.4 cc per tooth fluid volume flow

NOTE: See the **Accessories** section to order Fiber-Optic Cables and to order the Fluid Manifold.

U.S. and Foreign Patents Pending



01847

Table of Contents

Warnings	2
Installation	4
Operation	6
Maintenance	7
Troubleshooting	8
Service	9
Parts	11
Dimensions	15
Technical Data	15
Warranty	16
Graco Phone Number	16

Symbols

Warning Symbol



This symbol alerts you to the possibility of serious injury or death if you do not follow the instructions.

Caution Symbol



This symbol alerts you to the possibility of damage to or destruction of equipment if you do not follow the corresponding instructions.

! WARNING



INJECTION HAZARD

Spray from hose leaks or ruptured components can inject fluid into your body and cause an extremely serious injury, including the need for amputation. Splashing fluid in the eyes or on the skin can also cause a serious injury.

- Fluid injected into the skin might look like just a cut, but it is a serious injury. **Get immediate medical attention.**
- Do not stop or deflect fluid leaks with your hand, body, glove, or rag.
- Follow the **Pressure Relief Procedure** on page 6 whenever you: are instructed to relieve pressure; stop operation, or clean, check, or service the equipment; and install or clean the spray tip.
- Tighten all the fluid connections before operating the equipment.
- Check the hoses, tubes, and couplings daily. Replace worn, damaged, or loose parts immediately. Permanently coupled hoses cannot be repaired; replace the entire hose.



FIRE, EXPLOSION, AND ELECTRIC SHOCK HAZARD

- This equipment must only be installed by trained and qualified personnel.
- The meter's electrical chassis must be properly grounded. See **Check the Electrical Grounding** on page 5.
- Do not allow water or other liquids to spill on the electrical chassis.
- Do not immerse the chassis in fluids.
- The air line to the electrical chassis must be turned OFF and the pressure relieved before servicing or flushing the meter.

WARNING



INSTRUCTIONS

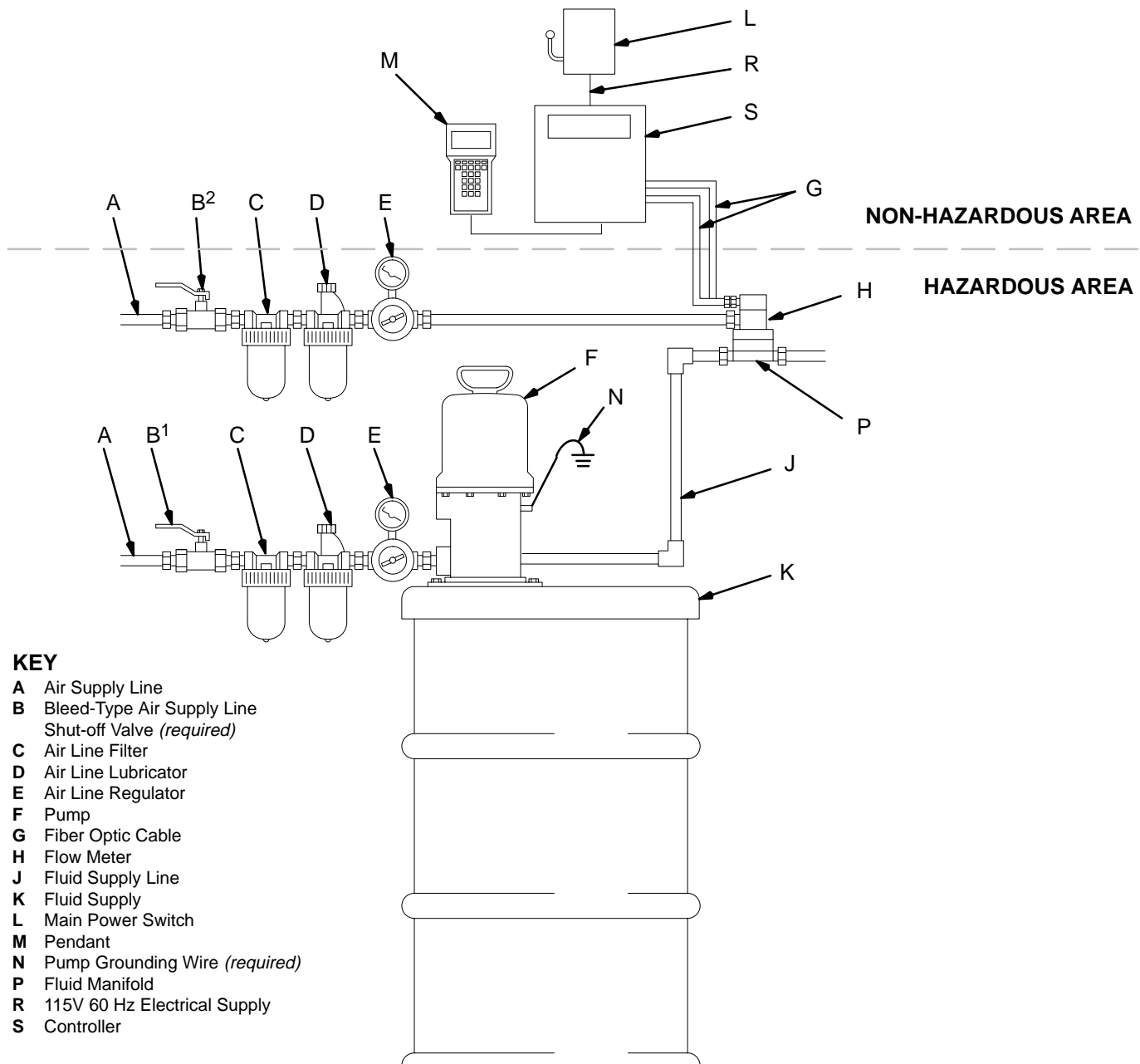


EQUIPMENT MISUSE HAZARD

Equipment misuse can cause the equipment to rupture, malfunction, or start unexpectedly and result in a serious injury.

