

P234 User Manual



max
Precision Flow Meters

Safety and Precautions



Never run the meter dry or blow compressed air through the meter. Damage will occur.



Never steam clean the meter. Damage will occur. (Bypass or remove the meter if necessary).



Do not disassemble the meter. Damage may occur. No serviceable parts inside.



Do not over pressurize the meter. Damage may occur. Maximum pressure is 3000 psi.



Do not operate P234 flow meters in a hazardous environment. For flow meters rated for ATEX, UL, or cUL Class 1, Div. 1 use in a hazardous environment, contact Max Machinery Sales at 707.433.2662 or www.maxmachinery.com.



Read the entire manual before installing and operating the meter.



Verify the fluid to be measured is compatible with the flow meter.



Filter your fluid to prevent damage from debris and foreign materials. 10 micron filtration recommended.



Install bypass plumbing around the flowmeter to allow for easier servicing and line purging/flushing without damaging the meter.



Follow all local regulations and your company safety procedures when installing, operating, servicing, and maintaining your flow meter.

Table of Contents

Safety and Precautions	i
Table of Contents	ii
How It Works	1
Installation	1
Mechanical	1
Operation	2
Electrical	3
Field Compensation of Transmitter	5
LED Functions	7
Specifications	8
Dimensions	10
Charts	10
Part Matrix	11
Available Accessories	13
Troubleshooting and Service Request	14
Additional Information Available	14

Max Machinery, Inc. (MMI) reserves the right to change product specifications without notice to improve performance, reliability, or manufacturability. MMI shall not be held liable for operational, technical, or editorial errors/omissions. Visit our web site for the latest version of this user manual.

Max Machinery, Inc., 33A Healdsburg Avenue, Healdsburg, CA 95448 USA
707.433.2662 | www.maxmachinery.com

max
Precision Flow Meters

How It Works

Max P234 Precision Flow Meters are positive displacement piston meters that are able to operate over a wide range of flow rates and fluid viscosities and are specifically designed to be compatible with aqueous based solutions. High accuracy measurement is achieved through precision machined radial pistons that move proportional to the flow. High resolution outputs are produced by measuring the direction and speed of the pistons and converting the signals to analog and frequency outputs. Flows can be monitored from 1 cc/min up to 2000 cc/min with fluid temperatures from 5 deg C to 90 deg C and a maximum pressure of 3000 psi (210 bar). The meter electronics are protected against water, dust, and most corrosive liquids. The 5-pin Turck connector provided is IP68 and mounts to the meter body via a PG-9 connection that can be adapted to conduit. Optional seal materials may be specified to allow for fluid compatibility.

The P234MEKP-#### is a variant meant for use with methyl ethyl ketone peroxide (MEKP) and similar chemicals. Different wetted materials are used to achieve compatibility. The flow range is from 1 cc/min up to 500 cc/min. Contact Max Machinery to determine if it is suitable for use in your application.

Max Machinery, Inc. designs, manufactures, calibrates, and refurbishes high accuracy, high resolution, precision liquid flow meters under an ISO 9001:2015 certified quality management system. All Max Precision Flow Meters are tested and calibrated in our lab and provide measurements traceable to NIST. If your calibration certificate is lost or missing, contact MMI with your meter serial number for a copy.

Installation

Orientation: The P234 mounts vertically with the inlet port on the bottom and the outlet port on the top (See diagram on page 2). This is the only manufacturer's suggested mounting that will allow for air to be purged from the system. Air in the system can cause response delays and errors in measurement.

Bypass Valves: Install valves to allow system start-up, filter replacement, or flow meter removal without completely shutting the system down and draining the lines. See diagram.

Failure to use a bypass at start up may lead to flow meter damage due to debris, overspeeding the meter with air in the lines, and pressure shock due to initial line surges.

Filtration: A 10 micron filter is recommended on the inlet side of the meter. If measuring bi-directional flow, a filter should be installed on both sides of the flow meter. Materials with fibrous or non-abrasive particulate matter may need to be run without filters.

