Proteus Industries Inc.

8000 Series

Liquid Flow Meters

TECHNICAL REFERENCE MANUAL

CONTENTS

1 OVERVIEW

Introduction

This document provides comprehensive technical information about the Proteus 8000 Series liquid flow meter. Product features, specifications and operating instructions described in this manual are valid for standard models and may not be applicable to customized versions.

Important Safety Information

Throughout these instructions, **NOTE**, **CAUTION** and **WARNING** statements are used to highlight important operational and safety information.

NOTE	**NOTE** statements provide additional information that is important to the successful operation of the device.
CAUTION!	**CAUTION** statements identify conditions or practices that could result in damage to equipment or other property.
WARNING!	**WARNING** statements identify conditions or practices that could result in personal injury or loss of life.

Taking proper precautions to avoid damage to your instrument's sensors during installation helps to ensure consistent, error-free operation, which lowers costs and assists on-time completion of your work.

The safety-related statements contained in these instructions provide an alert to installers and operators to take sensible steps to allow your 8000 Series instrument to operate correctly the first time and every time.

NOTE	
	It is recommended that the installation of this product be performed by qualified service personnel only.

Technical Support

For technical or applications assistance, please contact:

Proteus Industries Inc.
340 Pioneer Way
Mountain View, CA 94041
TEL: (650) 964-4163
FAX: (650) 965-0304
E-mail: tech@proteusind.com

Warranty

Proteus 8000 Series instruments are manufactured under ISO 9001 certified processes and are warranted to be free from defects in materials and workmanship for five (5) years from the date of shipment. The full text of this limited warranty is available on the Proteus Industries website at www.proteusind.com/warranty.

Capabilities Overview

» Flow measurement

8000 Series liquid flow meters measure heat transfer fluids and other liquids at flow rates up to 227 LPM / 60 GPM with an accuracy of ±3% of full scale with standard validation.

» Flow switching

The measured flow rate is continuously compared to a user-selected alarm trip point value. If the flow rate falls below this level, a built-in relay can be used to sound an alarm or shut down a system before damage is done to valuable equipment and products.

» Wide liquid temperature range

Standard brass and stainless steel models are capable of monitoring liquids at temperatures from -40 to 90 °C / -40 to 194 °F. Customization is available to extend the liquid temperature limit to above 150 °C / 302 °F.

» Fluid-specific calibration

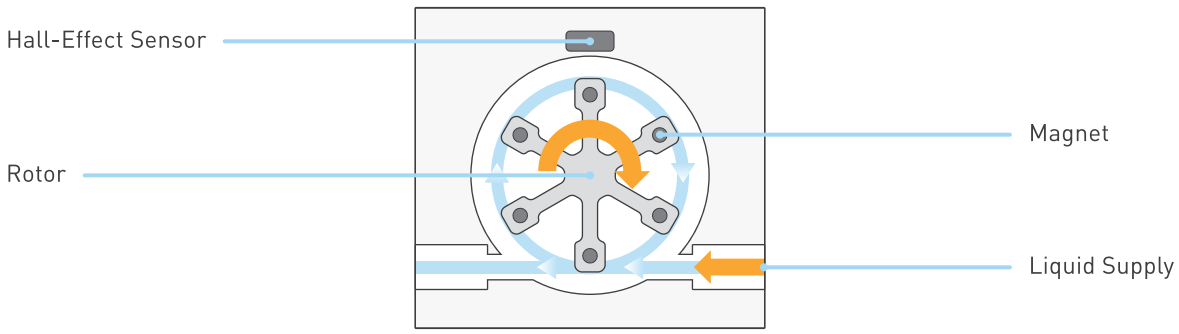
Specialized calibration is available to account for the viscosity effects of the fluid flowing through the device and the operating temperature.

» Easy trip point selection

A 16-position switch provides simple and accurate selection of the alarm flow rate. The switch is housed under a screw closure with a leak-tight O-ring seal to prevent unintentional adjustment. Instruments can also be programmed with a user-specified factory-preset trip point or other custom trip point value.

How It Works

As liquid flows through the flow sensor cavity, it causes the rotor to spin. Magnets embedded in the rotor switch a Hall-Effect sensor mounted in the sensor body. The rotational frequency of the rotor is measured by a microcomputer, and scaling factors entered into flash memory allow the volumetric flow rate to be calculated. Flow rate information is output as 0–10 or 0–5 VDC and 4–20 mA.



A built-in relay is programmed to change state when the measured flow rate falls below a preselected alarm value. A bright tri-color LED indicator functions as a traffic light to provide an instantaneous visual indication of the flow status.

3 SPECIFICATIONS AND PERFORMANCE

Materials, Flow Ranges, and Connections

The table below lists the available materials, flow ranges, and connections for standard 8000 Series products.

MODEL NUMBER			FLOW RANGE*		CONNECTION
POLYPROPYLENE	BRASS	STAINLESS STEEL	LPM	GPM	
	08004BN03	08004SN03	0.2 – 1.1	0.05 – 0.3	1/4" FNPT
08004PN06	08004BN06	08004SN06	0.2 – 2.2	0.06 – 0.6	1/4" FNPT
08004PN1	08004BN1	08004SN1	0.4 – 5.3	0.1 – 1.4	1/4" FNPT
08004PN2	08004BN2	08004SN2	0.95 – 9.5	0.25 – 2.5	1/4" FNPT
		08006SA2	0.95 – 9.5	0.25 – 2.5	9/16-18 SAE
08004PN4	08004BN4	08004SN4	1.1 – 17	0.3 – 4.5	1/4" FNPT
		08006SA4	1.1 – 17	0.3 – 4.5	9/16-18 SAE
	08006BN9	08006SN9	2.2 – 34	0.6 – 9.0	3/8" FNPT
08006PN10			2.2 – 38	0.6 – 10	3/8" FNPT
		08008SA10	3.0 – 38	0.8 – 10	3/4-16 SAE
08008PN14	08008BN14	08008SN14	5.3 – 53	1.4 – 14	1/2" FNPT
	08012BN16	08012SN16	4.5 – 60	1.2 – 16	3/4" FNPT
		08012SA16	4.5 – 60	1.2 – 16	1 1/16-12 SAE
08012PN19			5.7 – 72	1.5 – 19	3/4" FNPT
	08012BN40	08012SN40	11 – 151	3.0 – 40	3/4" FNPT
	08016BN40	08016SN40	15 – 151	4.0 – 40	1" FNPT
		08016SA40	15 – 151	4.0 – 40	1 5/16-12 SAE
08016PN50			15 – 189	4.0 – 50	1" FNPT
	08016BN60	08016SN60	19 – 227	5.0 – 60	1" FNPT

*Listed flow ranges are for water at 25 °C / 77 °F.

CAUTION!

DO NOT exceed the maximum rated flow rate of your 8000 Series flow meter.

Extended operation above the rated maximum flow rate of the instrument will reduce its usable life.

Other Wetted Materials

COMPONENT	AVAILABLE MATERIALS	
	STANDARD	OPTIONAL
Rotor	Kynar® (Black)	PPS
O-Ring	Viton®	Buna-N, Silicone Rubber
Rotor Shaft	316 Stainless Steel	Alumina

3 SPECIFICATIONS AND PERFORMANCE

Temperature and Pressure Limits

FLOW SENSOR MATERIAL	FACEPLATE MATERIAL	TEMPERATURE LIMIT*		OPERATING PRESSURE LIMIT		BURST PRESSURE (5:1)	
		°C	°F	kPa	psi	kPa	psi
Polypropylene	Clear Polysulfone	70	158	517	75	2586	375
Brass	Clear Polysulfone	90	194	621	90	3103	450
	Brass	90	194	1724	250	8618	1250
Stainless Steel	Clear Polysulfone	90	194	621	90	3103	450
	Stainless Steel	90	194	1724	250	8618	1250

*This is the fluid temperature that can be sustained with the flow meter cooled by ambient air up to 30°C / 86°F.

WARNING!

DO NOT exceed the temperature limit of the flow sensor body or faceplate material.

Operation above the rated temperature can cause failure and create a hazard to operators and equipment.

WARNING!

DO NOT exceed the pressure limit of the flow sensor body or faceplate material.

Operation above the rated pressure can cause failure and create a hazard to operators and equipment.

Electrical Requirements

Input Power Voltage	+24 VDC ± 10%
Input Power Consumption	< 1 W
Relay Contacts Maximum Current	1 A at 48 VDC
Voltage Output Maximum Sourcing Current	15 mA at 2 VDC output
Current Loop Voltage Compliance	0–22 VDC at 24 VDC input voltage
Cable Specifications	Length: 2.0 m / 6.6 ft • Flame Rating: VW-1

Performance Characteristics

The flow measurement capability of 8000 Series instruments can be qualified by three characteristics:

» Accuracy

Accuracy is the closeness of an indicated value to the actual value. It is expressed as a plus-or-minus percentage (±%) of the highest value at which the calibration adjustment is made.

» Linearity

Linearity is the closeness of a calibration to curve to its best-fit straight line. It is expressed as the maximum measured deviation of any calibration point from the ideal response line during a single calibration cycle.

» Repeatability

Repeatability is the ability of an instrument to reproduce readings when the same measured value is presented to it consecutively, under the same conditions, and in the same direction. It is expressed as the maximum difference between output readings.

Performance Characteristics (Continued)

Accuracy - Standard	± 3% of full scale with standard validation
Accuracy - Validated	± 2% of calibration value
Linearity	± 1.5% of full scale from 0.1 to 1.0 × full scale
Repeatability	± 1% of full scale from 0.1 to 1.0 × full scale
Outputs	Voltage: 0–10 VDC (default) OR 0–5 VDC • Current: 4–20 mA
Output Resolution	0–10 VDC: 10 mV steps • 0–5 VDC: 5 mV steps • 4–20 mA: 16 uA steps
Hysteresis	5% of full scale
Pressure Drop	< 69 kPa / 10 psi at the maximum flow rate for all versions except 08004PN06, 08004BN06, and 08004SN06. Pressure drop curves can be found in Appendix C on page 36 of this manual.
Enclosure Protection	NEMA 4X / IP66

Compliance and Certifications

» CE Compliance

2004/108/EC	Electromagnetic Compatibility
2006/95/EC	Low Voltage Directive

» Safety Compliance

EN 61010-1:2010	Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory Use

» Environmental Compliance

2011/65/EU	Restriction of Hazardous Substances (RoHS) Directive
2012/19/EU	Waste Electrical and Electronic Equipment (WEEE) Directive
1907/2006/EC	Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

» Electromagnetic Compatibility

EN 55011:2007	Industrial, Scientific and Medical (ISM) Radio-Frequency Equipment
EN 61326-1:2006	Electrical Equipment for Measurement, Control and Laboratory Use

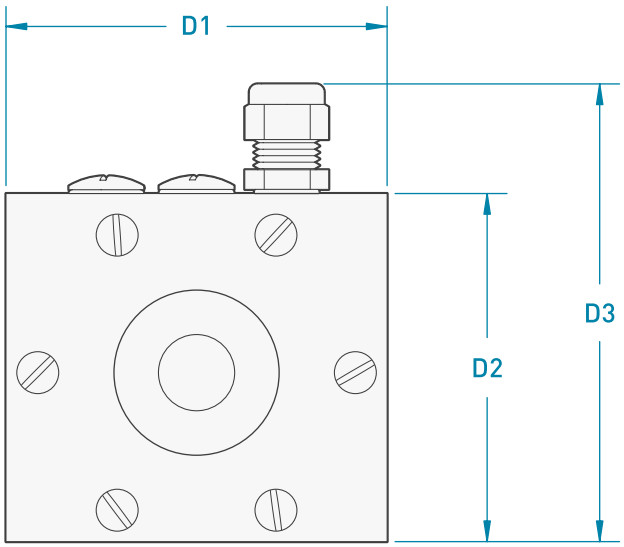
FCC Part 15 Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation.

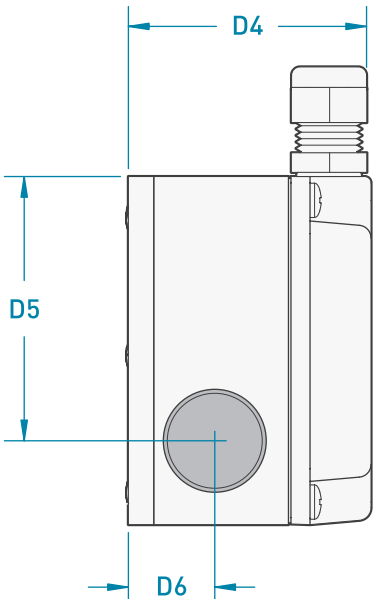
Dimensions

The size of an 8000 Series instrument is dependent on its flow range. Outline and three-dimensional drawings are accessible on the Proteus Industries website at www.proteusind.com/8000. Solid models are available upon request; please contact Proteus Technical Support for assistance.

FRONT



RIGHT SIDE



MODEL NUMBER			D1	D2	D3	D4	D5	D6
P.P.	B	S.S.						
08004PN06 08004PN1 08004PN2 08004PN4	08004BN03 08004BN06 08004BN1 08004BN2 08004BN4	08004SN03 08004SN06 08004SN1 08004SN2 08004SN4	76.20 mm 3.00 in	69.60 mm 2.74 in	91.44 mm 3.60 in	46.23 mm 1.82 in	52.83 mm 2.08 in	15.49 mm 0.61 in
08006PN10	08006BN9	08006SA2 08006SA4 08006SN9						
08008PN14	08008BN14	08008SA10 08008SN14	76.20 mm 3.00 in	69.60 mm 2.74 in	91.44 mm 3.60 in	48.51 mm 1.91 in	52.83 mm 2.08 in	17.27 mm 0.68 in
08012PN19	08012BN16 08012BN40	08012SN16 08012SA16 08012SN40	76.20 mm 3.00 in	69.60 mm 2.74 in	91.44 mm 3.60 in	55.88 mm 2.20 in	52.83 mm 2.08 in	20.32 mm 0.80 in
08016PN50	08016BN40 08016BN60	08016SN40 08016SA40 08016SN60	91.44 mm 3.60 in	80.26 mm 3.16 in	102.11 mm 4.02 in	68.33 mm 2.69 in	57.40 mm 2.26 in	24.89 mm 0.98 in

4 PHYSICAL INSTALLATION

Sensor Orientation

For best results, 8000 Series instruments should be mounted with the faceplate in the vertical plane.

Mounting the device with the flow connections uppermost can help eliminate entrained air from your system.

Pipe or Tube Mounting

If rigid piping or tubing is used, an 8000 Series instrument may be supported by direct connection to the pipe or tubing.

Panel Mounting

To mount the instrument behind a panel, a minimum of two (2) of the standard faceplate-securing screws will need to be replaced with longer screws to compensate for the thickness of the panel.

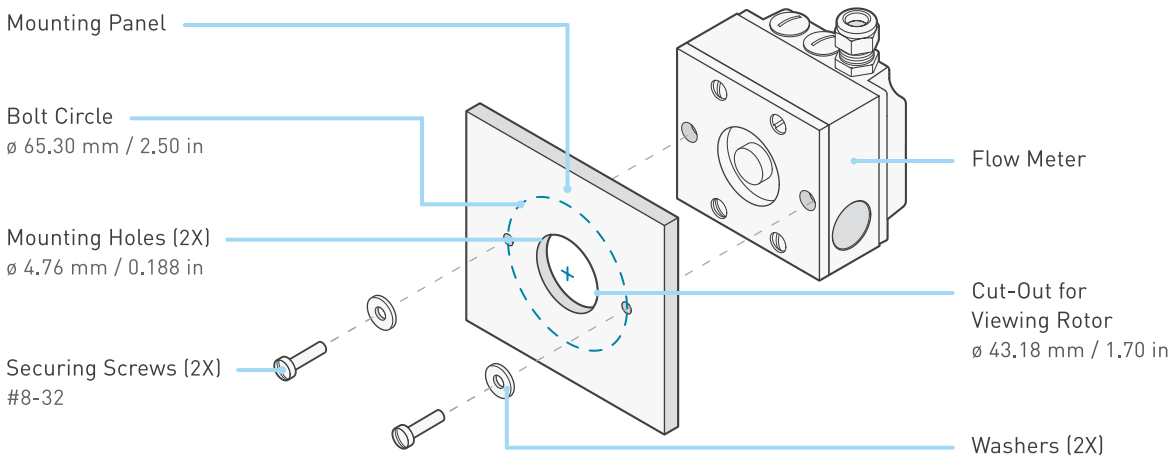
CAUTION!