- This equipment is for professional use only.
- Read all the instruction manuals, tags, and labels before operating the equipment.
- Use the equipment only for its intended purpose. If you are uncertain about usage, call your Graco distributor.
- Do not alter or modify this equipment. Use only genuine Graco parts and accessories.
- Check the equipment daily. Repair or replace worn or damaged parts immediately.
- Do not exceed the maximum working pressure of the lowest rated system component. This equipment has a **2800 psi (19.6 MPa, 196 bar) maximum working pressure**.
- Use fluids that are compatible with the equipment wetted parts. See the **Technical Data** section of all the equipment manuals. Read the fluid manufacturer's warnings.
- Route the hoses away from traffic areas, sharp edges, moving parts, and hot surfaces. Do not expose Graco hoses to temperatures above 180°F (82°C) or below -40°F (-40°C).
- Comply with all applicable local, state, and national fire, electrical, and other safety regulations.

Installation



KEY

- A Air Supply Line
- B Bleed-Type Air Supply Line Shut-off Valve (required)
- C Air Line Filter
- D Air Line Lubricator
- E Air Line Regulator
- F Pump
- G Fiber Optic Cable
- H Flow Meter
- J Fluid Supply Line
- K Fluid Supply
- L Main Power Switch
- M Pendant
- N Pump Grounding Wire (required)
- P Fluid Manifold
- R 115V 60 Hz Electrical Supply
- S Controller

The PRO Pulse Volumetric Flow Meter is designed to detect the pulses induced on a magnetic sensor each time a gear tooth passes by the sensor. A specific volume of fluid flows through the meter with each gear tooth rotation. See the front cover for the specific fluid volume flow of your meter.

Installing the System

⚠ WARNING

To help reduce the risk of serious injury, including splashing in the eyes or on the skin, the bleed-type air shut-off valve (B¹) must be installed in the system to relieve air trapped between this valve and the pump after the air is shut off. Trapped air can cause the pump to cycle unexpectedly. Locate the valve close to the pump.

The Typical Installation shown above is only a guide for selecting and installing the flow meter. For assistance in designing a particular type and size system for your application, contact your Graco representative.

Install the air line accessories in the order shown in the Typical Installation, using adapters as necessary.

Connect the air line to the Flow Meter by pressing the front ferrule (D) and back ferrule (C) onto the tubing (A). See Fig. 1. Press the assembly into the fitting (E) and tighten the nut (A). Connect the fiber optic cables by pressing the front ferrule (L) and back ferrule (K) onto the cable (G).

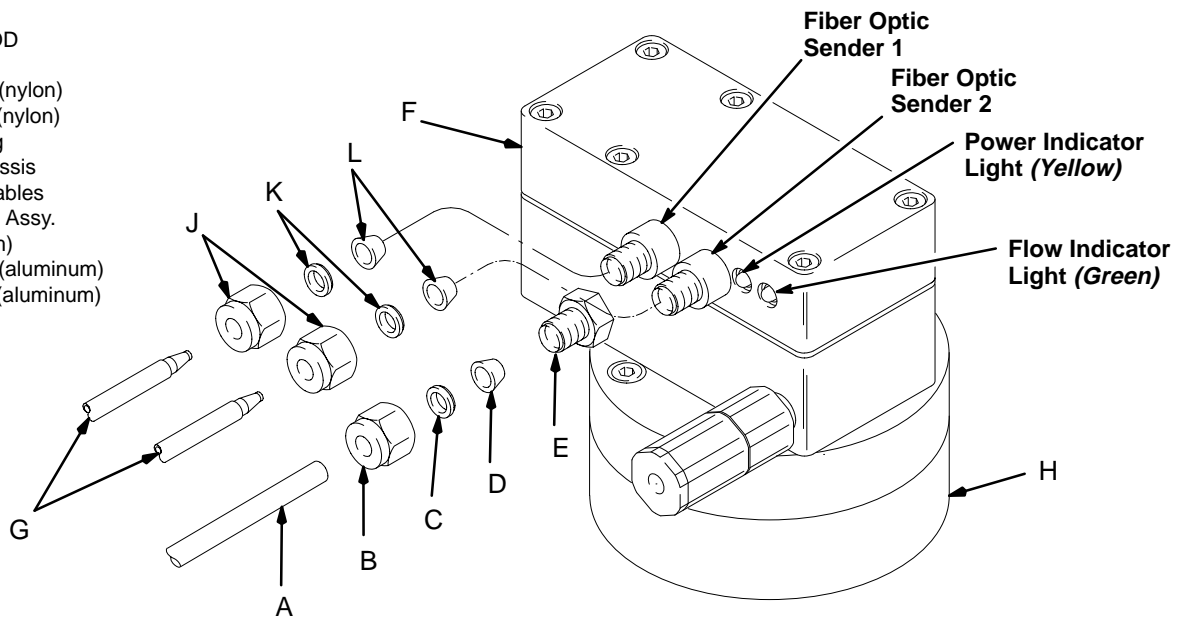
The maximum fiber optic cable length is 100 ft (30.5 m) with two splices. See **Accessories** on page 14 to order cables.