Clean Plumbing: Before installing the flow meter, the system lines should be cleaned and free of all debris or manufacturing particulates. Purging lines with compressed air or steam are typical cleaning methods. Do not use compressed air or steam on the Max flow meter, damage will occur.

Mechanical

Inlet and Outlet ports may be NPT or BSPP (G-Type). The product part number defines the type of liquid fitting. Use the part matrix located on page 10 to determine the type of ports on your product and the Specifications section on page 8 to determine the diameter and thread pitch.

The P234 may require additional mounting support beyond the fluid connection lines. Additional mounting holes are located on two opposing sides of the base of the product. These holes are 1/4-20 UNC located 1.125 inches apart horizontally.



Operation

Determine that the following parameters of your flow metering system are within the specifications for the specific meter being used:

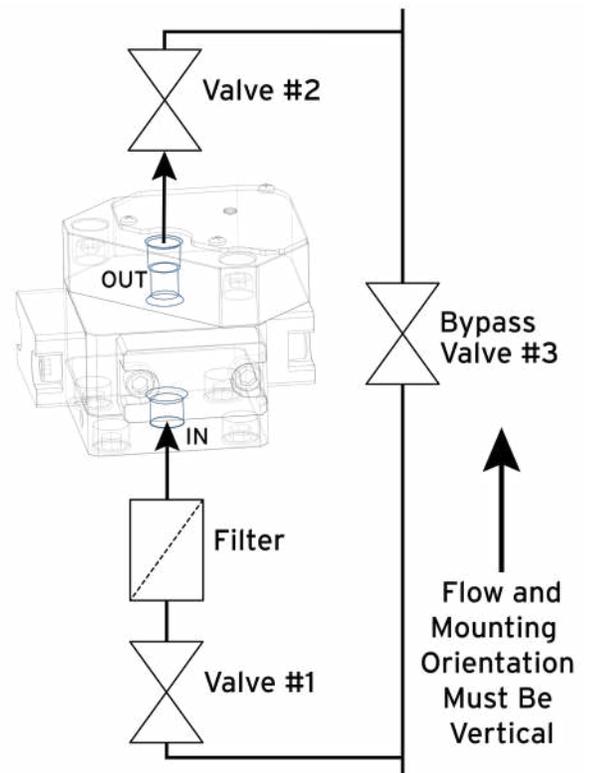
- Maximum System Pressure (Specifications)
- Differential Pressure across meter (Pressure Drop Curves)
- Maximum Flow Rate (Pressure Drop Curves)
- Metered Fluid Temperature (Sales specification, transmitter specifications)

If the difference in metered fluid temperature versus ambient is greater than 75°F (41.6°C), see the “High Temperature Start Up” section below.

With valves (#1) and (#2) closed, slowly open valve (#3) (bypass) to clear the lines of foreign particles and air. Slowly open the inlet valve (#1). Slowly open the outlet valve (#2). Completely close the bypass valve (#3).

No routine maintenance, cleaning, or lubrication of the flow meter is required. A routine filter cleaning schedule should be established. The system should be shut down if abnormal noises occur or if unusual differential pressures across the meter are encountered.

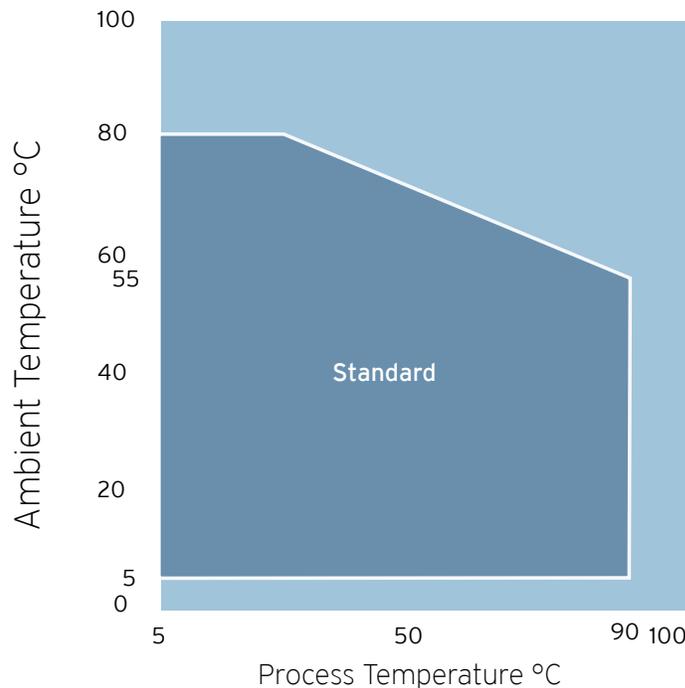
High Temperature Start Up: For fluids above 145°F (62.8°C) based on 70°F (21°C) ambient, a specific procedure is required. To avoid temperature shock, flow should be very slowly ramped up over approximately 5 min per 75°F (41.6°C) over ambient. Start with all valves closed and smoothly open valve #3 to allow bypass flow around the meter. Then over the calculated time interval for warmup, incrementally open valves #1 and #2 and incrementally close valve #3. If valving and a bypass circuit were not installed, then use supply pressure control to similarly ramp up flow rate slowly over time.