Ensure that the screws are not so long as to touch the end of the tapped hole in the instrument body or, for polypropylene units, to tear through the back of the plastic body if over-tightened.

CAUTION!

Use washers with a larger diameter than the countersinks in the faceplate in order to spread the load. Otherwise, cracks can develop in the faceplate because of extra stress on the countersinks.

1. Prepare the mounting panel by evenly spacing up to six (6) holes on a 65.3 mm / 2.50 in. bolt circle for the #8-32 securing screws. Using the two (2) holes on the horizontal plane is usually sufficient to support smaller instruments with metal bodies and all sensors with plastic bodies.
2. If you wish for the rotor to be visible, cut a 43.2 mm / 1.70 in. diameter hole with the same center as the bolt circle.



3. Remove two (2) or more of the screws securing the faceplate to the instrument body.
4. Place the unit behind the panel and insert the longer screws through the panel and into the instrument body.
5. Secure the screws in the body with a torque of approximately 10 in-lb (finger tight with a flat-head screwdriver).

Minimum Pipe/Connection Inside Diameter

NOTE

The flow response of an 8000 Series instrument, and thus its calibration, may be affected by the inside diameter (ID) of the incoming pipe or connecting device.

The table below lists the minimum pipe/connection IDs necessary for 8000 Series product calibrations to be valid. If the ID of your pipe or tube fitting at the point where it connects to the inlet port is less than the orifice ID of your instrument as shown on the table, the factory calibration values may be invalid.

Appropriate calibration procedures can be applied to allow 8000 Series instruments to be used with pipes and connections with IDs smaller than those shown. For more information, please contact Proteus Technical Support.

MODEL NUMBER			CONNECTION	MINIMUM INSIDE DIAMETER OF PIPE OR CONNECTION	
POLYPROPYLENE	BRASS	STAINLESS STEEL			
	08004BN03	08004SN03	1/4" FNPT	1.600 mm	0.063 in
08004PN06	08004BN06	08004SN06	1/4" FNPT	2.362 mm	0.093 in
08004PN1	08004BN1	08004SN1	1/4" FNPT	3.175 mm	0.125 in
08004PN2	08004BN2	08004SN2	1/4" FNPT	4.775 mm	0.188 in
		08006SA2	9/16-18 SAE	4.775 mm	0.188 in
08004PN4	08004BN4	08004SN4	1/4" FNPT	6.858 mm	0.270 in
		08006SA4	9/16-18 SAE	6.858 mm	0.270 in
	08006BN9	08006SN9	3/8" FNPT	9.398 mm	0.370 in
08006PN10			3/8" FNPT	10.16 mm	0.370 in
		08008SA10	3/4-16 SAE	10.16 mm	0.400 in
08008PN14	08008BN14	08008SN14	1/2" FNPT	11.68 mm	0.460 in
	08012BN16	08012SN16	3/4" FNPT	15.49 mm	0.610 in
		08012SA16	1 1/16-12 SAE	15.49 mm	0.610 in
08012PN19			3/4" FNPT	15.49 mm	0.610 in
	08012BN40	08012SN40	3/4" FNPT	20.32 mm	0.800 in
	08016BN40	08016SN40	1" FNPT	22.10 mm	0.870 in
		08016SA40	1 5/16-12 SAE	22.10 mm	0.870 in
08016PN50			1" FNPT	22.10 mm	0.870 in
	08016BN60	08016SN60	1" FNPT	25.40 mm	1.000 in

Proximity to Other Devices

NOTE

The flow response of an 8000 Series instrument, and thus its calibration, may be affected by the form of any devices attached to the inlet connection as well as any nearby upstream devices.

8000 Series instruments are typically unaffected by the form or proximity of downstream devices.

Proximity to Other Devices (Continued)

Elbows, T-pieces, valves, or filters located immediately upstream from the instrument can introduce a swirling motion to the liquid flow, reducing the linear velocity of the flow stream. Proteus recommends that a run of straight pipe with a length greater than 10 times the pipe ID be used between the instrument and any upstream devices to minimize these effects.

Appropriate calibration procedures must be applied to ensure an accurate flow measurement if elbows or T-pieces are to be attached directly to the inlet connection. For more information, please contact Proteus Technical Support.

Flow Direction

8000 Series flow meters with upper flow limits below 7.6 LPM / 2.0 GPM are sensitive to flow direction.

NOTE

For instruments with upper flow limits below 7.6 LPM / 2.0 GPM (model numbers ending in N03, N06, or N1) liquid flow should only be introduced into the device through the orifice labeled "IN" on the right-hand side of the body.

The performance of all other 8000 Series instruments is **not** sensitive to flow direction. Liquid flow can be introduced through either orifice.

Filtering

Your circulating liquid may contain particles. While not essential to the operation of the flow sensor, it is good practice to filter your liquid. A 100-micron filter is often used to remove rust and other particles from the liquid. This can increase the usability lifetime of pumps and other liquid system components, as well as reduce wear in the sensor.

Making Plumbing Connections

1. Identify the connection type and orifice size of your 8000 Series instrument from the table on page 8.

NOTE

It is recommended that connections to brass or stainless steel flow sensors be made with similar materials to minimize potential corrosion damage.

CAUTION!

DO NOT install metal fittings into units with polypropylene bodies.

The over-tightening of metal fittings in polypropylene bodies can permanently damage the NPT threads and prevent the creation of a leak-free connection.

2. Make connections to pipe or other fittings as required.

» NPT Pipe Thread Connections

Pipe threads seal by making metal-to-metal or plastic-to-plastic contact between male and female components. Consequently, they are particularly prone to the damaging effects of galling, which occurs when two surfaces move against each other under pressure.

Making Plumbing Connections (Continued)

» NPT Pipe Thread Connections (Continued)

For this reason, it is essential to use a high-quality lubricating and sealing material when installing pipe threads. It is recommended that you use a non-hardening pipe sealant, such as Teflon® (PTFE) tape or paste, on pipe threads to create leak-tight and lubricated junctions at all connection points.

CAUTION!

DO NOT use anaerobic pipe sealants such as Loctite® or Swak® brand sealants with 8000 Series instruments fitted with polysulfone faceplates. The aggressive chemical nature of solvent vapors arising from these materials can cause cracks to develop in the faceplate material.

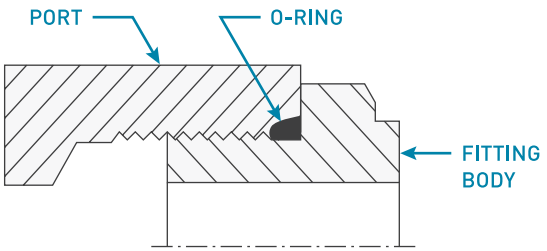
» SAE Straight Thread Connections

With SAE connections, an O-ring makes the seal while the threads hold the connecting assembly in place. Straight thread connections should receive a small amount of high-pressure lubricant before installation to prevent galling.

NON-ADJUSTABLE FITTINGS

i. Using a wrench, bring the non-adjustable fitting into firm contact with the face of the port.

ii. Check to be certain that the O-ring fits easily into the non-threaded recessed receiving area of the port, and that it is not pinched or damaged.



ADJUSTABLE FITTINGS

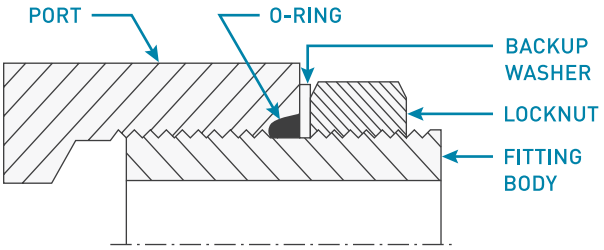
i. Ensure that the locknut is positioned so that the backup washer is in contact with the beginning of the threads farthest from the end of the fitting.

ii. Screw the fitting into the port until the backup washer makes contact with the sealing face.

iii. Check to be certain that the O-ring fits easily into the non-threaded recessed receiving area of the port, and that it is not pinched or damaged.

iv. Unscrew the fitting no more than one turn to position it in the desired direction.

v. Tighten the locknut firmly against the backup washer so that the fitting assembly is held securely in place.



3. Slowly turn the liquid flow ON.
4. Check for leaks at all connection points.
5. Tighten connections as required to eliminate leaks.
6. Eliminate entrained air from the instrument flow cavity. (See the NOTE statement on the following page.)

Making Plumbing Connections (Continued)

NOTE

Air bubbles entrained between the rotor spokes reduce resistance to the rotation of the rotor and allow the rotor to spin faster. As a result, the instrument will register a higher-than-actual flow rate until all air bubbles have been eliminated from the flow cavity.

The air bubbles may disperse out of the flow cavity over several hours of operation. The rate of dispersion is speeded by mounting the instrument with the flow path uppermost. Pulsing the liquid flow by rapidly increasing and decreasing the flow rate through the system can also assist by accelerating the bubbles toward the outlet port.

Making Electrical Connections

Standard 8000 Series instruments are fitted with a nine-core cable for connection to the user's control system.

CAUTION!

The installation of this product should only be performed by personnel familiar with the electrical circuitry and control functions of the system in which it is to be installed.

1. Locate the 24 VDC power source and turn it OFF.
2. Make all wire connections following the wiring diagram to the right.
3. Check all connections to ensure that they are secure.
4. Turn the 24 VDC power source ON.
   - » The flow status LED will turn ON.
   - » Refer to **Chapter 6: Trip Point Selection** on page 12 for more information.

WIRE COLOR	FUNCTION
(BARE)	Shield
RED	+24 VDC
BLACK	Ground
BROWN	Voltage Output
ORANGE	Current Output
YELLOW	Relay Common
BLUE	Relay Normally Open (N.O.)
WHITE	Relay Normally Closed (N.C.)
GREEN	Analog Ground

6 TRIP POINT SELECTION

Alarm Trip Point Value

The trip point value of an 8000 Series instrument is user-selectable by means of a 16-position rotary switch.

Selecting switch positions 1 to E sets the trip point flow rate in 5% steps from 10% to 75% of the upper limit of the flow range of the instrument, as illustrated in the table on the right.

The F switch position can be factory-programmed with a custom trip point value; if no custom value is specified, the default value will be 80% of the upper flow limit.

The factory default trip point values corresponding to each switch position for standard 8000 Series products can be found in Appendix A on page 22 of this manual.

POSITION	PERCENTAGE OF UPPER LIMIT OF FLOW RANGE
0	AutoAlarm™ » Sets trip point based on reference flow rate
1	10%
2	15%
3	20%
4	25% » Default setting for standard products
5	30%
6	35%
7	40%
8	45%
9	50%
A	55%
B	60%
C	65%
D	70%
E	75%
F	Programmed custom trip point value -OR- 80%

NOTE

Standard 8000 Series products are programmed with a factory default switch position of 4.

Non-standard instruments programmed with a customer-specified factory-preset trip point may be shipped with the switch set to any position between 1 and F.

Non-standard instruments programmed with a custom trip point value will be shipped with the switch set to the F position.

Setting the Trip Point

The 16-position rotary switch for selecting the alarm trip point value is located under the screw closure labeled SET on the top of the instrument.

CAUTION!

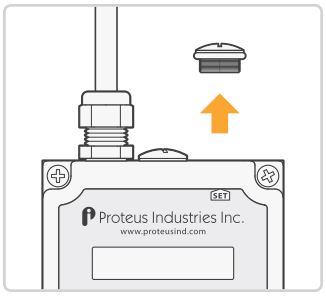
The screw closure should only be removed when the instrument is at ambient temperature.

When replacing the screw closure, ensure that it is sealed tightly.

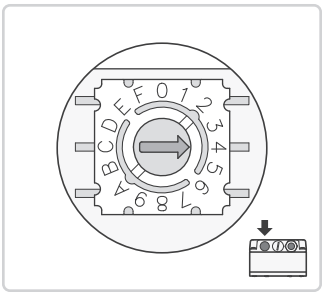
Failure to follow these precautions may result in moisture entering the enclosure, which can cause permanent damage to the electronics and render the device inoperable.

1. Remove the screw closure labeled SET using a flat-head screwdriver.

   Retain the closure and O-ring.



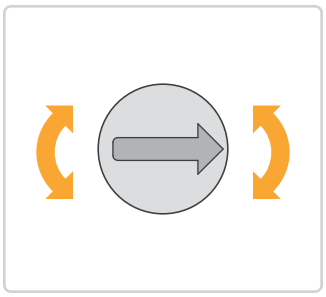
2. Identify the rotary switch visible through the screw closure orifice.



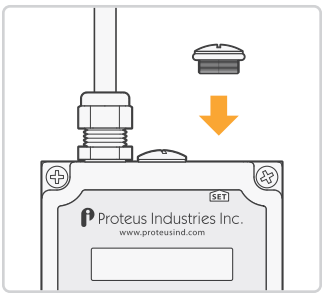
Setting the Trip Point (Continued)

3. Rotate the switch to the position that best matches your desired alarm trip point value.

   The new trip point will take effect immediately when the rotary switch position is changed.



4. Replace the screw closure and O-ring and tighten sufficiently to ensure that a leak-tight seal is created.



AutoAlarm™ Automatic Alarm Trip Point Setting Feature

The AutoAlarm™ feature allows the operator to set the alarm trip point value based on a measured reference flow rate.

AutoAlarm is activated when the rotary switch is turned to the 0 (zero) position. When activated, the 8000 Series microcomputer will set the alarm trip point to a calculated value equal to the current flow rate minus 20% of the upper limit of the instrument's flow range.

» For example, if a model 08012BN40 instrument (151 LPM upper limit) is measuring a liquid flow rate of 70 LPM when AutoAlarm is activated, the alarm trip point value will be calculated as follows:

Measured Flow Rate	70 LPM
– 20% of Upper Flow Limit	– 30 LPM
Alarm Trip Point Value	40 LPM

1. Adjust the liquid flow to the desired reference flow rate. Ensure that the flow rate is steady and that all air has been purged from the flow circuit.

NOTE

If the rotary switch is moved to the 0 (zero) position when there is no liquid flowing through the device, it will result in an error condition, indicated by the LED status indicator flashing AMBER continuously. The error can be cleared by returning the rotary switch to a non-zero position.

2. Turn the rotary switch to the 0 (zero) position.

   » The LED status indicator will turn GREEN and flash temporarily for five (5) seconds to indicate that the calculated alarm trip point value has been successfully stored.

   » The new alarm trip point value will take effect immediately.

NOTE

If the calculated trip point value is outside the flow range of the instrument, it will result in an error condition, indicated by the LED status indicator flashing AMBER continuously. The error can be cleared by returning the rotary switch to a non-zero position.

The calculated alarm trip point value is stored in the device's memory and will NOT be lost if input power is removed from the unit. The stored value is cleared automatically when the rotary switch is moved to a non-zero position.

Flow Status, LED Color and Relay State

The flow status of an 8000 Series flow meter is determined by the relationship between the actual flow rate, the selected alarm trip point value and the upper flow limit of the instrument.