01848

Installation

KEY

- A Tubing, 1/4" OD
- B Nut (nylon)
- C Ferrule, back (nylon)
- D Ferrule, front (nylon)
- E Air Inlet Fitting
- F Electrical Chassis
- G Fiber Optic Cables
- H Gear Housing Assy.
- J Nut (aluminum)
- K Ferrule, back (aluminum)
- L Ferrule, front (aluminum)



01849

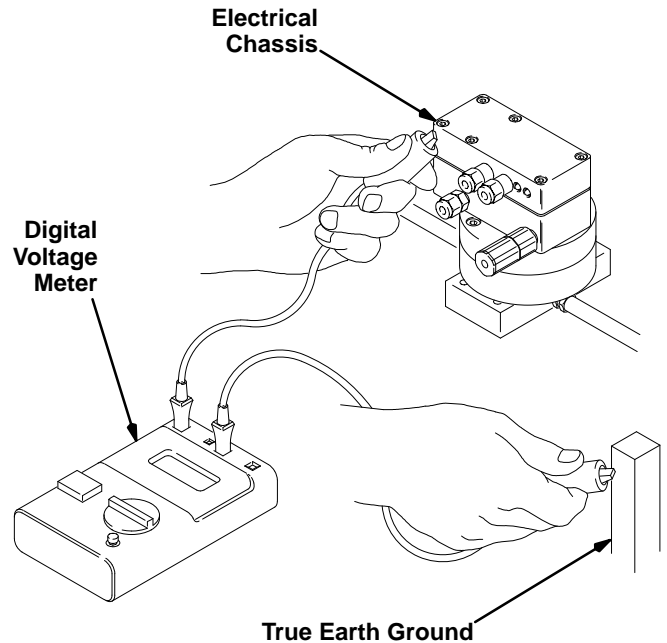
Fig. 1

Check the Electrical Grounding

⚠ WARNING

Proper electrical grounding of your system is essential when used with flammable or combustible liquids. For your safety, read the warning section **FIRE, EXPLOSION, AND ELECTRIC SHOCK HAZARD** on page 2.

Have a qualified electrician check the electrical grounding continuity between the flow meter electrical chassis and a true earth ground as shown in Fig. 2. If the resistance is greater than 25 ohms, check the mounting or add a ground strap to the chassis.




01850

Fig. 2

Operation

Pressure Relief Procedure

⚠ WARNING

INJECTION HAZARD
 Fluid under high pressure can be injected through the skin and cause serious injury. To reduce the risk of an injury from injection, splashing fluid, or moving parts, follow the **Pressure Relief Procedure** whenever you:

- are instructed to relieve the pressure,
- stop operating,
- or check or service any of the system equipment.

1. Turn off the air supply to the meter.
2. Allow air to exhaust out of the exhaust air port.
3. Turn off the fluid supply to the meter.
4. Shut off all electrical power to the fluid system or air system.
5. Follow the Pressure Relief Procedure for your fluid system dispensing device.

System Operating Checklist

Check the following list daily, before starting to operate the system, to help ensure you of safe, efficient operation.

- Be sure all operators are properly trained and qualified to safely operate your system.
- Be sure all operators are trained how to properly and completely relieve system pressure according to the **Pressure Relief Procedure**, at left.
- Be sure the system is thoroughly grounded. See **FIRE, EXPLOSION, AND ELECTRIC SHOCK HAZARD**, page 2, and **Check the Electrical Grounding**, page 5.
- Be sure the operator and all persons entering the installation site are properly grounded by wearing shoes with conductive soles or personal grounding straps.
- Be sure ventilation fans are operating properly.

Operation

Operate the flow meter between 20–50 psi (140–350 kPa, 1.4–3.5 bar) air inlet pressure. The yellow flow meter indicator light will come on when the proper air pressure is supplied. The green flow meter indicator light will blink on and off when the fluid is flowing.

Maintenance

CAUTION

Do not immerse the meter in solvent. Solvent could damage the meter's electrical components.

1. Clean the fluid and air line filters daily.
2. Clean the outside of the meter with a soft cloth dampened in a compatible solvent as needed.
3. Flush the fluid supply line and meter fluid reservoir daily with a compatible solvent as instructed at right.

Flushing the Meter

WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 6.

1. **Relieve the pressure.**
2. Connect the fluid line to the solvent supply unit.
3. Flush the meter until it is clean.
4. **Relieve the pressure**, then disconnect the fluid line from the solvent supply unit.
5. Reconnect the fluid line to the fluid (paint) supply.
6. Turn on the fluid supply.
7. Operate until the meter and fluid line are free of solvent.

Troubleshooting

WARNING

Installing and servicing this equipment requires access to parts that may cause electric shock or other serious injury if the work is not performed properly. Do not install or service this equipment unless you are trained and qualified.

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 6.

Before servicing this equipment always make sure to **relieve the pressure**.

Problem	Cause	Solution
Yellow LED is off; no power to flow meter	Insufficient air supply	Adjust air regulator.
	Turbine alternator not working	Check for dirt or moisture in turbine.
	Faulty turbine alternator	Be sure plug is in place on back of turbine alternator housing. Remove and test alternator.
	Excess moisture in air lines	Use filter-moisture separator.
	Turbine not connected to PC board	Connect 3-pin connector to square pins.
	Top PC board not connected to bottom PC board	Tighten bolts to compress gasket to 0.040" (1.02 mm)
	Alternator shorted to chassis	Check that insulating pad (2a) is in place. Replace pad if necessary.
	Meter gasket (5) is damaged	Replace gasket.
Green LED is off	Dried paint/fluid in gear track (gears are not moving)	Flush fluid section of meter as instructed in Maintenance on page 7, or disassemble and clean the gear housing assembly.
	Worn gears	Replace faulty gears.
	Electronic failure	Replace meter.