Electrical

Environment: The transmitter is rated to operate in the 5 C to 90 C fluid temperature range at an ambient temperature range of 5 C to 80 C. If the ambient temperature rises above 55 C (130F), the maximum fluid temperature at the flow meter is de-rated as shown in the chart below.

P234 Transmitter Permissible Temperatures



Transmitter installation is via a 5-pin, M12 style Turck connector. The connector is sealed to the body at the factory and is ready for use. If your installation requires conduit, PG-9 to conduit adapters are available from third parties. If using a conduit setup, use a sealed conduit connection and conduit stop to protect the electronics from moisture and corrosives. Follow the wiring diagrams on page 4 for replacing the 5-pin Turck connector with your own wiring.



WARNING: Electrical shock hazard. Serious or fatal injury may occur. Installation/Removal should only be completed by trained and authorized personnel.



WARNING: The P234 is not designed for use in hazardous locations. Adapting the meter to a conduit connection does not protect the system in a hazardous location. Do not use in a hazardous location as death or severe injury may occur.



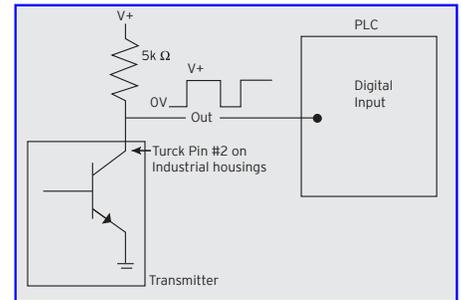
CAUTION: Verify transmitter output type (Analog or Frequency) before wiring. Inappropriate wiring could result in damaging the circuit. Installation/Removal should only be completed by trained and authorized personnel.

Frequency Output Transmitters (Versions ending with N/2)

	Turck® Connector		
	PCA Label	Pin #	Mating Cable Wire Color
Power (+5 to 26 Vdc)	V+	1	Brown
Common	Com	4	Black
Pulse Output	Ph A	2	White
Output Phase B (Quad only)	Ph B	5	Grey
Case Ground	Case	3	Blue

Current Sinking Wiring (Versions ending with S/2)

A current sinking device uses the transmitter's transistor output to act as a switch. A positive DC voltage must be applied to the transmitter's output pin (#2). When the pulse output is triggered, this voltage will be grounded to zero volts by the transmitter. Warning: Use a 5k ohm resistor to limit current if your system does not have any other means to limit the current into the transmitter.



Current Output Transmitters (Versions ending with A/2 or B/2) Voltage Output Transmitters (Versions ending with C/2 or D/2)

	Turck® Connector		
	PCA Label	Pin #	Mating Cable Wire Color
Power *	V+	1	Brown
Common	Com	4	Black
Signal Output (+)	Sig	5	Grey
Signal Output (-)**	Ret	2	White
Case Ground	Case	3	Blue

Voltage or Current Analog Transmitters (Models ending with A/2, B/2, C/2 or D/2)

* Analog transmitters with part numbers ending in A/2 or C/2 are 24Vdc power. Part numbers ending in B/2 or D/2 are 12Vdc power.