- **Flow Rate** — The actual measured flow rate of liquid passing through the device.
- **Alarm Trip Point** — The trip point value as selected by the user using the 16-position rotary switch.
- **Warning Limit** — A calculated value equal to the alarm trip point value plus a specified percentage of the upper flow limit of the instrument. The default percentage for standard products is 10%.

The table below describes the three flow status conditions and the corresponding LED color and relay state for each.

FLOW STATUS	FLOW RATE CONDITION	LED COLOR	RELAY STATE	
			N.O. CONTACT	N.C. CONTACT
Flow OK	Flow Rate > Warning Limit	Green	Closed	Open
Warning	Warning Limit ≥ Flow Rate > Alarm Trip Point	Amber	Closed	Open
Alarm	Alarm Trip Point ≥ Flow Rate	Red	Open	Closed

A bright tricolor LED located on the back of the device provides a clear visual indication of the current flow status.

- If liquid is NOT flowing, the LED will be RED, indicating that power is ON and that the liquid flow is below the selected alarm trip point value.
- If liquid IS flowing, the LED may be GREEN, AMBER or RED depending on the actual flow rate and the selected alarm trip point value, as described in the table above.

NOTE

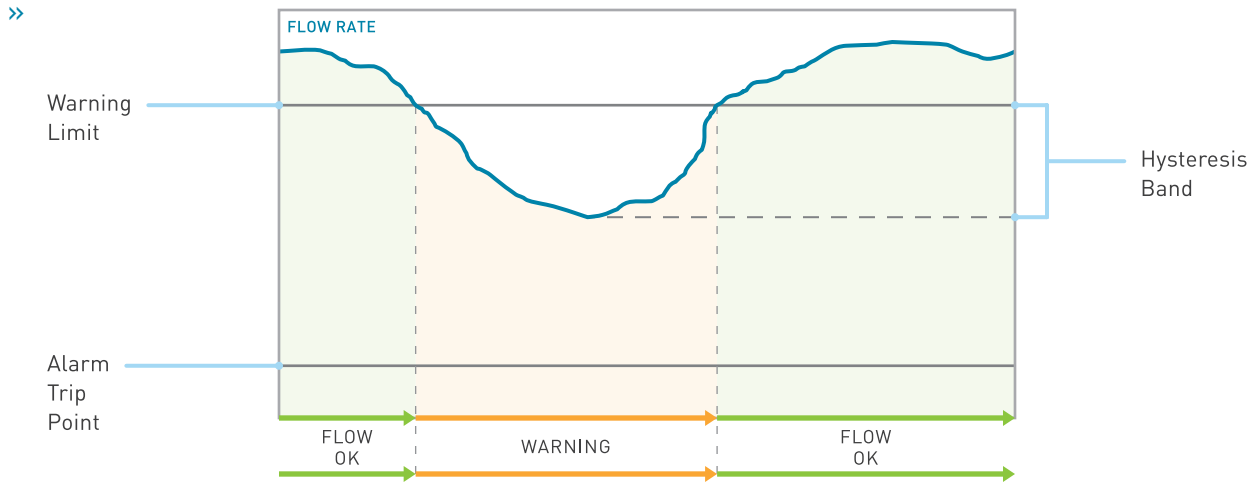
The flow rate at which the flow status LED changes from RED to AMBER and from AMBER to GREEN is dependent on the lowest measured flow rate immediately prior to the increase in flow.

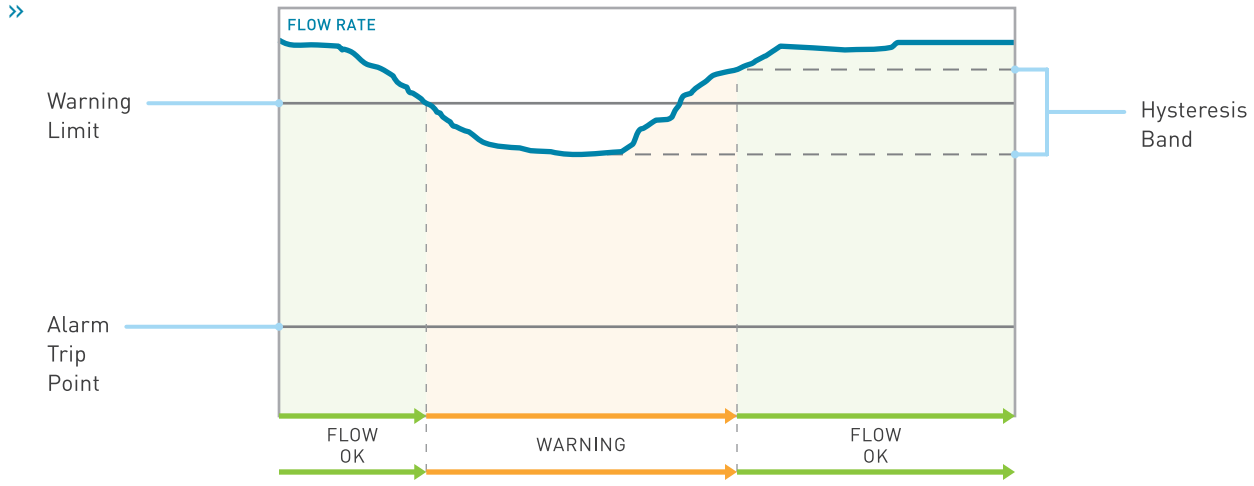
A hysteresis value equal to 5% of the upper flow limit of the instrument will apply to flow status transitions from Alarm to Warning and from Warning to Flow OK. If the liquid flow rate falls below the warning limit value or alarm trip point value and thereafter begins to increase, a hysteresis band will begin at the lowest flow rate at which flow was measured immediately prior to the increase.

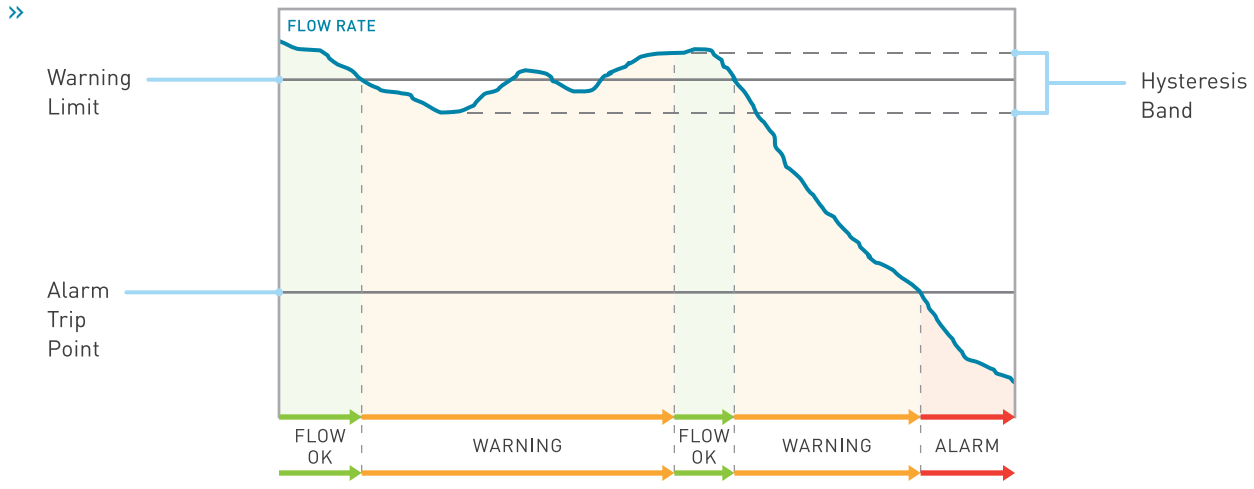
The flow status of the device and the corresponding LED color will not change until the flow rate has increased beyond the hysteresis band, even if the actual liquid flow rate increases above the warning limit value or alarm trip point value prior to doing so.

Examples of the effect of this hysteresis band on various flow status transitions are provided in the four illustrations on pages 15–16.

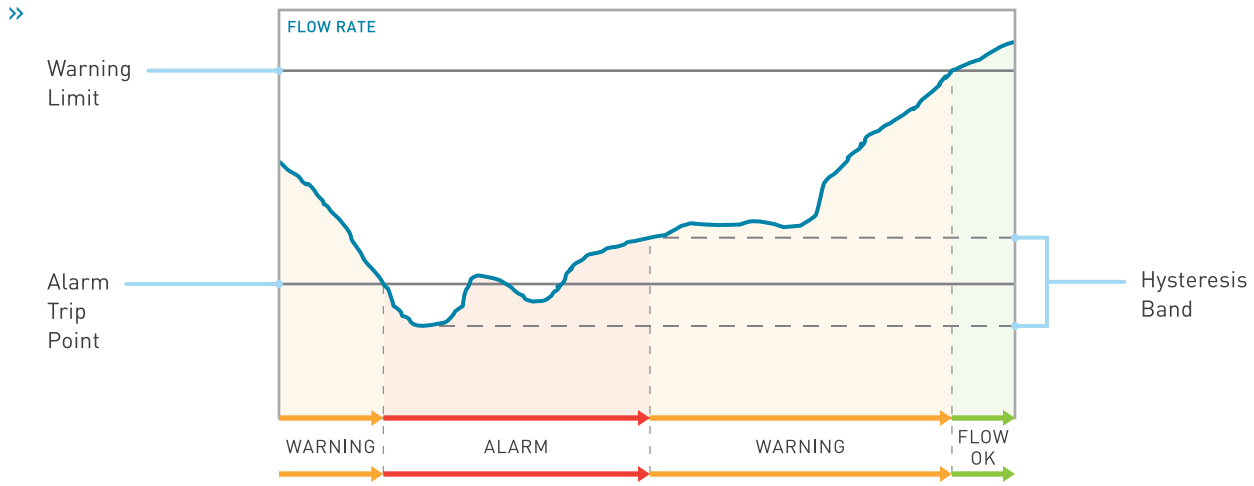
Flow Status, LED Color and Relay State (Continued)







Flow Status, LED Color and Relay State (Continued)



Analog Output Options

Standard 8000 Series instruments provide both current and voltage outputs. Output wiring assignments are shown in the diagram on page 11 of this manual.

» Current Output

4–20 mA current loop output directly proportional to the liquid flow rate

» Voltage Output

0–10 VDC (default) or 0–5 VDC output selectable by an internal switch (see below)

Voltage Output Selection

The slide switch for changing the voltage output setting is located under the screw closure located beside the cable relief on the top of the instrument.

NOTE

Unless otherwise specified on your purchase order, all 8000 Series instruments are shipped with a default voltage output setting of 0–10 VDC.

CAUTION!

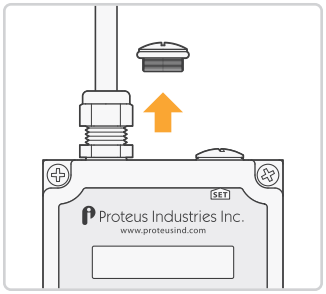
The screw closure should only be removed when the instrument is at ambient temperature.

When replacing the screw closure, ensure that it is sealed tightly.

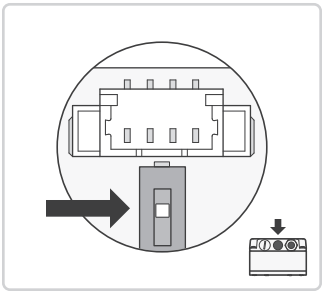
Failure to follow these precautions may result in moisture entering the enclosure, which can cause permanent damage to the electronics and render the device inoperable.

1. Remove the screw closure beside the cable relief using a flat-head screwdriver.

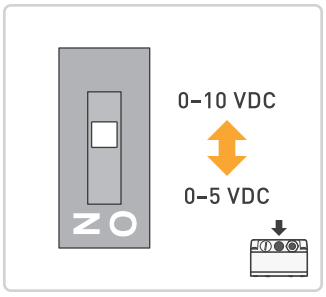
   Retain the closure and O-ring.



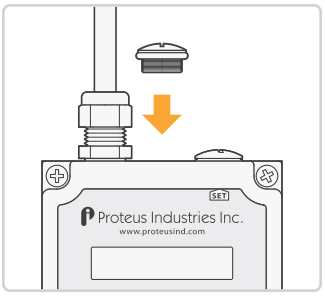
2. Identify the voltage output selection switch visible through the screw closure orifice.



3. Move the switch to the position corresponding to the desired output voltage, as illustrated in the diagram on the right.



4. Replace the screw closure and O-ring and tighten sufficiently to ensure that a leak-tight seal is created.



7 FLOW MEASUREMENT

Measuring the Flow Rate

The analog output of an 8000 Series instrument is directly proportional to the flow rate of the liquid passing through the device. The output range—4–20 mA, 0–10 VDC, or 0–5 VDC—corresponds to the range of liquid flow rates from zero to the upper flow limit of the instrument, as described in the **Materials, Flow Ranges, and Connections** section on page 3 of this document.

Calibration curves obtained from the measurement of multiple sensors are available in Appendix B on page 23 of this document. The equations under each graph may be used with a PLC or other control device to obtain a more accurate measure of the liquid flow rate.

NOTE	
	**While the flow response curves of 8000 Series instruments are extremely linear, they do NOT pass through zero, requiring the use of a linear regression formula or calibration graphs to derive the actual flow rate from the measured output.**

» Current Output

1. Connect the COM or negative (–) terminal of a digital multimeter or equivalent device to the GREEN analog ground wire.
2. Connect the positive terminal (+) of the multimeter to the ORANGE current output wire.
3. Measure the output current.
4. Estimate the liquid flow rate according to the flow response curve for your specific 8000 Series model as shown in Appendix B.

» Voltage Output

1. Connect the COM or negative (–) terminal of a digital multimeter or equivalent device to the GREEN analog ground wire.
2. Connect the positive terminal (+) of the multimeter to the BROWN voltage output wire.
3. Select a measurement range of 0–10 VDC or 0–5 VDC on the multimeter, if necessary.
4. Measure the output voltage.
5. Estimate the liquid flow rate according to the flow response curve for your specific 8000 Series model as shown in Appendix B.

Over-Range Failure

Exceeding the upper flow limit of an 8000 Series flow meter will result in an over-range failure.

- » If the flow rate exceeds the instrument's upper flow limit by 2–8%, the analog output signal will plateau at a value approximately 2% higher than the top of the output range.
- » If the flow rate exceeds the upper flow limit by more than 8%, the analog output signal will immediately drop to the zero value (0 VDC and 4 mA).

8 MAINTENANCE

Recommended Maintenance

NOTE	
	**Periodic maintenance of your 8000 Series flow meter is recommended to ensure reliable operation.**

Maintenance of 8000 Series instruments is normally limited to cleaning the chamber in which the rotor spins as well as annual recalibration. The frequency of cleaning will vary with the type of fluid being run through the device and the cleanliness of the fluid. In most cases, annual cleaning immediately prior to recalibration is sufficient.

NOTE	
	**The presence of contaminants or particulates in the fluid used with an 8000 Series instrument can greatly accelerate the wear to components inside the flow cavity and may necessitate the replacement of these perishable items.**

The flow response of an 8000 Series instrument will change as the rotor and its bearing shaft wear. Replacing these components will enhance the flow response of the device. Flow calibration is required to restore the validity of the instrument's flow measurement capability. Refer to the **Recalibration** section on page 21 for more information.

Rebuild Kits

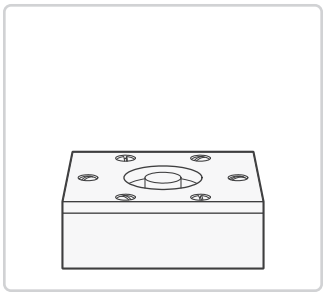
Rebuild kits containing replacements of all perishable 8000 Series components are available from Proteus Industries and our service partners around the world. For more information, please contact Proteus Sales at sales@proteusind.com or (650) 964-4163.