Service

⚠ WARNING

Installing and servicing this equipment requires access to parts that may cause electric shock or other serious injury if the work is not performed properly. Do not install or service this equipment unless you are trained and qualified.

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** on page 6.

NOTE: Check all possible remedies in the **Troubleshooting** section before disassembling the meter.

1. **Relieve the pressure** and flush the meter as described on page 7.
2. Disconnect the fiber optic cable(s) (G) from the electronic module (B). See Fig. 3.
3. Disconnect the air hose fitting and remove the air hose from the motor. Disconnect both fluid hose fittings and remove the fluid hose from the meter.
4. Remove the four screws (A) to separate the gear housing (F) from the manifold.

⚠ CAUTION

Never remove the electronic module (B) from the top gear housing (E). The electronic module is calibrated to the gear housing assembly and will not function properly if removed.

KEY

- A Screw
- B Electronic Module
- C O-Ring
- D Manifold
- E Top Gear Housing
- F Gear Housing Assy.
- G Fiber Optic Cable

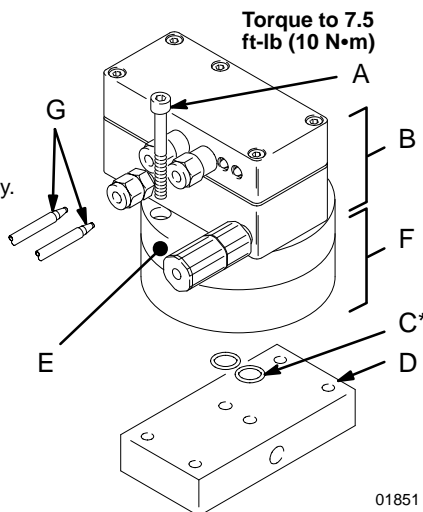


Fig. 3 Replacing the Turbine Alternator

1. Remove the top chassis (3) from the bottom chassis (2). See Fig. 4.

2. Disconnect the 3-pin connector (J) from the square pins (H).
3. Carefully pull the alternator (4) away from the top housing.
4. Using an ohmmeter, test the coil in the turbine alternator. Measure the resistance between the two outer terminals of the 3-pin connector (J). The resistance should be 3–5 ohms. If the reading varies from this value, replace the alternator (4).
5. Lubricate the alternator o-ring (4a) seal with petroleum jelly.
6. Insert the alternator (4) into the top chassis (3).
7. Connect the 3-pin connector (J) to the 3 square pins (H) in the top chassis (3).
8. Check to see that the gasket (5) is not damaged. If damaged, replace the gasket.
9. Snap the top and bottom chassis together.
10. Install and tighten the chassis screws (9) to 40 in-lbs (4.52 N•m).

KEY

- H Pins
- J 3-pin Connector
- 2 Bottom Chassis
- 3 Top Chassis
- 4 Alternator
- 4a Alternator O-Ring
- 5 Gasket
- 9 Chassis Screws

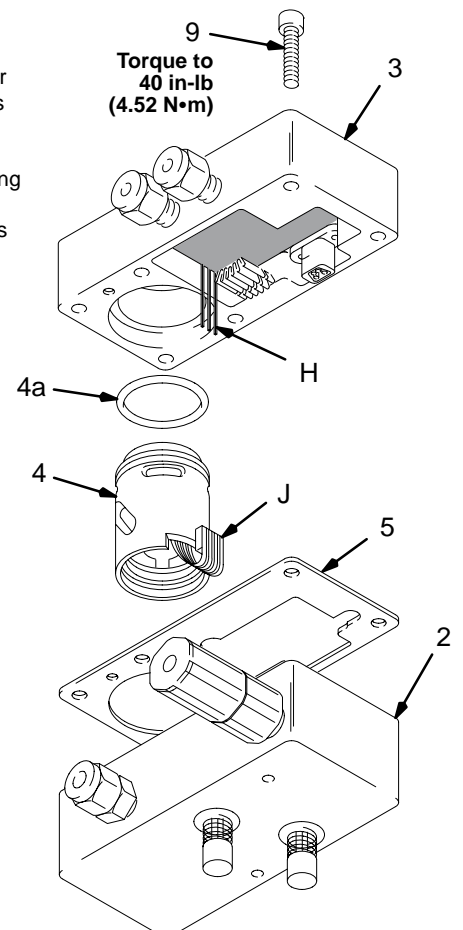


Fig. 4

Service

Replacing Worn Bearings

A repair kit is available to service the bearings. An asterisk after the description or reference letter indicates a part included with the repair kit. See page 11 to order the proper kit for your meter model.

⚠ CAUTION

This is a close-tolerance device. It will be damaged if forced apart during disassembly.

1. Loosen the four screws (N). See Fig. 5. Leave about two threads connected.
2. The two halves of the gear housing are pegged together and will be difficult to separate. The pegs are part of the top gear housing (E).

Hold the housing and tap the screws one at a time in a consistent sequence and eventually the two halves will come apart.

3. Before removing the gears (L), note which peg the gear is being removed from. The gears must be installed on the same peg they were removed from.

⚠ CAUTION

Always reinstall the gears on the peg they were removed from to ensure proper calibration with the electronic module.