** To minimize signal noise, analog output transmitters are fully isolated. If your PLC does not ground the negative signal input, there is a risk of a ground shift that could drive the signal out of the range of detection. To prevent this from occurring please consider installing a 10k pull down resistor between Common and Signal Output (-).

Field Compensation of Transmitter

The transmitter LED on the P234 top cover indicates a functioning system when it is producing a pulse output or detecting magnet travel in the meter.

An alternating blue/green LED indicates that the circuit is detecting a magnet and provides an output signal.

A steady or flashing red LED indicates a problem with the transmitter PCA. Contact Max Machinery to have your P234 flow meter refurbished.

The Compensation Algorithm adjusts for variations in Hall sensor and flow meter characteristics to provide a stable, undamped output frequency that accurately represents the instantaneous flow rate. This feature is factory set when the meter is assembled. If the transmitter PCA is replaced or reset, the compensation can be performed via the gold PCA button or through the software kit.

The only method of altering additional factory set parameters of the meter is through the Interface Software Kit, part number SFT-KIT-001. Pulse Output Scaling, Analog Output Limits and Scaling, Signal Filtering Options and Compensation settings are the adjustable variables.



WARNING: Electrical shock hazard. Serious or fatal injury may occur. Access should only be completed by trained and authorized personnel.



CAUTION: Before opening/accessing the electronics lid, make sure the top of the P234 meter and surrounding components are dry and no moisture or fluids can contact the electrical components. Non-warranty damage may occur.

Instructions to access the gold PCA button and software serial port:

- Unscrew the captured philips head screws on the electronics lid.
- Remove and set aside the lid with o-ring seal.
- Optional: follow instructions for SFT-KIT-001 to connect to software serial port.
- Follow field compensation instructions on page 6.
- To reinstall, ensure the o-ring seal is firmly seated. Assembly is then the reverse of disassembly.



Field Compensation of Transmitter Continued

When a transmitter PCA is replaced or reset in the field, the compensation routine should be performed to optimize the performance of the system. This routine requires a steady flow rate between 35 cc/min and 2000 cc/min. The flow meter being compensated must not be used for system flow rate feedback control during this process. The transmitter output is disabled during the compensation routine.

If you are unable to run a stable flow in the field, send your meter in to Max Machinery for calibration.

For the P234, the compensation routine is as follows:

1. Place your system in 'manual' mode or run in 'open loop' mode with no flow meter feedback control. Max transmitter output shuts off during field compensation routine. Loss of signal to 'closed loop control' modes can affect the flow stabilization of the system and the compensation of the Max meter.
2. Stabilize the flow rate between 35 cc/min and 2000 cc/min.
3. Activate the compensation routine:
 - A - When using the software via the serial port connection, select 'field compensation' in the software.
 - OR
 - B - If NOT using software, push the Gold PCA Button using a non-conductive tool.
4. The blue/green LED will change to solid blue for 4 revolutions of the meter. See table LED Functions on next page for duration of compensation process. Duration is dependent upon flow rate.
5. A green LED light indicates a successful update of the compensation, a red LED light indicates the new compensation failed. Additional information is available through the interface software.
6. Return your system to 'operating' mode or restore settings to allow for feedback control.

LED Functions

Normal Operation		
STATUS	LED	ACTION
Functioning - System Not Flowing	Blue or Green Steady	Meter is functioning, but no flow is detected in the system.
Functioning - System Flowing	Blue / Green alternating colors	Meter is functioning, flow is occurring in the system. Note: At high flow rates, the alternating Blue/Green flashes may appear as a single steady color.
Meter Malfunction	Red Steady	Refurbish Meter.
No Power / Meter Failure	No Light	<ul style="list-style-type: none"> - Verify power supply to meter. - Verify wiring follows diagrams on page 4. - If power and wiring are verified, refurbish meter.