Required Tools

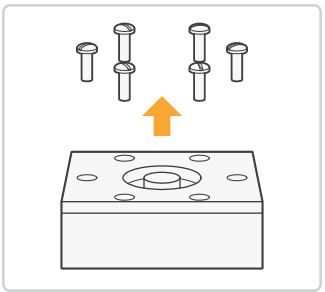
- Wrenches to disconnect the instrument from your flow circuit
- A flat-head screwdriver to remove the screws securing the faceplate to the flow sensor
- A soft cleaning cloth dampened with water, alcohol or a light detergent solution to clean the flow sensor components

Flow Sensor Maintenance Instructions

1. Turn liquid flow OFF and remove the instrument from your flow circuit.
2. Place the unit on a clean, flat surface.

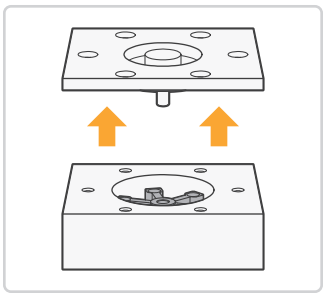


3. Remove and retain the six (6) screws securing the faceplate to the instrument body.



Flow Sensor Maintenance Instructions (Continued)

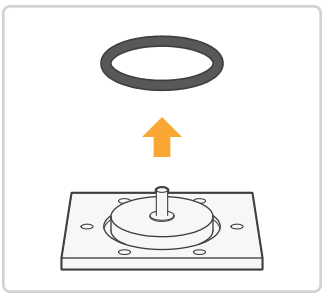
4. Separate the faceplate assembly from the body.



5. Separate the O-ring from the faceplate assembly and inspect it.

   If it is brittle, cracked or otherwise worn, replace the O-ring.

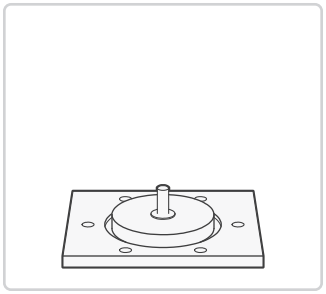
   Otherwise, clean with a damp cloth.



6. Inspect the stainless steel shaft on the faceplate assembly.

   If the shaft shows signs of scoring or other wear, replace the faceplate.

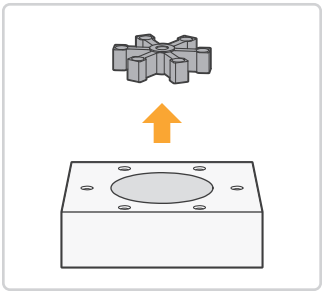
   Otherwise, clean with a damp cloth.



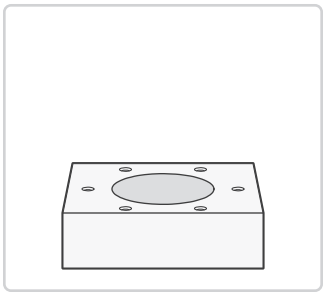
7. Remove the rotor from the flow sensor cavity and inspect it.

   If the bearing surface is worn or no longer round, replace the rotor.

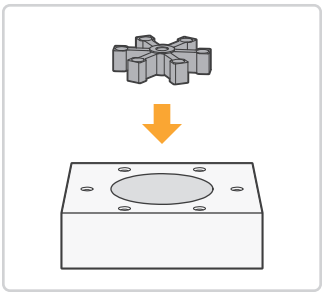
   Otherwise, clean with a damp cloth.



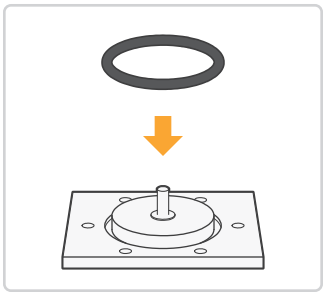
8. Clean the inside of the flow sensor cavity with a damp cloth.



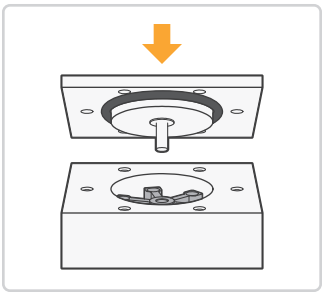
9. Place the rotor in the flow sensor cavity.



10. Position the O-ring inside the groove on the inner surface of the faceplate.

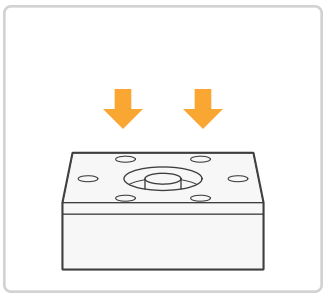


11. Carefully align the faceplate assembly with the flow sensor cavity so that the shaft will pass through the hole in the center of the rotor.

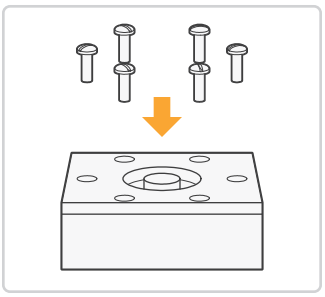


Flow Sensor Maintenance Instructions (Continued)

12. Confirm that the faceplate assembly is fitted correctly to the instrument body and that the holes in the faceplate are aligned with those in the body.



13. Fasten and tighten the six (6) retained securing screws.



14. Reinstall the 8000 Series instrument in your flow circuit. Replace the Teflon tape or other thread lubricant at all plumbing connections.
15. Turn liquid flow ON and check for leaks at the faceplate and all connecting ports.
16. Tighten all connections as required to eliminate leaks
17. Eliminate entrained air from the flow sensor cavity. (Refer to the NOTE statement on page 11 for more information.)

Recalibration

The calibration of an 8000 Series flow meter should be checked at regular 12-month intervals and recalibrated as required to ensure accurate flow measurement.

Proteus' world-class calibration expertise and equipment are available for convenient and cost-effective recalibration of 8000 Series instruments.

The Proteus Recalibration Process

1. When received at Proteus, the output of your device will be measured and recorded in its as-received state.
2. The rotor, faceplate assembly and sealing O-ring will be replaced.
3. The flow sensor cavity will be thoroughly cleaned.
4. The device will be reassembled and undergo rigorous leak and pressure testing.
5. The instrument will be recalibrated to its original specification against reference standards whose calibrations are statistically controlled against NIST- and NMI-traceable standards.
6. A new calibration certificate will be issued and a new calibration label will be affixed to the unit.
7. Upon completion, your device will be promptly and securely delivered to your facility, ready for use!

To obtain a price quotation and Return Material Authorization (RMA) number for the recalibration of your 8000 Series flow meter, please contact Proteus Sales at sales@proteusind.com or (650) 964-4163.

A DEFAULT ALARM TRIP POINT SETTINGS

Default Alarm Trip Point Settings for Standard Products

NOTE

The alarm trip point values provided in the tables below are the default settings for standard 8000 Series products only. Non-standard products with a custom trip point setting will be programmed with the custom value at the F position of the rotary switch.

» Liters Per Minute (LPM)

SWITCH POS.	UPPER FLOW LIMIT (LPM)												
	1.1	2.2	5.3	9.5	17	34	38	53	60	72	151	189	227
0	AutoAlarm » Sets the alarm trip point value based on a reference measured flow rate (see page 13)												
1	0.11	0.22	0.53	0.95	1.7	3.4	3.8	5.3	6.0	7.2	15.1	18.9	22.7
2	0.17	0.33	0.80	1.4	2.6	5.1	5.7	8.0	9.0	10.8	22.7	28.4	34.1
3	0.22	0.44	1.06	1.9	3.4	6.8	7.6	10.6	12.0	14.4	30.2	37.8	45.4
4	0.28	0.55	1.3	2.4	4.3	8.5	9.5	13.3	15.0	18.0	37.8	47.3	56.8
5	0.33	0.66	1.6	2.9	5.1	10.2	11.4	15.9	18.0	21.6	45.3	56.7	68.1
6	0.39	0.77	1.9	3.3	6.0	11.9	13.3	18.6	21.0	25.2	52.9	66.2	79.5
7	0.44	0.88	2.1	3.8	6.8	13.6	15.2	21.2	24.0	28.8	60.4	75.6	90.8
8	0.50	0.99	2.4	4.3	7.7	15.3	17.1	23.9	27.0	32.4	68.0	85.1	102.2
9	0.55	1.1	2.7	4.8	8.5	17.0	19.0	26.5	30.0	36.0	75.5	94.5	113.5
A	0.61	1.2	2.9	5.2	9.4	18.7	20.9	29.2	33.0	39.6	83.1	104.0	124.9
B	0.66	1.3	3.2	5.7	10.2	20.40	22.8	31.8	36.0	43.2	90.6	113.4	136.2
C	0.72	1.43	3.5	6.2	11.1	22.1	24.7	34.5	39.0	46.8	98.2	122.9	147.6
D	0.77	1.5	3.7	6.7	11.9	23.8	26.6	37.1	42.0	50.4	105.7	132.3	158.9
E	0.83	1.7	4.0	7.1	12.8	25.5	28.5	39.8	45.0	54.0	113.3	141.8	170.3
F	0.88	1.8	4.2	7.6	13.6	27.2	30.4	42.4	48.0	57.6	120.8	151.2	181.6

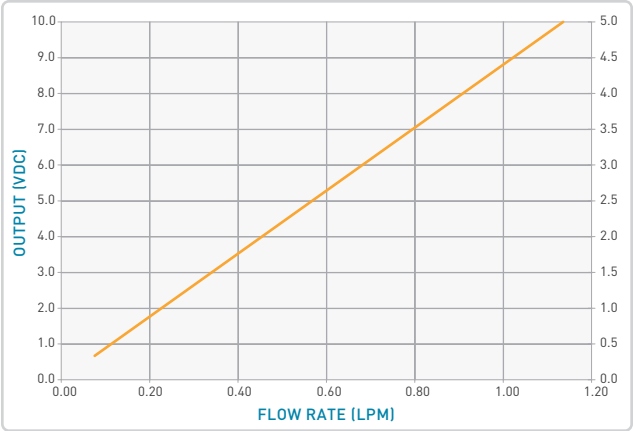
» Gallons Per Minute (GPM)

SWITCH POS.	UPPER FLOW LIMIT (GPM)												
	0.3	0.6	1.4	2.5	4.5	9.0	10	14	16	19	40	50	60
0	AutoAlarm » Sets the alarm trip point value based on a reference measured flow rate (see page 13)												
1	0.03	0.06	0.14	0.25	0.45	0.90	1.0	1.4	1.6	1.9	4.0	5.0	6.0
2	0.05	0.09	0.21	0.38	0.68	1.4	1.5	2.1	2.4	2.9	6.0	7.5	9.0
3	0.06	0.12	0.28	0.50	0.90	1.8	2.0	2.8	3.2	3.8	8.0	10.0	12.0
4	0.08	0.15	0.35	0.63	1.1	2.3	2.5	3.5	4.0	4.8	10.0	12.5	15.0
5	0.09	0.18	0.42	0.75	1.4	2.7	3.0	4.2	4.8	5.7	12.0	15.0	18.0
6	0.11	0.21	0.49	0.88	1.6	3.2	3.5	4.9	5.6	6.7	14.0	17.5	21.0
7	0.12	0.24	0.56	1.0	1.8	3.6	4.0	5.6	6.4	7.6	16.0	20.0	24.0
8	0.14	0.27	0.63	1.1	2.0	4.1	4.5	6.3	7.2	8.6	18.0	22.5	27.0
9	0.15	0.30	0.70	1.3	2.3	4.5	5.0	7.0	8.0	9.5	20.0	25.0	30.0
A	0.17	0.33	0.77	1.4	2.5	5.0	5.5	7.7	8.8	10.5	22.0	27.5	33.0
B	0.18	0.36	0.84	1.5	2.7	5.4	6.0	8.4	9.6	11.4	24.0	30.0	36.0
C	0.20	0.39	0.91	1.6	2.9	5.9	6.5	9.1	10.4	12.4	26.0	32.5	39.0
D	0.21	0.42	0.98	1.8	3.2	6.3	7.0	9.8	11.2	13.3	28.0	35.0	42.0
E	0.23	0.45	1.1	1.9	3.4	6.8	7.5	10.5	12.0	14.3	30.0	37.5	45.0
F	0.24	0.48	1.1	2.0	3.6	7.2	8.0	11.2	12.8	15.2	32.0	40.0	48.0

B FLOW RESPONSE CURVES

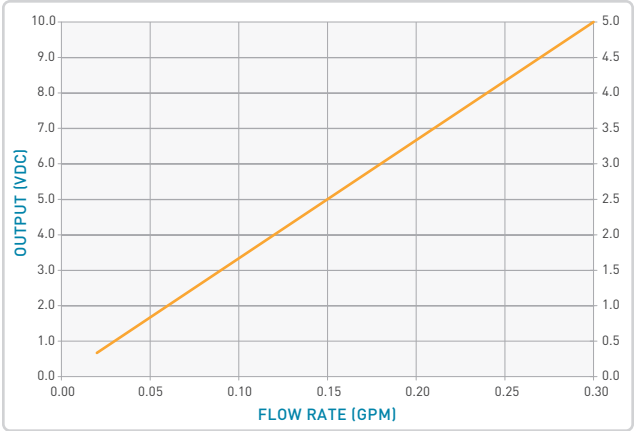
Model Numbers: 08004BN03 | 08004SN03

Output: VDC Flow Units: LPM



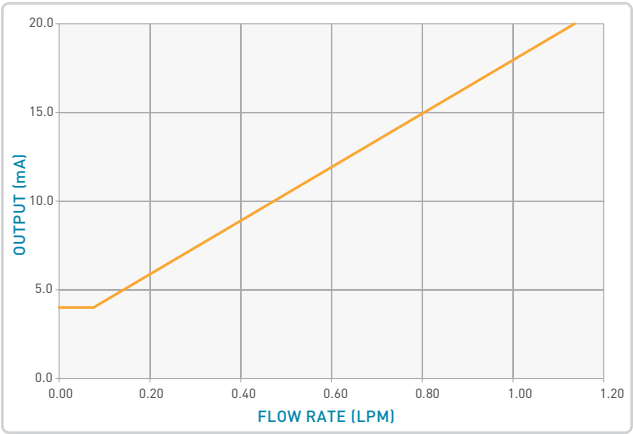
Formula for 10 VDC: y = 8.81x
Formula for 5 VDC: y = 4.40x

Output: VDC Flow Units: GPM



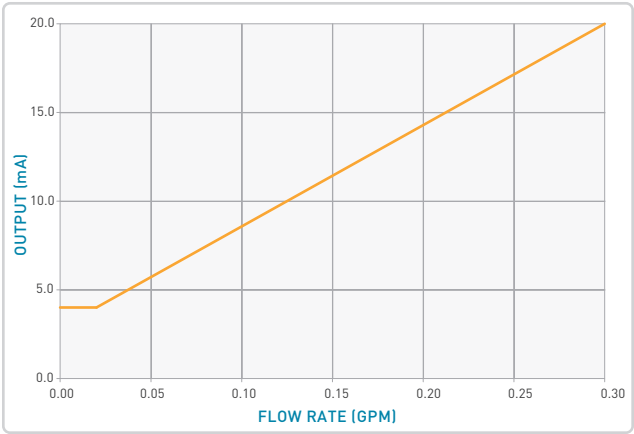
Formula for 10 VDC: y = 33.33x
Formula for 5 VDC: y = 16.67x

Output: mA Flow Units: LPM



Formula for 4–20 mA: y = 17.61x
Output is 4 mA when rotor is stopped.