4. Remove the gears (L) and washers (K).
5. Support a gear on its sides and position the bearing tool (T*) as shown in Fig. 6. Make sure the gear has sufficient clearance in the center to press out the bearings and spacers.
6. Press the bearing tool with an arbor press or tap it with a soft hammer until the bearings and spacers are removed. Repeat with the other gear.

To install the kit parts and assemble the gear housing:

1. Place a gear on a flat surface. Position the bearings (P*), spacers (R* and S*) and the bearing tool (T*) as shown in Fig. 7.
2. Press the bearing tool with the arbor press or tap it with a soft hammer until bearings and spacers are installed into the gear. Repeat with the other gear.

3. Install the o-ring (M*), washers (K*), and gear assemblies (L*). Be sure to install the gears on their proper pegs. See Fig. 5.
4. Press the gear housings together and secure them with the four screws (N). Torque the screws to 7.5 ft-lbs (10 N•m).
5. Install the meter back onto the adapter plate.

When installing the screws (A), replace the meter's two o-rings (C*) with the o-rings from the kit. Torque screws to 7.5 ft-lbs (10 N•m). See Fig. 3.

NOTE: Kit 223–276 has two sets of o-rings. Use the o-rings that match the o-rings you are replacing and discard the others.

⚠ CAUTION

Never immerse a meter in solvent for cleaning. Doing so will damage the electronics.

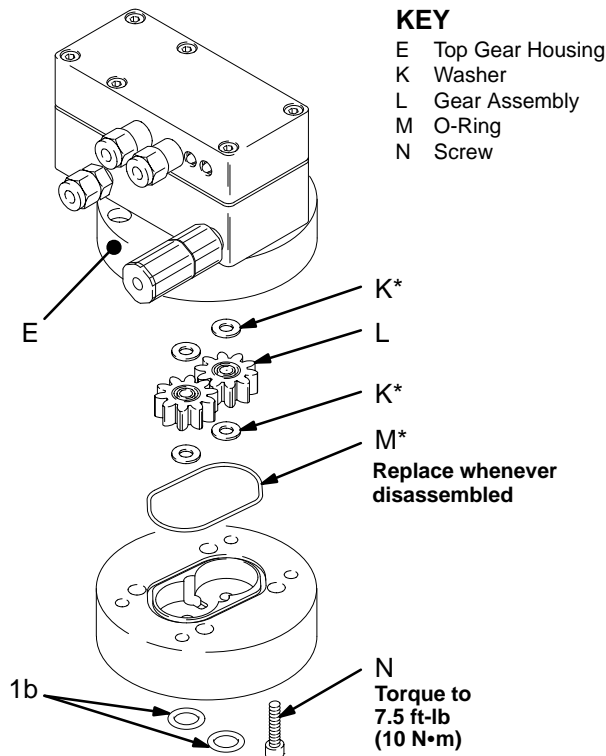


Fig. 5

01852A

Service

Removing Bearings

KEY

- L Gear Assembly
- T* Bearing Tool
- V* Bearings and Spacers
- W Support

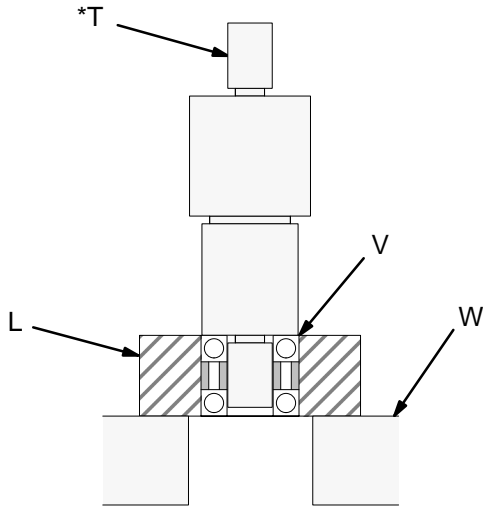


Fig. 6

0968

Installing Bearings

KEY

- L Gear
- P* Bearing
- R* Inner Spacer
- S* Outer Spacer
- T* Bearing Tool
- U Flat Surface