Compensation via Interface Software Kit or Gold PCA Button		
STATUS	LED	ACTION
Compensate button pushed/clicked	Blue Steady	- Steady light for 4-5 revolutions of meter.
Compensation Succeeded	Green Steady	<ul style="list-style-type: none"> - Steady light for 5 seconds. - Software will show "Success" on screen.
Compensation Failed	Red Steady	<ul style="list-style-type: none"> - Steady light for 5 seconds. - Software will show "Flow too low/ too high/ unstable" on screen.
<p>Note: Revolutions of meter are dependent on expected fluid flow rate. Per the P234 specifications, 4-5 revolutions of the meter take approximately the following amount of time at the stated flow rates:</p> <p>35 cc/min (minimum compensation flow rate) - 90 seconds</p> <p>100 cc/min - 35 seconds</p> <p>1000 cc/min - 15 seconds</p> <p>2000 cc/min (maximum meter flow rate) - 10 seconds</p>		
<p>If compensation fails, restart the compensation process. When using the Interface Software Kit, follow instructions provided to correct errors prior to attempting compensation again. If problems persist, contact Max Machinery at 707-433-2662 or at www.maxmachinery.com.</p>		

Specifications

SPECIFICATIONS

Flow Range	1 to 2000 cc/min
Accuracy (1 cP)	± 0.4% of reading over a 100:1 range
Maximum Operating Pressure	3000 psi (210 bar)
Weight	4.1 kg
Recommended Filtration	10 micron
Port Size(s)	1/4 inch NPT or G 1/4-19 BSPP
Fluids	Most aqueous based fluids with a pH between 4 and 12

MATERIALS OF CONSTRUCTION

External	Stainless steel, type 316, type 304; Blue Xylan 316 fasteners; Polycarbonate LED cover - avoid contact with solvents
Wetted	Stainless steel, type 316; Graphite; PEEK; Nickel Carbide
O-Rings	Standard: Viton® Optional: Teflon®, Perfluoroelastmer

FREQUENCY TRANSMITTER

Output Signal	Standard: 5 Vdc, single phase Optional: Quadrature 5 Vdc, two phase Current sinking, 20 mA max., single phase
K-Factor	Single Phase: 180 pulses/cc Two Phase: 360 pulses/cc, 4x decoded (90 pulses/cc/phase, 1x decoded)
Power Supply Requirements	5-26 Vdc @ 30ma
Ambient Operational Range	5°C to 80°C
Metered Liquid Temp Range (based on 20° ambient)	5°C to 90°C

ANALOG TRANSMITTER

Output Signal	Any range of ± 10V or ± 20mA linearized and damped with anti-dither protection
Power Supply Requirements	12Vdc @ 90 mA, 24Vdc @ 45 mA
Ambient Operational Range	5°C to 80°C
Metered Liquid Temp Range (based on 20° ambient)	5°C to 90°C

Specifications P234MEKP-### Variants

SPECIFICATIONS

Flow Range	1 to 500 cc/min
Accuracy (1 cP)	± 0.4% of reading over a 25:1 range
Maximum Operating Pressure	3000 psi (210 bar)
Weight	4.1 kg
Recommended Filtration	10 micron
Port Size(s)	1/4 inch NPT or G 1/4-19 BSPP
Fluids	Most aqueous based fluids with a pH between 4 and 12, specifically suited for methyl ethyl ketone peroxide

MATERIALS OF CONSTRUCTION

External	Stainless steel, type 316, type 304; Blue Xylan 316 fastners; Polycarbonate LED cover - avoid contact with solvents
Wetted	Stainless steel, type 316; Graphite; PEEK; Expanite hardened 316SS
O-Rings	Standard: Viton® Optional: Teflon®, Perfluoroelastmer