Output: mA Flow Units: GPM

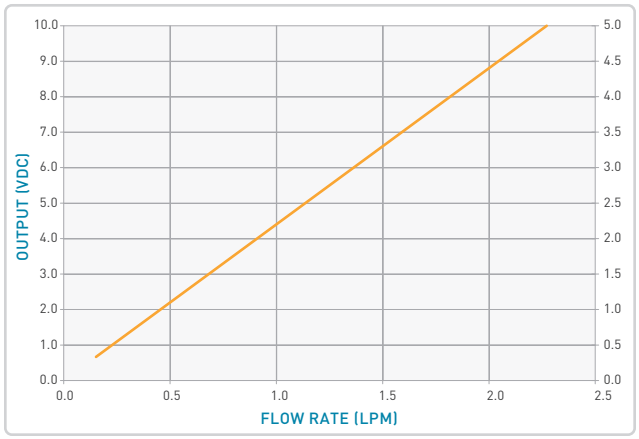


Formula for 4–20 mA: y = 66.67x
Output is 4 mA when rotor is stopped.

B FLOW RESPONSE CURVES

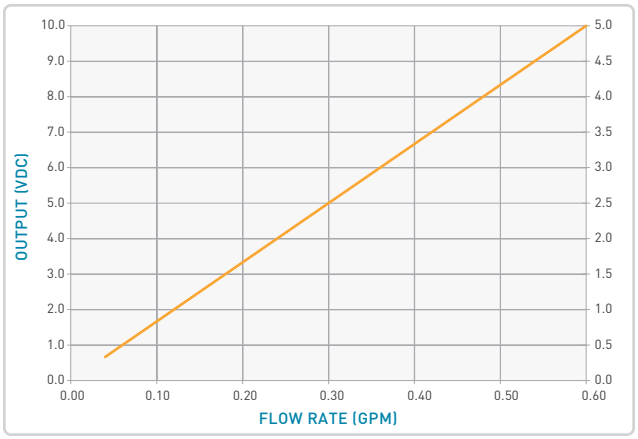
Model Numbers: 08004BN06 | 08004PN06 | 08004SN06

Output: VDC Flow Units: LPM



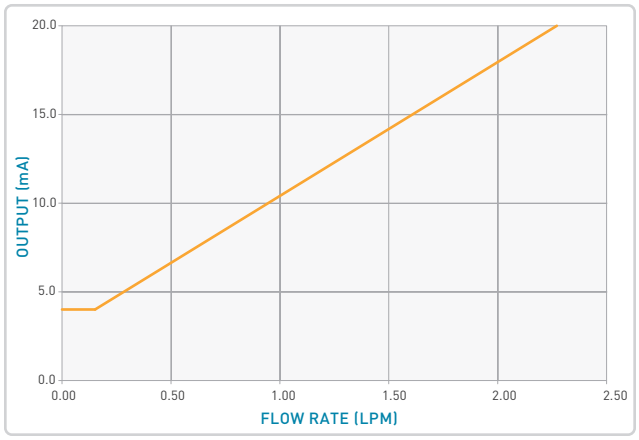
Formula for 10 VDC: y = 4.40x
Formula for 5 VDC: y = 2.20x

Output: VDC Flow Units: GPM



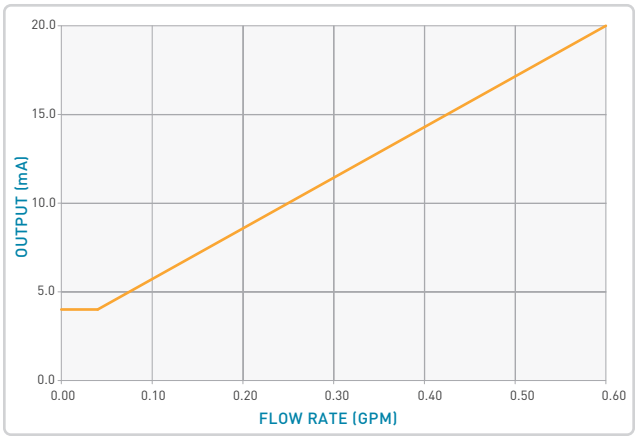
Formula for 10 VDC: y = 16.67x
Formula for 5 VDC: y = 8.33x

Output: mA Flow Units: LPM



Formula for 4–20 mA: y = 8.80x
Output is 4 mA when rotor is stopped.

Output: mA Flow Units: GPM

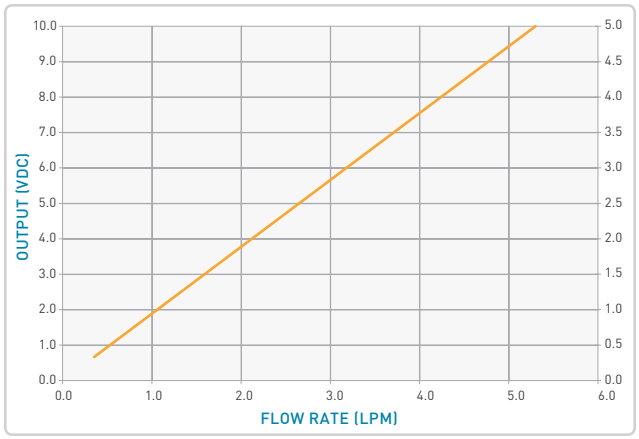


Formula for 4–20 mA: y = 33.33x
Output is 4 mA when rotor is stopped.

B FLOW RESPONSE CURVES

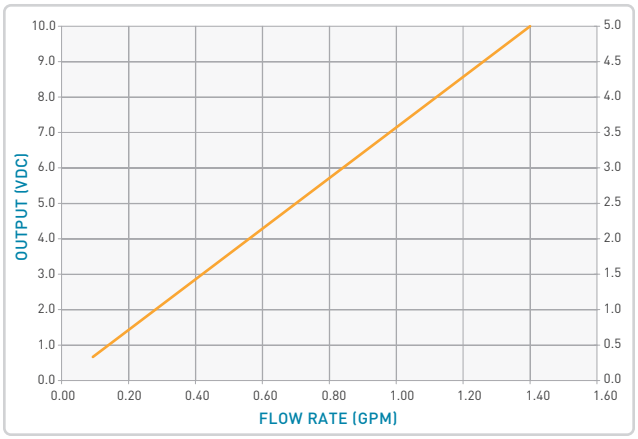
Model Numbers: 08004BN1 | 08004PN1 | 08004SN1

Output: VDC Flow Units: LPM



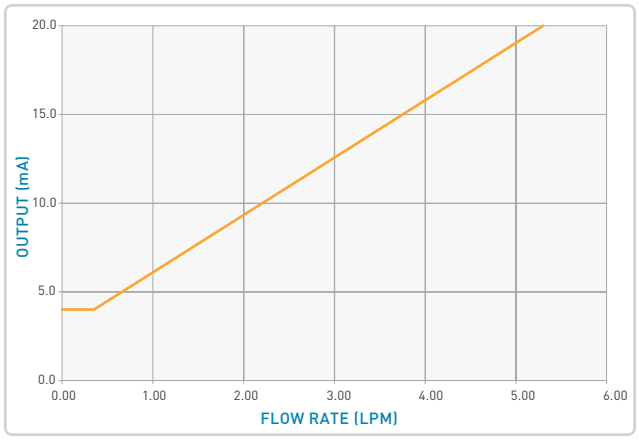
Formula for 10 VDC: y = 1.89x
Formula for 5 VDC: y = 0.94x

Output: VDC Flow Units: GPM



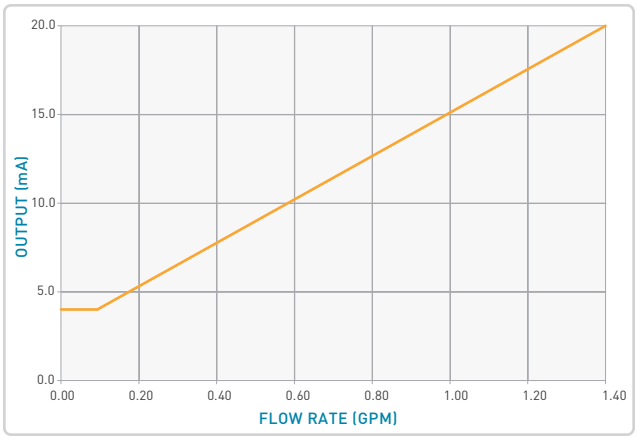
Formula for 10 VDC: y = 6.15x
Formula for 5 VDC: y = 3.57x

Output: mA Flow Units: LPM



Formula for 4–20 mA: y = 3.77x
Output is 4 mA when rotor is stopped.

Output: mA Flow Units: GPM

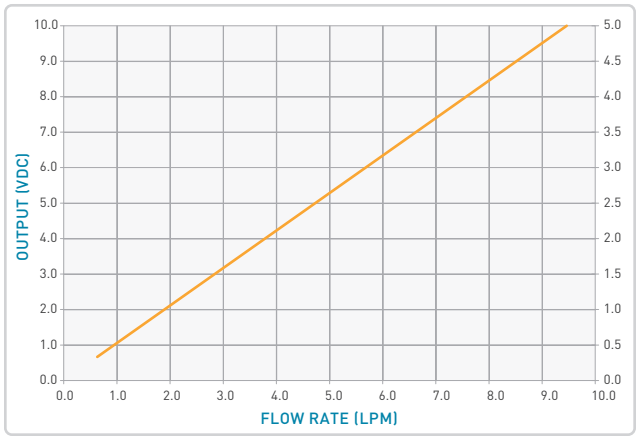


Formula for 4–20 mA: y = 14.28x
Output is 4 mA when rotor is stopped.

B FLOW RESPONSE CURVES

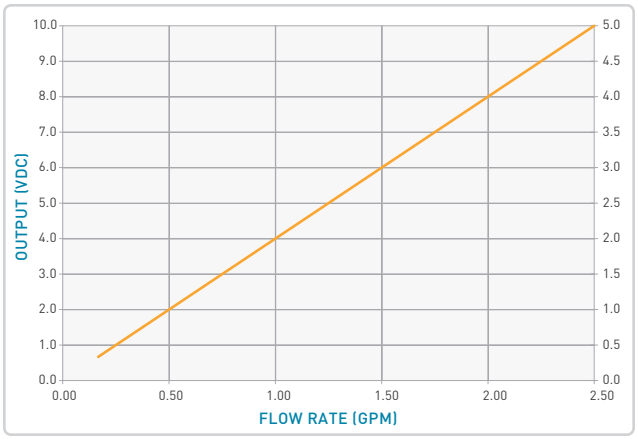
Model Numbers: 08004BN2 | 08004PN2 | 08004SN2 | 08006SA2

Output: VDC Flow Units: LPM



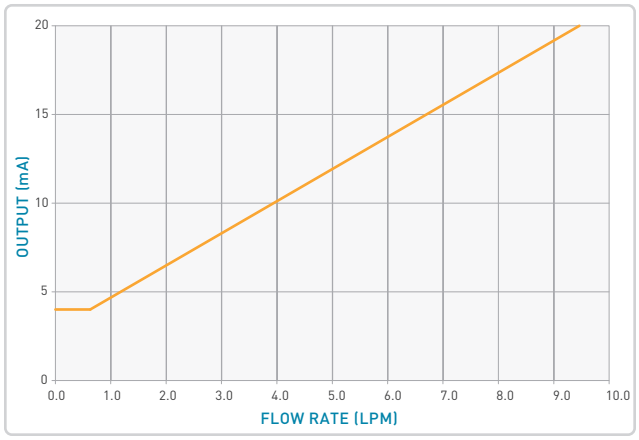
Formula for 10 VDC: y = 1.05x
Formula for 5 VDC: y = 0.53x

Output: VDC Flow Units: GPM



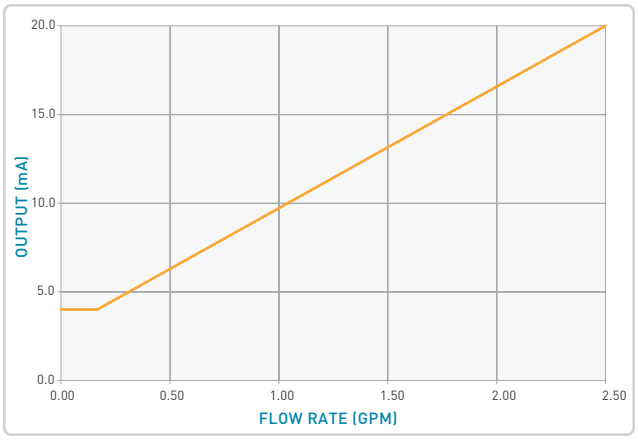
Formula for 10 VDC: y = 4.00x
Formula for 5 VDC: y = 2.00x

Output: mA Flow Units: LPM



Formula for 4–20 mA: y = 2.11x
Output is 4 mA when rotor is stopped.

Output: mA Flow Units: GPM

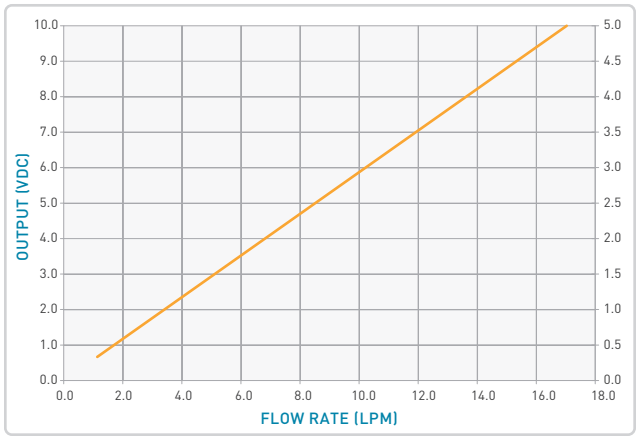


Formula for 4–20 mA: y = 8.00x
Output is 4 mA when rotor is stopped.

B FLOW RESPONSE CURVES

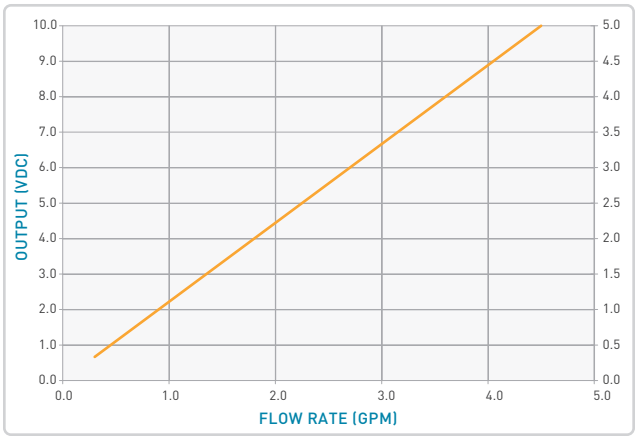
Model Numbers: 08004BN4 | 08004PN4 | 08004SN4 | 08006SA4

Output: VDC Flow Units: LPM



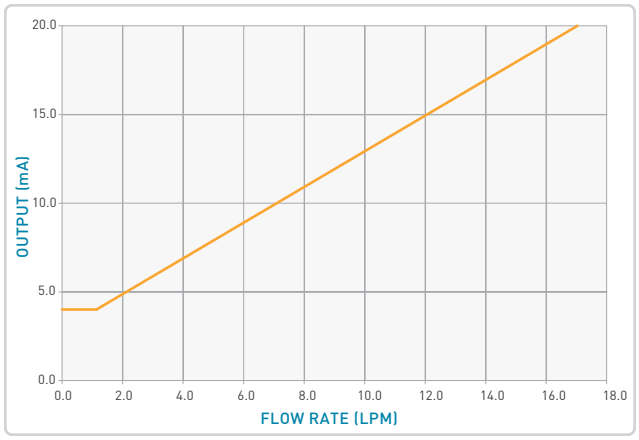
Formula for 10 VDC: y = 0.59x
Formula for 5 VDC: y = 0.29x

Output: VDC Flow Units: GPM



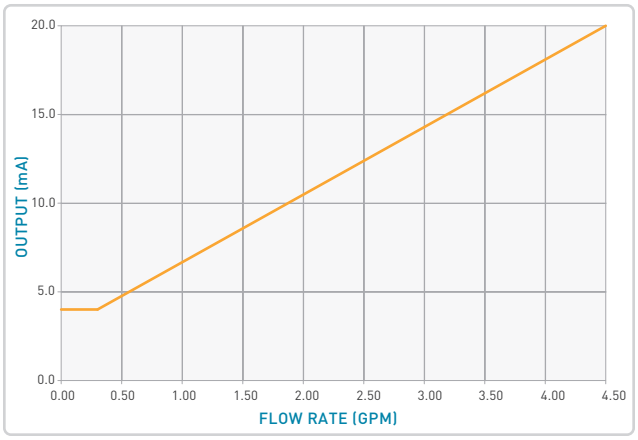
Formula for 10 VDC: y = 2.22x
Formula for 5 VDC: y = 1.11x

Output: mA Flow Units: LPM



Formula for 4–20 mA: y = 1.17x
Output is 4 mA when rotor is stopped.

