



INSTRUCTIONS

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

Model PPM 200™

Precision Pulse Volumetric Fluid Flow Meter

Displays instantaneous flow, batch total flow, and cumulative total flow

210 bar (3000 psi) Maximum Fluid Working Pressure

Flow Range is 30 cc/min. (1.0 oz./min.) to 1000 cc/min. (34 oz./min.)

Part No. 236-316, Series A

Intrinsically Safe for Class I, Division 1, Group D

Hazardous Indoor locations

ENTITY PARAMETERS

V_{max} 14 VDC

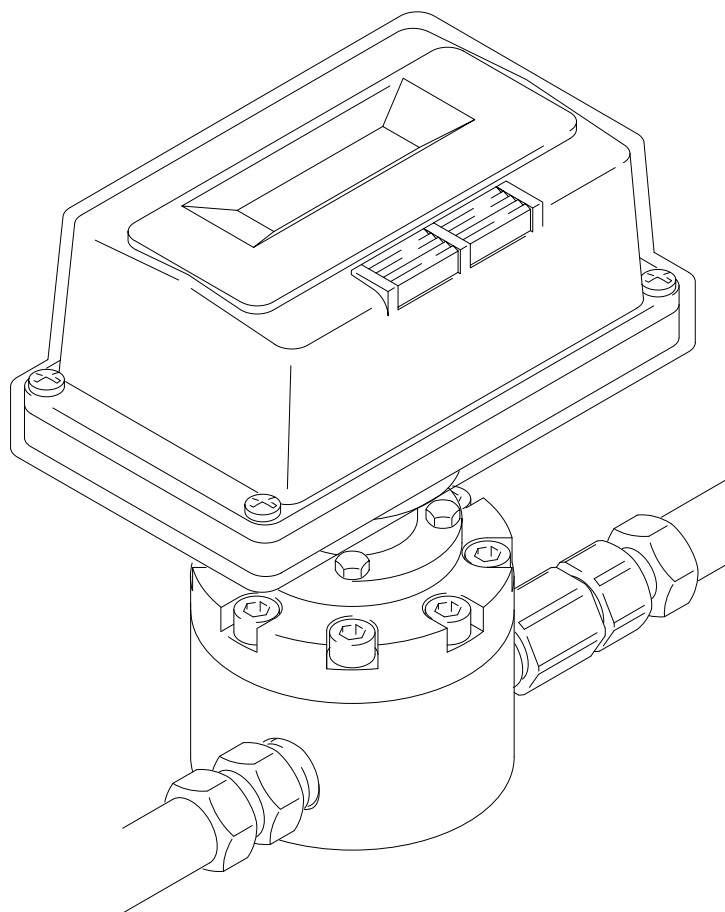
I_{max} 150 mA

C_i 6.3 μ F

L_i $\approx$ 0 mH



APPROVED



02710

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 instructions.

! WARNING



FIRE, EXPLOSION, AND ELECTRIC SHOCK HAZARD

Improper grounding, poor air ventilation, open flames, or sparks can cause a hazardous condition and result in a fire or explosion and serious injury.

- Electrical equipment must only be installed, operated, and serviced by personnel who are trained and qualified to do so and who have read the requirements stated within this instruction manual.
- This meter is intrinsically safe for Class I, Division 1, Group D hazardous indoor (NEMA 1) locations.
- Ground the equipment, including the flow meter, fluid supply unit, and the fluid supply line. See the **Installation** section, pages 6 to 8.
- Do not use the flow meter with an isolation stand.
- Do not spill water or other liquids on the flow meter electrical chassis.
- You must replace the I.S. (*intrinsically safe*) power pack and repair the electronic module in a non-hazardous location.
- Provide fresh air ventilation to avoid the buildup of flammable fumes from solvent or the fluid being dispensed.
- If there is any static sparking while using the equipment, **stop operating immediately**. Identify and correct the problem.



INJECTION HAZARD

Spray from the dispensing device, 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 10 whenever you: are instructed to relieve the pressure; stop dispensing; or clean, check, or service the equipment.
- 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.

⚠ WARNING



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 instruction manuals, tags, and labels before operating the equipment.
- Use the equipment only for its intended purpose. If you are uncertain about usage, call Graco Technical Assistance at 1-800-543-0339.
- 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 **210 bar (3000 psi) maximum fluid working pressure**.
- Route the hoses away from the traffic areas, sharp edges, moving parts, and hot surfaces. Do not expose Graco hoses to temperatures above 82°C (180°F) or below -40°C (-40°F).
- Fluid hoses must have spring guards on both ends to protect them from rupture caused by kinks or bends near the couplings.
- Use fluids or solvents that are compatible with the equipment wetted parts. See the **Technical Data** section of all the equipment manuals. Read the fluid and solvent manufacturer's warnings.
- Comply with all applicable local, state and national fire, electrical and other safety regulations.



TOXIC FLUID HAZARD

Hazardous fluids or toxic fumes can cause a serious injury or death if splashed in the eyes or on the skin, swallowed, or inhaled.

- Know the specific hazards of the fluid you are using. Read the fluid manufacturer's warnings.
- Store hazardous fluid in an approved container. Dispose of the hazardous fluid according to all local, state, and national guidelines.
- Wear appropriate protective clothing, gloves, eyewear, and respirator.

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Flow Meter Functions

FUNCTION	MEASURING MODE	DISPLAY
Display of the batch total flow volume		The total free flow volume that is going through the passage from the point of pressing the <i>Reset ON</i> button for the desired time. <i>6 digit display (liters) with 2 decimal points</i>
Display of the cumulative, non-resetable total flow volume	Blank display	The total flow volume going through the passage. <i>8 digit display (liters) with 2 decimal points</i>
Display of the instantaneous flow volume		The display of the flow volume going through the passage per minute. (cc/min.) <i>4 digit display (cc/min.) with 0 decimal points</i>
		The display of the flow volume going through the passage per hour. (liters/hour) <i>3 digit display (liters/hour) with 1 decimal point</i>

Installation

WARNING



FIRE, EXPLOSION, AND ELECTRIC SHOCK HAZARD

To reduce the risk of a fire, explosion, or electric shock:

- All electrical equipment must only be installed by a qualified electrician.
- Read and follow the **Hazardous Location Wiring of Intrinsically Safe Circuits** instructions, page 5.