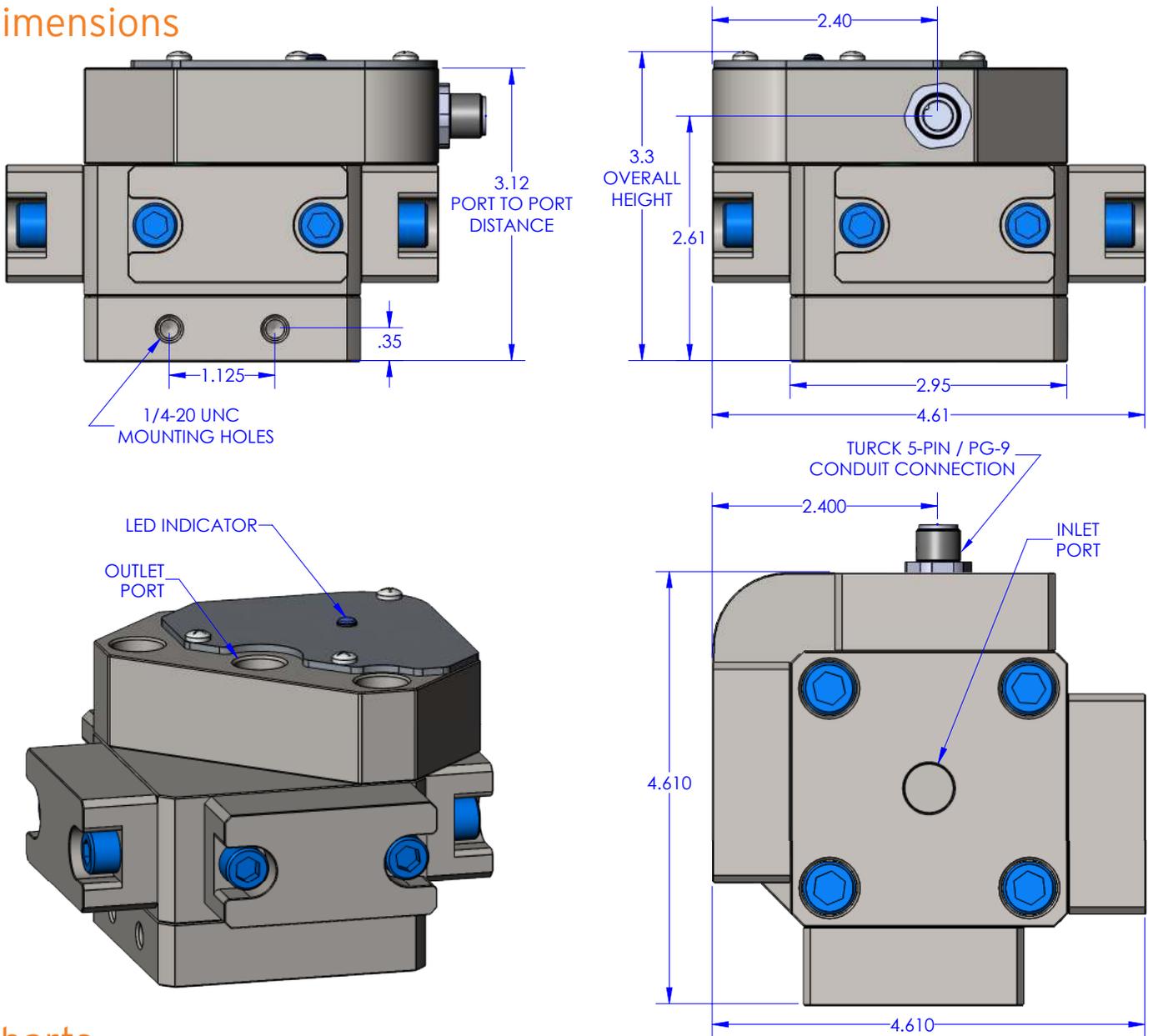
FREQUENCY TRANSMITTER

Output Signal	Standard: 5 Vdc, single phase Optional: Quadrature 5 Vdc, two phase Current sinking, 20 mA max., single phase
K-Factor	Single Phase: 180 pulses/cc Two Phase: 360 pulses/cc, 4x decoded (90 pulses/cc/phase, 1x decoded)
Power Supply Requirements	5-26 Vdc @ 30ma
Ambient Operational Range	5°C to 80°C
Metered Liquid Temp Range (based on 20° ambient)	5°C to 90°C