Output: mA Flow Units: GPM

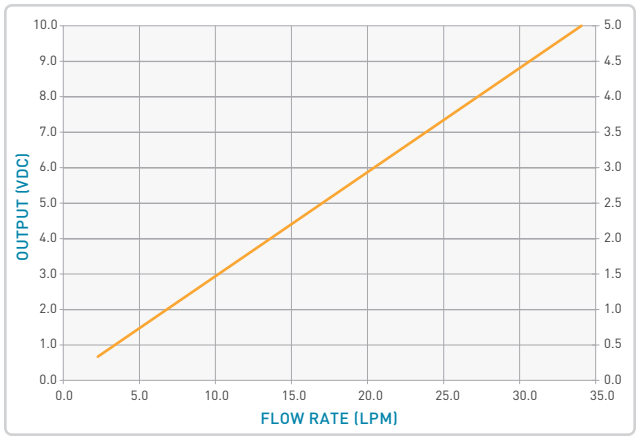


Formula for 4–20 mA: y = 4.44x
Output is 4 mA when rotor is stopped.

B FLOW RESPONSE CURVES

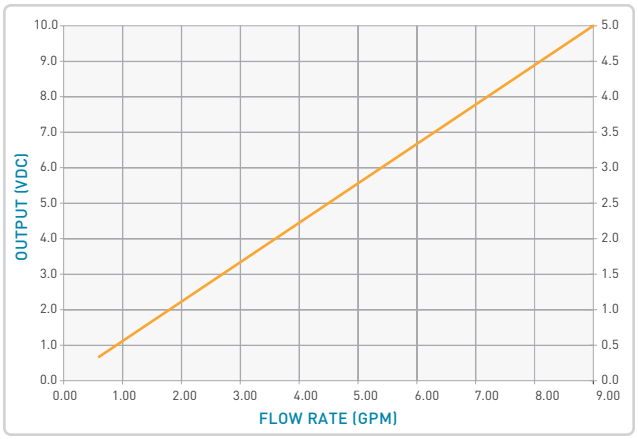
Model Numbers: 08006BN9 | 08006SN9

Output: VDC Flow Units: LPM



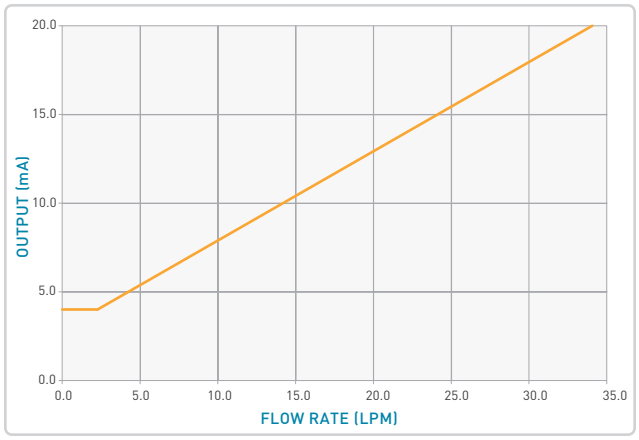
Formula for 10 VDC: y = 0.29x
Formula for 5 VDC: y = 0.15x

Output: VDC Flow Units: GPM



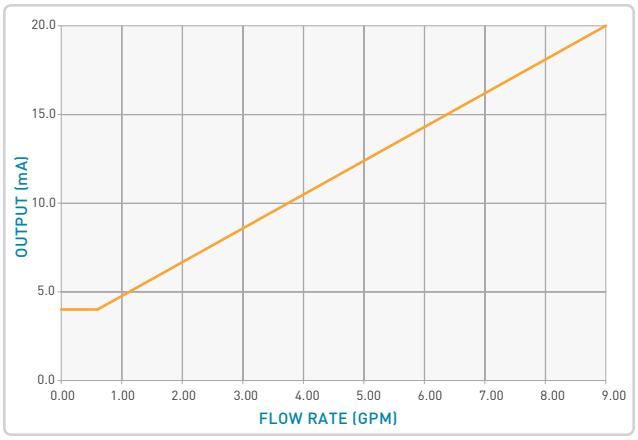
Formula for 10 VDC: y = 1.11x
Formula for 5 VDC: y = 0.56x

Output: mA Flow Units: LPM



Formula for 4–20 mA: y = 1.99x
Output is 4 mA when rotor is stopped.

Output: mA Flow Units: GPM

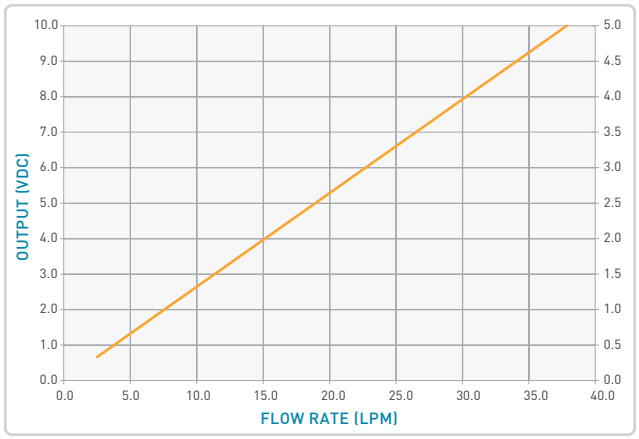


Formula for 4–20 mA: y = 0.53x
Output is 4 mA when rotor is stopped.

B FLOW RESPONSE CURVES

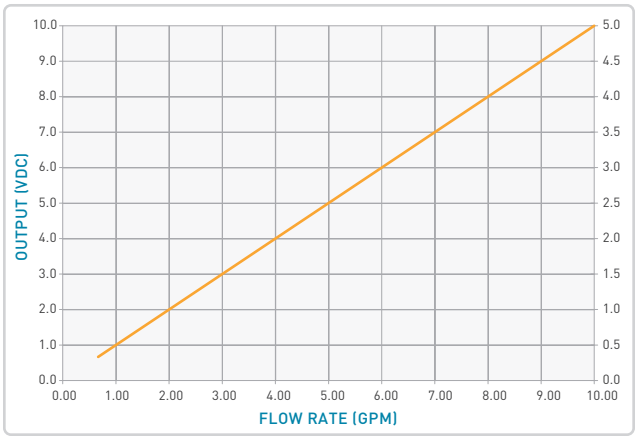
Model Numbers: 08006PN10 | 08008SA10

Output: VDC Flow Units: LPM



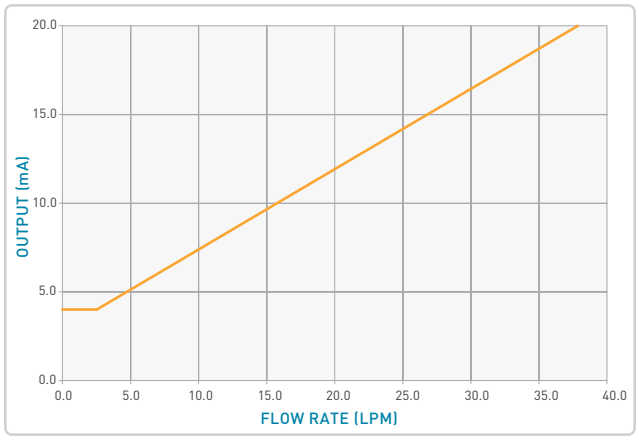
Formula for 10 VDC: y = 0.26x
Formula for 5 VDC: y = 0.13x

Output: VDC Flow Units: GPM



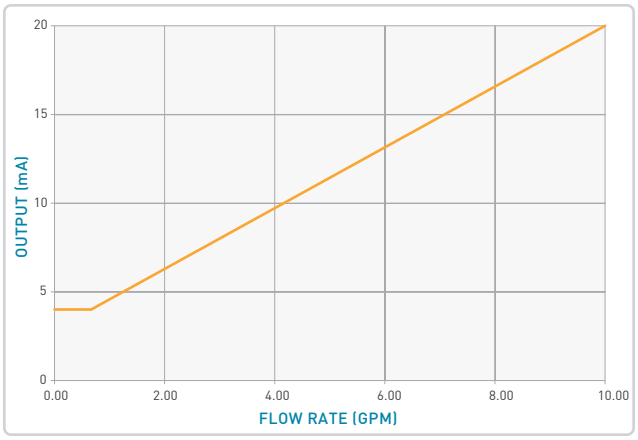
Formula for 10 VDC: y = 1.00x
Formula for 5 VDC: y = 0.50x

Output: mA Flow Units: LPM



Formula for 4–20 mA: y = 0.53x
Output is 4 mA when rotor is stopped.

Output: mA Flow Units: GPM

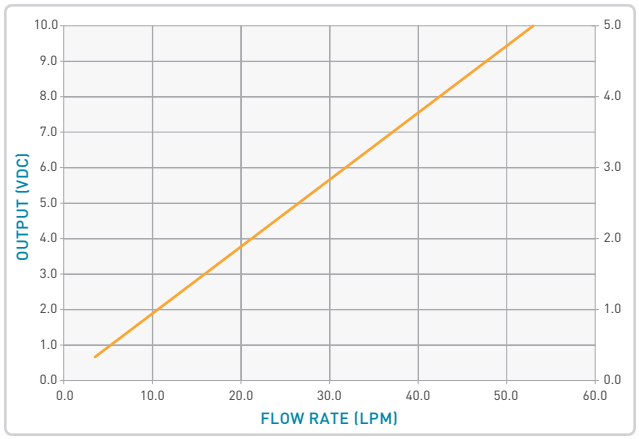


Formula for 4–20 mA: y = 2.00x
Output is 4 mA when rotor is stopped.

B FLOW RESPONSE CURVES

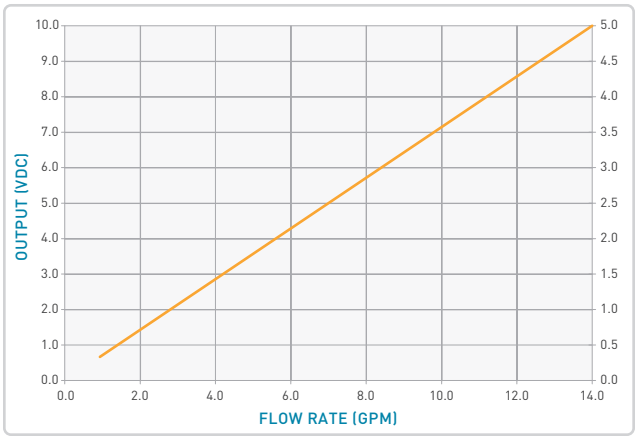
Model Numbers: 08008BN14 | 08008PN14 | 08008SN14

Output: VDC Flow Units: LPM



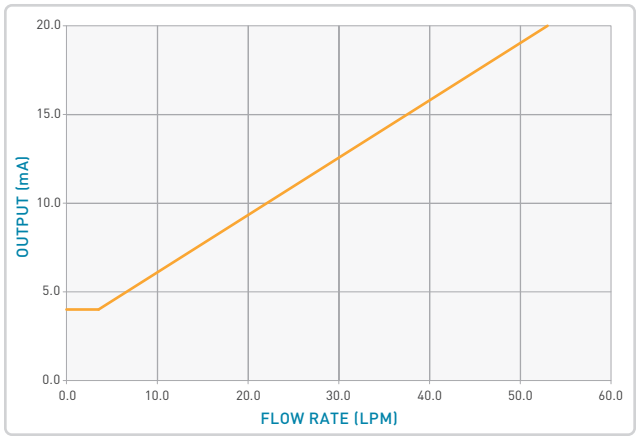
Formula for 10 VDC: y = 0.189x
Formula for 5 VDC: y = 0.094x

Output: VDC Flow Units: GPM



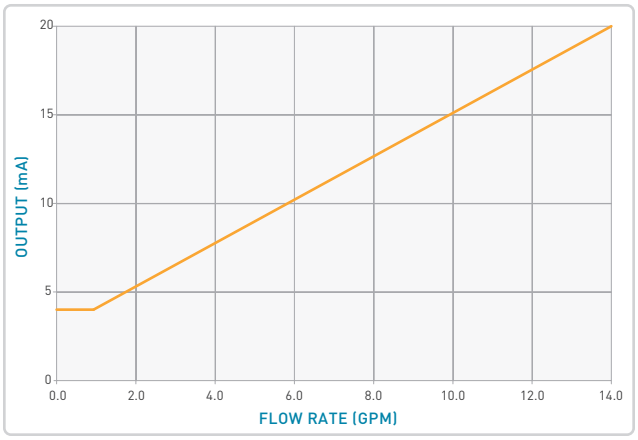
Formula for 10 VDC: y = 0.714x
Formula for 5 VDC: y = 0.357x

Output: mA Flow Units: LPM



Formula for 4–20 mA: y = 0.377x
Output is 4 mA when rotor is stopped.

Output: mA Flow Units: GPM

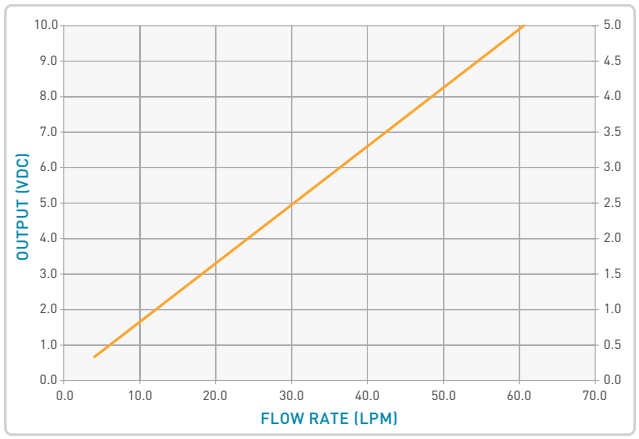


Formula for 4–20 mA: y = 1.430x
Output is 4 mA when rotor is stopped.