- A barrier module must be used when the meter is installed in a hazardous location with remote monitoring in a non-hazardous location. See the **Technical Data**, page 18, for the recommended barrier module.

Remote Monitoring

The flow meter can be used with many data acquisition and control systems. The flow meter will send an output pulse for each rotation of the rotor. The flow volume per one pulse (*K-factor*) is about 3.6 cc per pulse. The actual K-factor for your meter is marked on the inside cover of the meter.

The Graco PPD 200 Remote Display, part no. 235-616, is available. It displays total volume, batch volume, and flow rate.

The following electric cables are available for connecting the meter sensor to the PPD 200 Remote Display.

Cable Part No.	Cable Length in meters (feet)
235-800	1.83 (6)
235-801	4.58 (15)
235-802	7.63 (25)
235-803	10.98 (36)
235-804	15.25 (50)
235-805	22.88 (75)
235-806	30.50 (100)
235-807	38.13 (125)
235-808	45.75 (150)
235-809	61.00 (200)

Accessories are available from your Graco representative. Refer to the Product Data Sheet for the meter, Form No. 305-618. For assistance in designing a system that is customized for your application, contact your Graco representative or Graco Technical Assistance, see page 17.

Installation

Hazardous (*classified*) Location Wiring of Intrinsically Safe Circuits

 WARNING	
	FIRE AND EXPLOSION HAZARD The transmitting of flammable atmosphere from one area to another through a multi-conductor cable can cause a fire or explosion and result in a serious injury and property damage. Follow the instructions below and refer to NEC Article 504, ANSI standards ISA-RP12.6, and Canadian Electrical Code, Appendix F.

In installations where intrinsically safe circuits are contained in a multi-conductor cable capable of transmitting flammable mixtures through the cable core, the cable core must be either sealed or vented. A Graco cable seal, part no. 110–458, is available.

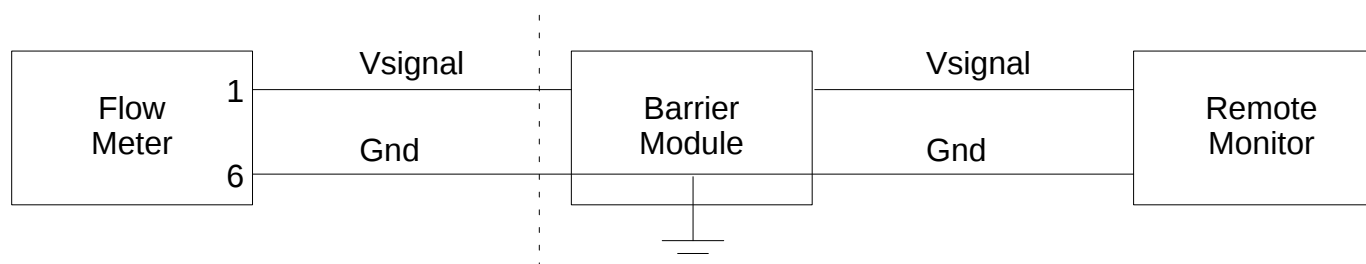
The purpose of such sealing or venting is to prevent the cable from transmitting the flammable atmosphere from one area of a hazardous location to another or from a hazardous location to a non-hazardous location at a rate of more than 198 cm³ of air per hour at a pressure of 1493 Pa (0.007 feet³/hour of air at a pressure of 6 inches of water), with both ends of the cable at atmospheric pressure.

Installation Drawing for CSA Approval

Part No. 236–316

**Intrinsically Safe For Class I, Division 1,
Group D Hazardous Location**

NOTE: This installation drawing is for the use of the PPM 200 with a remote monitor. A barrier module is not required if the PPM 200 is used as a stand-alone meter (i.e. no external wiring).



HAZARDOUS LOCATION

NON-HAZARDOUS LOCATION

Connector No.	
1	0 V (gnd)
2	no connection
3	no connection
4	no connection
5	no connection
6	pulse (Vsignal)



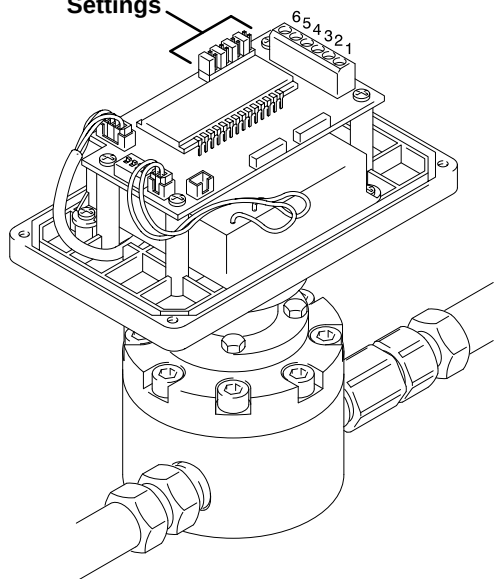
INTRINSICALLY SAFE
SECURITE INTRINEQUE

Exia

Barrier Module shall be CSA Certified type with parameters of 13.9 V_{max} and 208 Ω min.

Wiring installation must meet Canadian Electrical Code Part I, Appendix F.

**Factory
Jumper
Settings**



2711

Cable Wiring and Dip Switch Settings

When Using PPM 200 Flow Meter with PPD 200 Remote Display 235-616
(PPM 200 Meter used in Class I, Division 1, Group D Hazardous Location)