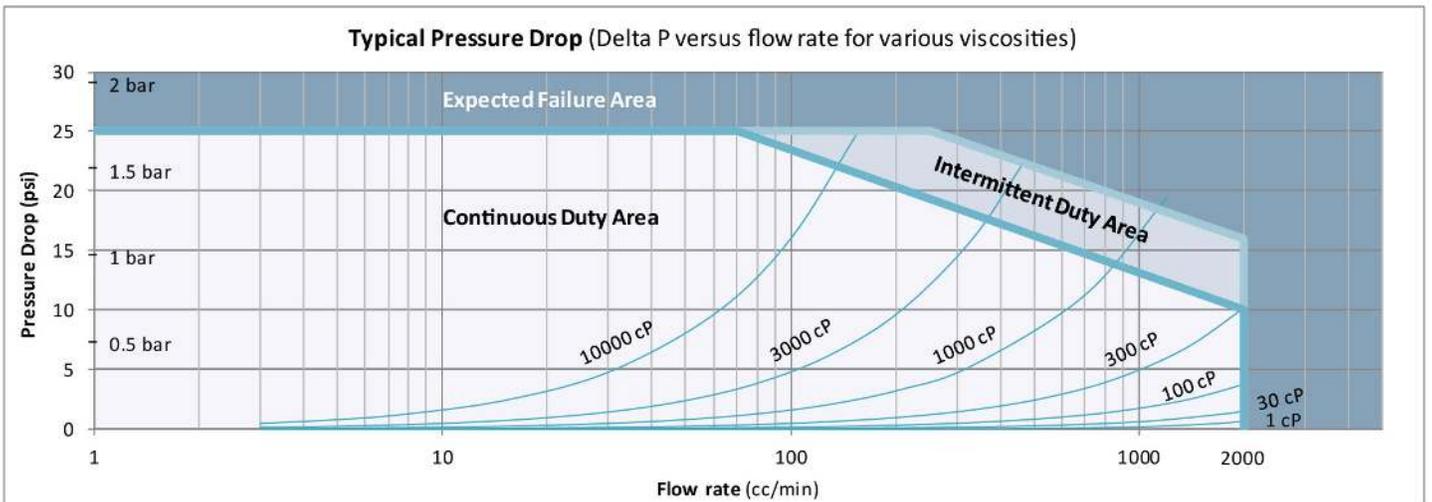
ANALOG TRANSMITTER

Output Signal	Any range of ± 10V or ± 20mA linearized and damped with anti-dither protection
Power Supply Requirements	24Vdc @ 45 mA
Ambient Operational Range	5°C to 80°C
Metered Liquid Temp Range (based on 20° ambient)	5°C to 90°C

Dimensions



Charts



Positive Displacement Flow Meters Piston Type, P-Series 3000 psi (210 bar) rated, Water Based Fluids

Flow Meter Selections Transmitter Selections

Model # MZ NA / 1 1 / 2 - Non-Standard Options
Bi-Directional Cal: BID

Max Flow Range

2 Liters/Min P234 MZ

Pressure

3000 psi (210 bar) MZ

Fluid Connection

NPT 1
G-Type / BSPP 6

Seal Selection

Viton® - FKM 1
Teflon® - PTFE 3
Perfluoroelastomer - FFKM 5

Options

None NA

A
A
A
A
P
Q
P

Output Type

A 4-20mA Output - Powered by 24 Vdc
B 4-20mA Output - Powered by 12 Vdc
C 0-10 Volt Output - Powered by 24 Vdc
D 0-10 Volt Output - Powered by 12 Vdc
N 5V Pulse/Freq. - Powered by 5-26 Vdc
N 5V Quadrature - Powered by 5-26 Vdc
S Current Sinking, Single Phase

Temperature Rating

1 90°C Industrial

Electrical Connection

1 Industrial, Turck® Connector

Signal Type

P Pulse
A Analog
Q Quadrature



Product includes single directional calibration, bi-directional calibrations for Analog and Quadrature devices are optional.