B FLOW RESPONSE CURVES

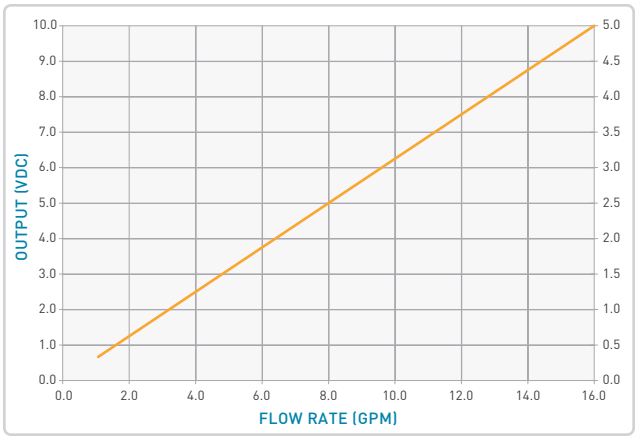
Model Numbers: 08012BN16 | 08012SA16 | 08012SN16

Output: VDC Flow Units: LPM



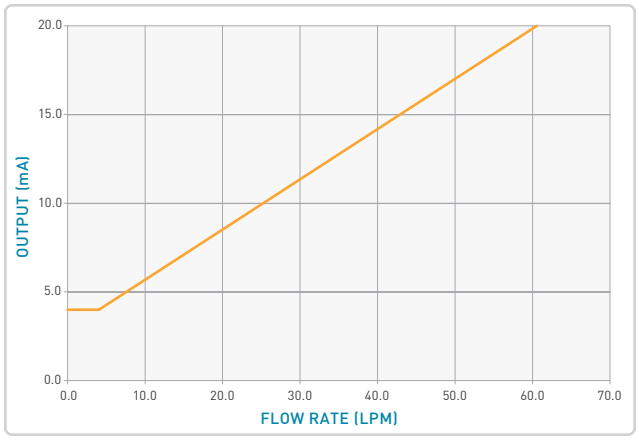
Formula for 10 VDC: y = 0.165x
Formula for 5 VDC: y = 0.082x

Output: VDC Flow Units: GPM



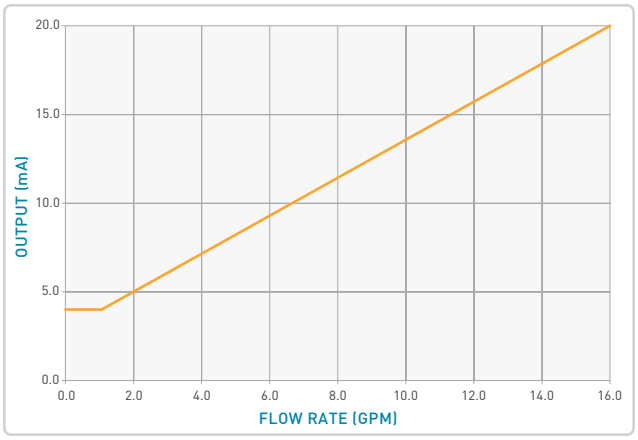
Formula for 10 VDC: y = 0.625x
Formula for 5 VDC: y = 0.313x

Output: mA Flow Units: LPM



Formula for 4–20 mA: y = 0.330x
Output is 4 mA when rotor is stopped.

Output: mA Flow Units: GPM

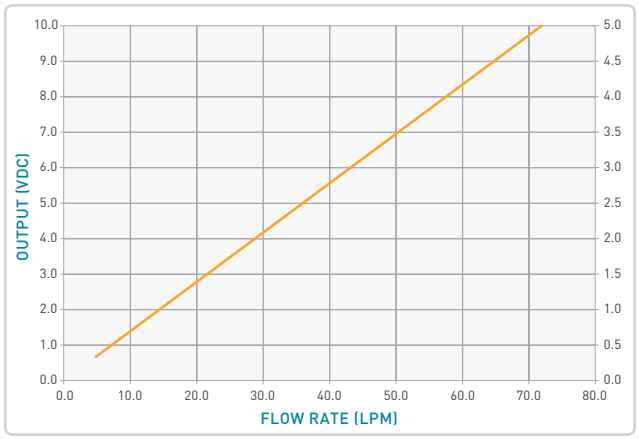


Formula for 4–20 mA: y = 1.250x
Output is 4 mA when rotor is stopped.

B FLOW RESPONSE CURVES

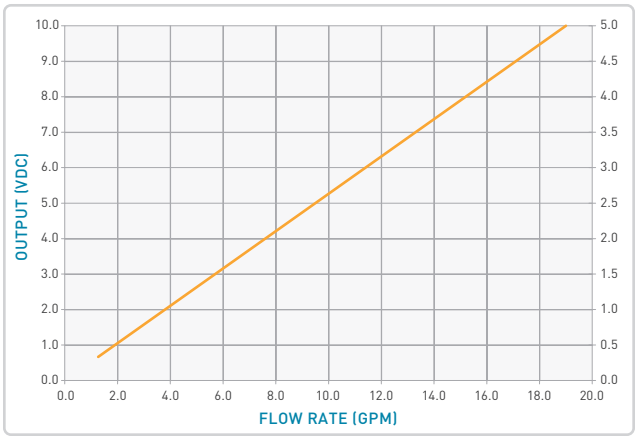
Model Number: 08012PN19

Output: VDC Flow Units: LPM



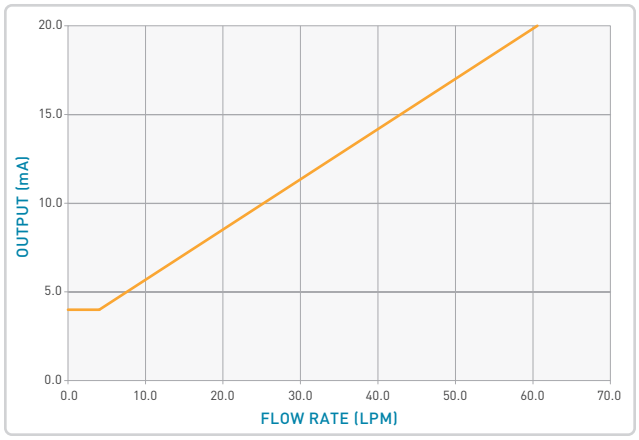
Formula for 10 VDC: y = 0.129x
Formula for 5 VDC: y = 0.069x

Output: VDC Flow Units: GPM



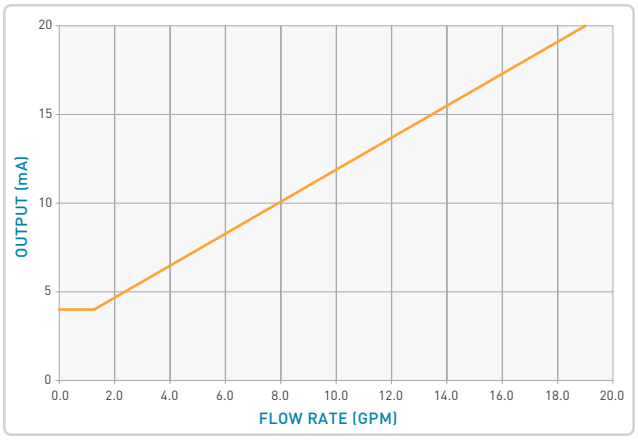
Formula for 10 VDC: y = 0.526x
Formula for 5 VDC: y = 0.263x

Output: mA Flow Units: LPM



Formula for 4–20 mA: y = 0.278x
Output is 4 mA when rotor is stopped.

Output: mA Flow Units: GPM

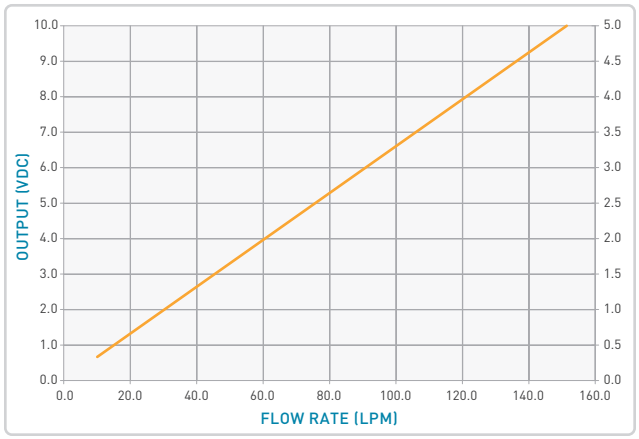


Formula for 4–20 mA: y = 1.052x
Output is 4 mA when rotor is stopped.

B FLOW RESPONSE CURVES

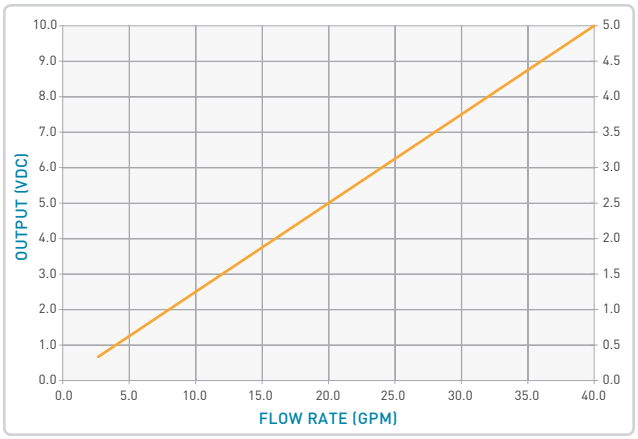
Model Numbers: **08012BN40 | 08012SN40 | 08016SA40 | 08016BN40 | 08016SN40**

Output: VDC Flow Units: LPM



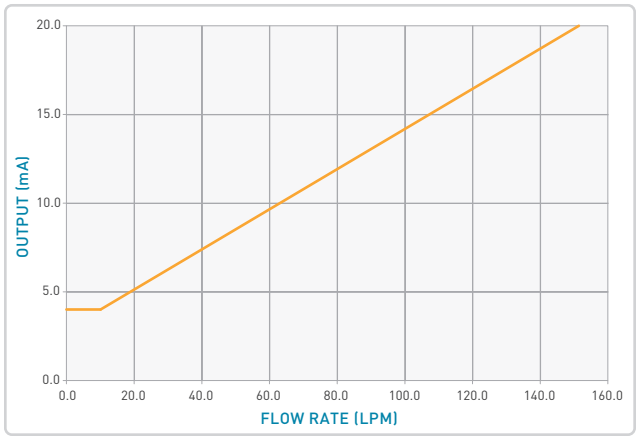
Formula for 10 VDC: y = 0.066x
Formula for 5 VDC: y = 0.033x

Output: VDC Flow Units: GPM



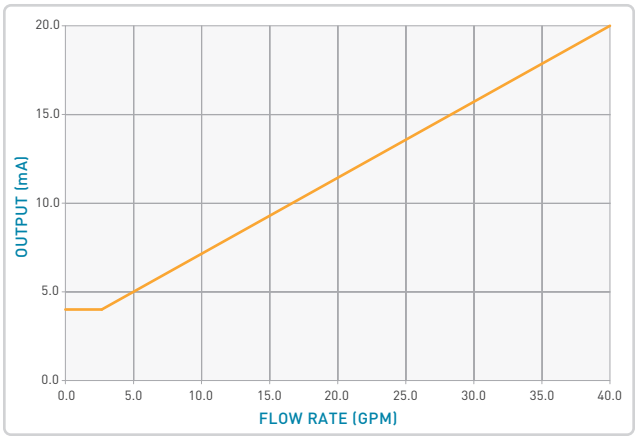
Formula for 10 VDC: y = 0.250x
Formula for 5 VDC: y = 0.125x

Output: mA Flow Units: LPM



Formula for 4–20 mA: y = 0.132x
Output is 4 mA when rotor is stopped.

Output: mA Flow Units: GPM

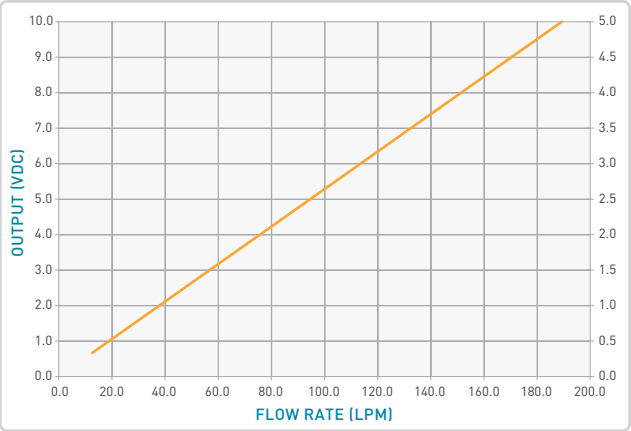


Formula for 4–20 mA: y = 0.500x
Output is 4 mA when rotor is stopped.

B FLOW RESPONSE CURVES

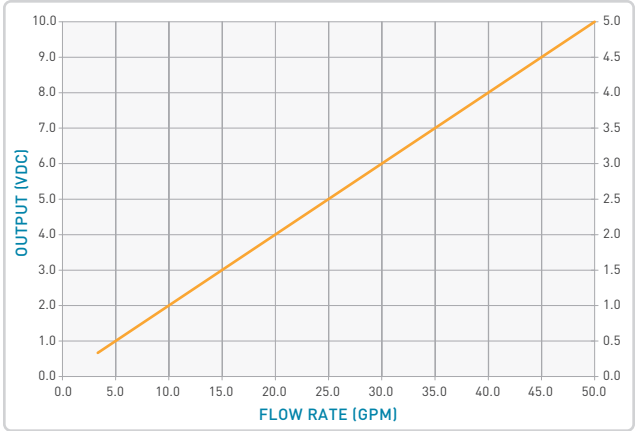
Model Number: 08016PN50

Output: VDC Flow Units: LPM



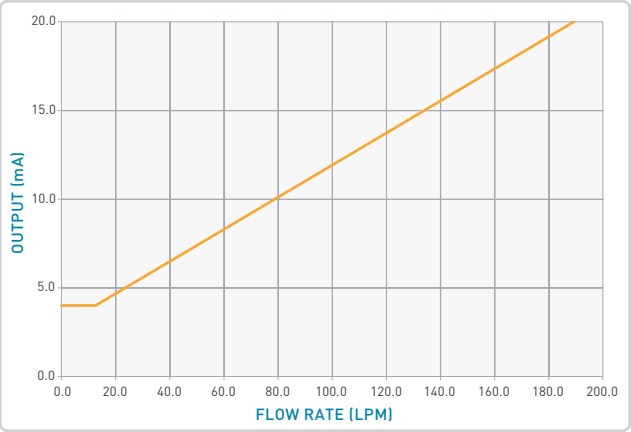
Formula for 10 VDC: y = 0.053x
Formula for 5 VDC: y = 0.026x

Output: VDC Flow Units: GPM



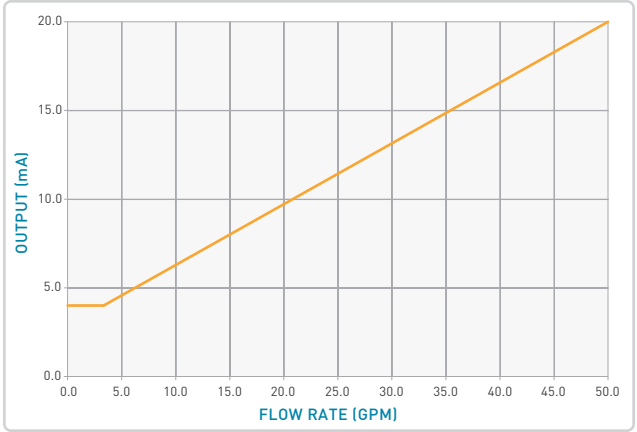
Formula for 10 VDC: y = 0.200x
Formula for 5 VDC: y = 0.100x

Output: mA Flow Units: LPM



Formula for 4–20 mA: y = 0.106x
Output is 4 mA when rotor is stopped.

Output: mA Flow Units: GPM

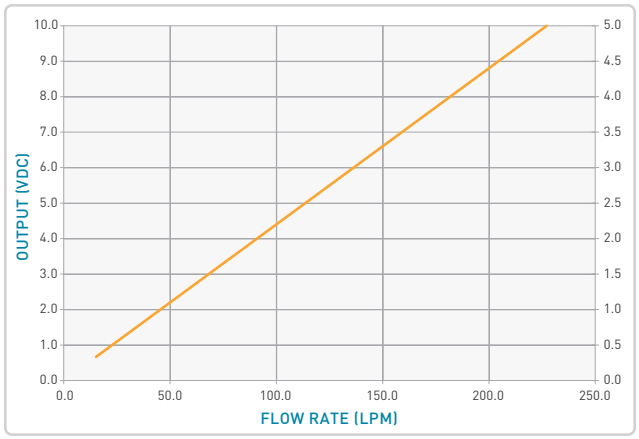


Formula for 4–20 mA: y = 0.400x
Output is 4 mA when rotor is stopped.