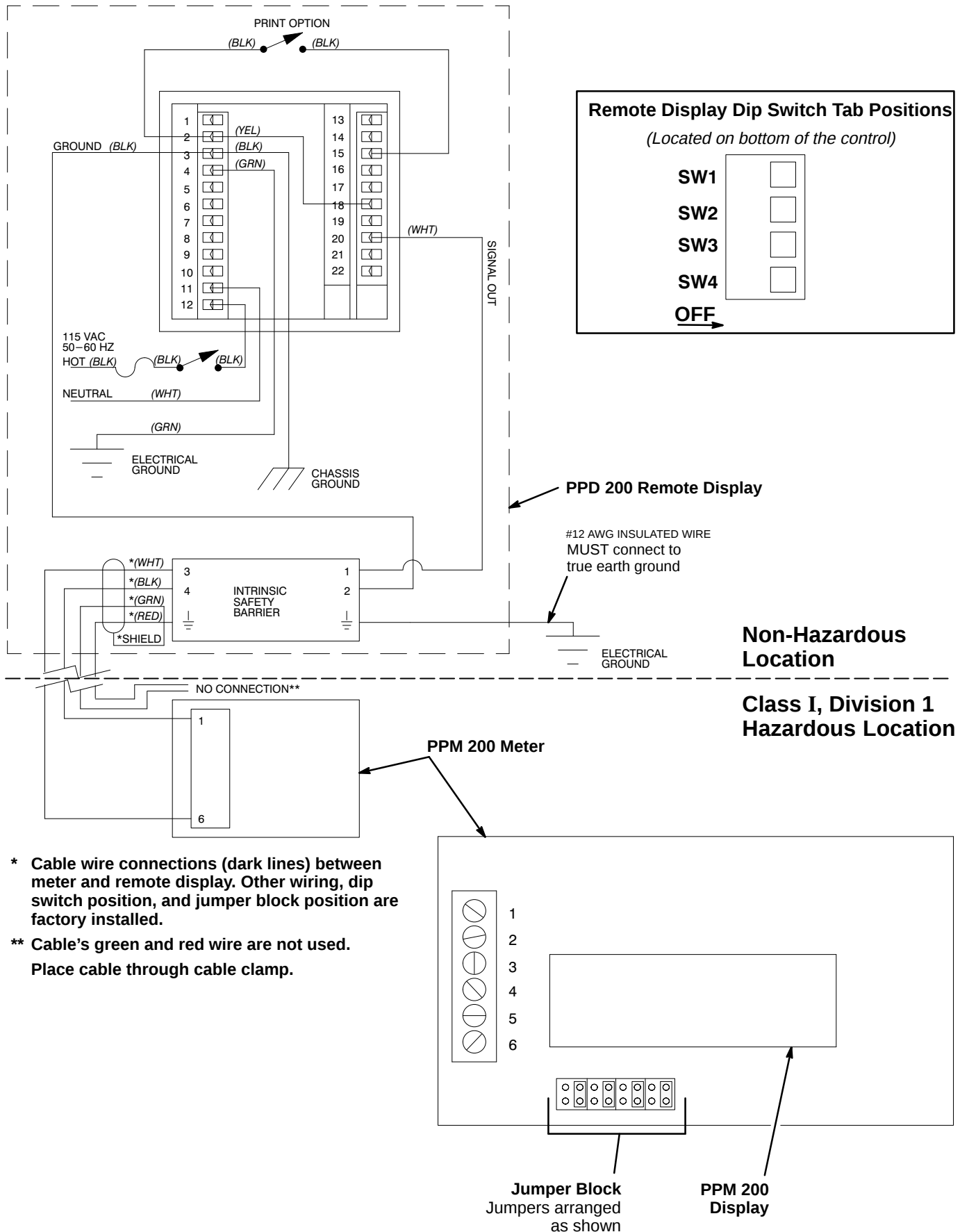


Fig. 1

Installation

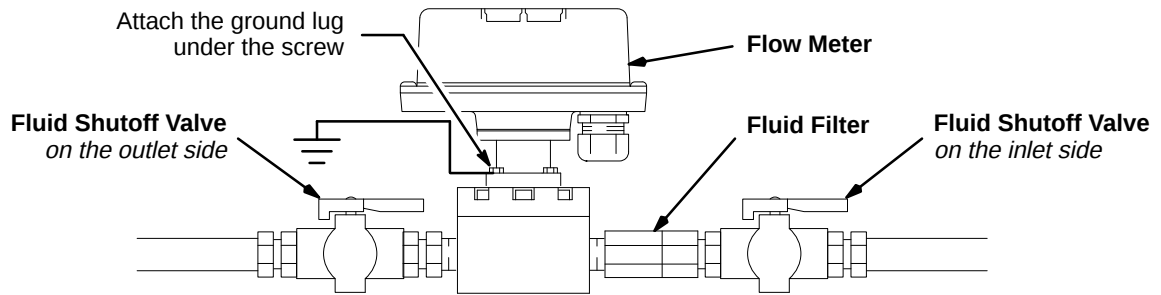


Fig. 2

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Dust and Foreign Matter

Avoid allowing dust or foreign matter from entering the flow meter by taking the following precautions:

- Thoroughly flush the fluid supply lines before installing the flow meter.
- Install the fluid filter at the flow meter inlet.
- When installing the fittings, make sure that no sealing tape overlaps into the inside of the pipe.

Flow Meter Location

NOTE: Flow volume can only be measured at the location where the flow meter is installed.

- Install the flow meter where there is little vibration.
- Do not install the meter where it is damp or receives direct sunlight.
- Locate the meter where the temperature is between 0 to 50°C (0 to 122°F) and humidity is below 95% RH.

- When using the flow meter with an electrostatic spray unit, install the flow meter at least 2 meters (6.56 feet) from the unit. Electric noise will interfere with the meters ability to measure fluid flow accurately.
- Refer to Fig. 2 and 3 to locate and install the flow meter, filter, bypass line, and fluid shutoff valves.

WARNING



COMPONENT RUPTURE HAZARD

 The quick-disconnect fittings shown in Fig. 3 are shown as part of a typical installation. To reduce the risk of a serious injury or property damage caused by component rupture, never operate the flow meter above the maximum working pressure of the fittings. Read **Equipment Misuse Hazard** on page 3.

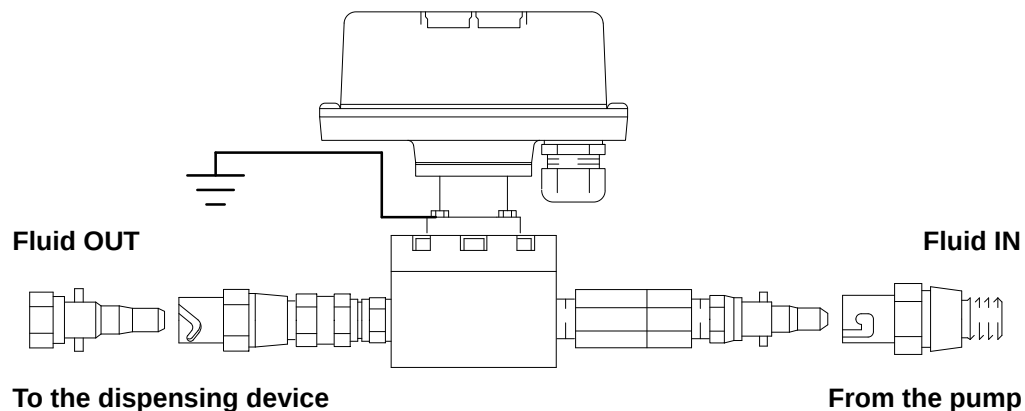


Fig. 3

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Operation

Pressure Relief Procedure

WARNING



INJECTION HAZARD

The system pressure must be manually relieved to prevent the system from starting or spraying accidentally. Fluid under high pressure can be injected through the skin and cause a serious injury. To reduce the risk of an injury from injection, splashing fluid, electric shock, or moving parts, follow the **Pressure Relief Procedure** whenever you:

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

1. Turn off the fluid supply to the meter.
2. Shut off all the electrical power to the fluid system or air system.
3. Follow the Pressure Relief Procedure for your fluid system dispensing device.