Positive Displacement Flow Meters Piston Type, P-Series 3000 psi (210 bar) rated, MEKP Based Fluids

Part Number	Fluid Connection	Transmitter
P234-MEKP-001	NPT	Pulse: 5V Frequency. - Powered by 5-26 Vdc
P234-MEKP-002	NPT	Pulse: Current Sinking, Single Phase
P234-MEKP-003	NPT	Quadrature: 5V A/B signal - Powered by 5-26 Vdc
P234-MEKP-004	NPT	Analog: 4-20mA Output - Powered by 24 Vdc
P234-MEKP-005	NPT	Analog: 0-10 Volt Output - Powered by 24 Vdc
P234-MEKP-010	BSPP	Pulse: 5V Frequency. - Powered by 5-26 Vdc
P234-MEKP-020	BSPP	Pulse: Current Sinking, Single Phase
P234-MEKP-030	BSPP	Quadrature: 5V A/B signal - Powered by 5-26 Vdc
P234-MEKP-040	BSPP	Analog: 4-20mA Output - Powered by 24 Vdc
P234-MEKP-050	BSPP	Analog: 0-10 Volt Output - Powered by 24 Vdc
P234-MEKP-100	SAE	Pulse: 5V Frequency. - Powered by 5-26 Vdc
P234-MEKP-200	SAE	Pulse: Current Sinking, Single Phase
P234-MEKP-300	SAE	Quadrature: 5V A/B signal - Powered by 5-26 Vdc
P234-MEKP-400	SAE	Analog: 4-20mA Output - Powered by 24 Vdc
P234-MEKP-500	SAE	Analog: 0-10 Volt Output - Powered by 24 Vdc

-BID option: Product includes single directional calibration, bi-directional calibrations for Analog and Quadrature devices are optional.

All options or variations not listed above are standard across all meter variants. All P234-MEKP meters come with Perfluoroelastomer seals, Industrial housing rated to 90 C, and Turck M12 connector.



Available Accessories

Accessories to support your system and simplify your installation and maintenance are available direct from Max. Request yours when you order your flow meter. See the website for information and options.

Interface Software Kit

Part #	Description
SFT-KIT-001	USB drive transmitter programming software and serial cable. The following adjustments may be made to the signal output: Pulse Output Scaling, Analog Output Limits and Scaling, Signal Filtering Options and Compensation settings.



Cables

Part #	Description
181-294-060	7 meter cable - 5-pin Turck® to wire
181-294-061	15 meter cable - 5-pin Turck® to wire



Model 122 Combination Rate Indicator/Totalizers 110/220 Vac powered (frequency input)

Model	Description
122-200-000	Panel mount indicator with dual-line, 6-digit display (0.6" and 0.46"). Produces an isolated 4-20mA analog output. Provides 24 Vdc transmitter power. Can be programmed to show rate, total and/or grand total. Initial programming included as default or customer specified values.



381 Series Filters and Filter Elements

Model	Description
381-102-000	Inline filter with 10 micron element included. O-rings options available to match your flow meter and system requirements.



Troubleshooting and Service Request

Problem	Corrective Action
No Flow through meter or high pressure drop across meter	
Solidified material blocking rotation	Heat meter to melt material. Do not exceed maximum meter operating temperature.
Debris damage or internally clogged	Refurbish meter.
Meter broken	Refurbish meter.
Fluid passes through meter, but no flow is indicated	
Transmitter cable or conduit cable incorrectly wired	Verify DC power is present at the PCA. Use a multi-meter to measure the transmitter output independent of the display or PLC.
Meter not turning	Refurbish meter.
Indicated flow does not agree with expected readings	
Air in the line	Air bubbles displace the meter just like a liquid. If you see over-reporting, purge all air from lines.
Indicator not calibrated properly	Verify K-Factor for the meter in use and compare this value to the setting used in the display.
Excessive reverse flow in system	Max transmitters' anti-dither function buffers up to 1 revolution of reverse flow. An incorrect flow total can be reported if the system reverse flow is greater than 1 meter revolution.

Additional Information Available

MMI provides refurbishment and calibration services. For more details or to submit your Service Request, go to <https://www.maxmachinery.com/services/>.

Additional information about our products, including STEP files and Sample Calibration sheets, may be found on our website at <https://www.maxmachinery.com/downloads/>.

MMI products are covered under our standard manufacturer's warranty. Details may be found at <https://www.maxmachinery.com/warranty/>.