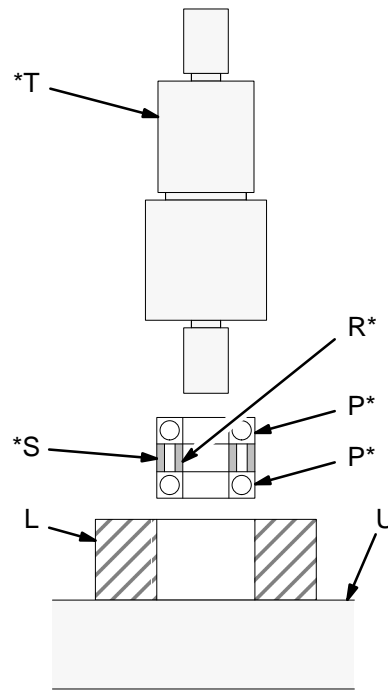


Fig. 7

0969

Parts

Bearing Repair Kit 223–276

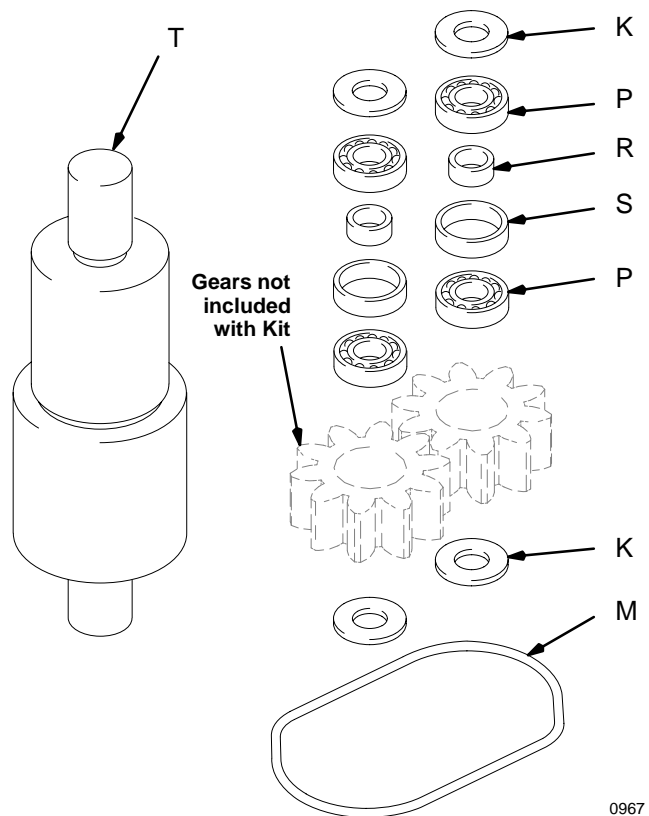
For Meter Model 235–402,
with 0.1 cc per tooth fluid volume flow

Bearing Repair Kit 223–277

For Meter Model 235–403,
with 0.4 cc per tooth fluid volume flow

Bearing Repair Kits include the following parts:

Ref. Letter	Description	Qty.
C	O-RINGS, (not shown, See Fig. 3)	2 or 4
K	WASHER	4
M	O-RING	1
P	BEARINGS	4
R	INNER SPACER	2
S	OUTER SPACER	2
T	BEARING TOOL	1



0967

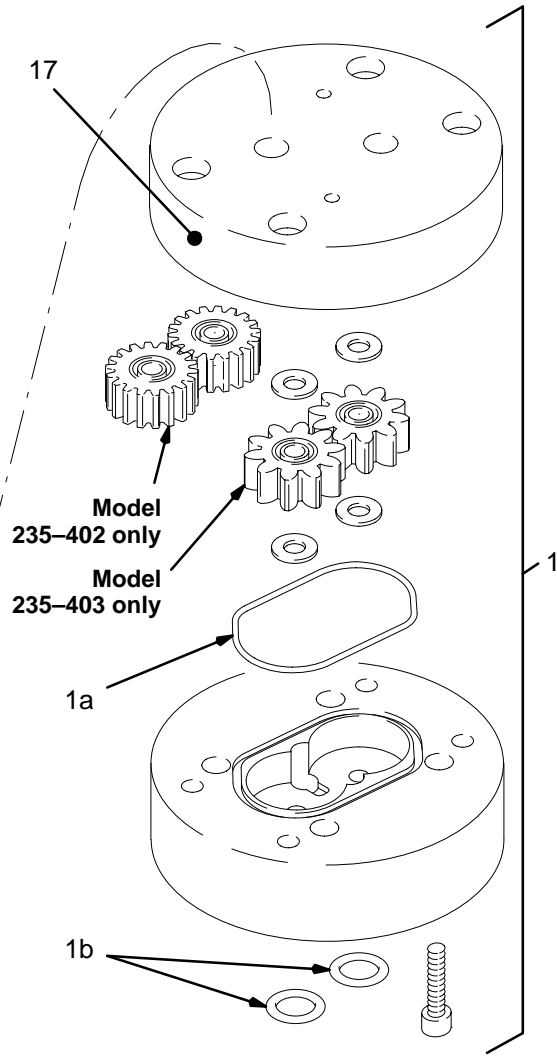
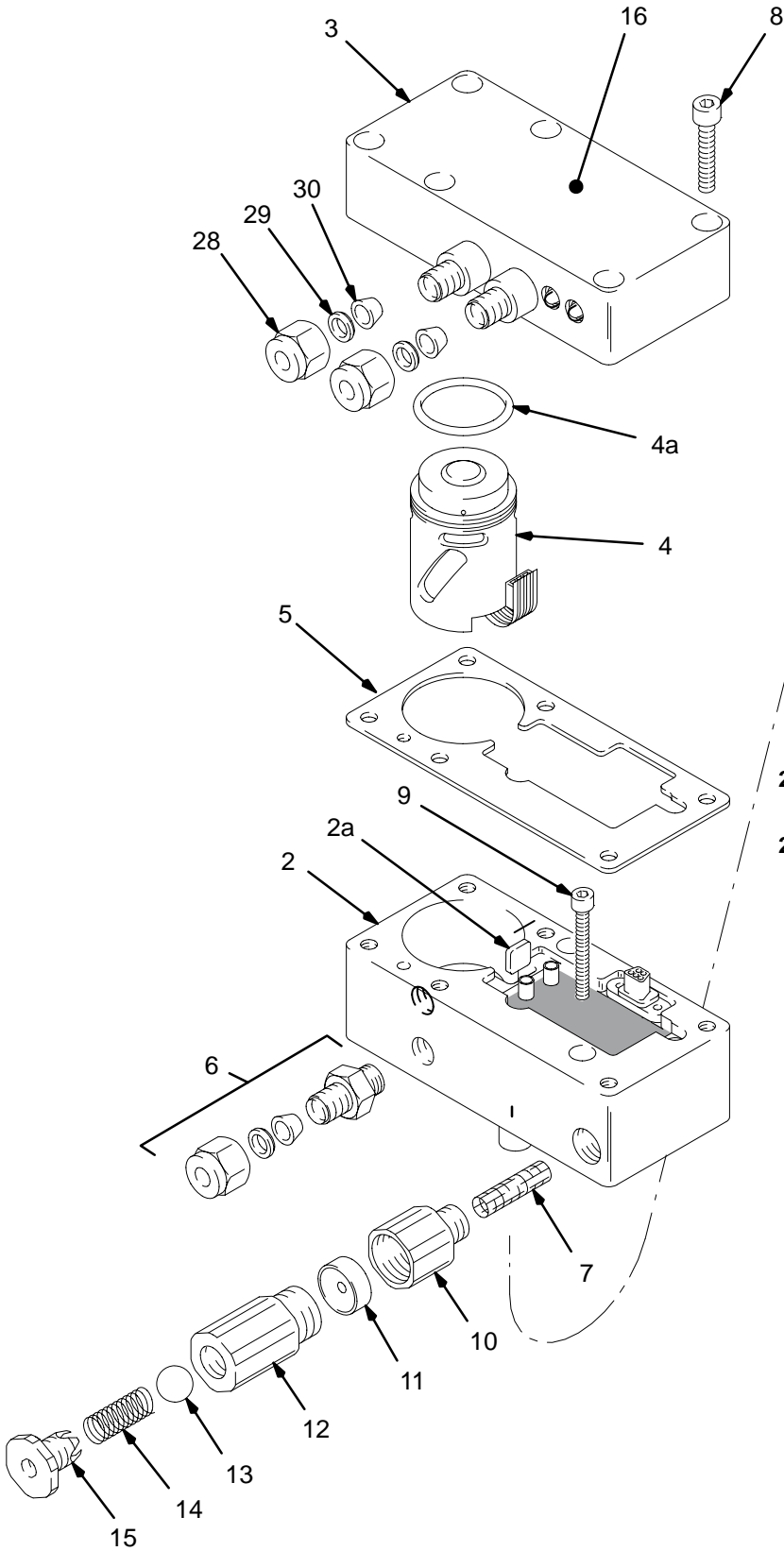
Parts