Recommended Usage

CAUTION

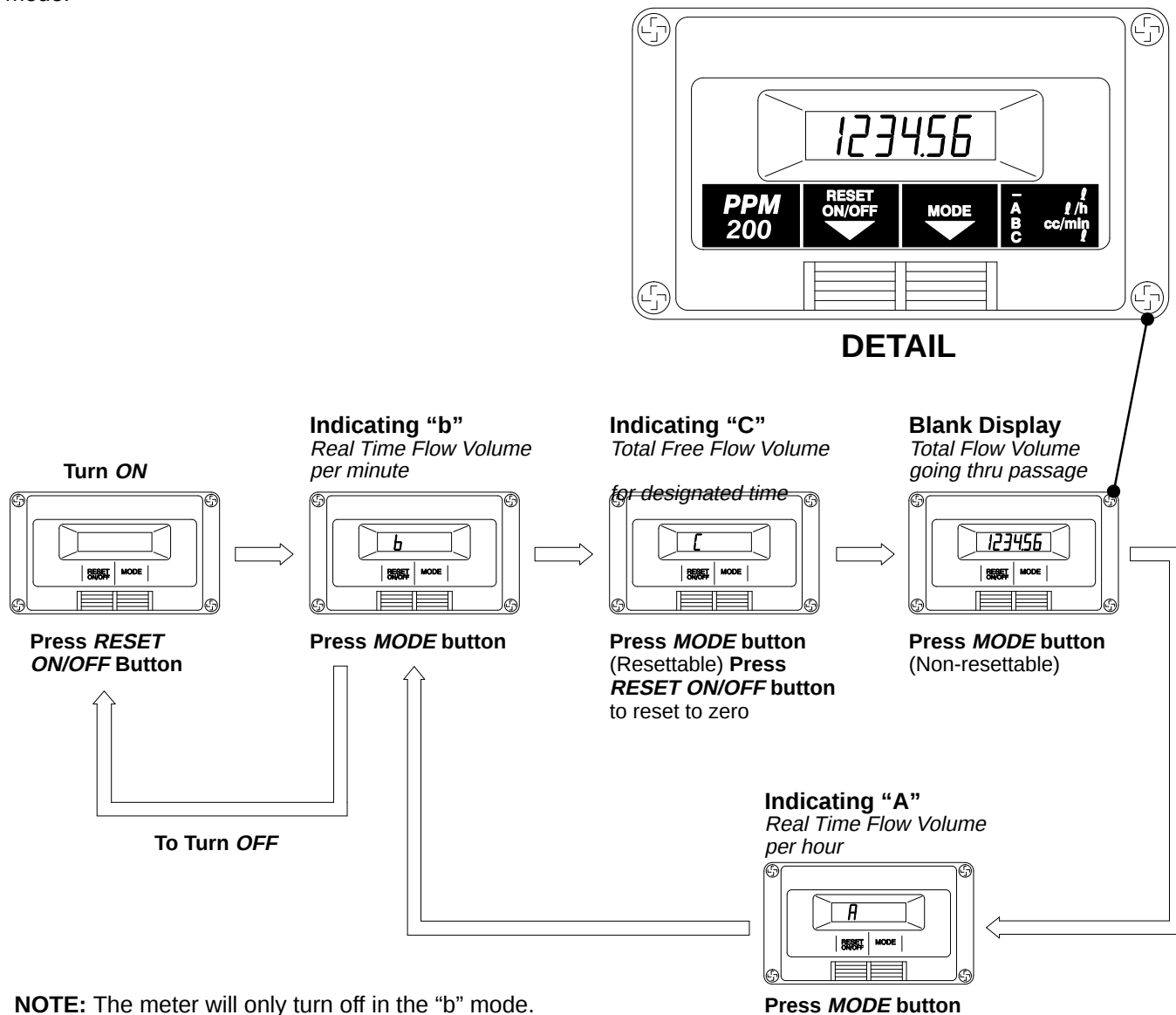
The flow meter rotor can be damaged if it rotates at too high a speed. To avoid high speed rotation, open the fluid valve gradually. Do not over-speed the rotor with air or solvent. To prolong meter life, do not use the meter above the maximum flow rate of 1000 cc/min. (34 oz./min.).

- The flow meter can be used with fluids that are 0 to 50°C (0 to 122°F).
- Use the flow meter with the filter provided, as abrasive fluids can cause problems with the rotor.
- When the flow meter is used with low viscosity fluids, such as solvent, it will not be accurate at low flow rates, under 50 cc/min. (1.69 oz./min.). See the graph, page 19.
- Do not use the flow meter with fluids that are not compatible with the “Wetted Parts” listed in the **Technical Data** on page 18.
- Do not allow the fluid to set in the flow meter. Before shutting down the system, flush the meter as instructed in **Maintenance**, page 13.

Operation

Operating the Flow Meter

Follow the steps shown in Fig. 4 when turning the flow meter *ON* or *OFF* or when changing the measuring mode.



NOTE: The meter will only turn off in the "b" mode.

Fig. 4

01038

Operation

Exceeding Flow Volume

When the flow volume goes over 1500 cc/min.,  will be displayed on the meter panel. If this happens, adjust the flow volume immediately. If this display occurs in the “A” or “b” mode, it will change soon after the flow volume is steady and within its limit.