B FLOW RESPONSE CURVES

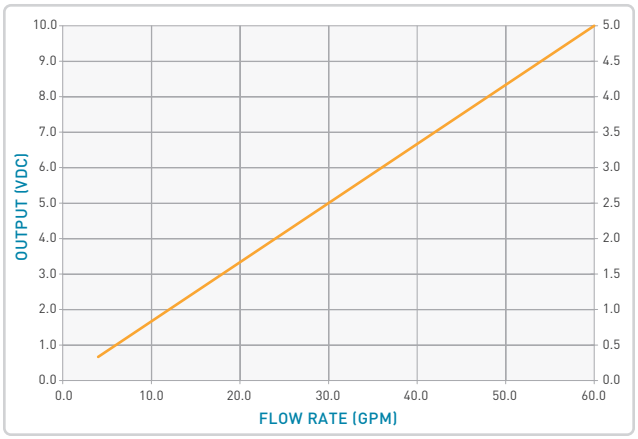
Model Numbers: 08016BN60 | 08016SN60

Output: VDC Flow Units: LPM



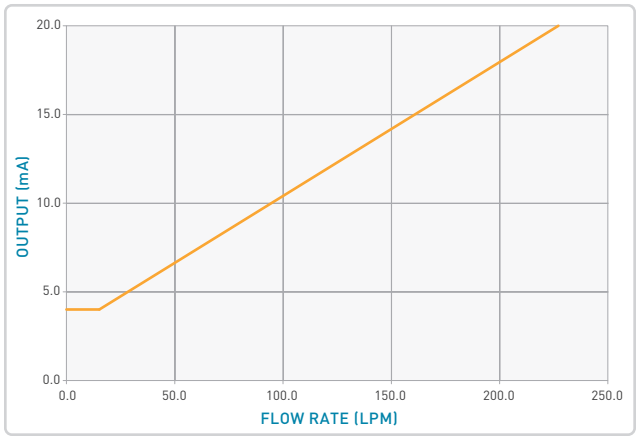
Formula for 10 VDC: y = 0.044x
Formula for 5 VDC: y = 0.022x

Output: VDC Flow Units: GPM



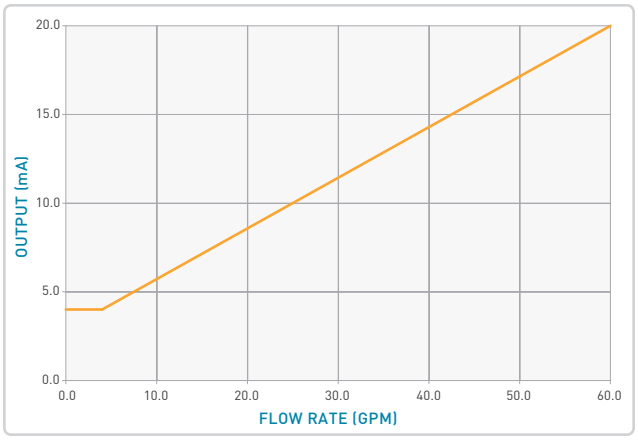
Formula for 10 VDC: y = 0.166x
Formula for 5 VDC: y = 0.083x

Output: mA Flow Units: LPM



Formula for 4–20 mA: y = 0.088x
Output is 4 mA when rotor is stopped.

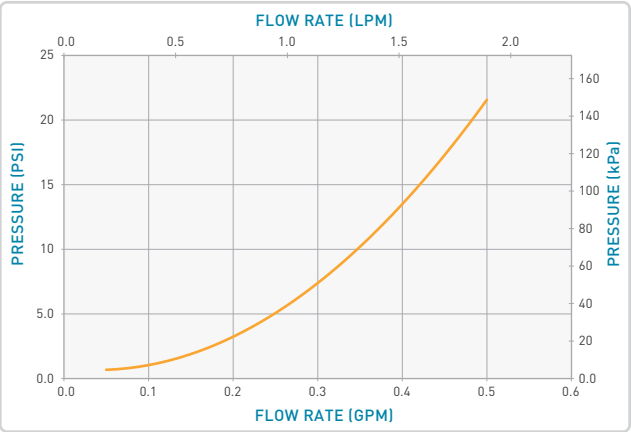
Output: mA Flow Units: GPM



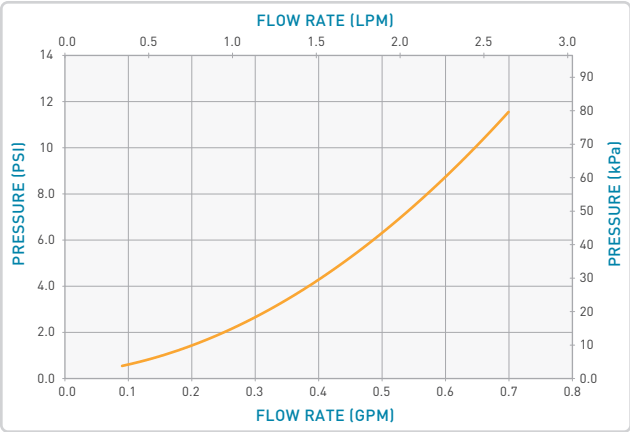
Formula for 4–20 mA: y = 0.333x
Output is 4 mA when rotor is stopped.

C PRESSURE DROP CURVES

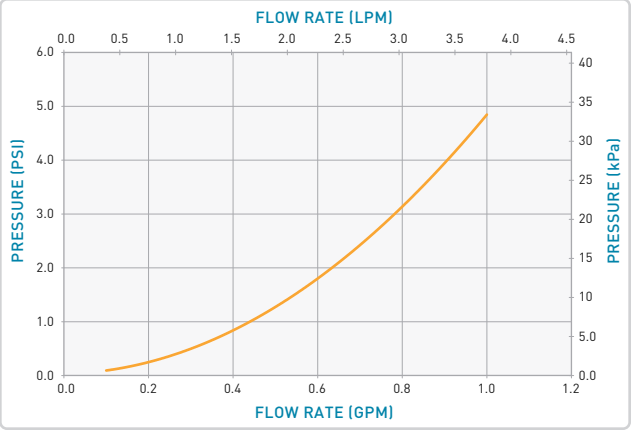
Model Numbers: 08004BN03 | 08004SN03



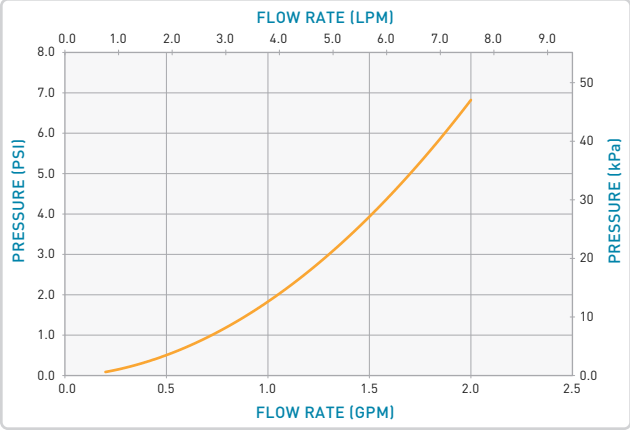
Model Numbers: 08004BN06 | 08004PN06
08004SN06



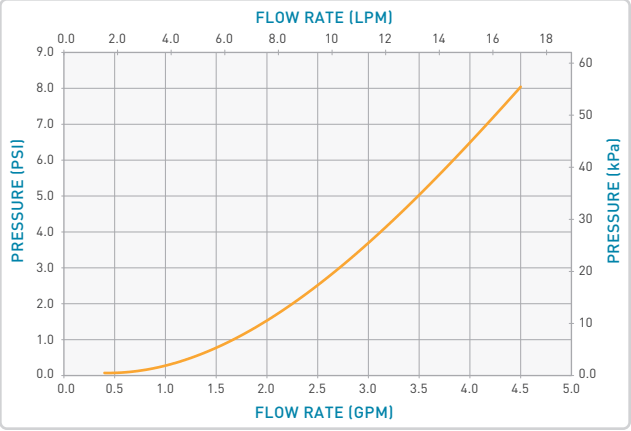
Model Numbers: 08004BN1 | 08004PN1
08004SN1



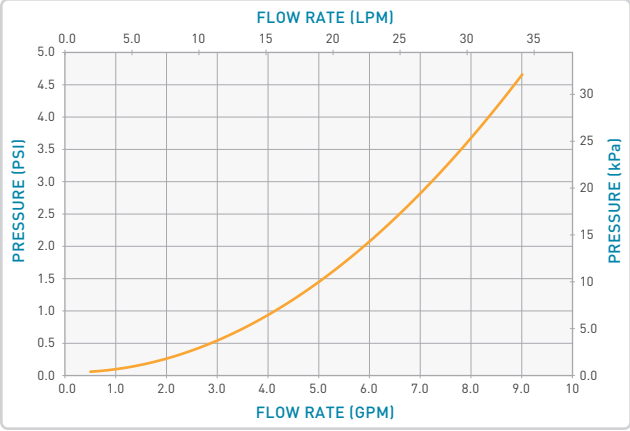
Model Numbers: 08004BN2 | 08004PN2
08006SA2 | 08004SN2



Model Numbers: 08004BN4 | 08004PN4
08004SN4 | 08006SA4

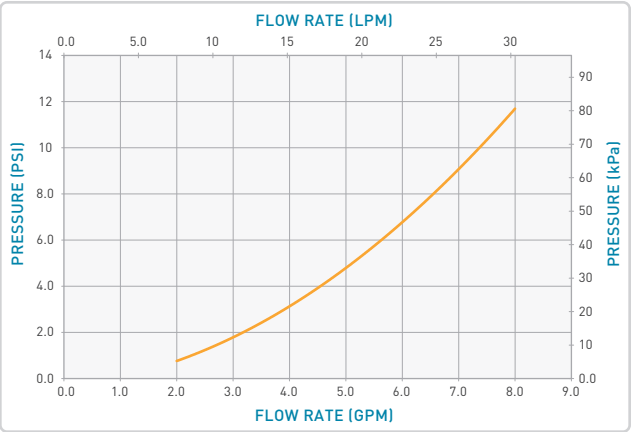


Model Numbers: 08006BN9 | 08006PN10
08006SN9

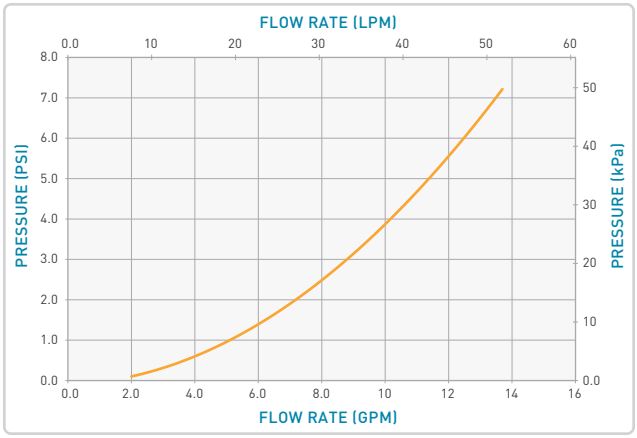


C PRESSURE DROP CURVES

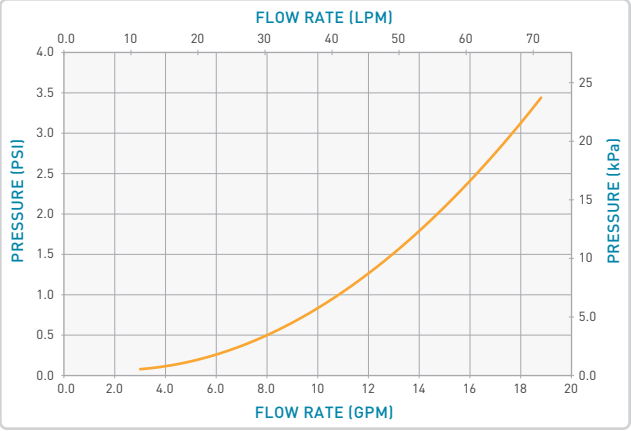
Model Number: 08008SA10



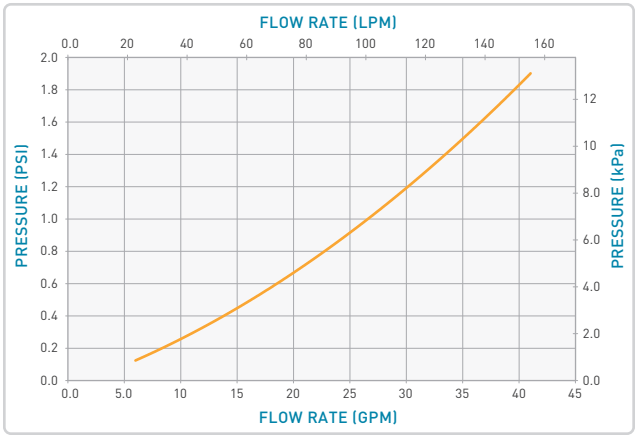
Model Numbers: 08008BN14 | 08008PN14
08008SN14



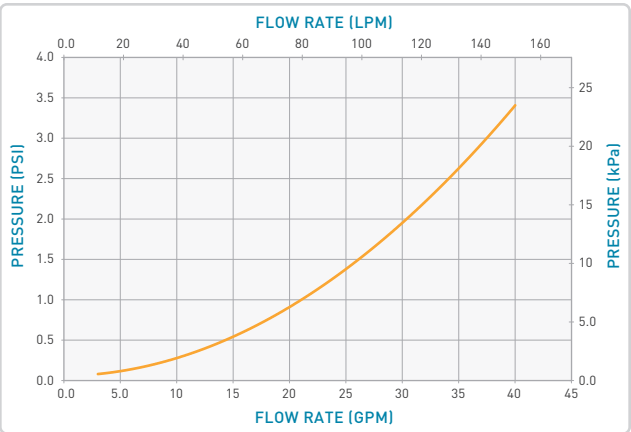
Model Numbers: 08012BN16 | 08012PN19
08012SA16 | 08012SN16



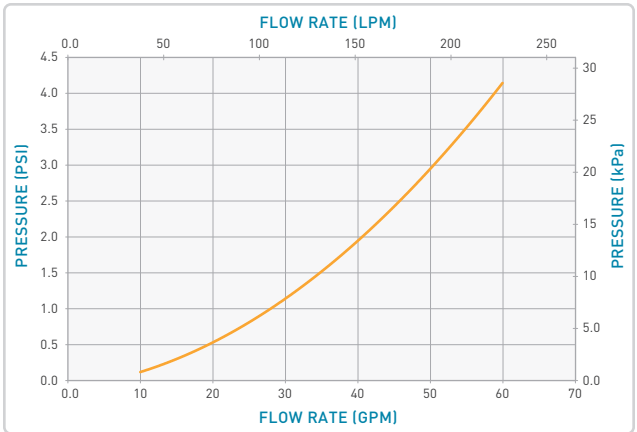
Model Numbers: 08012BN40 | 08012SN40



Model Numbers: 08016BN40 | 08016PN50
08016SA40 | 08016SN40



Model Numbers: 08016BN60 | 08016SN60



Proteus Industries Inc.
340 Pioneer Way, Mountain View, CA 94041
Tel: (650) 964-4163 Fax: (650) 965-0304
www.proteusind.com sales@proteusind.com

8000TRM Rev 003 08/2016