Part No. 235-402, Series A

0.1 cc per tooth fluid volume flow

Part No. 235-403

with 0.4 cc per tooth fluid volume flow



Parts

Part No. 235–402, Series A

0.1 cc per tooth fluid volume flow

Part No. 235–403, Series A

0.4 cc per tooth fluid volume flow

Ref No.	Part No.	Description	Qty.
1		GEAR HOUSING ASSY; Ordering information below; Includes replaceable items 1a & 1b	1
1a	111–073	. O-RING, fluid housing; PTFE	1
1b	111–070	. O-RING, fluid ports; PTFE	2
2	224–277	CHASSIS ASSY, bottom; Includes item 2a	1
2a	186–924	. PAD, insulating	1
3	224–276	CHASSIS ASSY, top	1
4	224–603	ALTERNATOR; Includes item 4a	1
4a	110–073	. O-RING, alternator; Viton®	1
5	186–852	GASKET, adhesive backing	1
6	111–157	FITTING, air inlet; 1/4" tube	1
7	186–853	FLAME ARRESTOR	1
8	110–420	SCREW, cap; 10–24 x 1.5"	6
9	111–308	SCREW, top mounting; M4 x 0.7 x 30 mm long	2

Ref No.	Part No.	Description	Qty.
10	186–922	FITTING, valve	1
11	107–107	WASHER, flow	1
12	186–921	BODY	1
13	101–435	BALL	1
14	108–046	SPRING	1
15	186–923	RETAINER	1
16*	187–125	LABEL, warning	1
17*	187–124	LABEL, warning	1
28	111–284	NUT, tube fitting; 1/4" OD	2
29	111–285	FERRULE, back; 1/4" OD	2
30	111–286	FERRULE, front; 1/4" OD	2

* Additional warning labels available at no charge from Graco.

Viton® is a registered trademark of the Du Pont Company.

To Order Gear Housing Assembly (item 1)

To replace the Gear Housing Assembly, you must send the complete flow meter assembly back to your local Graco distributor. The flow meter needs to be recalibrated when a new gear housing is installed.

Accessories

Fiber Optic Cables

Fiber Optic Cable Assembly

For connection between the controller and flow meter.

PART NO.	LENGTH
224-690	6 ft (1.8 m)
224-691	15 ft (5 m)
224-692	25 ft (8 m)
224-693	36 ft (11 m)
224-694	50 ft (15 m)
224-695	75 ft (23 m)
224-696	100 ft (30.5 m)

Fiber Optic Cable Extender

For connection between the flow meter and bulkhead connector or between two bulkhead connectors.

PART NO.	LENGTH
224-670	6 ft (1.8 m)
224-671	15 ft (5 m)
224-672	25 ft (8 m)
224-673	36 ft (11 m)
224-674	50 ft (15 m)
224-675	75 ft (23 m)
224-676	100 ft (30.5 m)

Bulkhead Connector 224-261

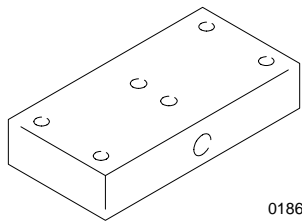
For connection between two fiber optic cables.

Grounding Clamp and Wire 222-011

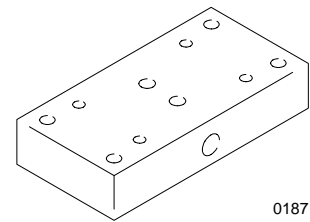
12 ga, 25 ft (7.6 m) wire

Fluid Manifold

Contact your local Graco representative to order proper manifold.