I.S. Power Pack Alarm Display

 **WARNING**



FIRE, EXPLOSION, AND ELECTROSTATIC SHOCK HAZARD

To reduce the risk of a fire, explosion, or electric shock, you must replace the power pack and repair the electronic module in a non-hazardous location.

When the power pack’s power is getting weak, *bAtt* will be displayed on the meter panel.

NOTE: The unit will continue displaying “bAtt” for approximately six months. After that time, the cumulative flow memory will be lost and reset to “0”. The rest of the meter memory will be maintained.

Install a new power pack. The flow meter cannot measure flow volume when the power pack is low. To change the power pack, see page 15.

No Flow Volume Display

If there is no flow volume display, check the following:

CAUSE	SOLUTION
1. Flow volume is too low to be measured	1. Increase the flow volume.
2. Fluid is not flowing	2. Check for clogs in the fluid line or in the meter. See Cleaning the Meter Chamber , page 14.
3. Rotor is not moving, even though the fluid is flowing	3. See Cleaning the Meter Chamber , page 14.
4. Power pack is low	4. Replace the power pack. See Changing the I.S. Power Pack , page 15.

Checking the Meter Accuracy

 **CAUTION**

The meter accuracy may change due to normal wear. Check the meter accuracy periodically, based upon the conditions of your application.

1. To check the accuracy of the meter, switch the *MODE* button to the “C” mode. See Fig. 4, page 11.
2. Press the *RESET* button to reset the “C” display to zero (0).
3. With the air (fan and atomizing) to the dispensing device turned off, trigger the fluid into a graduated cylinder; dispense at least 500 cc of the fluid.
4. Measure the volume of fluid in the beaker in cubic centimeters and read the volume on the flow meter display in liters.

Use the following formula to determine the accuracy of the meter.

$$\left[\frac{A - (B \times 1000)}{A} \right] \times 100 = \text{Accuracy (\%)}$$

Where *A* = Volume (cc) of fluid in beaker
and *B* = Volume (liters) of fluid on meter display

If the flow meter accuracy is outside of your acceptable limit, return the meter to Graco for recalibration or repair.

Maintenance

⚠ WARNING



INJECTION HAZARD

To reduce the risk of a serious injury, follow the **Pressure Relief Procedure** on page 10 whenever you:

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

⚠ CAUTION

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

- Clean the fluid filter (6) periodically to avoid damage to the main fluid chamber of the meter. See Fig. 5.
- A protective cover is supplied with the flow meter to prevent paint buildup on the meter face. Clean the cover and outside of the meter with a soft cloth dampened in a compatible solvent as needed.
- Flush the fluid supply line and meter fluid reservoir daily with a compatible solvent as instructed at right.

NOTE: The 3/8 npt hex nipple (8) is permanently bonded to the meter body to ensure a permanent fluid seal. Do not remove this fitting. See Fig. 5.

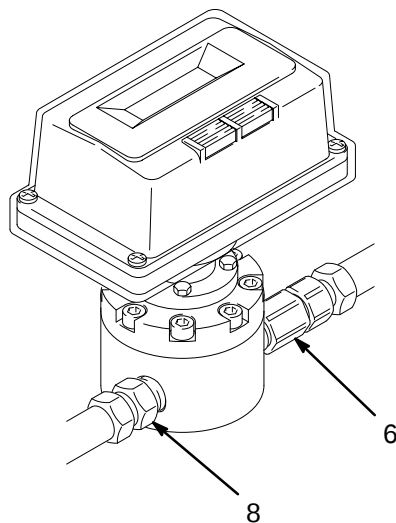
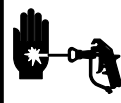


Fig. 5

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Flushing the Meter

⚠ WARNING



INJECTION HAZARD

To reduce the risk of a serious injury, follow the **Pressure Relief Procedure** on page 10 whenever you are instructed to relieve the pressure.

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.
5. Disconnect the fluid line from the solvent supply unit.
6. Reconnect the fluid line to the fluid (*paint*) supply.
7. Turn on the fluid supply.
8. Operate the system until the meter and fluid line are free of solvent.

⚠ CAUTION

If the system will be shut down for any length of time, be sure to leave a small amount of thinner inside the flow meter chamber. Allowing the chamber to dry up may cause the rotor to adhere to the chamber.

Maintenance

Cleaning the Meter Chamber

WARNING



INJECTION HAZARD

To reduce the risk of a serious injury, follow the **Pressure Relief Procedure** on page 10 whenever you are instructed to relieve the pressure.

1. Relieve the pressure.
 2. Remove the four screws (9). See Fig. 6.
 3. Separate the display module (C) and the meter cover (11).
 4. Remove the eight screws (10).
 5. Separate the meter cover (11) and the fluid chamber (13).
- NOTE:** Replace the o-ring (3) whenever the meter is disassembled.
6. Rotate the rotor (4) slightly by hand. If the rotor does not turn smoothly, remove the rotor from the chamber (13), and clean both parts with thinner.
 7. Assemble the parts in reverse order. Torque the screws (10) opposite and evenly to 21 N•m (15 ft-lb). Torque the screws (9) opposite and evenly to 6 N•m (4 ft-lb).

CAUTION

The flow meter rotor is calibrated with the fluid chamber it is assembled into. After cleaning the rotor, install it back into its original fluid chamber. Installing the rotor in another fluid chamber will affect the meter accuracy.

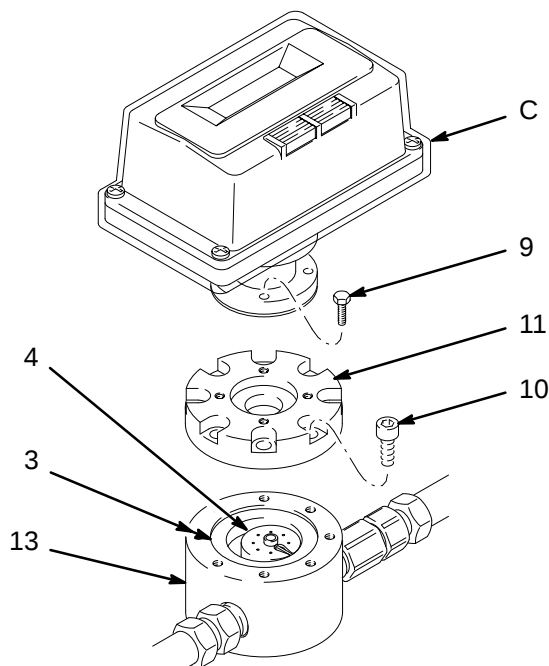


Fig. 6

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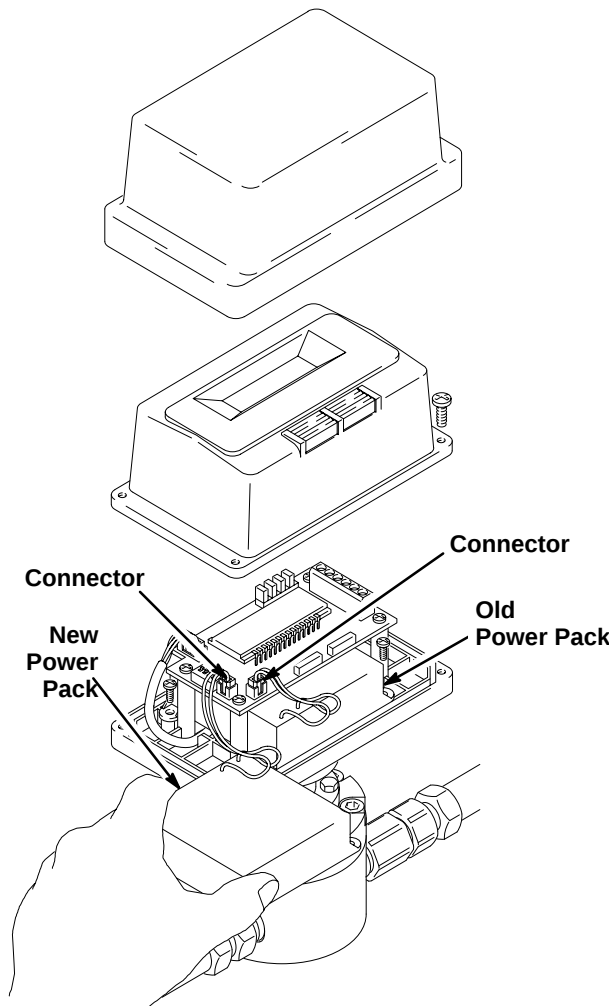
Maintenance

Changing the I.S. Power Pack

⚠ WARNING	
	FIRE, EXPLOSION, AND ELECTROSTATIC SHOCK HAZARD To reduce the risk of a fire, explosion, or electric shock, you must replace the power pack and repair the electronic module in a non-hazardous location.

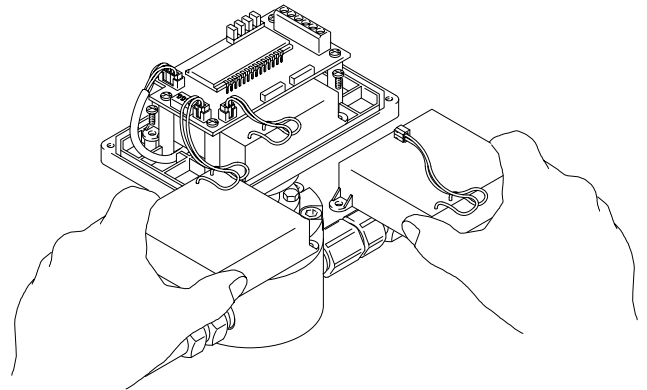
⚠ CAUTION	
Do not disconnect the old power pack from the meter until the new power pack is connected. If both of the power pack connectors are disconnected at the same time, the total cumulative flow will be lost from the meter memory.	

STEP 1: Remove the covers and connect the new power pack to the extra meter connector.



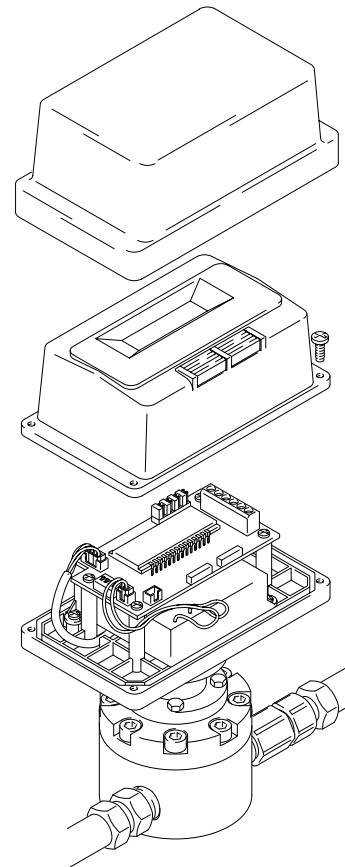
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STEP 2: Disconnect and remove the old power pack. There are lithium batteries inside the power pack. Be sure to properly dispose of them.