Part No. 223-869



Part No. 624-708

Fluid Filter 223-160

5000 psi (35.0 MPa, 350 bar) Maximum Working Pressure
Stainless steel bowl and polyethylene support.

NOTE: This filter has a 60 mesh screen. To prevent premature flow meter wear, use a 100 mesh screen. Order Part No. 167-026 when you order the filter.

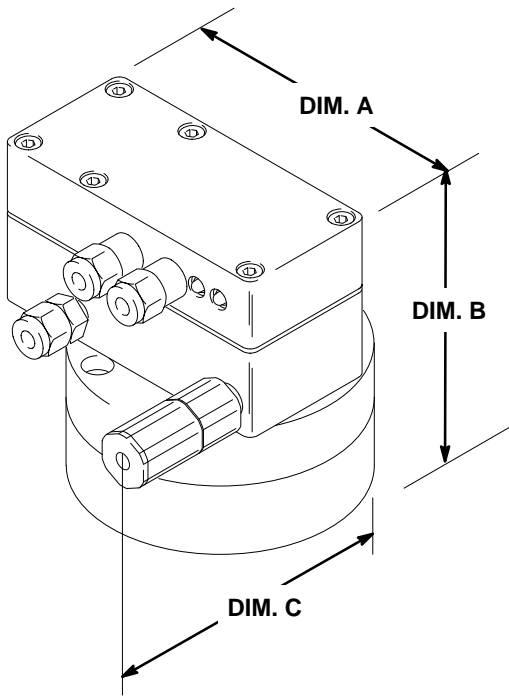
100 Mesh Filter Screen 167-026

For use with Fluid Filter 223-160.

Bleed-type Master Air Valve 107-142

300 psi (2.1 MPa, 21 bar) Maximum Working Pressure
Relieves air trapped in the air line between the pump air inlet and this valve when closed. 1/2" npt

Dimensions



Part No.	Dim. A	Dim. B	Dim. C
235-402	4.25 in (108 mm)	4.10 in. (104 mm)	4.44 in. (113 mm)
235-403	4.25 in (108 mm)	4.25 in. (108 mm)	4.50 in. (114 mm)

01847

Technical Data

Category	Data
Maximum Working Fluid Pressure	2800 psi (19.6 MPa, 196 bar)
Maximum Working Air Pressure	50 psi (350 kPa, 3.5 bar)
Fluid Pressure Operating Range	0-2800 psi (0-19.6 MPa, 0-196 bar)
Air Pressure Operating Range	20-50 psi (140-350 kPa, 1.4-3.5 bar)
Air Inlet	1/4 inch OD tube
Maximum Fiber Optic Cable Length	100 ft (30.5 m) with two splices
Wetted Parts	Stainless Steel, PTFE

Manual Change Summary

This manual was revised to include the changes from PCN C.

The Graco Warranty

Graco warrants all equipment listed in this manual which is manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale by an authorized Graco distributor to the original purchaser for use. With the exception of any special extended or limited warranty published by Graco, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

This warranty does not cover, and Graco shall not be liable for general wear and tear, or any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non-Graco component parts. Nor shall Graco be liable for malfunction, damage or wear caused by the incompatibility of Graco equipment with structures, accessories, equipment or materials not supplied by Graco, or the improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by Graco.

This warranty is conditioned upon the prepaid return of the equipment claimed to be defective to an authorized Graco distributor for verification of the claimed defect. If the claimed defect is verified, Graco will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser transportation prepaid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor, and transportation.

Graco's sole obligation and buyer's sole remedy for any breach of warranty shall be as set forth above. The buyer agrees that no other remedy (including, but not limited to, incidental or consequential damages for lost profits, lost sales, injury to person or property, or any other incidental or consequential loss) shall be available. Any action for breach of warranty must be brought within two (2) years of the date of sale.

GRACO MAKES NO WARRANTY, AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE IN CONNECTION WITH ACCESSORIES, EQUIPMENT, MATERIALS OR COMPONENTS SOLD BUT NOT MANUFACTURED BY GRACO. These items sold, but not manufactured by Graco (such as electric motors, gas engines, switches, hose, etc.), are subject to the warranty, if any, of their manufacturer. Graco will provide purchaser with reasonable assistance in making any claim for breach of these warranties.

In no event will Graco be liable for indirect, incidental, special or consequential damages resulting from Graco supplying equipment hereunder, or the furnishing, performance, or use of any products or other goods sold hereto, whether due to a breach of contract, breach of warranty, the negligence of Graco, or otherwise.

FOR GRACO CANADA CUSTOMERS

The parties acknowledge that they have required that the present document, as well as all documents, notices and legal proceedings entered into, given or instituted pursuant hereto or relating directly or indirectly hereto, be drawn up in English. Les parties reconnaissent avoir convenu que la rédaction du présente document sera en Anglais, ainsi que tous documents, avis et procédures judiciaires exécutés, donnés ou intentés à la suite de ou en rapport, directement ou indirectement, avec les procédures concernées.

Graco Phone Number

TO PLACE AN ORDER, contact your Graco distributor, or call this number to identify the distributor closest to you:
1-800-367-4023 Toll Free.

*All written and visual data contained in this document reflects the latest product information available at the time of publication.
Graco reserves the right to make changes at any time without notice.*

Sales Offices: Minneapolis, Detroit, Los Angeles
Foreign Offices: Belgium, Canada, England, Korea, France, Germany, Hong Kong, Japan

GRACO INC. P.O. BOX 1441 MINNEAPOLIS, MN 55440-1441

PRINTED IN U.S.A. 308-287 February 1993, Revised July 1997