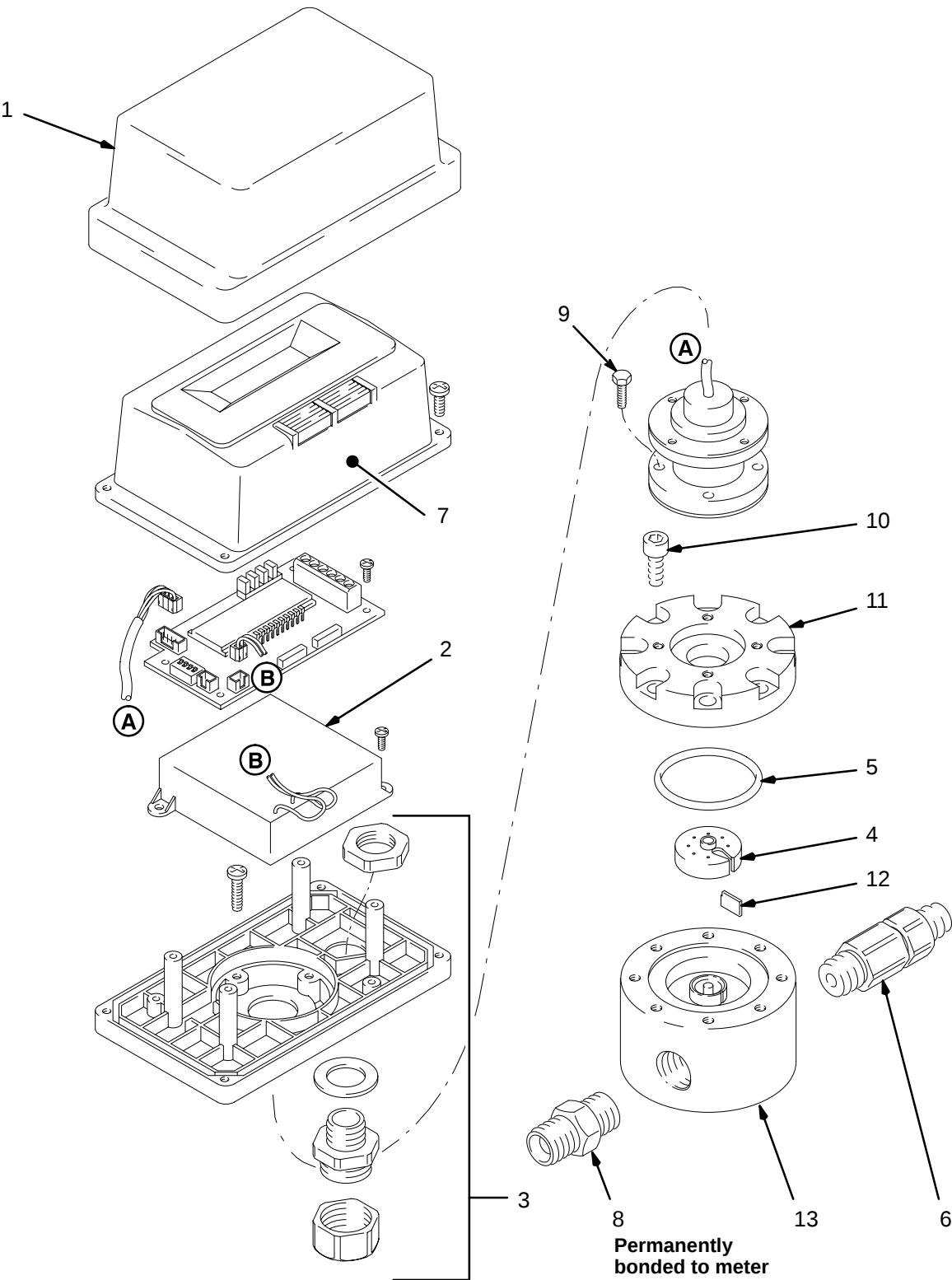
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STEP 3: Install the new power pack in the meter, and install the covers.



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Parts



Parts

Part No. 236-316, Series A

PPM 200 Precision Pulse Volumetric Fluid Flow Meter

Ref.

No.	Part No.	Description	Qty.
1	185-823	COVER, protective	1
2	110-429	I.S. POWER PACK	1
3	110-503	CABLE CONNECTOR	1
4	236-322	ROTOR	1
5	108-825	O-RING	1
6*	236-315	FLUID FILTER; 200 mesh (74 micron) element, 1/4 npt(f) inlet, 3/8 npt(m) outlet	1
7▲	190-048	LABEL, warning	1
8	601-843	FITTING, 3/8-18 npt(m)	2
9	112-487	SCREW, M4 x 12	4
10	112-488	SCREW, M6 x 16	8
11	189-193	COVER, meter	1
12	189-197	PLATE	1
13	189-192	CHAMBER, meter fluid	1

▲ Replacement Warning labels are available at no cost.

☞ Replacing these parts may effect the meter accuracy. See page 12.

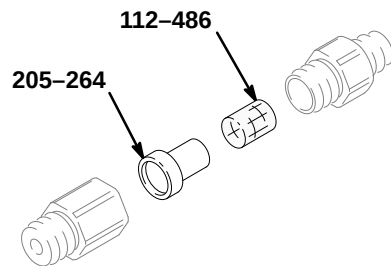
* See the replacement filter and element below.

Replacement Parts for the Fluid Filter

Stainless Steel Disc Filter 205-264

Stainless Steel Screen Element 112-486

200 mesh (74 micron). Order both parts.



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Graco Phone Numbers

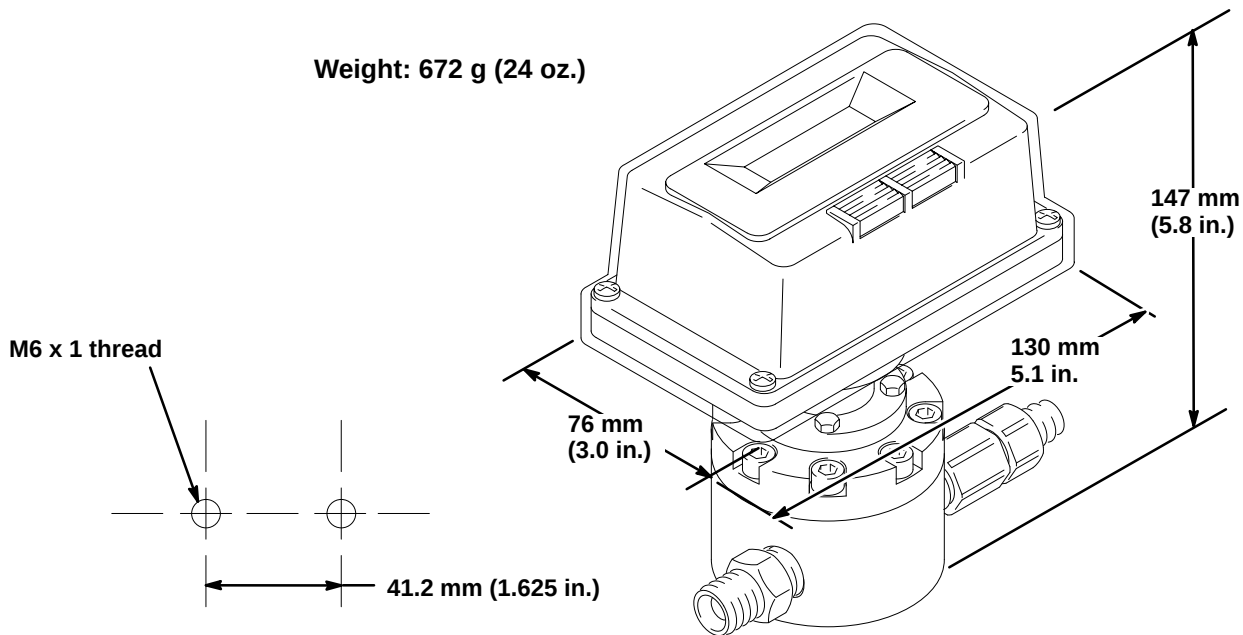
TO PLACE AN ORDER, contact your Graco distributor, or call Graco: **1-800-328-0211 Toll Free**

FOR TECHNICAL ASSISTANCE, service repair information or answers about the application of Graco equipment, call: **1-800-543-0339 Toll Free**

Manual Change Summary

1. Changed the filter wetted parts information in the Technical Data.
2. Added a note about the initial meter accuracy to the Technical Data.

Dimensions



Technical Data

Maximum Fluid Working Pressure . 210 bar (3000 psi)
 Flow Rate Range 30 cc/min. (1.0 oz./min.) to
 1000 cc/min. (34 oz./min.)
 Initial Accuracy* $\pm 3\%$ of actual reading
 Meter Inlet/Outlet 3/8 npt(m)
 Filter Element Size 200 mesh (74 micron)
 Fluid Temperature Range 0–50°C (0–122°F)
 Fluid Viscosity Range Refer to **Recommended
 Usage** on page 10 and the
Performance Chart on page 19

Meter Parts 304 & 316 stainless steel, PEEK,
 Teflon®, rare earth cobalt
 Filter Wetted Parts** . . . 301 and 416 stainless steel or
 304 and 430 stainless steel

* The initial accuracy of the meter is $\pm 3\%$ of the actual display reading. However, the accuracy of the meter electronic display reading is affected by the the display resolution, which is 10 cc for batch and cumulative total flow volume.

** The filter element may not be suitable for all water-base fluids; call your Graco representative for assistance.

Teflon® is a registered trademark of the DuPont Company.

Technical Data

Recommended Barrier Module Spec

R. Stahl, Inc.
Intrinsic Safety Barrier
Model No. 9001/01-137-065-10

Operational Data

Rated Voltage: 12 V $\pm$ 10%
Maximum Voltage: 13.6 V
Fuse Current (I): 65.3 mA
End-to-End Resistance (R): 208 Ω

Outputs are Intrinsically Safe for Class I, II, III, Division 1 and 2, Groups A-G

Safety Description in accordance to standards issued by Factory Mutual-Class No. 3610-1979 (entity concept parameters)

Open Circuit Voltage (V oc): 13.6 V
Short Circuit Current (I sc): 65.3 mA
Allowed External Capacitance (Ca):

A, B: 1.1 μ F
C, E: 3.2 μ F
D, F, G: 8.5 μ F

Allowed External Inductance (La):

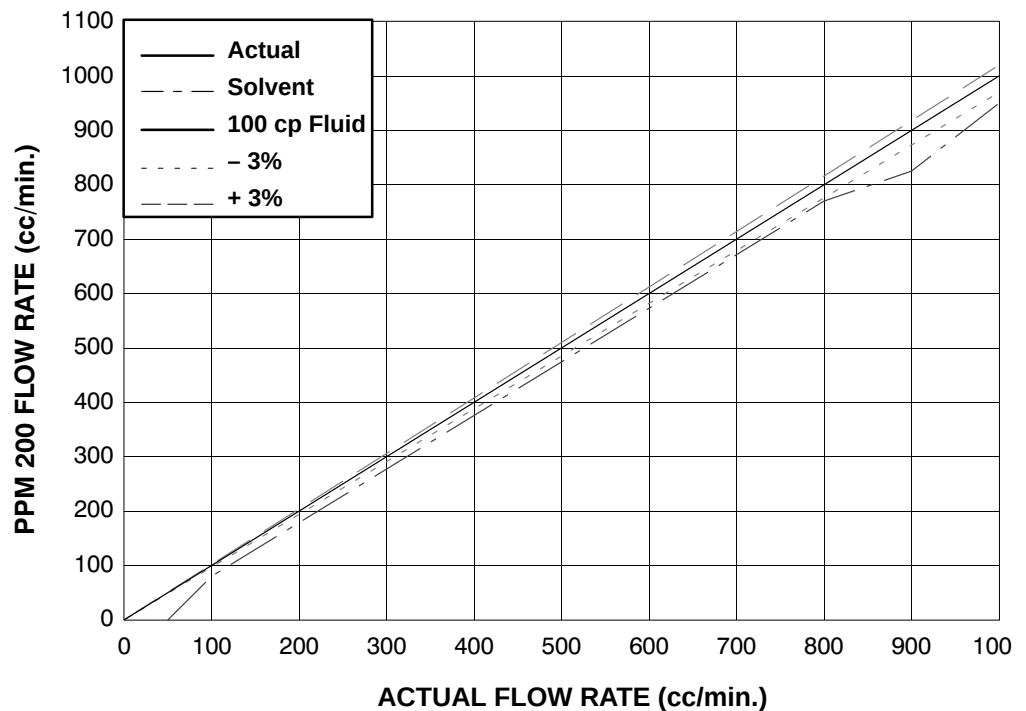
A, B: 8.1 mH
C, E: 31.2 mH
D, F, G: 66.5 mH

Safety Description in accordance to standards issued by CSA-22.2 No. 157/79

Open Circuit Voltage (V oc): 13.9 V
End-to-End Resistance (R): 208 Ω

Performance Chart

For most of the commonly used coatings, the flow meter will provide accurate flow readings to within $\pm$ 3%



The Graco Warranty and Disclaimers

WARRANTY

Graco warrants all equipment manufactured by it 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. As purchaser's sole remedy for breach of this warranty, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment proven 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, 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 with Graco equipment of 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 claim. 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.

DISCLAIMERS AND LIMITATIONS

The terms of this warranty constitute purchaser's sole and exclusive remedy and are in lieu of any other warranties (express or implied), **including warranty of merchantability or warranty of fitness for a particular purpose**, and of any non-contractual liabilities, including product liabilities, based on negligence or strict liability. Every form of liability for direct, special or consequential damages or loss is expressly excluded and denied. In no case shall Graco's liability exceed the amount of the purchase price. Any action for breach of warranty must be brought within two (2) years of the date of sale.

EQUIPMENT NOT COVERED BY GRACO WARRANTY

Graco makes no warranty, and disclaims all implied **warranties of merchantability and fitness for a particular purpose**, with respect to accessories, equipment, materials, or components sold but not manufactured by Graco. These items sold, but not manufactured by Graco (such as electric motor, 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.

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

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